Final
Environmental Assessment
F-16 Formal Training Unit Permanent Beddown and Relocation
Holloman Air Force Base, New Mexico

September 2023

Department of the Air Force
49th Wing

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Privacy Advisory

This Environmental Assessment (EA) is provided for public comment in accordance with the National Environmental Policy Act of 1969 (NEPA), the President's Council on Environmental Quality (CEQ) NEPA Regulations (40 Code of Federal Regulations [CFR] Parts 1500 to 1508), and 32 CFR Part 989, *Environmental Impact Analysis Process (EIAP)*. For this EA, the updated September 2020 CEQ NEPA rules (85 Federal Register 43304 through 43376) are being followed, as modified by the CEQ NEPA Implementing Regulations Revisions Final Rule, effective 20 May 2022. The EIAP provides an opportunity for public input on Department of the Air Force (DAF) decision-making, allows the public to offer inputs on alternative ways for the DAF to accomplish what it is proposing, and solicits comments on the DAF's analysis of environmental effects.

Public commenting allows the DAF to make better, informed decisions. Letters or other written or oral comments provided may be published in the EA. As required by law, comments provided will be addressed in the EA and made available to the public. Providing personal information is voluntary. Any personal information provided will be used only to identify your desire to make a statement during the public comment portion of any public meetings or hearings or to fulfill requests for copies of the EA or associated documents. Private addresses will be compiled to develop a mailing list for those requesting copies of EA; however, only the names of the individuals making comments and specific comments will be disclosed. Personal home addresses and phone numbers will not be published in the EA.

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This document has been verified that it does not exceed the 75 pages, not including appendices, as defined in 40 CFR § 1501.5(f). As defined in 40 CFR § 1508.1(v) a "page" means 500 words and does not include maps, diagrams, graphs, tables, and other means of graphically displaying quantitation or geospatial information.

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COVER SHEET
FINAL ENVIRONMENTAL ASSESSMENT (EA)
FOR THE F-16 FORMAL TRAINING UNIT PERMANENT BEDDOWN AND RELOCATION,
HOLLOMAN AIR FORCE BASE, NEW MEXICO

a. *Responsible Agency*: United States Air Force (Air Force)

b. *Cooperating Agency*: Department of the Interior, National Park Service

c. *Proposals and Actions:* This Environmental Assessment analyzes a Proposed Action to permanently beddown additional F-16 Formal Training Unit (FTU) squadrons in support of the FTU Permanent Beddown and Relocation Plan. The Proposed Action would include the permanent relocation of F-16 aircraft; pilot, maintenance, and support personnel; and support vehicles and equipment at Holloman Air Force Base (AFB). Minor construction, including the expansion and renovation of existing buildings, installation of additional sunshades, and the installation of additional lighting on aircraft parking ramps, as well as the interior modifications of some facilities, would be required to support the permanent addition of F-16 FTU maintenance, support, and administrative activities. In addition, an auxiliary airfield, Roswell International Air Center (ROW), would support pilot training. The Special Use Airspace (SUA), Air Traffic Control Assigned Airspace (ATCAA), Military Training Routes (MTRs) and training ranges currently used for training by Holloman AFB would continue to be utilized by the F-16 FTU squadrons.

d. *For Additional Information:* Mr. Spencer Robison at 49th Civil Engineer Squadron/Environmental Compliance, 550 Tabosa Avenue, Holloman AFB, New Mexico 88330 or by email at spencer.robison@us.af.mil.

e. *Designation:* Final EA

f. *Abstract:* This EA has been prepared pursuant to provisions of the National Environmental Policy Act (NEPA), Title 42 United States Code §§ 4321 to 4347, implemented by Council on Environmental Quality (CEQ) Regulations, Title 40, Code of Federal Regulations Parts 1500 to 1508, and 32 Code of Federal Regulations Part 989, *Environmental Impact Analysis Process (EIAP)*.

The purpose of the Proposed Action is to optimize fighter pilot production to meet the Air Education Training Command's (AETC) mission of training and educating Airmen. Furthermore, the Proposed Action would realign AETC assets to meet mission requirements specified in the F-16 Beddown and Relocation Plan to address fighter production shortfalls. The need for the Proposed Action is to permanently base the F-16 FTU. Increasingly, fighter pilots of the Combat Air Forces have been operating on degraded levels of proficiency and training readiness resulting from diminishing fiscal resources. Air Force readiness is currently affected by several issues including training, weapon system sustainment, and facilities. Training in particular has become an increasing concern as worldwide commitments, high operations tempo, and fiscal and manpower limitations detract from available training resources. The Proposed Action would facilitate AETC's ability to fulfill its training mission.

Under Alternative 1, a squadron composed of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory (BAI) F-16 Block 40 aircraft, currently based at Holloman AFB on an interim basis, would be permanently assigned to Holloman AFB as the 8th Fighter Squadron (8 FS). The estimated maximum 5,000 sorties and 7,500 patterns the 8 FS fly annually at Holloman AFB would be permanent. ROW would be used for additional pattern training as an emergency field. Under Alternative 1, the F-16 FTU squadron would continue to use SUA and ATCAAs proximate to Holloman AFB and would continue to conduct an estimated 5,000 annual training sorties. An estimated 400 Regular Air Force (RegAF) personnel composed of instructor pilots and support personnel, as well as contracted logistics support personnel currently based at Holloman AFB, would remain. Some minor construction to expand existing facilities, as well as interior renovations for the permanent beddown of the 8 FS, would be necessary. Under Alternative 2, the squadron of F-16 aircraft FTU described in Alternative 1 would be permanently assigned to Holloman AFB as the 8 FS and an additional F-16 aircraft FTU squadron would be permanently relocated to Holloman AFB. The 8 FS would continue to fly an estimated 5,000 sorties and 7,500 training patterns and the additional F-16 FTU squadron would fly an estimated maximum additional 5,000 sorties and 7,500 patterns annually at Holloman AFB and in the SUA and ATCAAs as described under Alternative 1. Under this alternative, the 8 FS and additional F-16 FTU squadron would fly an estimated additional 199 sorties to ROW and perform an estimated 581 additional patterns per year. Under Alternative 2 an additional 475 personnel would be associated with the permanent beddown of two squadrons for a total of approximately 875 personnel composed of 175 RegAF personnel and the contractor equivalent of approximately 700 personnel to fill direct and indirect support functions.

The analysis of the affected environment and environmental consequences of implementing the Proposed Action and alternatives, when considered with reasonably foreseeable future actions, concluded that there would be no significant or long-term adverse impacts from the F-16 beddown and relocation at Holloman AFB, ROW, or in the SUA, ATCAAs, and training ranges for the following resources: airspace management and use; noise; safety; air quality; biological resources; cultural resources; land use; infrastructure, transportation, and utilities; hazardous materials and wastes, contaminated sites, and toxic substances; socioeconomics; and environmental justice and the protection of children.

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FINDING OF NO SIGNIFICANT IMPACT (FONSI)
F-16 FORMAL TRAINING UNIT PERMANENT BEDDOWN AND RELOCATION
HOLLOMAN AIR FORCE BASE, NEW MEXICO

Pursuant to provisions of the National Environmental Policy Act (NEPA), 42 United States Code §§ 4321 to 4370h; Council on Environmental Quality (CEQ) Regulations, CEQ Update to the Regulations Implementing the Procedural Provisions of NEPA (16 July 2020), 40 Code of Federal Regulations (CFR) Parts 1500 to 1508; and 32 CFR Part 989, *Environmental Impact Analysis Process (EIAP),* the Department of the Air Force (DAF) prepared the attached Environmental Assessment (EA) to address the potential environmental consequences associated with the F-16 Formal Training Unit (FTU) Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico.

Purpose and Need

The purpose of the Proposed Action is to optimize fighter pilot production to meet the Air Education Training Command's (AETC) mission of training and educating Airmen. Furthermore, the Proposed Action would realign AETC assets to meet mission requirements specified in the F-16 Beddown and Relocation Plan to address fighter production shortfalls. The need for the Proposed Action is to permanently base the F-16 FTU. Increasingly, fighter pilots of the Combat Air Forces have been operating at degraded levels of proficiency and training readiness resulting from diminishing fiscal resources. Air Force readiness is currently affected by several issues including training weapon system sustainment, and facilities. Training in particular has become an increasing concern as worldwide commitments, high operations tempo, and fiscal and manpower limitations detract from available training resources. The Proposed Action would facilitate AETC's ability to fulfill its training mission.

Description of Proposed Action and Alternatives

The Air Force is proposing to permanently beddown additional F-16 FTU squadrons in support of the Formal Training Unit Permanent Beddown and Relocation Plan. The Proposed Action would allow AETC to continue to optimize fighter pilot production to meet its mission.

The Proposed Action would include the permanent relocation of the F-16 aircraft; pilot, maintenance, and support personnel; and support vehicles and equipment. Minor construction, including the expansion and renovation of existing buildings, installation of additional sunshades, and the installation of additional lighting on aircraft parking ramps, as well as the interior modifications of some facilities, would be required to support the permanent addition of F-16 FTU maintenance, support, and administrative activities. In addition, an auxiliary airfield proximate to the beddown location would be beneficial to support pilot training.

The Special Use Airspace (SUA), Air Traffic Controlled Assigned Airspace (ATCAAs), Military Training Routes (MTRs), and training ranges currently used for training by Holloman AFB would continue to be utilized by the F-16 FTU squadrons. The SUA includes restricted areas and Military Operations Areas (MOAs). The proposed primary airspace includes White Sands Missile Range (WSMR) Restricted Areas R-5107A, B, C, D E, H, J, and K, and R-5111A/B; Beak MOAs and ATCAAs, and the Wiley ATCAA, Talon High A, B, and C and Talon Low A and B MOAs and ATCAA; and the McGregor Range Restricted Areas (R-5103A, B, and C). Secondary airspace that may also be used include the Cato, Pecos, Smitty, and Valentine MOAs.

In addition to the No Action Alternative, two alternatives for the proposed permanent beddown and relocation were evaluated in the EA.

Alternative 1: Permanent Beddown of One Additional F-16 Squadron at Holloman

Under Alternative 1, a squadron composed of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory (BAI) F-16 Block 40 aircraft, currently based at Holloman AFB on an interim basis, would be permanently assigned to Holloman AFB as the 8th Fighter Squadron (8 FS). The estimated maximum 5,000 sorties and 7,500 patterns the 8 FS fly annually at Holloman AFB would be permanent - Roswell International Air Center (ROW) would be used for additional pattern training as an emergency field, flying an estimated additional 92 sorties and performing an estimated 207 additional patterns per year. Under Alternative 1, the additional F-16 FTU squadron would continue to use SUA, ATCAAs, and training ranges proximate to Holloman AFB. The sorties proposed are well within the number of sorties analyzed in the *Special Use Airspace Optimization Final Environmental Impact Statement (Final EIS) and Record of Decision (ROD)* (Air Force, 2021).

An estimated 400 Regular Air Force (RegAF) personnel composed of instructor pilots and support personnel, as well as contracted logistics support personnel currently based at Holloman AFB, would remain. Some minor construction to expand existing facilities, as well as interior renovations for the permanent beddown of the 8 FS, would be necessary. In this signed FONSI, the Air Force is identifying Alternative 1 as the preferred alternative.

Alternative 2: Permanent Beddown of the Existing Interim F-16 Squadron and Adding One Additional F-16 Squadron at Holloman AFB

Under Alternative 2, the squadron of F-16 aircraft FTU described in Alternative 1 would be permanently assigned to Holloman AFB as the 8 FS and an additional F-16 aircraft FTU squadron would be permanently relocated to Holloman AFB. The 8 FS would continue to fly an estimated 5,000 sorties and 7,500 training patterns, and the additional F-16 FTU squadron would fly an estimated maximum additional 5,000 sorties and 7,500 patterns annually at Holloman AFB and in the SUA, ATCAAs, and training ranges as described under Alternative 1. The sorties proposed are well within the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). Under this alternative, the 8 FS and additional F-16 FTU squadron would fly an estimated additional 199 sorties to ROW and perform an estimated 581 additional patterns per year. Under Alternative 2 an additional 475 personnel would be associated with the permanent beddown of two squadrons for a total of approximately 875 personnel composed of 175 active-duty Air Force RegAF personnel and the contractor equivalent of approximately 700 personnel to fill direct and indirect support functions. Inclusion of Alternative 2 provides analysis to evaluate future capacity for a fourth squadron at Holloman AFB. In order to implement Alternative 2, a separate Secretary of the Air Force (SecAF) review and decision would be required.

No Action Alternative

Under the No Action Alternative, the 8 FS would not be permanently based and would remain at Holloman AFB while other beddown locations are considered and additional environmental analysis is completed. If no other location is selected, the F-16s may be placed into temporary storage at Holloman AFB or some other location until a final deposition decision is reached. If it is necessary for the F-16s to be parked for 6 months or longer, the aircraft may be moved to the 309th Aerospace Maintenance and Regeneration Group at Davis-Monthan AFB, Arizona, for preservation storage until the aircraft are ready to return to service. Under the No Action Alternative, the amount of F-16 pilot training could be reduced, and the fighter pilot shortage would be expected to increase.

Summary of Findings

Potentially affected environmental resources were identified through communications with state and federal agencies and review of past environmental documentation. Specific environmental resources with the potential for environmental consequences include airspace management and use; noise; safety; air quality; biological resources; cultural resources; land use; infrastructure, transportation, and utilities; hazardous materials and wastes, contaminated sites, and toxic substances; socioeconomics; and environmental justice and the protection of children.

Airspace Management and Use

There would be negligible, long-term effects on airspace management and use at Holloman AFB and ROW under Alternative 1. Under Alternative 1, the permanent estimated 5,000 annual sorties (about a 10 percent permanent increase in operations) in the Holloman AFB airspace is not expected to impact the operational capacity or necessitate changes to airspace locations or dimensions of any of the airspaces around Holloman AFB. Of the 5,000 annual sorties at Holloman AFB, the 8 FS would fly an estimated additional 92 sorties to ROW and perform an estimated 207 additional patterns per year. The additional 207 patterns that would be flown in the ROW airspace represent a 20 percent increase over the baseline F-16C patterns flown.

There would be minor, long-term effects on airspace management and use at Holloman AFB and ROW under Alternative 2. Under Alternative 2, the 5,000 annual sorties currently flown by the 8 FS and the addition of an estimated 5,000 annual sorties from the proposed additional F-16 FTU squadron (about a 40 percent increase in 8 FS permanent annual operations) in the Holloman AFB airspace are not expected to impact the operational capacity or necessitate changes to airspace locations or dimensions of any of the airspaces around Holloman AFB. Of the 10,000 permanent additional annual sorties at Holloman AFB, the 8 FS and additional F-16 FTU would fly an estimated additional 199 sorties to ROW and perform an estimated 581 additional patterns per year. The projected 10,000 additional sorties are consistent with the projections in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). The additional 581 patterns that would be flown in the ROW airspace represent a 40 percent increase over the baseline F-16C patterns flown.

No airspace modifications are included as part of Alternative 1 or 2. The SUA, ATCAAs, MTRs and training ranges proposed for use have the capacity, are in locations, and have the dimensions necessary to support the additional sorties proposed under both alternatives. Negligible, long-term impacts on airspace are expected from implementation of Alternative 1 and minor, long-term impacts on airspace are expected from implementation of Alternative 2. Under Alternative 1, the estimated 5,000 annual training sorties flown by the 8 FS in the affected SUA and ATCAAs would be permanent. Under Alternative 2, there would be an increase of an estimated 10,000 permanent annual training sorties in the affected SUA and ATCAAs. In addition, there would be an increase of 65 annual sorties in the MTRs. Under both alternatives, the proposed permanent beddown would use all the SUA and ATCAAs; however, the net number of sorties across the SUA and ATCAAs (except the Talon MOAs and ATCAA) would not increase. The number of total sorties that would be flown by Holloman AFB within the Talon MOAs and ATCAA would not exceed the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). The minor increase in annual sorties within MTRs would result in negligible impact on airspace.

Noise

There would be negligible, long-term effects on the noise environments of Holloman AFB and ROW under Alternatives 1 or 2. Under Alternative 1, the noise environment at Holloman AFB would be identical to existing conditions. The noise levels generated by the increase in sorties and closed patterns would increase the overall noise environment in the vicinity of ROW; however, at representative noise sensitive locations modeled, the day-night average sound level (DNL), would increase by less than 1 decibel on the A-weighted scale (dBA) DNL. The DNL at these points of interest (POIs) and the surrounding areas would be long term, likely unnoticeable, and not significant under Alternative 1 for ROW. Under Alternative 2, noise levels generated by the increase in sorties and closed patterns would increase the overall noise environment in the vicinity of Holloman AFB and ROW; however, at representative noise sensitive locations modeled, the DNL would increase by an amount ranging from 0- to 1-dBA. The increased DNL at these POIs and the surrounding areas would be long term, likely unnoticeable, and not significant.

Negligible, long-term impacts on the noise environment within the SUA, ATCAAs, and MTRs are expected from the implementation of Alternative 1 or 2. Under Alternative 1, the noise environment within SUAs, ATCAAs, and MTRs would be identical to the existing conditions, with operations by the 8 FS becoming permanent. Subsonic and supersonic noise levels caused by aircraft operations within the SUA, ATCAAs, and MTRs have previously been analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021) and the *Holloman AFB Combat Air Forces Adversary Air EA* (Air Force, 2020). Assessments for supersonic noise indicate that projected c-weighted day night levels (CDNLs) within the MOAs would not exceed the United States (US) Army Public Health Command and United States Environmental Protection Agency (USEPA) thresholds for significant impact and, similarly, no adverse impacts to hearing and health would be anticipated. The most commonly used flight tract for supersonic operations near White Sands National Park (WSNP) Visitor Center is 5-miles to the east. Those operations are typically flown at 18,000 to 30,000 feet (ft) above mean sea level (MSL) and at that lateral distance would not generate overpressures at WSNP Visitor Center. A smaller number of flights are conducted over Yonder East but most are conducted at 18,000 ft above MSL or higher and are usually flown a few miles to the west of the WSNP Visitor Center. As a cooperating agency, the National Park Service (NPS) expressed concerns about aircraft noise in general due to Holloman AFB flight operations and in particular about sonic booms at WSNP. The Air Force responded to NPS by providing information about Holloman AFB supersonic operations, describing their standard supersonic flight profiles and airspace utilization. As part of this, noise modeling was conducted to assess sonic boom levels at the WSNP Visitor Center. The NPS also provided a letter after the Draft EA and Proposed FONSI comment period expired expressing additional concerns, especially if Alternative 2 were implemented and accordingly the number of squadrons were to be increased over the interim level of squadrons. That concern was considered and the Air Force is identifying Alternative 1, which makes the existing interim squadron permanent and does not add an additional squadron, as the preferred alternative.

Supersonic profiles at higher altitudes (greater than 30,000 ft above MSL) would be audible but would not generate overpressures at WSNP Visitor Center that would cause damage to historic pueblo-adobe construction. Even the smaller number of supersonic operations at 18,000 ft MSL are flown far enough laterally from the WSNP Visitor Center such that they would not generate overpressures at WSNP Visitor Center. Given the supersonic flight parameters of interim and proposed permanent F-16 operations from Holloman AFB and the many studies on effects of overpressure from sonic booms, absent scientific data showing that overpressures are different than estimated, Alternative 1 or Alternative 2 would not cause a significant effect on structures at WSNP. Holloman AFB personnel are willing to work with NPS to consider more data if it is forthcoming and to ensure supersonic flight profiles and rules of flight are followed.

Note that airspace noise was not analyzed for the Wiley ATCAA and Pecos MOAs in either the *Special Use Airspace Optimization Final EIS and ROD* or the *Holloman AFB Combat Air Forces Adversary Air EA* analyses. However, while the proposed additional FTU squadrons under Alternative 2 would use all the SUA and ATCAAs, including the Wiley ATCAA and Pecos MOAs, the net number of sorties across all proposed SUA and ATCAAs would not increase, and therefore would result in no significant change in noise levels for these airspaces. The minor increase in the number of sorties within the MTRs under Alternative 2 would result in a long-term, negligible impact on the noise environment.

Safety

No impacts on safety at Holloman AFB, ROW, and in the SUA, ATCAAs, and MTRs are expected from implementation of Alternative 1 or 2. Alternatives 1 and 2 would comply with flight safety rules following applicable airport, Federal Aviation Administration (FAA), and Air Force safety guidance as identified in Defense Contract Management Agency Instruction 2819.01 including ground safety (emergency response and safety zones), explosives safety, and flight safety, including bird/wildlife-aircraft strike hazard (BASH) procedures.

Air Quality

There would be no impact on the region's ability to meet National Ambient Air Quality Standards (NAAQS) for all regulated pollutants under Alternative 1 or 2. Holloman AFB is part of the El Paso-Las Cruces-Alamogordo Interstate Air Quality Control Region (AQCR). Currently, Otero County is designated as an unclassifiable/attainment area for all criteria pollutants (per designations included in the Air Force's Air Conformity Applicability Model [ACAM]) and as a result are not subject to General Conformity regulations (40 CFR 51 and 93). Holloman AFB operates under a Stationary Source Operating Permit and potential emissions of all criteria pollutants should not exceed the 250 tons per year (tpy) major Prevention of Significant Deterioration (PSD) source threshold.

Under Alternative 1, aircraft operations at Holloman AFB would not increase or change in any way. The only new air emissions would be direct and indirect emissions sources resulting from construction and post-construction activities. All emissions are below the 250 tpy (and 25 tpy for lead [Pb]) insignificance indicator for all criteria pollutants. Aircraft operations at ROW would not increase or change current operational levels under Alternative 1 and no new construction is planned. As a result, no changes to air emissions are anticipated at ROW under this alternative.

No changes in operations within the SUA are proposed under Alternative 1. As a result, there would be no impacts to air quality in the airspaces used for training under this alternative.

Under Alternative 2, increased air emissions would be associated with aircraft operations of the additional F-16 FTU squadron at Holloman AFB and ROW. This increase includes emissions from ground support activities in the vicinity of the Holloman AFB airfield, proposed new construction and renovation, and proposed new personnel commuting to the installation in their vehicles. All of the criteria pollutant emissions associated with airfield operations, new facilities construction, and new facilities operations are below the 250 tpy (and 25 tpy for Pb) insignificance indicator. The increase in the levels of aircraft ground support activities and the increase in number of new personnel would result in additional criteria pollutant emissions. These emission increases would result in long-term, moderate, adverse effects on air quality in and around the vicinity of the base. The analysis results demonstrate that, if implemented, Alternative 2 would result in increased emissions, but is not likely to interfere with the region's ability to maintain compliance with the NAAQS for criteria pollutants.

Under Alternative 2, the SUA used by Holloman AFB would include additional sorties at or below 3,000 ft above ground level (AGL). Air quality analysis from aircraft operations within some of the proposed SUA under Alternative 2 were previously analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021) and have therefore been excluded from this analysis. Out of the proposed additional 5,000 F-16C sorties analyzed, almost all sorties include low-altitude (less than 3,000 ft AGL) operations. Estimated net emissions from the SUA would be entirely additive, as implementation of Alternative 2 in the SUA would not alter existing operations in the SUA. WSMR Restricted airspace overlies five counties in New Mexico. A small portion of Doña Ana County, outside the boundaries of WSMR, is in a regulatory area for small particulate matter (PM_{10}) and ozone (O_3) (volatile organic compound [VOC] and oxides of nitrogen [NO_x] are precursors). As a result, WSMR emissions were compared against the insignificance indicator level of 100 tpy for VOC and NO_x (ozone precursors) and for PM_{10}. Estimated emissions for VOC and PM_{10} in WSMR would be well below the insignificance indicator levels, and emissions for all other attainment level criteria pollutants would be safely below the 250 tpy PSD indicator levels. There would be long-term, moderate, adverse effects on ambient air quality in the WSMR airspace. Additionally, there may be some haze that would develop as the aircraft moves across its flight path, but the haze would likely occur for a very short duration and would dissipate easily over the large areas of the SUA. Therefore, impacts on visibility from the alternative within Class 1 areas in proximity to WSMR would be short-term, adverse, but not likely significant based on the dispersive nature of these emissions in the vast expanses of these airspaces. The McGregor Range Restricted Areas overlies portions of Otero County in New Mexico, which is designated attainment for all criteria pollutants. The highest emissions from proposed operations in this SUA would be well below the 250 tpy insignificance indicator levels. The Pecos MOAs overlie counties in New Mexico that are designated attainment for all criteria pollutants. The highest emissions from proposed operations in this SUA would be well below the 250 tpy insignificance indicator levels. Overall, the additional emissions caused by F-16C operations in the any of the SUA analyzed would not be considered significant with respect to air quality impacts.

Biological Resources

Under Alternatives 1 or 2, ground disturbing activities at Holloman AFB would be limited to minor construction in areas either improved or previously disturbed, and the contractor would be required to implement best management practices (BMPs) and obtain permits to limit the disturbance to native plants (if present). As such, no impact to native vegetation would be associated with this alternative. Potential impacts to wildlife and threatened and endangered species would be associated with the short-term presence of heavy equipment and noise associated with construction activities. The potential short-term impacts would not jeopardize the continued existence of a species, result in an overall decrease in population diversity, abundance, or fitness, or in any way impact a listed species.

Under Alternatives 1 or 2, the additional aircraft and operations at Holloman AFB may increase the potential for long-term impacts to birds and other wildlife. The continued adherence to the BASH prevention program would reduce the likelihood for bird and wildlife aircraft strikes. The state listed Baird's sparrow, bald eagle, neotropic cormorant, and peregrine falcon are known to occur only as transient species on Holloman AFB and would not be present on habitats adjacent to the airfield; therefore, they would not be impacted by implementation of Alternatives 1 or 2. The monarch butterfly also has the potential to occur on Holloman AFB. While there would be no impacts to monarch butterfly habitat, they may be subject to direct impacts and mortality from aircraft strikes and jet blast. While potential monarch butterfly mortality from aircraft strikes and jet blast has not been quantified, there is no evidence to suggest that this is a major threat to monarch butterflies. The U.S. Air Force Pollinator Conservation Reference Guide does not identify increased flight levels as threats to monarch butterflies and there are no management recommendations related to flight activities identified in the guide, as most of the recommendations are focused on protecting habitat, increasing habitat, and reducing pesticide use

(United States Fish and Wildlife Service [USFWS], 2017). As such, the Air Force has made a “may affect, but not likely to adversely affect” determination for the federal candidate monarch butterfly at Holloman AFB from implementation of Alternatives 1 or 2.

On ROW, under Alternatives 1 or 2, there would be no ground-disturbing activities. Like Holloman AFB, BASH reduction measures would limit potential impacts on birds and other wildlife from aircraft strikes and potential impacts within ROW airspace would be long-term and minor. While the lesser prairie-chicken has been documented in Chaves County, it would not experience any change in existing noise levels under Alternative 1, and only experience a slightly increased noise environment under Alternative 2. The Proposed Action would not be expected to adversely affect the lesser prairie-chicken or its habitat. While piping plover have been documented in Chaves County, habitat for piping plover is not located near ROW. As with Holloman AFB, the monarch butterfly has the potential to occur on ROW. The Air Force has made a “no effect” determination for the lesser prairie-chicken and piping plover, and a “may affect, but not likely to adversely affect” determination for the monarch butterfly at ROW from implementation of Alternatives 1 or 2.

Within the SUA, ATCAAs, and training ranges under Alternative 1 or 2, the noise environment and ground disturbing activities would not change from the current conditions. Potential long-term impacts on wildlife from the continued or increased use of chaff and flare in the SUA and ATCAAs would be limited to wildland fire from flare use, a startle effect from chaff and flare deployment, inhalation of chaff fibers or flare combustion products, and ingestion of plastic caps from chaff and flare deployment. These potential impacts, however, would be minimal because of use restrictions, the low toxicity of components, and the minimal noise and visibility associated with these munitions. The continued and potential increased use of chaff and flares would have potential long-term and minor impacts on wildlife under Alternatives 1 or 2.

The aircraft movement, aircraft noise, and the use of defensive countermeasures in the SUA, ATCAAs, MTRs, and training ranges would have no effect on federally listed amphibians, crustaceans, fish, mollusks, plants, and reptiles, especially considering there is no net change in the number of operations or noise emissions in the SUA or ATCAAs and the continued use of chaff and flare would not impact species or habitat. In addition, amphibians, fish, mollusks, and reptiles, as well as the federally listed New Mexico meadow jumping mouse and Peñasco least chipmunk, would not be startled by occasional low altitude F-16 flights, as aircraft movement would be obscured by vegetation, woody debris, and rocks, and there would be no effect from implementation of Alternatives 1 or 2. The Air Force has made a “no effect” determination for these species.

The potential impacts from low-flying aircraft during training to the listed lesser prairie-chicken, northern aplomado falcon, Mexican spotted owl, piping plover, southwestern willow flycatcher, yellow-billed cuckoo and monarch butterfly include aircraft strikes or the possibility that breeding and foraging birds and the Mexican gray wolf may be startled. The potential for aircraft strikes of these species is low. Moreover, aircraft training has occurred in these airspaces for decades, and most wildlife has likely become habituated to aircraft movement and noise. Furthermore, the sonic boom events would be highly isolated and rare in the SUA and ATCAAs and would occur in areas where supersonic flights currently occur with military training activities. As such, continued and increased number of sonic booms would have no impact on threatened and endangered species. There would be no ground-disturbing activities from the permanent operations in the airspace and there is no critical habitat on training ranges, therefore, there would be no effect to critical habitat beneath the SUA, ATCAAs, and MTRs. The Air Force has made a “may affect, not likely to jeopardize the continued existence” determination for northern aplomado falcon, Mexican gray wolf, and the monarch butterfly. The Air Force has made a “may affect, but not likely to adversely affect” determination for lesser prairie-chicken, Mexican spotted owl, piping plover, southwestern willow flycatcher, and yellow-billed cuckoo. A “no effect” determination has also been made for designated critical habitat located within the SUA, ATCAAs, and MTRs. The Air Force received concurrence from the US Fish and Wildlife Service field office.

Similar to the federally listed species, the Proposed Action would not impact state listed amphibians, crustaceans, fish, mollusks, or plants in the SUA, ATCAA, and MTR region of influence (ROI). In addition, potential impacts to state listed birds would be long term and minor as described above for federally listed birds. There would be no potential impacts to the state listed fossorial mammals by occasional low-altitude F-16 flights, as aircraft movement would be obscured by vegetation, woody debris, and rocks for these species. Potential impacts to spotted bat would be long-term and minor, the additional operations are expected to have minimal disturbance to foraging activities. Impacts to the Texas state listed black bear (*Ursus americanus*) within the IR-

192/194 MTR would be the same as those described for the Mexican gray wolf, with potential long-term, minor impacts due to noise and visual disturbance from low-level flights.

Since there would be no ground-disturbing activities from continued operations within the SUA, ATCAAs, MTRs there would be no impact to invasive plants or wildlife under Alternatives 1 or 2. In addition, because the training range impact areas are well maintained and contain very little vegetation, there would be no impact to invasive plants or wildlife on training ranges.

Cultural Resources

Under Alternative 1, ground disturbing activities at Holloman AFB would be limited to minor construction in areas that are improved or previously disturbed. No historic properties are located within or adjacent to these areas. No ground disturbance or construction is planned at ROW. The estimated 5,000 annual training sorties currently flown by the 8 FS would become permanent, resulting in no true increase to current noise levels. Forty-seven architectural historic properties listed in the National Register of Historic Places (NRHP) are located beneath the SUA and ATCAAs, including the White Sands Historic District, located within White Sands National Park and Gran Quivira Mission Complex, part of Salina Pueblo Missions National Monument (both located under WSMR no fly zones). In addition to these architectural resources, approximately 60 NRHP-listed archaeological sites (both subsurface and those with surface remains), lie in the counties under the airspace. No known traditional cultural properties (TCPs) are located under the airspace. Sound levels in the existing noise environment are well beneath the threshold know to impact structural integrity, and ground disturbance would be limited to existing ranges. Seventy-one architectural historic properties listed in the NRHP are located beneath the MTRs. In addition to these architectural resources, approximately 70 NRHP-listed archaeological sites (both subsurface and those with surface remains), lie in the counties under the MTRs. No known TCPs are located under the MTRs. No ground disturbance is associated with use of established MTRs. Per 36 CFR § 800.5, it is determined that implementation of Alternative 1 would result in no adverse effects to historic properties. Concurrence with this determination was received from the New Mexico State Historic Preservation Office (SHPO).

Under Alternative 2, ground disturbing activities at Holloman AFB would also be limited to minor construction in areas that are either improved or previously disturbed. No historic properties are located within or adjacent to these areas. No ground disturbance or construction is planned at ROW. Approximately 5,000 interim sorties and 7,500 training patterns would be made permanent and an additional 5,000 interim sorties and 7,500 training patterns would be added in existing airspace, with negligible impacts to the noise environment and ground disturbance limited to existing ranges. No ground disturbance is associated with use of established MTRs. Therefore, as outlined in Alternative 1, per 36 CFR § 800.5, it is determined that implementation of Alternative 2 would result in no adverse effects to historic properties. Concurrence with this determination was received from the New Mexico SHPO.

Land Use

Changes in the noise environment can affect land use compatibility, resulting in increased noise exposure. Under Alternative 1, there would be no change in the noise environment at Holloman AFB, including the representative POIs. At ROW, the number of acres (ac) under the greater than 65-dBA DNL noise contour would increase approximately 51 ac; however, representative POI noise levels increased by less than 1-dBA DNL. Changes to the noise environment of these POIs and the surrounding areas would be long term but likely unnoticeable; therefore, impacts to land use under Alternative 1 would be negligible.

Under Alternative 2, the number of ac under the greater than 65-dBA DNL noise contour increased approximately 533 ac at Holloman AFB. Noise levels at representative POIs would increase from 0- to 1-dBA DNL. The number of ac under the greater than 65-dBA DNL noise contour would increase approximately 130 ac at ROW. Noise levels at representative POIs would increase by less than 1-dBA DNL. As with Holloman AFB, while the dBA DNL increases of these POIs and the surrounding areas would be long term, the change in noise level would likely not be noticeable. Therefore, impacts to land use under Alternative 2 would be long-term, but negligible.

Infrastructure, Transportation, and Utilities

Under Alternative 1, there would be no additional demand on infrastructure, transportation, or utilities on Holloman AFB. No major construction is proposed, with the exception of some minor new construction for expansion and renovation of existing facilities. Existing facilities are fully serviced by utilities such as gas, electric, water/wastewater, and solid waste. Increased traffic is not expected; therefore, no impacts to access at installation gates or on base are anticipated. As such, no impacts are expected to infrastructure, transportation, or utilities on Holloman AFB. No additional demand on infrastructure, transportation, and utilities are expected at ROW. As such, there would be no impacts to infrastructure, transportation, or utilities under Alternative 1.

Under Alternative 2, the addition of 475 personnel would result in increased vehicular traffic at Holloman AFB and could cause additional congestion at the Main Gate, particularly during peak traffic times. Otherwise, additional traffic on the installation is not anticipated to reduce the level of service, as the roadway network is expansive and provides for additional capacity. The installation's electric, natural gas, water/wastewater, and solid waste management systems have adequate capacity to support the additional 475 personnel and their families. No additional demand on infrastructure, transportation, and utilities is expected at ROW. Potential impacts to infrastructure at Holloman AFB, in the form of possible traffic congestion at the Main Gate, would be long-term and minor under Alternative 2.

Hazardous Materials and Waste, Environmental Restoration Program Sites, and Toxic Substances

Under Alternatives 1 or 2, short- and long-term negligible adverse impacts on hazardous materials, petroleum products, and hazardous wastes could occur at Holloman AFB and ROW. Hazardous materials and petroleum products would be contained, stored, and managed appropriately in accordance with Air Force Manual (AFMAN) 32-7002, Environmental Compliance and Pollution Prevention, and the Holloman AFB Spill Prevention Control and Countermeasures Plan and Emergency Response procedures to minimize the potential for release. Hazardous materials required and used at ROW would be procured, controlled, and tracked by the fixed-base operator (FBO). Given the relatively small quantity of sorties planned for ROW, the impact from the increased hazardous materials used to support the additional F-16 aircraft would be long-term and negligible. Significant impacts from hazardous materials and petroleum products would not be expected at Holloman AFB or ROW.

There are no Environmental Restoration Program (ERP) sites located proximate to the facilities identified for construction and renovation at Holloman AFB. The main ramp area of Holloman AFB is flanked by a number of ERP sites. Avoidance of these sites would result in no impact on contaminated sites from implementation of Alternative 2 at Holloman AFB. The McGaffey and Main Groundwater Plume is located about 3 miles away from the boundaries of ROW. From this distance, the groundwater plume would not impact ROW operations. Additionally, any site activity at ROW would not impact the existing groundwater plume. Therefore, there are no impacts to ERP sites at under Alternative 1.

No asbestos survey information is available for the buildings identified for construction and renovation at Holloman AFB. No asbestos-containing material (ACM) or lead-based paint (LBP) impacts would be expected during renovations and construction with adherence to the Holloman AFB Asbestos Management and Operations Plan. Should levels of radon above 4 picoCuries per liter (pCi/L) be detected during construction or renovation projects at Holloman AFB, the Installation Radiation Safety Officer would work with Installation civil engineering personnel to develop an interim mitigation plan and a long-term mitigation plan. No environmental impacts from radon are expected under Alternative 1. Removal of light fixtures has the potential to disturb polychlorinated biphenyls (PCBs). Fixtures would be disposed of in accordance with Air Force Instruction (AFI) 32-7086, Hazardous Material Management and the removal and proper disposal of light fixtures containing PCBs would be a long-term, negligible beneficial impact.

Socioeconomics

Under Alternative 1, minor construction projects at Holloman AFB would result in beneficial but short-term negligible impacts to the local economy through increases in payroll taxes, employment rates, and local sales volumes. The approximately 400 RegAF personnel composed of instructor pilots and support personnel, as well as contracted logistics support personnel currently based at Holloman AFB, would remain and become permanent staff. There would be no economic impact from converting 400 staff from temporary to permanent and no additional economic impact from continued F-16 FTU squadron operations. Sortie and training pattern increases at ROW represent a small increase in total military flights and only a negligible increase in expenditures in the ROW region would be expected. The increase in noise at POIs and surrounding areas at both Holloman AFB and ROW would be long term, likely unnoticeable, and not significant, having no impact on housing values and recreational opportunities.

Under Alternative 2, minor construction projects at Holloman AFB would also result in beneficial but short-term negligible impacts to the local economy. The permanent relocation of two squadrons would include increasing staffing levels 16 percent above those reported in 2016. An unknown number of additional family members and FTU students would also increase the population on base and within Otero County. It is anticipated that the City of Alamogordo and Otero County would have the resources to accommodate the population change and continue to provide public services such as schools, law enforcement, firefighting, and medical services with no significant impacts. Additionally, there is no indication that there would be inadequate housing in the region for the additional personnel, their families, and potential additional FTU students. Increased expenditures would provide a long-term, minor beneficial impact on the ROI through increased payroll tax revenue and the purchase of additional equipment, materials, and fuel needed for aircraft operations and maintenance under Alternative 2. Additional sorties and training patterns at ROW continue to represent a small increase in total military flights. Negligible increases in expenditures in the ROW region would be expected from the additional sorties. The increase in the noise environment from POIs and surrounding areas at Holloman AFB and ROW would be long term, likely unnoticeable, and not significant. This increase in noise would be expected to have no impact on housing values and recreational opportunities.

Environmental Justice and the Protection of Children

Implementation of Alternative 1 or 2 at Holloman AFB or ROW would not result in any significant adverse environmental impacts. There would be no disproportionate impact to minority or low-income populations, and neither alternative would not result in disproportionate environmental health or safety risks to children. Alternative 1 or 2 at Holloman AFB or ROW would not substantially affect populations covered by Executive Order (EO) 12898 or 13405 by excluding persons, denying persons benefits, or subjecting persons to discrimination or disproportionate environmental or human health risks.

Reasonably Foreseeable Future Actions

The EA considered the potential incremental impacts that could result from Proposed Action and alternatives when added to reasonably foreseeable future actions. No potentially significant impacts were identified as a result of the Proposed Action when combined with reasonably foreseeable future actions.

Mitigation

The EA analysis concluded that the Proposed Action and alternatives would not result in significant environmental impacts; therefore, no mitigation measures are required. Best Management Practices and environmental commitments are described and recommended in the EA where applicable.

Conclusion

Finding of No Significant Impact. After review of the EA prepared in accordance with the requirements of the NEPA; CEQ regulations; and 32 CFR Part 989, *EIAP,* and which is hereby incorporated by reference, I have determined that the proposed F-16 permanent beddown and relocation at Holloman AFB under Alternatives 1 or 2 would not have a significant impact on the quality of the human or natural environment. Accordingly, an EIS will not be prepared. This decision has been made after considering all submitted information, including a review of public and agency comments submitted during the 30-day public comment period, and considering a full range of practical alternatives that meet project requirements and are within the legal authority of the United States Air Force.

SPEARS.JUSTIN.B.1132139586 Digitally signed by SPEARS.JUSTIN.B.1132139586 Date: 2023.09.19 17:29:08 -06'00'

9/19/23

JUSTIN B. SPEARS, Colonel, USAF
Commander, 49th Wing

DATE

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LIST OF ACRONYMS AND ABBREVIATIONS

8 FS	8th Fighter Squadron
311 FS	311th Fighter Squadron
314 FS	314th Fighter Squadron
49 CES/CEIE	49th Civil Engineer Squadron/Environmental Compliance
49 MXG	49th Maintenance Group
49 WG	49th Wing
54 FG	54th Fighter Group
ac	acre(s)
ACAM	Air Conformity Applicability Model
ACM	asbestos-containing material
ACS	American Community Survey
AETC	Air Education and Training Command
AFB	Air Force Base
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFOSH	Air Force Occupational Safety and Health
AFPD	Air Force Policy Directive
AEP	Airport Emergency Plan
AGL	above ground level
Air Force	United States Air Force
AMU	Aircraft Maintenance Unit
AOC	Area of Concern
APE	Area of Potential Effects
APZ	Accident potential zone
AQCR	Air Quality Control Region
AST	aboveground storage tank
ATC	Air Traffic Control
ATCAA	Air Traffic Control Assigned Airspace
BAI	Backup Aircraft Inventory
BASH	Bird Aircraft Strike Hazard
BGEPA	Bald and Golden Eagle Protection Act
BISON-M	Biota Information System of New Mexico
BLM	Bureau of Land Management
BMP	best management practice
CAA	Clean Air Act
CATM	captive air training missiles
CDDAR	Crash Damaged or Disabled Aircraft Recovery
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
COC	Community of Comparison
CSEL	C-weighted sound exposure level
CWA	Clean Water Act
CZ	Clear zone
DAF	Department of the Air Force
dBA	decibels on the A-weighted scale
DNL	day-night average sound level
DoD	Department of Defense
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ERP	Environmental Restoration Program
ESA	Endangered Species Act
ESOHC	Environmental Safety and Occupational Health Council

ft	foot/feet
FAA	Federal Aviation Administration
FBO	fixed-base operator
FONSI	Finding of No Significant Impact
FTU	formal training unit
FY	fiscal year
GWP	Global Warming Potential
GHG	Greenhouse gases
IAP	initial accumulation points
IFR	Instrument Flight Rules
INRMP	Integrated Natural Resources Management Plan
IPaC	Information for Planning and Consultation
Kelly Field	Joint Base San Antonio-Lackland (Kelly Field), Texas
kHz	kilohertz
kV	kilovolt
LBP	lead-based paint
L_{dnmr}	onset-rate adjusted monthly day-night average sound level
LHWC	Lake Holloman Wetland Complex
LTO	landing and take-off
MBTA	Migratory Bird Treaty Act
MGD	million gallons per day
MG	million gallons
mi^2	square miles
MILCON	Military Construction
MMRP	Military Munitions Response Program
MOA	Military Operations Area
MSL	mean sea level
MTR	Military Training Route
MVA	megavolt ampere
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMCRIS	New Mexico Cultural Resources Information System
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environmental Department
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NRHP	National Register of Historic Places
NTSB	National Transportation Safety Board
O_3	ozone
OSHA	Occupational Safety and Health Administration
PAA	Primary Aircraft Assigned
Pb	Lead
PCBs	polychlorinated biphenyls
pCi/L	picoCuries per liter
$PM_{2.5}$	respirable particulate matter, including particulates equal to or less than 2.5 microns in diameter
PM_{10}	respirable particulate matter, including particulates equal to or less than 10 microns in diameter
POI	Point of Interest
ppm	parts per million
PSD	Prevention of Significant Deterioration
psf	pounds per square foot

Q-D	quantity distance
RCRA	Resource Conservation and Recovery Act
RegAF	Regular Air Force
ROAA	Record of Air Analysis
ROD	Record of Decision
ROI	region of influence
ROW	Roswell International Air Center
RPZ	runway protection zone
SCP	State Cleanup Program
SecAF	Secretary of the Air Force
SHPO	State Historic Preservation Officer
SO_2	sulfur dioxide
SPCCP	Spill Prevention Control and Countermeasures Plan
SUA	special use airspace
SWPPP	Stormwater Pollution Prevention Plan
TCE	trichloroethene
TCP	traditional cultural properties
TGO	touch and go
tpy	tons per year
US	United States
USACE	US Army Corps of Engineers
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
VOC	volatile organic compound
WHMP	Wildlife Hazard Management Plan
WSMR	White Sands Missile Range
WWTP	wastewater treatment plant

CHAPTER 1 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The United States Air Force (Air Force) proposes to permanently relocate the F-16 Fighting Falcon Formal Training Unit (FTU) that is currently based on an interim basis at Holloman Air Force Base (AFB), New Mexico. Furthermore, the Air Force proposes to permanently relocate a fourth F-16 FTU squadron in support of the F-16 aircraft FTU Permanent Beddown and Relocation Plan. The mission of the F-16 FTU is to train F-16 pilots and maintainers to support the Air Force. The proposed permanent relocation would allow for sustained F-16 pilot training to meet Air Force pilot production goals. The permanent relocation of F-16 squadrons to Holloman AFB would also allow for continuity in F-16 pilot training and maintenance.

The Environmental Impact Analysis Process (EIAP) allows the Department of the Air Force (DAF) to thoroughly examine the Proposed Action to permanently relocate F-16 FTU squadrons, to identify potential issues affecting the environment during the decision-making process A description of the EIAP and associated laws and regulations can be found in **Appendix A.** The EIAP, in compliance with National Environmental Policy Act (NEPA) guidance, includes public and agency review of information pertinent to the Proposed Action and alternatives. Information about stakeholder coordination and consultation, as well as letters sent and responses received, are included in **Appendix A**.

1.2 BACKGROUND

The Proposed Action is part of the F-16 Beddown and Relocation Plan, which was put in place to produce more F-16 fighter pilots and provide Hill AFB the capacity to host F-35 operations. Under the plan, the Air Force relocated two squadrons of F-16 aircraft from Hill AFB to locations currently hosting an F-16 FTU. These squadrons were relocated from Hill AFB because of insufficient capacity at Hill AFB to support both the F-35 and F-16 operations. It was determined in the F-16 Beddown and Relocation Plan that the best use for the F-16s departing Hill AFB was to be reassigned into a training mission to increase fighter pilot production. In 2017, the Air Force completed the *Interim Relocation of Two F-16 Squadrons Environmental Assessment* (EA). The relocation was intended to be temporary (approximately 5 years) during selection and preparation of the permanent F-16 FTU beddown locations. The EA analyzed four potential interim relocation installations considered by the Air Force for the F-16 mission that included Holloman AFB, New Mexico; Joint Base San Antonio-Lackland (Kelly Field), Texas; and Luke AFB and Tucson International Airport (Morris Air National Guard Base), Arizona.

After the completion of the EA, the Secretary of the Air Force (SecAF) determined that both squadrons of F-16s, a total of 45 aircraft, would be relocated to Holloman AFB on an interim basis. In October 2017, the 8th Fighter Squadron (8 FS), composed of 28 F-16 aircraft, relocated from Hill AFB to Holloman AFB. Prior to the interim relocation, two squadrons of F-16s were assigned to the 54th Fighter Group (54 FG) at Holloman AFB, the 311th Fighter Squadron (311 FS), and 314th Fighter Squadron (314 FS). The remaining 17 F-16s continued to be assigned to Hill AFB but were temporarily located at other bases. In May 2019, the SecAF permanently relocated the other 17 aircraft to Nellis AFB, Nevada, to meet evolving mission needs. In February 2020, the SecAF assessed that, pending completion of environmental analysis, the F-16 FTU would be permanently relocated. In April 2020, SecAF approved Holloman AFB as the preferred location for permanent relocation.

1.3 Purpose and Need for the Action

The purpose of the Proposed Action is to optimize fighter pilot production to meet the Air Education Training Command (AETC) mission of training and educating Airmen. Furthermore, the Proposed Action would realign AETC assets to meet mission requirements specified in the F-16 Beddown and Relocation Plan to address fighter production shortfalls.

The need for the Proposed Action is to permanently base the F-16 FTU. Air Force readiness is currently affected by several issues, including training, weapon system sustainment, and facilities. Training in particular has become an increasing concern as worldwide commitments, high operations tempo, and fiscal and manpower limitations detract from available training resources. The Proposed Action would facilitate AETC's ability to fulfill its training mission.

1.4 Cooperating Agencies

The Air Force is the lead agency for this EA and the National Park Service (NPS) is a cooperating agency as defined in 40 Code of Federal Regulations (CFR) 1508.5. White Sands National Park, which protects a portion of the world's largest gypsum dunefield, lies directly southwest of Holloman AFB, sharing a small portion of its boundary with the base. The NPS has provided subject matter expertise during the development of the EA. The NPS does not have a NEPA requirement or a decision to make on this proposal. Information about cooperating agency coordination is included in **Appendix A**.

CHAPTER 2 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The Air Force is proposing to permanently beddown F-16 FTU squadrons in support of the FTU Permanent Beddown and Relocation Plan. The Proposed Action would allow AETC to continue to optimize fighter pilot production to meet its mission.

The Proposed Action would include permanent relocation of the F-16 aircraft; the pilot, maintenance, and support personnel; and support vehicles and equipment. The permanent relocation of the F-16 FTU may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities, as well as for administrative functions by FTU personnel. For details on the number of aircraft required and proposed construction and renovations, see **Sections 2.3.2** and **2.3.3**. In addition, an auxiliary airfield proximate to the beddown location would be beneficial to support pilot training.

2.2 ALTERNATIVE SELECTION PROCESS

In accordance with 32 CFR § 989.8(c), selection standards were developed to establish a means for determining if an alternative meets the purpose and need for the action, the reasonableness of an alternative, and whether an alternative should be carried forward for further analysis in the EA. Consistent with 32 CFR § 989.8(c), the following selection standards were used to identify reasonable alternatives for analysis in the EA.

2.2.1 *Selection Standards*

1. **Mission Compatibility.** Only installations currently assigned with a training mission and F-16s are considered as candidates for the permanent relocation because those locations already have F-16 training simulators; operations, maintenance, and academic training facilities; access to airspace and ranges, including the ability to drop training munitions; a hydrazine response area on the airfield; hydrazine storage and servicing facilities; and barriers compatible with F-16 operations.
2. **Available Facilities and Infrastructure.** The location must have adequate facilities and infrastructure to maximize the efficiencies of the Proposed Action and to offer the ability to optimize the F-16 pilot training mission. The permanent beddown installation should have available facilities, to include training simulators; operations, maintenance, and academic training facilities; live munitions loading areas on the airfield; as well as adequate aircraft ramp space and existing infrastructure requiring only limited construction or renovation to support the additional F-16s.
3. **Adequate Airspace and Range Capacity and Availability.** The proposed location must have access to existing airspace that is adequate in size and configured to permit the full spectrum of F-16 Tactics, Techniques, and Procedures. The required airspace dimension and vertical extent (floor and ceiling) of the airspace must provide the size and configuration to support aerial combat training missions; permit long-range, high-speed aircraft combat; and allow the F-16s to operate at a broad range of altitudes consistent with combat tactics. Furthermore, the airspace and ranges must be located within sufficient proximity to support unrefueled training. Available ranges must allow for the ability to drop training, inert, and live munitions. AETC has a finite number of flying hours that can be used to train F-16 pilots and as such the need to maximize training time and minimize low-value transit time.
4. **Schedule and Timing**. The selected installation must be able to meet the immediate beddown and sustainment timelines for the additional F-16 FTU squadrons by fiscal year (FY) 2023.

2.2.2 *Alternatives Considered*

The NEPA and Council on Environmental Quality (CEQ) regulations mandate the consideration of reasonable alternatives to the Proposed Action. “Reasonable alternatives” are those that could also be used to meet the purpose of and need for the Proposed Action. The NEPA process is intended to support flexible, informed decision-making; the analysis provided in this EA, and feedback from stakeholders, will inform decisions made about whether, when, and how to execute the Proposed Action. Among the alternatives evaluated is the No Action Alternative, which evaluates the potential consequences of not undertaking the Proposed Action. This section presents reasonable alternatives for evaluation and assesses them relative to selection standards.

2.2.2.1 Screening of Candidate Base Location Alternatives

Two locations were considered by the Air Force for the permanent beddown of the F-16 FTU and include Holloman AFB, New Mexico and Kelly Field, Texas (**Figure 2-1**). At this time, no other Continental United States bases potentially meet the purpose of and need for the Proposed Action and candidate base location selection standards. Kelly Field was eliminated from further consideration because it did not meet the purpose and need for the action or the selection standards as described in **Section 2.4.1**. While Luke AFB and Morris Air National Guard Base were considered for the interim beddown, capacity conditions at these locations changed and, as such, were no longer considered viable for the permanent beddown of additional F-16 FTU squadrons. A comparison of alternatives is provided in **Table 2-1**.

Holloman AFB is in south-central New Mexico, near the City of Alamogordo. It is in Otero County, New Mexico, 6 miles southwest of Alamogordo (**Figure 2-2**). The main base encompasses 51,813 acre (ac) and is bounded to the west by the White Sands National Park and to the south by Highway 70 (**Figure 2-3**). Holloman AFB supports about 21,000 active-duty Air Force, Air National Guard, Air Force Reserve, retirees, Department of Defense (DoD) civilians, and their family members.

In 2010, the 49th Fighter Wing became the 49th Wing (49 WG) with the addition of remotely piloted aircraft. The 49 WG supports the F-16 Fighting Falcon, T-38 Talon, and MQ-9 Reaper RPA. The 54 FG is an F-16 FTU and a unit of the 49 WG. Holloman AFB is also home to 635th Materiel Maintenance Group and 704th Test Group. Holloman AFB provides support for the United States (US) Army’s White Sands Missile Range (WSMR) military testing area as well as the White Sands Space Harbor for National Aeronautical and Space Administration missions.

Roswell International Air Center (ROW), in Roswell, New Mexico, is located near Holloman AFB and is currently utilized by the 49 WG for additional pattern training and as an emergency divert field (**Figure 2-4**).

Table 2-1
Comparison of Alternative Candidate Basing Locations for the Permanent Beddown and Relocation of F-16 Formal Training Unit Squadrons

Alternative Locations Considered	Selection Standards				Meets Selection Standards
	Mission	Facilities and Infrastructure	Airspace and Range Capacity	Schedule and Timing	
Holloman AFB	Yes	Yes	Yes	Yes	Yes
Kelly Field	Yes	No	Yes	No	No

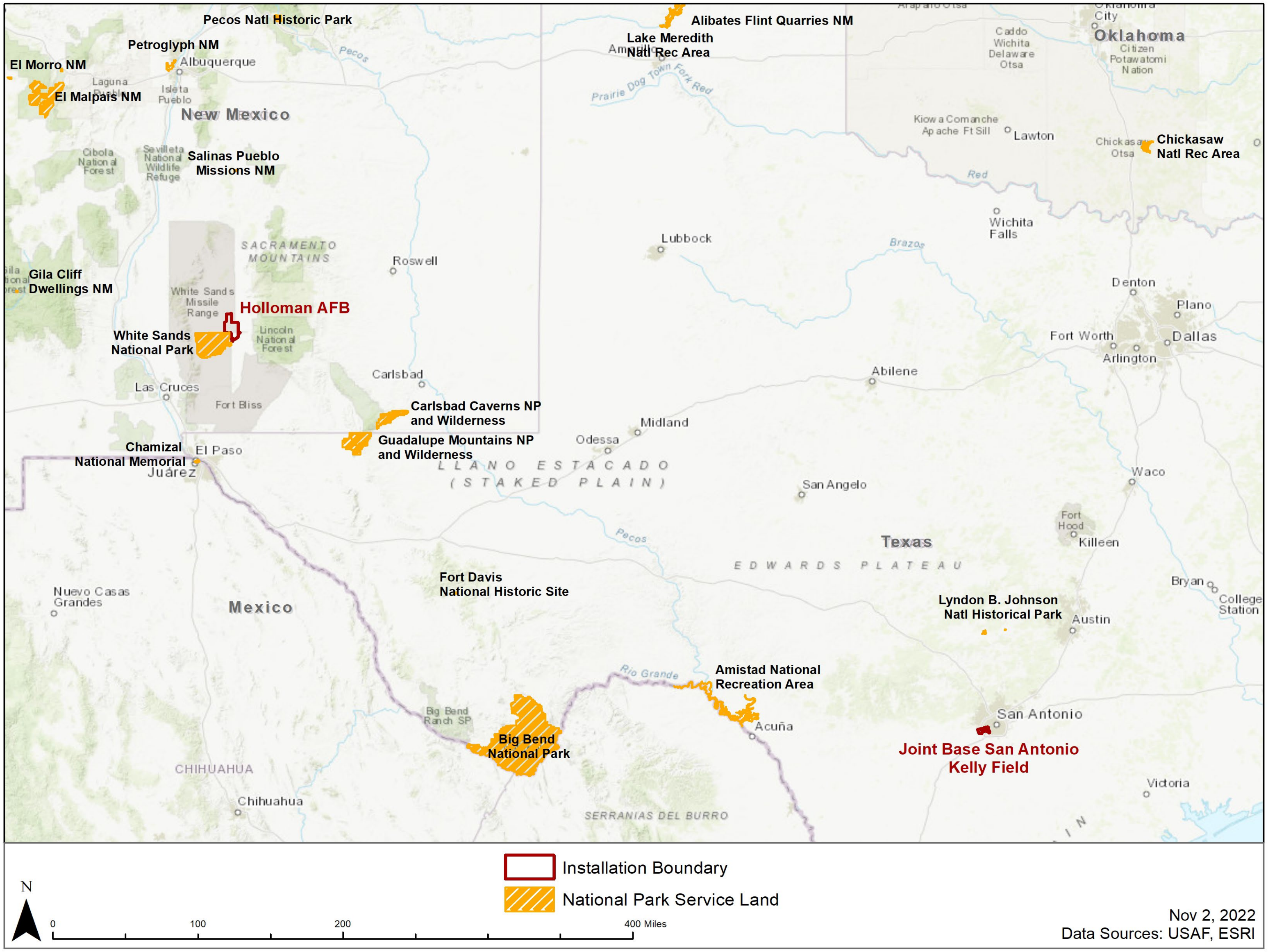

Figure 2-1. Alternative Locations for the Permanent Beddown and Relocation of F-16 Formal Training Unit Squadrons.

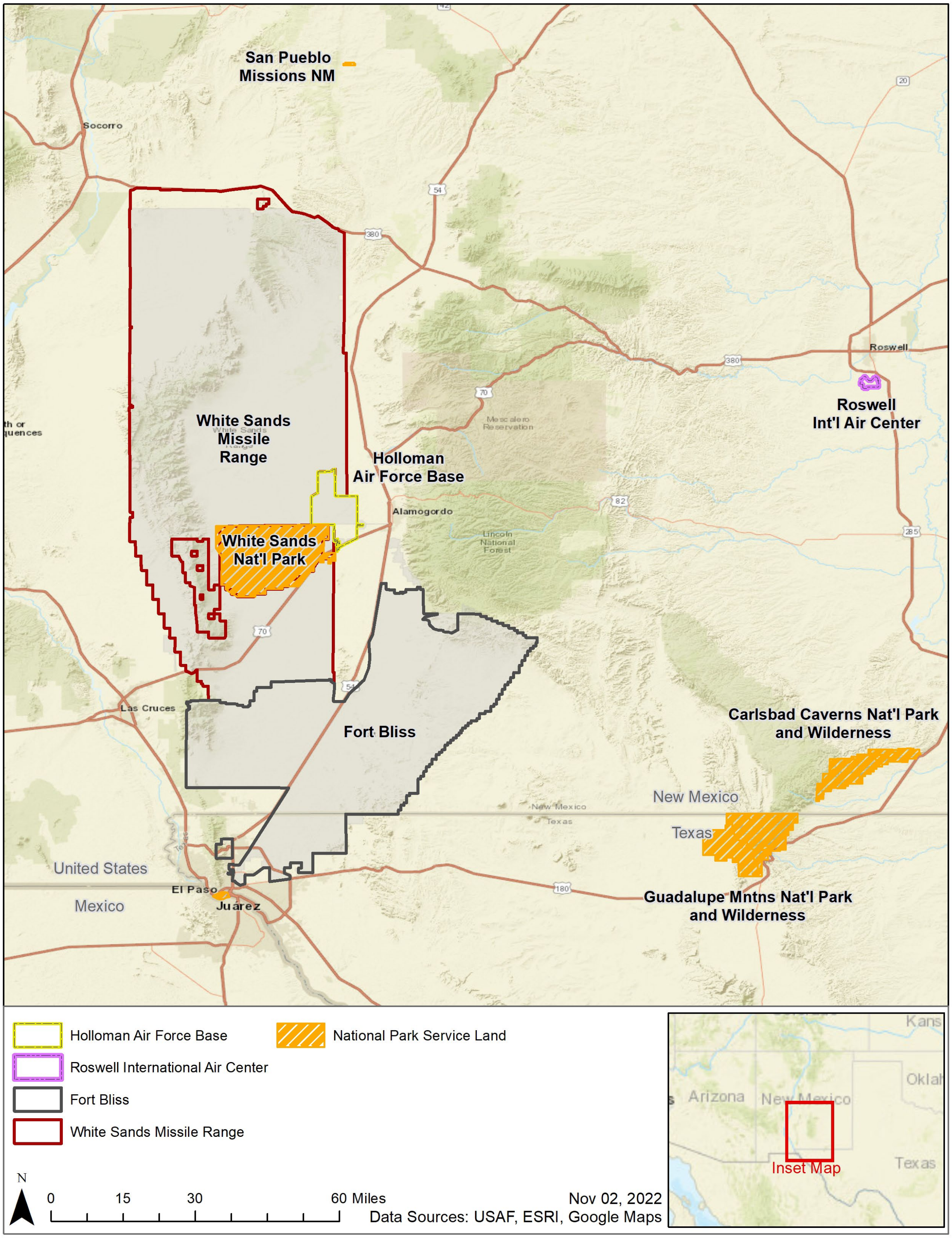

Figure 2-2. Location of Holloman Air Force Base and Roswell International Air Center (Regional View).

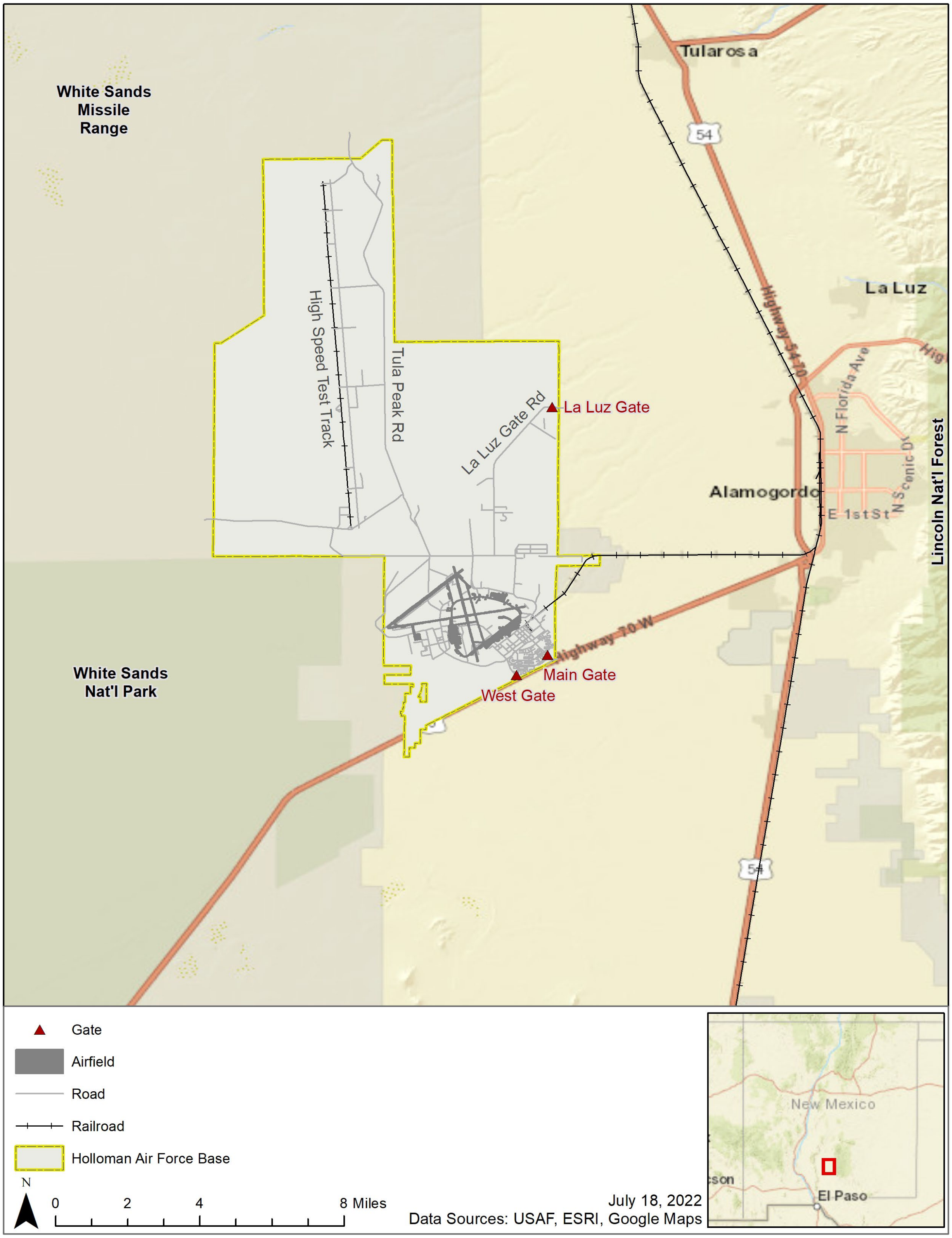

Figure 2-3. Location of Holloman Air Force Base (Local View).

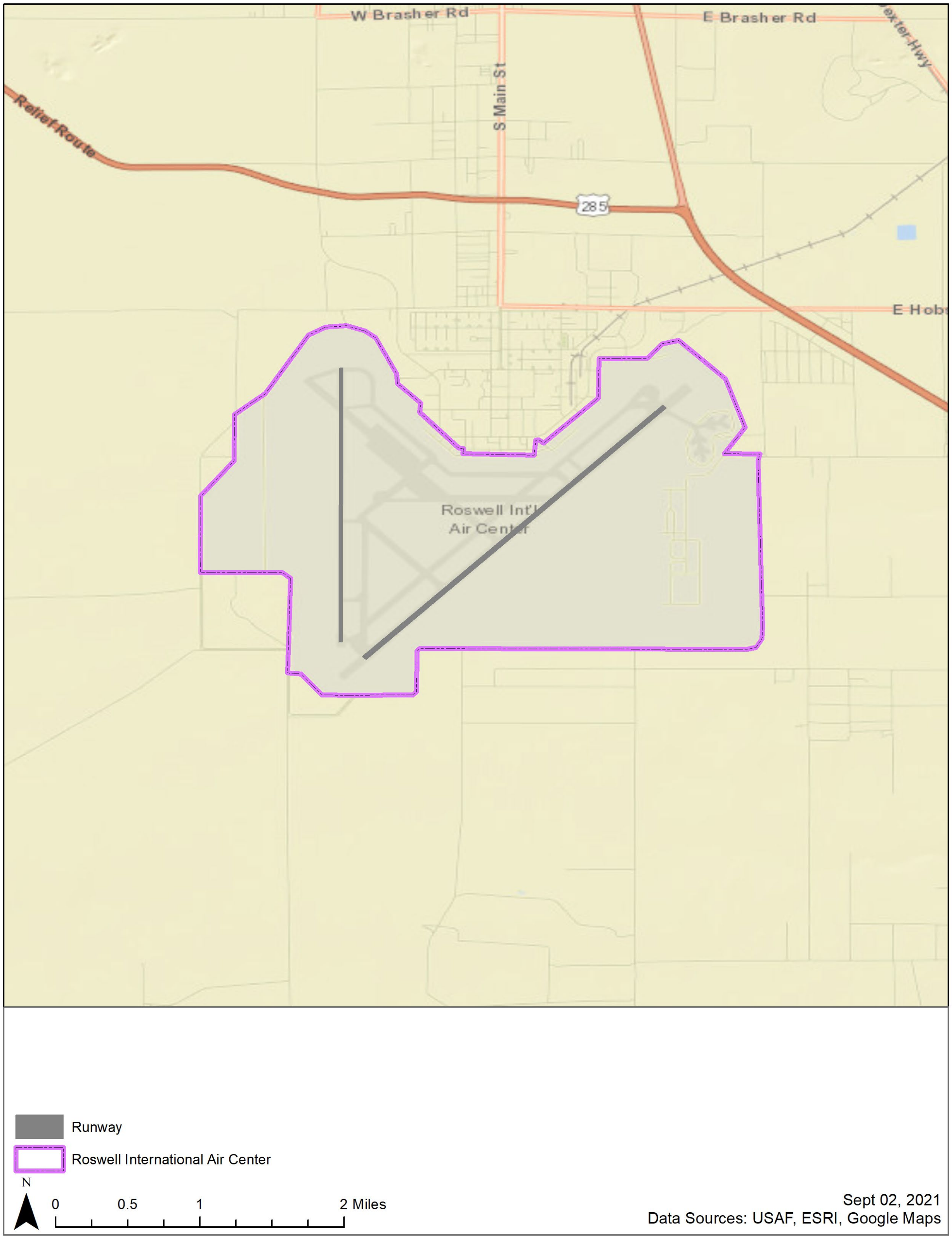

Figure 2-4. Location of Roswell International Air Center (Local View).

2.3 Description of Alternatives Considered for Detailed Analysis

2.3.1 *Proposed Action Elements Common to All Alternatives*

2.3.1.1 Aircraft

The Air Force proposes to permanently relocate and beddown additional F-16 FTU squadrons at Holloman AFB. The F-16 is a single-engine, supersonic multirole fighter aircraft capable of filling both air-to-air combat and air-to-surface attack roles. The F-16C model is a single-seated version, while the F-16D model is a two-seated version, both of which are currently based at Holloman AFB. The specifications of aircraft proposed for permanent relocation are described in **Table 2-2**. For details on the number of aircraft required, see **Sections 2.3.2** and **2.3.3**.

Table 2-2
Aircraft Specifications of F-16 Aircraft Proposed for Permanent Beddown

Build[1]	Wingspan (feet)	Wing Area (square feet)	Length (feet)	Height (feet)	Engine type[2]
Block 40	31	300	49.33	16.71	F110-GE-100
Block 42	31	300	49.33	16.71	F100-PW-220

Notes:
1. The single-seated and two seated versions have the same specifications.
2. Block 40 aircraft are configured with General Electric (GE) Engines and Block 42 aircraft are configured with Pratt and Whitney engines.

2.3.1.2 Aircraft Operations

Under the Proposed Action, each additional F-16 FTU squadron would conduct up to 5,000 annual sorties and 7,500 patterns at Holloman AFB and within special use airspace (SUA), Air Traffic Control Airspace (ATCAAs), and Military Training Routes (MTRs) proximate to the installation as described below. Air Force convention is to describe daily flying schedules in terms of total sorties and a “flight turn pattern.” A flight turn pattern allows the FTU to fly available aircraft multiple times per day to maximize available flying opportunities for assigned pilots. Flight turn patterns are designed to allow aircraft to fly, land, complete appropriate post-flight inspections, get refueled, and fly again. For training purposes, night operations are defined as those performed any time after sunset. In consideration of penalties assigned to noise levels, “environmental night” is from 10:00 pm to 7:00 am. At Holloman AFB, approximately 10 percent of the total sorties at the installation would occur during environmental night.

Airspace Proposed for Use

The SUA and ATCAAs currently used for training by assigned aircraft at the permanent beddown location would also be used by the additional F-16 FTU squadrons (**Table 2-3** and **Figure 2-5**). SUA includes restricted areas and Military Operations Areas (MOAs), which provide airspace for military aircraft training and serve to warn nonparticipating aircraft of potential danger. A restricted area is typically used by the military due to safety or security concerns. Hazards include existence of unusual and often invisible threats posed by artillery use, aerial gunnery, or guided missiles. An MOA is designated airspace outside of Class A airspace to separate or segregate certain nonhazardous military activities from Instrument Flight Rules (IFR) traffic. Activities in MOAs include, but are not limited to, air combat maneuvers, air intercepts, and low altitude tactics. The defined vertical and lateral limits vary for each MOA. While MOAs generally extend from 1,200 feet (ft) above ground level (AGL) to 18,000 ft mean sea level (MSL), the floor may extend below 1,200 ft AGL if there is a mission requirement and there is minimal adverse aeronautical effect. ATCAAs are assigned to Air Traffic Control (ATC) to segregate air traffic between specified activities being conducted within the assigned airspace and other IFR traffic. ATCAA is the equivalent of an MOA at 18,000 ft MSL and above. This airspace is not depicted on any chart but is often an extension of a MOA to higher altitudes and usually referred to by the same name. This airspace remains under control of the Federal Aviation Administration (FAA) when not in use to support general aviation activities.

Holloman AFB and the surrounding military airspace provide a critical venue to train F-16 pilots (**Table 2-3**). The primary airspace that would be used by the 8 FS include WSMR Restricted Areas R-5107A, B, C, D, E, H, J, and K, and R-5111A/B; Beak MOAs and ATCAAs, and the Wiley ATCAA, Talon High A, B, and C and Talon Low A and B MOAs and ATCAA; and McGregor Range Restricted Areas (R-5103A, B and C). Secondary airspace that may also be used include the Cato, Pecos, Smitty, and Valentine MOAs. **Figure 2-5** shows the locations of the SUA, ATCAAs, and training ranges proposed for use. While the proposed additional FTU squadrons would use all the SUA and ATCAAs, the net number of sorties across the SUA and ATCAAs, except for the Talon ATCAA and MOAs, would not increase. See **Sections 2.3.2** and **2.3.3** for additional information on sorties within the Talon SUA and ATCAAs.

Table 2-3
Special Use Airspace and Air Traffic Control Assigned Airspace Used by Holloman Air Force Base

Airspace	Current Altitude	Supersonic Operations
WSMR Restricted Areas (R-5107 & R-5111)	Surface to Unlimited	At or above 10,000 ft MSL
Wiley East ATCAA	FL180 to FL400	At or above 23,000 ft MSL
Beak A, B, and C ATCAAs	FL180 to FL400	At or above 23,000 ft MSL
Beak A, B, and C MOAs	12,500 ft MSL to, but not including, FL 180	--
Talon ATCAA	FL180 to FL400	At or above 30,000 ft MSL
Talon High A, B, and C MOAs	12,500 ft MSL to, but not including, FL 180	--
Talon Low A and B MOA	500 ft AGL to, but not including, 12,500 ft MSL	--
McGregor Range Restricted Areas (R-5103 A-C)	Surface to Unlimited	Allowed in R-5103B and C at or above 10,000 ft MSL
Cato MOA	13,500 ft MSL to, but not including, FL 180	--
Pecos North High/Low; South MOAs	North High - 11,000 ft MSL up to, but not including, FL 180 North Low – 500 ft AGL up to, but not including, 11,000 ft MGL South – 500 ft AGL up to, but not including, FL 180	--
Smitty MOA	500 ft AGL to, but not including, 13,500 ft MSL, excluding the airspace below 1,600 ft AGL along the western edge	--
Valentine MOA	15,000 ft MSL to, but not including, FL 180	--

Notes:
1. The travel distance to Valentine MOA exceeds the 120 nautical miles travel distance standard for optimizing F-16 pilot training sorties. This MOA is available but is not practicable for F-16 pilot training given the distance; therefore, was not assessed.

AGL=above ground level; ATCAA=Air Traffic Control Assigned Airspace; FL= flight level (vertical altitude expressed in hundreds of ft); ft=feet; MOA=Military Operations Area; MSL=mean sea level; WSMR=White Sands Missile Range

Training Ranges

Training ranges are used for air-to-ground combat training as well as inert and live practice bombing in support of Air Force and other DoD units. The training ranges that would continue to be used under the Proposed Action include Oscura and Red Rio Training Ranges located beneath the WSMR SUA, and the

Centennial Training Range located beneath the R-5103 restricted areas of the McGregor Range (**Figure 2-5**).

The Oscura Training Range is on open terrain that slopes very slightly down to the east between 4,000 and 4,100 ft in elevation. The range is an active Close Air Support, small arms, and helicopter gunnery range in Lincoln County, New Mexico. The Weapons Impact Area consists of approximately 4,240 ac with a Range Safety Zone of 57,210 ac.

The Red Rio Training Range is in a mountain valley, Red Canyon, which runs southeasterly from the divide between the south end of Chupadera Mesa and the Oscura Mountains in Socorro County, New Mexico. The range is located between 5,500 and 6,500 ft in elevation. It is an active gunnery and bombing range with one live drop area for explosive munitions and two miles of gunnery and inert-bomb targets. The Weapons Impact Area is approximately 1,950 ac, with a Range Safety Zone of 55,680 ac.

The Centennial Training Range is on rolling uplands east of and above the basin, near the western edge of Otero Mesa, between 5,000 and 5,500 ft in elevation. The range is an active gunnery and inert bombing range in Otero County, New Mexico. The Weapons Impact Area is 5,120 ac with a Range Safety Zone of 94,730 ac.

Military Training Routes

MTRs were developed for use by the military for the purpose of providing opportunities for low-level, high-speed training and to access other training areas. In general, MTRs are established below 10,000 ft MSL for operations at speeds more than 250 knots, the airspeed limit for other aircraft flying below 10,000 ft MSL. An MTR may be comprised of multiple segments with designated floor and ceiling altitudes, along with lateral boundaries established to determine its geographic location. MTRs are divided into three sub-types: visual routes (VRs), instrument routes (IRs), and slow-speed low-altitude routes (SRs). Operations on VRs are conducted only when the weather is at or above Visual Flight Rule minimums of five miles or more visibility and a weather ceiling of 3,000 ft or more. Operations on IRs are flown under IFR conditions where pilots use instruments without the aid of ground-based visual cues and may fly during periods of reduced visibility. Operations on SRs occur at routes below 1,500 ft AGL at airspeeds of 250 knots or less.

In addition to aircraft activity currently operating in the SUA, ATCAAs, and training ranges, F-16s from Hollman AFB, and transient aircraft (those not stationed at Holloman AFB) utilize MTRs IR-192/194, IR-134/195, and VR-176. (**Figure 2-5**). Occasionally, these aircraft also utilize MTR IR-133/142 at altitudes from 100 ft AGL up to 12,000 ft MSL. While the MTRs used by aircrews at Holloman AFB have minimum altitudes down to 100 ft AGL, low-altitude training missions flown by FTU F-16s would only occur at altitudes down to 500 ft AGL to meet certification requirements outlined in Air Force Manual (AFMAN) 11-2F-16V1, *F-16 Aircrew Training*.

The sorties proposed under Alternative 1 are well within the number of sorties previously analyzed in the *Special Use Airspace Optimization Final Environmental Impact Statement and Record of Decision* (Air Force, 2021) for IR-192/194, IR-134/195, and VR 176, and have therefore been excluded from this analysis under Alternative 1. Likewise, less than 100 sorties a year are flown on IR-133/142 and would not increase under Alternative 1 and therefore have also been removed from analysis under Alternative 1. Under Alternative 2, annual sorties for MTRs would increase as follows:

- IR-192/194 from 21 to 55 sorties;
- IR-134/195 from 6 to 15 sorties;
- VR-176 remains at 223 sorties; and,
- IR-133/142 from 31 to 55 sorties

2.3.1.3 Personnel

Additional personnel consisting of Regular Air Force (RegAF) personnel and contractor logistics personnel would accompany each proposed squadron. These personnel consist of pilots, maintainers, logisticians, administrative, and other support personnel.

2.3.1.4 Facilities and Infrastructure

Facilities includes structures required for maintenance, training, logistics, and administrative activities required to support each additional squadron. Facilities also includes the aircraft parking ramp. Only minor construction and renovations would be expected at the installation to support additional F-16 FTU squadrons and associated pilots and support personnel. Construction may include expansion and renovation to existing buildings, installation of additional sunshades and additional lighting on aircraft parking ramps, and interior renovations. Proposed construction and renovations would optimize facilities for their intended use. For details on proposed construction and renovations, see **Sections 2.3.2** and **2.3.3**. Some infrastructure improvements may also be necessary, such as outside plant, inside plant, and wireless infrastructure upgrades.

2.3.1.5 Munitions

The additional aircraft would operate with advanced radar and electronic targeting systems during engagements. Similar to the currently assigned F-16s, the munitions used to support the current FTU training syllabus includes defensive countermeasures such as RR188 chaff, MJU-7 and MJU-206 flares; BDU-33 practice bombs with either hot or cold spotting charges, 20-millimeter target practice (20mm TP) cannon ammunition; as well as inert GBU-12/38, BDU-56, and MK-82/BDU-50 bombs. The use of countermeasure chaff and flares during training sortie operations within a specific airspace and at altitudes would occur as authorized by the FAA permit and would account for local weather and fire hazard conditions. In addition, additional FTU squadrons would train with captive air training missiles (CATMs), specifically CATM-9 Sidewinder and CATM-120 Advanced Medium Range Air-to-Air Missile. Descriptions of the live and training munitions proposed for use are provided in **Appendix F**.

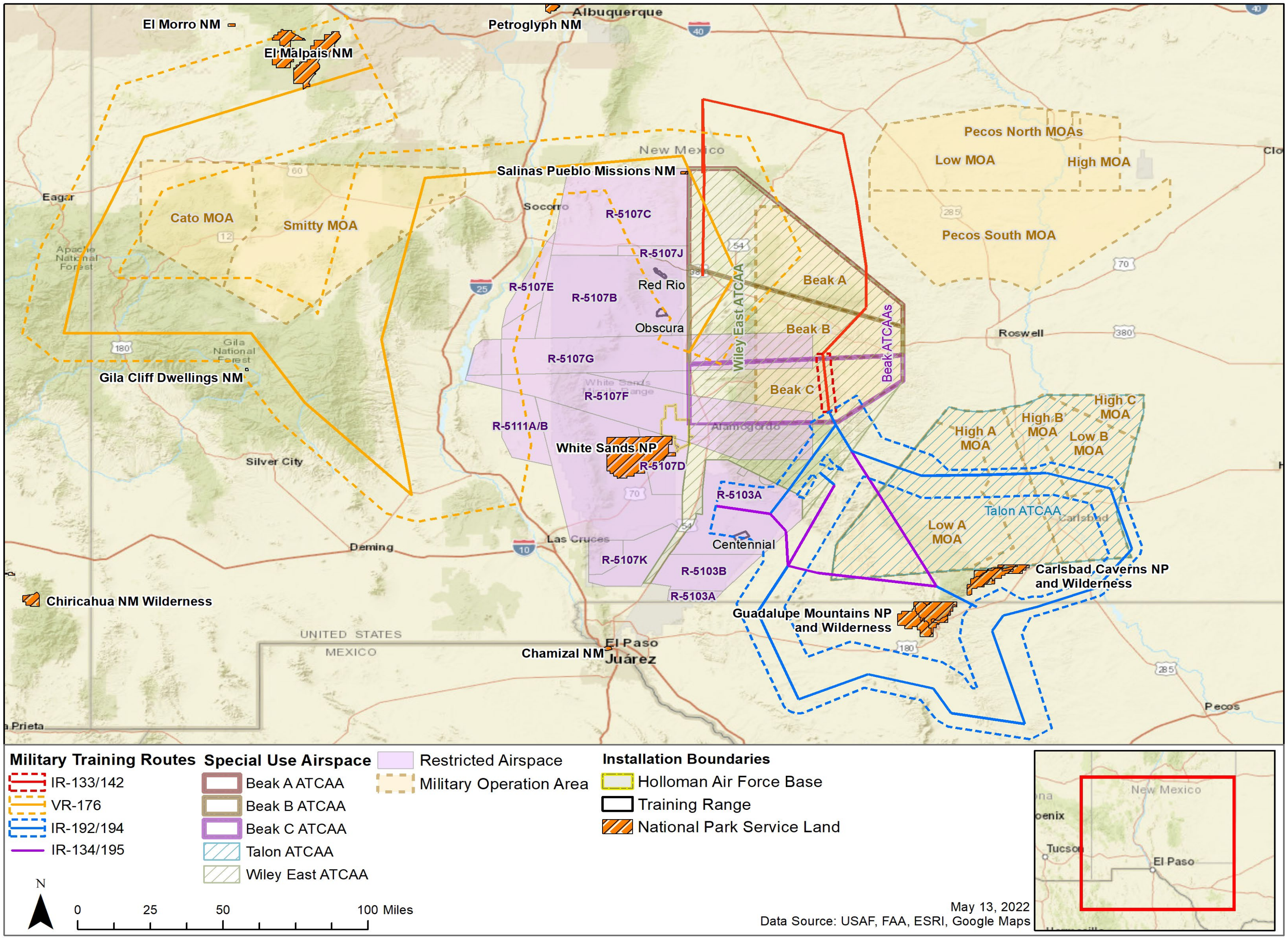

Figure 2-5. Special Use Airspace, Air Traffic Control Assigned Airspace, Military Training Routes, and Training Ranges Used by F-16 Formal Training Unit Squadrons at Holloman Air Force Base Included in the Proposed Action.

2.3.2 *Alternative 1 – Permanent Beddown of One Additional F-16 Squadron at Holloman AFB*

Under Alternative 1, a squadron comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory (BAI) F-16 Block 40 aircraft, currently based at Holloman AFB on an interim basis, would be permanently assigned to Holloman AFB as the 8 FS. This addition would increase the number of F-16s permanently based at Holloman AFB to 75 PAA and 6 BAI Block 40/42 F-16 aircraft. Under Alternative 1, the estimated maximum 5,000 sorties and 7,500 patterns the 8 FS flies annually at Holloman AFB would become permanent.

ROW would be used for additional pattern training as an emergency field. Under this alternative, the 8 FS would fly an estimated additional 92 sorties to ROW and perform an estimated 207 additional patterns per year. Additional training capabilities at ROW would provide future support beneficial to the FTU (e.g., touch and go's (TGOs), full stop landings and take-offs [LTOs]); the construction of necessary arresting gear or other safety assets would be considered at that time and separate environmental analysis would be completed as required.

Under Alternative 1, the additional F-16 FTU squadron would continue to use SUA, ATCAAs, training ranges, and MTRs proximate to Holloman AFB and would continue to conduct an estimated 5,000 annual training sorties in the Talon SUA and ATCAAs. The sorties proposed under Alternative 1 are well within the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021).

Under Alternative 1, an estimated 400 RegAF personnel composed of instructor pilots and support personnel, as well as contracted logistics support personnel currently based at Holloman AFB would remain.

Holloman AFB has enough facilities to support this alternative. The facilities currently used by the F-16 FTU, including the runways, taxiways, aprons, and structures would remain in use to support the mission. Some minor construction to expand existing facilities, as well as interior renovations for the permanent beddown of the 8 FS, would be necessary. Proposed projects include three minor construction projects. **Table 2-4** provides additional information on the proposed projects. The permanently assigned F-16 FTU squadron would continue to use the SUA, ATCAAs, MTRs, and training ranges.

2.3.3 *Alternative 2 – Permanent Beddown of the Existing Interim F-16 Squadron and One Additional F-16 Squadron at Holloman AFB*

Under Alternative 2, the squadron of F-16 aircraft FTU, composed of 25 PAA with 2 BAI F-16 Block 40 aircraft currently based at Holloman AFB on an interim basis would be permanently assigned to Holloman AFB as the 8 FS and an additional F-16 aircraft FTU squadron, composed of a 25 PAA of either Block 40 or 42 aircraft would be permanently relocated to Holloman AFB. Inclusion of Alternative 2 provides analysis to evaluate future capacity for a fourth squadron at Holloman AFB. In order to implement Alternative 2, a separate SecAF review and decision would be required.

Under Alternative 2, both F-16 FTU squadrons would use the SUA, ATCAAs, training ranges, and MTRs. The 8 FS would continue to fly an estimated 5,000 sorties and 7,500 training patterns and the additional F-16 FTU squadron would fly an estimated maximum additional 5,000 sorties and 7,500 patterns annually at Holloman AFB. The sorties proposed for training within the Talon SUA and ATCAAs would remain within the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). ROW would be used for additional pattern training and as an emergency divert field. Under this alternative, the 8 FS and additional F-16 FTU squadron would fly an estimated additional 199 sorties to ROW and perform an estimated 581 additional patterns per year. Additional training capabilities at ROW would provide future beneficial support to the FTU (e.g., TGOs, full stop LTOs); the construction of necessary arresting gear or other safety assets would be considered at that time and separate environmental analysis would be completed as required.

Under this alternative, the estimated 400 personnel that includes instructor pilots and contractor logistics support maintainers associated with the 8 FS described in Alternative 1 would remain at Holloman AFB, and an estimated additional 475 personnel consisting of pilots, maintainers, logisticians, administrative, and other support personnel would either relocate or would be hired to fill empty billets. Under Alternative 2 an additional 475 personnel would be associated with the permanent relocation of two squadrons for a total of approximately 875 personnel composed of 175 RegAF personnel and the contractor equivalent of approximately 700 personnel to fill direct and indirect support functions.

Holloman AFB has enough facilities to support Alternative 2. The facilities currently used by the F-16 FTU, including the runways, taxiways, aprons, and structures, would remain in use to support the mission. Some minor construction to expand existing facilities, as well as interior renovations and installation of additional sunshades and lighting on the aircraft parking ramp for the permanent beddown of two F-16 FTU squadrons, would be necessary. **Table 2-4** provides a summary on the proposed projects. The F 16 FTU squadrons would continue to use the SUA, ATCAAs, training ranges, and MTRs.

2.3.4 *No Action Alternative*

Analysis of the No Action Alternative provides a benchmark, enabling decision-makers to compare the magnitude of the potential environmental effects of the Proposed Action. NEPA requires an EA to analyze the No Action Alternative. No action means that an action would not take place at this time, and the resulting environmental effects from taking no action would be compared with the effects of allowing the proposed activity to go forward. No action for this EA reflects the status quo, where a permanent beddown location for the F-16 FTU was not established and additional locations or another disposition of the F-16s would have to be considered. Under the No Action Alternative, declines in trained fighter pilots could occur, causing declining quality of pilot production, which consequently results in unsustainable operations posing an unacceptable threat to national security.

Under the No Action Alternative, the F-16 FTU would not be permanently based and would remain at Holloman AFB while other beddown locations are considered and additional environmental analysis completed. If no other location is selected, the F-16s may be placed into temporary storage at Holloman AFB or some other location until a final deposition decision is reached. If it is necessary for the F-16s to be parked for 6 months or longer, the aircraft may be moved to the 309th Aerospace Maintenance and Regeneration Group at Davis-Monthan AFB, Arizona, for preservation storage until the aircraft are ready to return to service. Under the No Action Alternative, the amount of F-16 pilot training could be reduced, and the fighter pilot shortage would be expected to increase.

Table 2-4
Proposed Construction and Renovation Projects to Support the Permanent Beddown of Additional F-16 Formal Training Unit Squadrons

Alternative 1 or 2	Function	Location	Description	Estimated Project Size	Estimated Project Start
1 or 2	Aircraft Maintenance Unit	Building 297	Construct additional space onto the existing facility to enable pre-staging of aircraft maintenance equipment to facilitate sortie generation.	4,000 ft^2	July 2023[a]
1 or 2	Vertical Tank Storage System	Hangar 565	Construct a new pre-engineered metal building to house system equipment adjacent to existing hangar.	8,000 ft^2	July 2023[a]
1 or 2	Refueler Maintenance	Building 314	Construct additional R11 staging area adjacent to existing building to increase refueling efficiency.	15,000 ft^2	July 2023[a]
2	Sunshades and Lighting	Main Ramp	Install an additional 16 sunshades and lighting on existing aircraft parking ramp.[a]	90,000 ft^2	12 months before arrival of first aircraft from second squadron
2	Aircraft Maintenance Unit	Building 293	Construct additional space onto the existing facility to enable pre-staging of aircraft maintenance equipment to facilitate sortie generation.	4,000 ft^2	12 months before arrival of first aircraft from second squadron
2	Vertical Tank Storage System	Hangar 565	Construct a new pre-engineered metal building to house system equipment adjacent to existing hangar.	8,000 ft	18 months before arrival of first aircraft from second squadron
2	Fighter Squadron Commend Section	Building 1062	Construct additional space to house the additional Command Section.	8,000 ft^2	18 months before arrival of first aircraft from second squadron
2	Permanent Party Dormitory	Building 584	Renovate existing dormitory facility.	15,575 ft^2	24 months before arrival of first aircraft from second squadron
2	Fitness Center	Building 588	Construct an addition to the existing facility for additional gymnasium space.	8,000 ft^2	July 2023[a]
2	Child Development Center	Building 647	Construct an addition to the current facility to add two additional classrooms.	5,000 ft^2	July 2023[b]

Table 2-4
Proposed Construction and Renovation Projects to Support the Permanent Beddown of Additional F-16 Formal Training Unit Squadrons

Alternative 1 or 2	Function	Location	Description	Estimated Project Size	Estimated Project Start
2	Youth Center / School Age Program	Building 648	Renovate the facility to increase efficiency. Construct an addition for two new instructional spaces.	8,000 ft^2	July 2023[a]

Notes:
a. Construction projects to retrofit and/or install new lighting are in compliance with UFC 3-530-01.

b. According to the Air Force Strategic Basing Process, after the Finding of No Significant Impact (if appropriate), the Secretary of the Air Force issues a final basing decision. This date is based on an estimated January 2023 basing decision.

Abbreviations: ft^2=square feet; FTU=formal training unit

2.4 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

Kelly Field was considered for the permanent beddown and relocation but eliminated from further consideration because it would not meet the purpose and need for the action or the selection standards (refer to **Section 2.2.1**). The 149 FW currently has 24 F-16s assigned. Kelly Field does not have the available facilities and infrastructure needed to accommodate an additional F-16 FTU. Moreover, Kelly Field does not meet the schedule and timing requirement due to the time required for the Military Construction (MILCON) planning and funding process and the subsequent construction of facilities and infrastructure to support additional F-16 FTU squadrons. Kelly Field has been eliminated from further analysis in the EA.

2.5 COMPARISON OF POTENTIAL ENVIRONMENTAL CONSEQUENCES

The potential impacts associated with alternatives are summarized in **Table 2-5.** The summary is based on information discussed in detail in **Chapter 3** and includes a concise definition of the issues addressed and the potential environmental impacts associated with each alternative.

Table 2-5
Comparison of Potential Environmental Consequences of the Alternatives by Resource

Resource	Alternative 1	Alternative 2	No Action Alternative
Airspace Management and Use	Negligible and long-term impacts at Holloman AFB and ROW Negligible impacts at the SUA, ATCAAs, and MTRs proposed for use	Minor and long-term impacts at Holloman AFB and ROW Minor impacts at the SUA, ATCAAs, and MTRs proposed for use	No change to airspace management and use at Holloman AFB, ROW, or in the SUA, ATCAAs, and MTRs proposed for use
Noise	Negligible and long-term impacts at Holloman AFB, ROW, and the SUA, ATCAAs, and MTRs proposed for use	Negligible and long-term impacts at Holloman AFB, ROW, and the SUA, ATCAAs, and MTRs proposed for use	No change to the noise environment at Holloman AFB, ROW, or in the SUA, ATCAAs, and MTRs proposed for use
Safety	No impacts at Holloman AFB, ROW, or in the SUA, ATCAAs, and MTRs proposed for use	No impacts at Holloman AFB, ROW, or in the SUA and ATCAAs and minor, long-term impacts at the MTRs proposed for use	No change to ground, flight, or explosive safety at Holloman AFB, ROW, or in the SUA, ATCAAs, and MTRs proposed for use
Air Quality	No impact on the region's ability to meet NAAQS for all regulated pollutants	No impact on the region's ability to meet NAAQS for all regulated pollutants	No change to air quality at Holloman AFB, ROW, or in the airspace proposed for use
Biological Resources	No short or long-term impacts on vegetation or habitat Minor adverse, short and long-term impacts on wildlife from increased noise Minor adverse long-term impacts on birds and other wildlife from potential aircraft/bird collisions Minor adverse long-term impacts to vegetation and wildlife from the continues use of chaff and flare No impacts to federally listed amphibians, fish, mollusks, reptiles, crustaceans, and plant species. Long-term, minor impacts to lesser prairie-chicken, northern aplomado falcon, Mexican spotted owl, piping plover,	No short or long-term impacts on vegetation or habitat Minor adverse, short and long-term impacts on wildlife from increased noise Minor adverse long-term impacts on birds and other wildlife from potential aircraft/bird collisions Minor adverse long-term impacts to vegetation and wildlife from the continues use of chaff and flare No impacts to federally listed amphibians, fish, mollusks, reptiles, crustaceans, and plant species. Long-term, minor impacts to lesser prairie-chicken, northern aplomado falcon, Mexican spotted owl, piping plover, southwestern willow flycatcher, yellow-billed cuckoo, Mexican gray wolf, and	No change to biological resources at Holloman AFB, ROW, or in the SUA, ATCAAs, and MTRs proposed for use

Table 2-5
Comparison of Potential Environmental Consequences of the Alternatives by Resource

Resource	Alternative 1	Alternative 2	No Action Alternative
	southwestern willow flycatcher, yellow-billed cuckoo, Mexican gray wolf, and monarch butterfly from potential visual disturbance, aircraft strikes, and noise Minor, long-term impact to the state listed spotted bat from visual disturbance, aircraft strikes and noise and negligible adverse impacts to gray-banded kingsnake, mottled rock rattlesnake, and reticulated Gila monster from training range use No short or long-term impacts on invasive vegetation or wildlife	monarch butterfly from potential visual disturbance, aircraft strikes, and noise Minor, long-term impact to the state listed spotted bat from visual disturbance, aircraft strikes and noise and negligible adverse impacts to gray-banded kingsnake, mottled rock rattlesnake, and reticulated Gila monster from training range use No short or long-term impacts on invasive vegetation or wildlife	
Cultural Resources	No adverse effects to historic properties (i.e., any prehistoric, historic, or cultural district, site, building, structure, or object included in, or eligible for inclusion on, the National Register of Historic Places)	No adverse effects to historic properties (i.e., any prehistoric, historic, or cultural district, site, building, structure, or object included in, or eligible for inclusion on, the National Register of Historic Places)	No change to cultural resources at Holloman AFB, ROW, or in the SUA, ATCAAs, or MTRs proposed for use
Land Use	No impacts to land use at Holloman AFB. Negligible and long-term impacts at ROW	Negligible and long-term impacts at Holloman AFB and ROW	No change to land use at Holloman AFB or ROW
Infrastructure, Transportation, and Utilities	No impacts at Holloman AFB or ROW	Minor impacts at Holloman AFB and no impacts at ROW	No change to infrastructure at Holloman AFB or ROW

Table 2-5
Comparison of Potential Environmental Consequences of the Alternatives by Resource

Resource	Alternative 1	Alternative 2	No Action Alternative
Hazardous Materials and Waste, Environmental Restoration Program Sites, and Toxic Substances	Short-term, negligible adverse impacts would occur from generating hazardous and petroleum wastes during renovation and construction activities at Holloman AFB. Minor impact from increased use or management of hazardous materials at Holloman AFB and ROW No impacts from radon, asbestos-containing materials, lead-based paint, or polychlorinated biphenyls at Holloman AFB and ROW No impacts to ERP Sites at Holloman AFB and ROW	Short-term, negligible adverse impacts would occur from generating hazardous and petroleum wastes during renovation and construction activities at Holloman AFB. Minor impact from increased use or management of hazardous materials at Holloman AFB and ROW No impacts from radon, asbestos-containing materials, lead-based paint, or polychlorinated biphenyls at Holloman AFB and ROW No impacts to ERP Sites at Holloman AFB and ROW	No change to hazardous materials and wastes and toxic substances at Holloman AFB or ROW
Socioeconomics	Potential minor, beneficial impact from possible annual expenditures at Holloman AFB and ROW	Potential minor, beneficial impact from possible annual expenditures at Holloman AFB and ROW	No change to income and employment at Holloman AFB or ROW
Environmental Justice and Protection of Children	No disproportionate impacts on minority or low-income populations in the community at Holloman AFB or ROW No disproportionate impacts on children in the community at Holloman AFB or ROW	No disproportionate impacts on minority or low-income populations in the community at Holloman AFB or ROW No disproportionate impacts on children in the community at Holloman AFB or ROW	No disproportionate impacts on minority populations, low-income communities, children, or the elderly in the community at Holloman AFB or ROW

Notes: AFB = Air Force Base; ATCAA = Air Traffic Control Assigned Airspace; MTR= Military Training Routes; NAAQS = National Ambient Air Quality Standards; ROW = Roswell International Air Center; SUA = special use airspace; ERP = Environmental Restoration Program

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CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This EA analyzes potential impacts on existing environmental conditions associated with the Proposed Action and alternatives at Holloman AFB, New Mexico. The analysis considers the current, baseline conditions of the affected environment and compares those with conditions that might occur should the Air Force implement either of the Proposed Action Alternatives or the No Action Alternative. The existing conditions of several resources have also been described in detail in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021) and the *Holloman AFB Combat Air Forces Adversary Air EA* (Air Force, 2020).

A justification for those resources eliminated from analysis is provided in this section. Then, each resource included in the analysis is defined, its evaluation criteria are outlined, and the geographic scope of potential consequences, or the region of influence (ROI), is identified. Lastly, a description of the existing conditions and discussion of potential effects, cumulative impacts, and other environmental considerations for each resource are presented by location.

3.1 Resource Areas Eliminated From Analysis

Several resources were considered relative to the Proposed Action but were not carried forward for analysis. They include resources whose baseline conditions lacked a relationship to, and any potential to be altered by, implementation of the Proposed Action.

3.1.1 *Water Resources*

Water resources include groundwater, surface waters, floodplains, and wetlands. Groundwater is found in underground areas, known as aquifers, which consist of permeable and porous rock or unconsolidated substrate where water can be stored within soil or rock pore spaces. Surface water includes all lakes, ponds, rivers, streams, impoundments, and wetlands within a defined area or watershed. Groundwater and surface water are both impacted by stormwater infiltration and runoff generated during rain events. Floodplains are areas that are flooded periodically by the lateral overflow of surface water bodies.

The United States Army Corps of Engineers (USACE) defines wetlands as “those areas that are inundated or saturated with ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions” (US Environmental Laboratory, 1987). Wetlands generally include swamps, marshes, bogs, and similar areas (33 CFR Part 328). The Clean Water Act (CWA) of 1972 (33 U.S. Code § 1251 *et seq.*) regulates discharges of pollutants in surface waters of the United States. Section 404 of the CWA establishes a program to regulate the discharge of dredged and fill material into waters of the US, including wetlands. The isolated wetlands on Holloman AFB do not meet the definition of Waters of the US (Holloman AFB, 2018a).

Water resources are vulnerable to contamination and quality degradation. The primary concerns associated with the Proposed Action include effects on water quality during and after construction. There are no wetlands or other surface waters within the boundaries of the proposed locations. In addition, none of the project areas are within 100-year floodplains and construction activities would not include excavation deep enough to affect groundwater.

Only minor construction activities in the form of additions to existing facilities would occur under the Proposed Action. In accordance with the Holloman AFB Stormwater Pollution Prevention Plan (SWPPP), prior to any applicable activities, the contractor would be trained in the relevant aspects of the SWPPP to manage stormwater associated with the construction activity and work with the Holloman AFB Stormwater Program Manager to ensure compliance with the SWPPP for pre- and post-construction activities (Holloman AFB, 2005). The Holloman AFB SWPPP addresses all requirements outlined in the National Pollutant Discharge Elimination System (NPDES) Storm Water Multi-Sector General Permit as outlined in the *2000 Final Reissuance of the National Pollutant Discharge Elimination System (NPDES) Storm Water*

Multi-Sector General Permit for Industrial Activities (65 FR 64746). In accordance with the Holloman AFB SWPPP, construction contractors would comply with regulatory requirements, coordinate construction best management practices (BMPs) to minimize stormwater contamination, and design guidelines for BMPs for stormwater management specific to the construction activities. In addition, no proposed ground disturbing activities would occur in or adjacent to the Lake Holloman Wetland Complex (LHWC) area. The LHWC is in the southernmost part of the base and is an area that has been modified from remnants of a large alkali playa lake environment (Holloman AFB, 2018a).

For any construction projects that would disturb 5,000 square ft or more of ground area, Holloman AFB must adhere to the guidance within Section 438 of the Energy Independence and Security Act of 2007 that requires federal agencies to reduce stormwater runoff from federal development and redevelopment projects to protect water resources and maintain or restore predevelopment site hydrology to the maximum extent that is technically achievable. As a result of in-place precautions to protect surface water, the proposed construction activities are not expected to affect water quantity and therefore would not adversely affect water resources.

Under the Proposed Action, there would be no ground-disturbing activities within SUA or ATCAAs. The proposed F-16 FTU operations in the SUA and ATCAAs would not affect water quality or quantity. Based on the rare and infrequent nature of fuel dumps as well as in-place safety precautions, these emergency procedures are not likely to adversely affect water resources. Water resources are not carried forward for further detailed analysis in this EA.

3.1.2 *Earth Resources*

Earth resources are defined as the physiography, topography, geology, and soils of a given area. Physiography and topography pertain to the general shape and arrangement of a land surface, including its height and the position of its natural and human-made features. Geology is the study of the Earth’s composition and provides information on the structure and configuration of surface and subsurface features. Such information derives from field analysis based on observations of the surface and borings to identify subsurface composition. Soils are the unconsolidated materials overlying bedrock or other parent material. Soils typically are described in terms of their complex type, slope, and physical characteristics. Differences among soil types in terms of their structure, elasticity, strength, shrink-swell potential, and erosion potential affect their abilities to support certain applications or uses. In appropriate cases, soil properties must be examined for their compatibility with construction activities or types of land use.

Protection of unique geological features, minimization of soil erosion, and the siting of facilities in relation to potential geologic hazards were considered when evaluating potential impacts of the Proposed Action on geological resources. Generally, impacts can be avoided or minimized if proper construction techniques, erosion control measures, and structural engineering designs are incorporated into project development. Effects on geology and soils would be adverse if they were to alter the lithology, stratigraphy, and geological structures that control groundwater quality, distribution of aquifers and confining beds, and groundwater availability, or change the soil composition, structure, or function within the environment. All construction included in the Proposed Action would occur on developed land or improved land. The surficial geology at these sites has been previously altered through grading and recontouring. Appropriate sediment and erosion controls would be implemented and maintained prior to and throughout all construction phases to minimize surface runoff.

Under the Proposed Action, there would be no ground-disturbing activities within the SUA or ATCAAs to affect soil resources. Under the airspace, the use of nontoxic defensive countermeasures, as well as the infrequent nature of fuel dumps and in-place safety precautions in their event, are not likely to adversely affect soil resources. Earth resources were not carried forward for detailed analysis.

3.2 ANALYZED RESOURCES AND EVALUATION CRITERIA

The following is provided in this section: a description of general evaluation criteria and impact levels, the list of analyzed resources, and a description of the geographic scope or ROI of potential consequences for the resources analyzed. The ROI boundaries will vary depending on the nature of each resource (**Table 3-1**). For example, the ROI for some resources, such as air quality, extends over a larger jurisdiction unique to the resource. The specific criteria for evaluating impacts and assumptions for the analyses are presented under each resource area. Evaluation criteria for most potential impacts were obtained from standard criteria; federal, state, or local agency guidelines and requirements; and legislative criteria.

Impacts are defined in general terms and are qualified as adverse or beneficial, and as short- or long-term. For the purposes of this EA, short-term impacts are generally considered those impacts that would have temporary effects. Long-term impacts are generally considered those impacts that would result in permanent effects. Impacts are defined as:

- negligible, the impact is localized and not measurable or at the lowest level of detection;
- minor, the impact is localized and slight but detectable;
- moderate, the impact is readily apparent and appreciable; or
- major, the impact is severely adverse or highly noticeable and considered to be significant.

Major impacts are considered significant and receive the greatest attention in the decision-making process. The significance of an impact is assessed based on the relationship between context and intensity. Major impacts require application of a mitigation measure to achieve a less than significant impact. Moderate impacts may not meet the criteria to be classified as significant, but the degree of change is noticeable and has the potential to become significant if not effectively mitigated. Minor impacts have little to no effect on the environment and are not easily detected; impacts defined as negligible are the lowest level of detection and generally not measurable. Beneficial impacts provide desirable situations or outcomes.

Impacts and their significance, as well as the means (e.g., BMPs) for reducing potential adverse environmental impacts are also discussed for each resource. **Table 3-1** indicates the resources identified for analysis for each ROI. Reasonably foreseeable future actions that could result in an increased affect to environmental resources in conjunction with the Proposed Action are discussed in **Appendix B**.

Table 3-1
Region of Influence for Resources Analyzed in the Environmental Assessment

Resource	Region of Influence		
	Holloman Air Force Base	Roswell International Air Center	Airspace[1]
Airspace Management and Use	X	X	X
Noise	X	X	X
Safety	X	X	X
Air Quality	X	X	X
Biological Resources	X	X	X
Cultural Resources	X	X	X
Land Use	X	X	
Infrastructure	X	X	
Hazardous Materials and Wastes and Toxic Substances	X	X	
Socioeconomics	X	X	
Environmental Justice and Protection of Children	X	X	

Note:
1. Airspace includes the White Sands Missile Range Restricted Airspace R-5107 and 5111; Wiley East Air Traffic Control Assigned Airspace (ATCAA); Beak ATCAA and Beak A, B, and C Military Operations Areas (MOAs); Talon ATCAA, High A, B, and C MOAs, and Low A and B MOAs; McGregor Range R-5103A, B, and C; Cato MOA; Smitty MOA, Pecos North High/Low and South MOAs; and Valentine MOA; and the associated Military Training Routes (IR-192/194, IR-134/195, VR-176, and IR-133/142.

3.3 Airspace Management and Use

3.3.1 *Definition of the Resource*

Airspace management involves the direction, control, and handling of flight operations in the airspace that overlies the borders of the US and its territories. The FAA has the responsibility to plan, manage, and control the structure and use of all airspace over the United States. FAA rules govern the national airspace system, and FAA regulations establish how and where aircraft may fly. Collectively, the FAA uses these rules and regulations to make airspace use as safe, effective, and compatible as possible for all types of aircraft, from private propeller-driven planes to large, high-speed commercial and military jets.

Aircraft use different kinds of airspace according to the specific rules and procedures defined by the FAA for each type of airspace. For the Proposed Action, F-16 FTU training activities would utilize SUA and MTRs proximate to Holloman AFB. The primary airspace that would be used by the 8 FS and proposed additional F-16 FTU squadrons include the SUA, ATCAAs, training ranges, and MTRs described in **Section 2.3.1.2**.

The ROIs for airspace use and management for Holloman AFB and ROW include each airfield/airport and its respective environs as well as the SUA and MTRs described above and depicted on **Figure 2-5**. Additional details on airspace management and use can be found in **Appendix C.1.**

3.3.2 *Environmental Consequences Evaluation Criteria*

Adverse impacts on the airspace surrounding the airfields or the SUA, ATCAAs, and MTRs might include modifications to the airspace or significantly increasing flight operations within the airspace because of the Proposed Action. For this EA, an impact is considered significant if it modifies airport airspace, SUA, ATCAA, or MTR location, dimensions, or aircraft operational capacity.

3.3.3 *Existing Conditions*

3.3.3.1 Holloman Air Force Base

The Holloman AFB airfield is operated by the 54 FG supporting military operations conducted by units stationed at the base. Military training has occurred in the vicinity of Holloman AFB since 1942. Most of the operations at Holloman AFB are performed by the 54 FG F-16C aircraft, primarily by the 311 FS, 314 FS, and 8 FS.

Air Traffic Control (ATC) for Holloman AFB is provided by the Air Force. The control tower manages the aircraft flying in Class D airspace within a range of 5 miles of the base; when aircraft fly beyond this range, control is transferred to terminal radar approach control (Holloman AFB, 2021a).

A variety of factors can influence the annual level of operational activity at an airfield, including economics, national emergencies, and maintenance requirements. Operations consist of arrivals and departures (itinerant) by primarily military aircraft, with a smaller amount of general aviation traffic flights. Based military aircraft use makes up about 96 percent of the airfield use, with the remaining amount used by civilian general aviation and transient aircraft flights **(Table 3-2)**.

Table 3-2
Annual Operations at Holloman Air Force Base

Use	Annual Operations	Percentage of Use
F-16C (311, 314 FS)	50,000	48.7
F-16C (8 FS)	25,000	24.3
Other Based Military	23,800	23.2
Civilian	1,152	1.1
Transient	2,740	2.7
Total	**102,692**	**100**

8 FS = 8th Fighter Squadron; 311 FS = 311th Fighter Squadron; 314 FS = 314th Fighter Squadron

3.3.3.2 Roswell International Air Center

ROW is a municipal airport and aviation-related business park located 5 miles south of the City of Roswell in Chaves County, New Mexico (ROW, 2018). ROW, originally an Army airfield and training facility during World War II, now serves a variety of civilian and military aircraft flights and aircraft maintenance and storage. The towered airport has two runways, 3/21 and 17/35, with lengths of 13,001 and 9,999 ft.

Operations at ROW consist of arrivals and departures of itinerant and local operations (including patterns) primarily by military aircraft, with a smaller number of civilian operations (**Table 3-3**).

Table 3-3
Annual Operations at Roswell International Air Center

Use	Annual Operations	Percentage of Use
Military (Including F-16C)	31,333	66.5
Civilian (Air Carrier, Air Taxi, and General Aviation)	15,816	33.5
Total	**47,149**	**100**

3.3.3.3 Special Use Airspace

The affected environment for airspace management includes SUA, ATCAAs, and training ranges as described in **Section 2.3.1.2** where aircraft based at Holloman AFB perform training operations.

3.3.3.4 Military Training Routes

The affected environment for airspace management includes MTRs as described in **Section 2.3.1.2** where aircraft based at Holloman AFB perform training operations.

3.3.4 *Environmental Consequences – Alternative 1*

3.3.4.1 Holloman Air Force Base and Roswell International Air Center

The permanent estimated 5,000 annual sorties (about a 10 percent permanent increase in operations) in the Holloman AFB airspace is not expected to impact the operational capacity or necessitate changes to airspace locations or dimensions of any of the airspaces around Holloman AFB. Potential impacts on the airspace are expected to be negligible and long-term. Of the 5,000 annual sorties at Holloman AFB, the 8 FS would fly an estimated additional 92 sorties to ROW and perform an estimated 207 additional patterns per year. The additional 207 patterns that would be flown in the ROW airspace represent a 20 percent increase over the baseline F-16C patterns flown and, similar to Holloman AFB, potential impacts on the ROW airspace are expected to be negligible and long-term.

3.3.4.2 Special Use Airspace

With implementation of Alternative 1, the estimated 5,000 annual training sorties flown by the 8 FS in the affected SUA and ATCAAs would be permanent. While the proposed permanent beddown of the 8 FS would use all the SUA and ATCAAs, the net number of sorties, except for the Talon ATCAA and MOAs, would not increase. The number of total sorties that would be flown by Holloman AFB within the Talon ATCAA and MOAs would not exceed the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021).

No airspace modifications are included as part of Alternative 1. The SUA and ATCAAs proposed for use have the capacity, are in locations, and have the dimensions necessary to support the additional sorties proposed under Alternative 1. Negligible impacts on airspace are expected from implementation of Alternative 1.

3.3.4.3 Military Training Routes

The sorties proposed under Alternative 1 are well within the number of sorties previously analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021) for IR-192/194, IR-134/195, and VR-176 and have therefore been excluded from this analysis. Currently, less than 100 sorties a year are flown on IR-133/142. No increase in sorties is expected under Alternative 1, therefore negligible impacts on airspace are expected from implementation of Alternative 1.

3.3.5 *Environmental Consequences – Alternative 2*

3.3.5.1 Holloman Air Force Base and Roswell International Air Center

The permanent 5,000 annual sorties currently flown by the 8 FS and the addition of an estimated 5,000 annual sorties from the proposed additional F-16 FTU squadron (about a 40 percent increase in 8 FS permanent annual operations) in the Holloman AFB airspace are not expected to impact the operational capacity or necessitate changes to airspace locations or dimensions of any of the airspaces around Holloman AFB. Potential impacts on the airspace are expected to be minor and long-term. Of the 10,000 permanent additional annual sorties at Holloman AFB, the 8 FS and additional F-16 FTU would fly an estimated additional 199 sorties to ROW and perform an estimated 581 additional patterns per year. The projected 10,000 additional sorties are consistent with the projections in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). The additional 581 patterns that would be flown in the ROW airspace represent a 40 percent increase over the baseline F-16C patterns flown; however, similar to Holloman AFB, potential impacts on the ROW airspace are expected to be minor and long-term.

3.3.5.2 Special Use Airspace

With implementation of Alternative 2, there would be an increase of an estimated 10,000 permanent annual training sorties in the affected SUA and ATCAAs. While the 8 FS and proposed additional FTU squadron would use all the SUA and ATCAAs, the net number of sorties, except for the Talon ATCAA and MOAs, would not increase. The number of total sorties that would be flown by Holloman AFB within the Talon ATCAA and MOAs would not exceed the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021).

No airspace modifications are included as part of Alternative 2. The SUA and ATCAAs proposed for use have the capacity, are in locations, and have the dimensions necessary to support the additional sorties proposed under Alternative 2. Negligible impacts on airspace are expected from implementation of Alternative 2.

3.3.5.3 Military Training Routes

The sorties proposed under Alternative 2, as described in Section 2.3.1.2, represent a minor increase in annual sorties compared to the number of sorties previously analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021) including IR-192/194 from 21 to 55 sorties, IR-134/195 from 6 to 15 sorties, IR-133/142 from 31 to 55 sorties and VR-176 unchanged at 223 sorties. Under Alternative 2, less than 100 sorties a year are flown on each of the three routes with an increase in sorties, therefore, negligible impacts on airspace are expected from implementation of Alternative 2.

3.3.6 *Environmental Consequences – No Action Alternative*

Under the No Action Alternative, F-16 FTU squadrons would not be permanently based at Holloman AFB. The 8 FS would remain while other beddown locations are considered and additional environmental analysis completed. No changes would occur to airspace management or use at Holloman AFB, ROW, or the SUA, ATCAAs, or MTRs.

3.3.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

There would be no modifications to the existing airspace under Alternative 1 or Alternative 2 at Holloman AFB and ROW. As airspace demand in the region increases, the Air Force, in conjunction with other managing agencies, would continue coordination to reduce potential impacts. Potential effects on airspace management and use, when added to reasonably foreseeable future actions, are expected to be negligible under Alternatives 1 and 2 for both Holloman AFB, ROW, and the SUA, ATCAAs, and MTRs.

3.4 NOISE

3.4.1 *Definition of the Resource*

Military aircraft generate two types of sound, subsonic noise, and supersonic noise. Aircraft subsonic noise consists of two major types of sound events: flight events (including takeoffs, landings, and flyovers) and stationary events, such as engine maintenance run-ups. Aircraft in supersonic flight (exceeding the speed of sound, Mach 1) cause sonic booms. A sonic boom is characterized by a rapid increase in pressure, followed by a decrease before a second rapid return to normal atmospheric levels. This change occurs very quickly, typically within a few tenths of a second, and is usually perceived as a “bang-bang” sound. Noise metrics and other acoustic principles are described in much greater detail in **Appendix C.2.**

Noise metrics quantify subsonic and supersonic noise in a standard way. There are several metrics that can be used to describe a range of situations, from a particular individual event to the cumulative effect of all noise events over a long time. For this analysis, noise is expressed using several metrics including: A-weighted decibels (dBA), day-night average sound level (DNL or L_{dn}), onset-rate adjusted monthly day-night average sound level (L_{dnmr}), C-weighted sound exposure level (CSEL), and overpressure (pounds per square foot [psf]). These noise metrics are calculated using the following software programs: NOISEMAP (Czech and Plotkin, 1998; Wasmer and Maunsell, 2006a, 2006b), MR_NMAP (Lucas and Calamia, 1997), PCBoom (Plotkin, 2002), and BooMap (Plotkin, 1993). Noise models and modeling inputs are described in much greater detail in **Appendix D.1.**

The ROI for noise includes Holloman AFB, ROW, and the SUA, ATCAAs, and MTRs described in **Section 2.3.1.2**.

3.4.2 *Existing Conditions*

3.4.2.1 Holloman Air Force Base

As is normal for a military installation with an active runway, the primary driver of noise at Holloman AFB is aircraft operations. Standard aircraft operations include take-offs, landings, closed patterns, and static run-ups.

In addition to aviation noise, some additional noise results from the day-to-day activities associated with operations, maintenance, and the industrial functions associated with the operations of the installation. These noise sources include the operations of ground-support equipment and other transportation noise from vehicular traffic. Noise resulting from aircraft operations remains the dominant noise source.

Aircraft operations at Holloman AFB consist of a variety of jet engine aircraft. Existing annual aircraft operations at Holloman AFB total 102,692, as listed in **Table 3-4**. An operation is defined as a single takeoff or landing. Closed patterns consist of two operations, one departure and one arrival (e.g., two closed pattern circuits consist of four total operations). The table pattern numbers are operation counts, not pattern circuit counts. Holloman AFB's Runways 16 and 25 are used for the majority of aircraft operations. A more detailed existing annual aircraft operations table can be found in **Appendix C.1**.

Table 3-4
Existing Annual Aircraft Operations Summary at Holloman Air Force Base

Aircraft	Departures		Arrivals		Closed Patterns		Total Operations		
	Day	Night	Day	Night	Day	Night	Day	Night	Total
F-16C (311 & 314 FS)	9,500	500	9,300	700	29,400	600	48,200	1,800	50,000
F-16C (8 FS)	4,750	250	4,650	350	14,700	300	24,100	900	25,000
Other Based Military	6,277	1,978	7,990	265	7,210	80	21,477	2,323	23,800
Civilian	576	0	576	0	0	0	1,152	0	1,152
Transient	1,370	0	1,370	0	0	0	2,740	0	2,740
Grand Total	**22,473**	**2,728**	**23,886**	**1,315**	**51,310**	**980**	**97,669**	**5,023**	**102,692**

8 FS = 8th Fighter Squadron; 311 FS = 311th Fighter Squadron; 314 FS = 314th Fighter Squadron

The resultant 65- to 85-dBA DNL contours in 5-dBA increments for the existing daily flight events at Holloman AFB are depicted on **Figure 3-1** along with noise sensitive points of interest (POIs) selected for the study. The area within the DNL contours for the existing conditions is listed in **Table 3-5**. In accordance with Air Force Handbook 32-7084, *Air Installation Compatible Use Zone Program Manager's Guide*, generally, all land uses are compatible with noise from aircraft operations at the 65-dBA DNL noise level. It should be emphasized that these noise levels, which are often shown graphically as contours on maps, are not discrete lines that sharply divide louder areas from land largely unaffected by noise. Instead, they are part of a planning tool that depicts the general noise environment around the airport based on typical aviation activities. Areas beyond the 65-dBA DNL can also experience levels of appreciable noise depending on flight activity or weather conditions. In addition, DNL contours may vary from year to year along with fluctuations in operations, funding levels, and other factors. Static run-up operations, such as maintenance and pre/postflight run-ups, were also modeled. A more detailed discussion of static operations at Holloman AFB can be found in **Appendix C.1**.

Table 3-5
Existing Day-Night Average Sound Level Area Affected at Holloman Air Force Base

Noise Level (dBA DNL)	Area Within Noise Contour (ac)
>65	9,537
>70	4,885
>75	2,892
>80	1,583
>85	734

Notes: Area (on- and off-airport property) was based off the NOISEMAP-modeled noise contours and used to calculate the amount of land within each noise contour. The amounts shown are cumulative (i.e., the acreage within the >85-dBA contour is also within all the lower noise level contours).
ac=acres; dBA = A-weighted decibel; DNL = Day-Night Average Sound Level

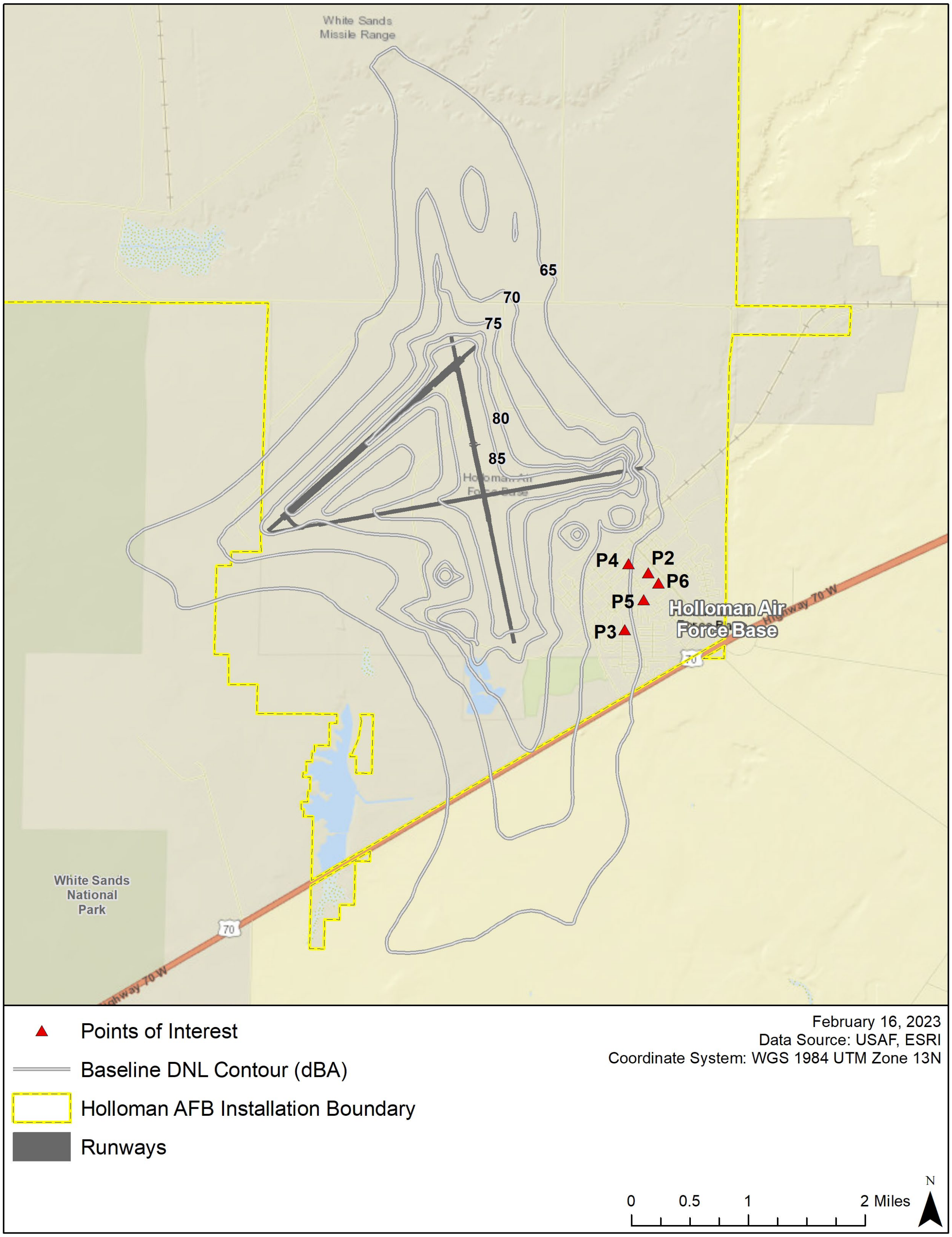

Figure 3-1. Existing Day-Night Average Sound Level Contours at Holloman Air Force Base.

The POIs identified in the vicinity of Holloman AFB are also shown in **Table 3-6** and **Figure 3-2**. **Table 3-6** shows the DNL as a result of aircraft operations at Holloman AFB at the six POIs for the existing conditions.

Table 3-6
Existing Day-Night Average Sound Level at Points of Interest at Holloman Air Force Base

Points of Interest		DNL (dBA)
ID	Description	
P1	White Sands National Park Historic Visitor Center	49
P2	Child Development Center 1	66
P3	Child Development Center 2	64
P4	Embry-Riddle Aeronautical University	65
P5	Holloman Elementary School	64
P6	Holloman Middle School	63

Note: POI levels based on the NOISEMAP-modeled noise exposures.
dBA = A-weighted decibel; DNL = Day-Night Average Sound Level; POI = point of interest

3.4.2.2 Roswell International Air Center

As is normal for active civil airports, the primary driver of noise at ROW is aircraft operations. Standard aircraft operations include take-offs, landings, closed patterns, and static run-ups.

In addition to aviation noise, some additional noise results from the day-to-day activities associated with operations, maintenance, and the industrial functions associated with operations of the airport. These noise sources include the operations of ground-support equipment and other transportation noise from vehicular traffic. Noise resulting from aircraft operations remains the dominant noise source.

Aircraft operations at ROW consist of a variety of military and civilian aircraft. Existing annual aircraft operations at ROW total 47,149, as listed in **Table 3-7**. An operation is defined as a single takeoff or landing. Closed patterns consist of two operations, one departure and one arrival (e.g., two closed pattern circuits consist of four total operations). The table pattern numbers are operation counts, not pattern circuit counts. ROW Runway 21 is used for the majority of aircraft operations. A more detailed existing annual aircraft operations table can be found in **Appendix C.1**.

Table 3-7
Existing Annual Aircraft Operations Summary at Roswell International Air Center

Aircraft	Departures		Arrivals		Closed Patterns		Total Operations		
	Day	Night	Day	Night	Day	Night	Day	Night	Total
F-16C	230	0	230	0	920	0	1,380	0	1,380
Other Military	14,976	0	14,976	0	0	0	29,953	0	29,953
Air Carrier	1,001	253	1,002	253	0	0	2,003	506	2,509
Air Taxi	1,405	43	1,406	43	0	0	2,811	86	2,897
General Aviation	4,314	891	4,314	891	0	0	8,628	1,782	10,410
Grand Total	**21,926**	**1,187**	**21,928**	**1,187**	**920**	**0**	**44,775**	**2,374**	**47,149**

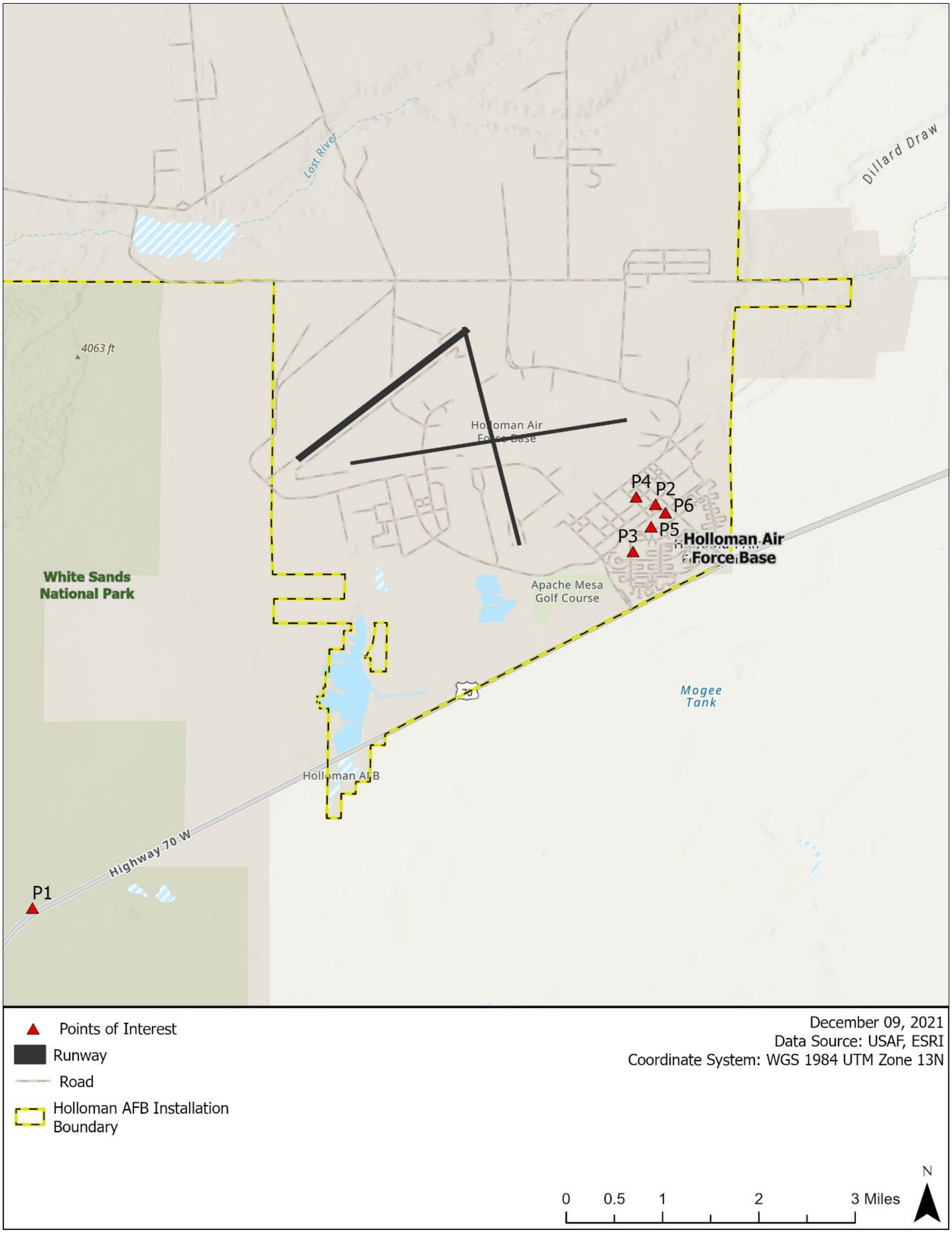

Figure 3-2. Representative Points of Interest at Holloman Air Force Base.

The resultant 65- to 85-dBA DNL contours in 5-dBA increments for the existing daily flight events at ROW along with noise sensitive POIs are depicted on **Figure 3-3**. The area within the DNL contours for the existing conditions are listed in **Table 3-8**. In accordance with Air Force Handbook 32-7084, *Air Installation Compatible Use Zone Program Manager's Guide*, generally all land uses are compatible with noise from aircraft operations at the 65-dBA DNL noise level. It should be emphasized that these noise levels, which are often shown graphically as contours on maps, are not discrete lines that sharply divide louder areas from land largely unaffected by noise. Instead, they are part of a planning tool that depicts the general noise environment around the airport based on typical aviation activities. Areas beyond the 65-dBA DNL can also experience levels of appreciable noise depending on flight activity or weather conditions. In addition, DNL contours may vary from year to year along with fluctuations in operations, funding levels, and other factors. Static run-up operations, such as maintenance and pre/postflight run-ups, were also modeled. A more detailed discussion of static operations at ROW can be found in **Appendix D**.

Table 3-8
Existing Day-Night Average Sound Level Area Affected at Roswell International Air Center

Noise Level (dBA DNL)	Area Within Noise Contour (ac)
>65	7,484
>70	3,548
>75	1,899
>80	1,071
>85	580

Notes: Area (on- and off-airport property) was based off the NOISEMAP-modeled noise contours and used to calculate the amount of land within each noise contour. The amounts shown are cumulative (i.e., the acreage within the >85-dBA contour is also within all the lower noise level contours).
dBA = A-weighted decibel; DNL = Day-Night Average Sound Level

The POIs identified in the vicinity of ROW are shown in **Table 3-9** and **Figure 3-4**). These POIs are made up of noise-sensitive receptors such as homes, schools, hospitals, and places of worship. **Table 3-9** shows the DNL as a result of aircraft operations at ROW at the nine POIs for the existing conditions.

Table 3-9
Existing Day-Night Average Sound Level at Points of Interest at Roswell International Air Center

Points of Interest		DNL (dBA)
ID	Description	
P1	Church On the Move	60
P2	Carson City Road	65
P3	West Eyman Street	62
P4	Circle Cross Street	66
P5	West Hobbs and Sunset Avenue	61
P6	Sunset Elementary	58
P7	Mountain View Middle School	52
P8	Roswell High School	52
P9	Sierra Middle School	55

Note: POI levels based on the NOISEMAP-modeled noise exposures.
dBA = A-weighted decibel; DNL = Day-Night Average Sound Level

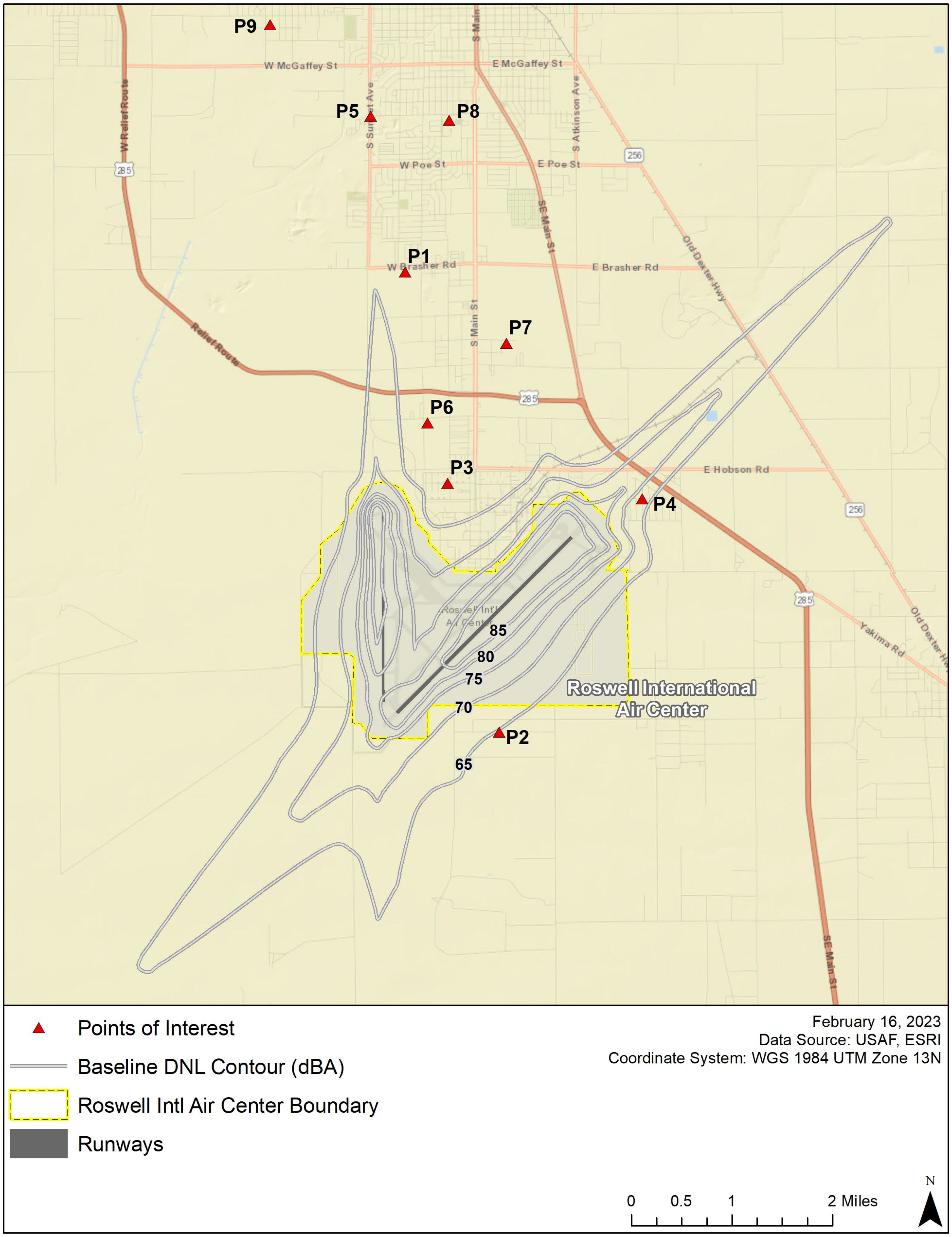

Figure 3-3. Existing Day-Night Average Sound Level Contours at Roswell International Air Center.

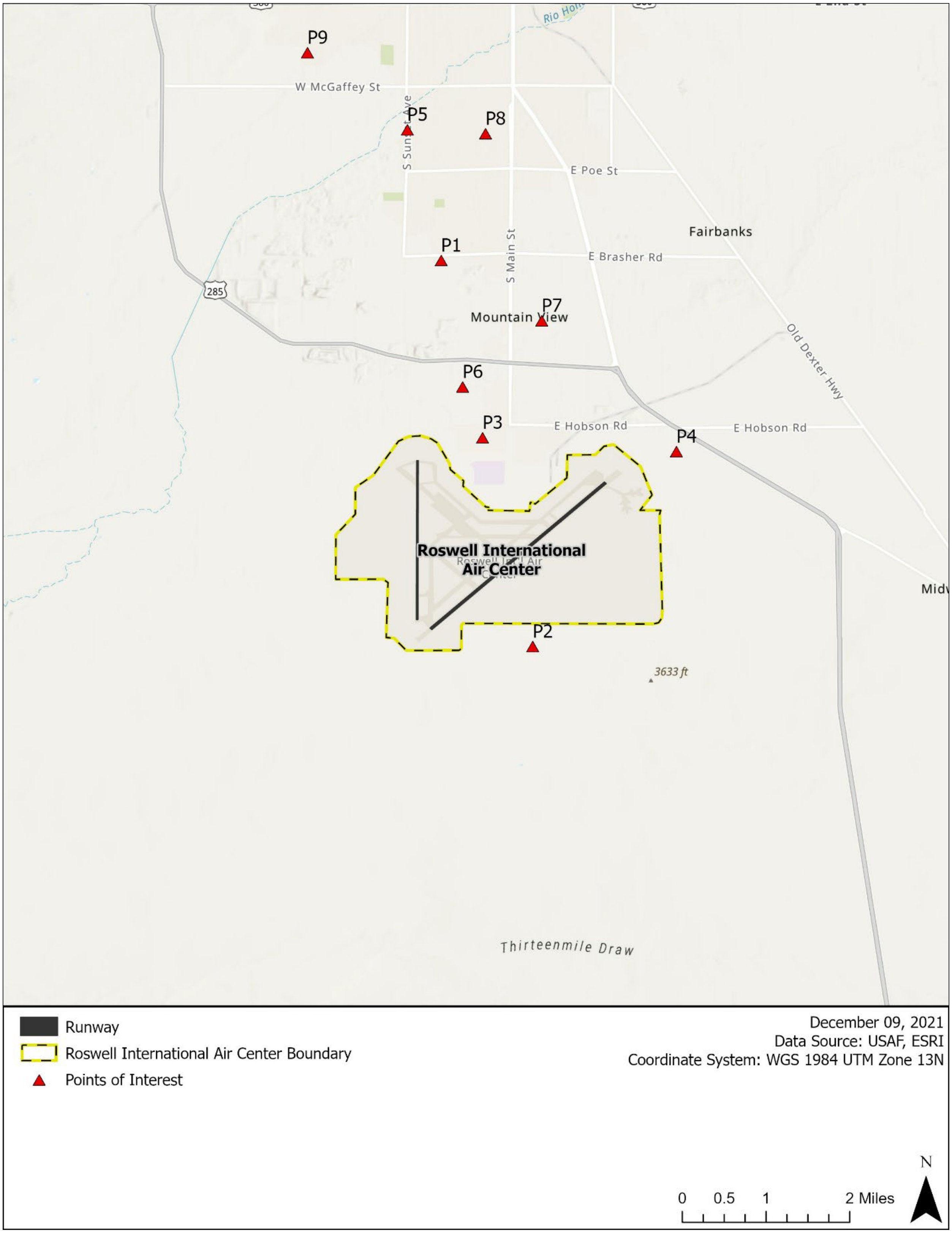

Figure 3-4. Representative Points of Interest at Roswell International Air Center.

3.4.2.3 Special Use Airspace

The primary SUA used by Holloman AFB F-16C aircraft are described in **Section 2.3.1.2**. Subsonic and supersonic noise levels due to aircraft operations within most of the airspaces were previously analyzed in the *Special Use Airspace Final EIS and ROD* (Air Force, 2021) and the *Holloman AFB Combat Air Forces Adversary Air EA* (Air Force, 2020).

Assessments for supersonic noise indicate that projected CDNLs within the MOAs would not exceed the US Army Public Health Command and United States Environmental Protection Agency (USEPA) thresholds for significant impact and, similarly, no adverse impacts to hearing and health would be anticipated. The *Special Use Airspace Optimization Final EIS and ROD* estimates single event sonic boom levels under these airspaces to be less than 1-psf and the likelihood of a sonic boom resulting in any structural impact is negligible. The *Holloman AFB Combat Air Forces Adversary Air EA (*Air Force, 2020) contained detailed analysis on supersonic flying in closer proximity to Holloman AFB. As a cooperating agency, the NPS expressed concerns about aircraft noise in general due to Holloman AFB flight operations, and in particular about sonic booms at the WSNP Visitor Center. The Air Force responded to NPS by providing information about Holloman AFB supersonic operations, describing their standard supersonic flight profiles and airspace utilization. As part of this, noise modeling was conducted to assess sonic boom levels at the WSNP Visitor Center.

Supersonic profiles at higher altitudes (greater than 30,000 ft MSL) would be audible but would not generate overpressures at WSNP Visitor Center which would cause damage to WSNP Visitor Center historic pueblo-adobe construction (King et al., 1988). The most commonly used flight tract for supersonic operations near WSNP Visitor Center is 5-miles to the east. Those operations are typically flown at 18,000 to 30,000 ft MSL and at that lateral distance overpressures would not be generated at WSNP Visitor Center. Most supersonic flying in the vicinity of Holloman AFB is performed along a north-south tract that is above the runway. This is due to safety concerns based on the need to be in close proximity to the runway in case there is engine trouble or another mechanical problem. Furthermore, it is more fuel efficient to fly in close proximity to the runway. A smaller number of flights are conducted over Yonder East but most are conducted at 18,000 ft MSL or higher and are usually flown a few miles to the west of the WSNP Visitor Center; although Yonder East's rectangle does include a portion over the WSNP. Expected overpressures from those altitudes and lateral distance would not generate overpressures at WSNP Visitor Center that would cause damage.

Information provided by NPS indicate that cracks in the adobe headquarters structure have existed back to at least 1988. It is unknown whether those cracks were caused by heating and cooling, subsidence, construction defects, seismic events, tour bus vehicle vibrations, or supersonic operations from previously-based, much larger aircraft from Holloman AFB or a myriad of other factors. Given the supersonic flight parameters of interim and proposed permanent F-16 operations from Holloman AFB and the many studies on effects of overpressure from sonic booms, absent scientific data showing that overpressures are different than estimated, the conclusion is that there is no significant effect from Holloman AFB supersonic operations on structures at WSNP. Holloman AFB personnel are willing to work with NPS to consider more data if it is forthcoming and to ensure supersonic flight profiles and rules of flight are followed.

3.4.2.4 Military Training Routes

The primary military training routes used by Holloman AFB F-16C aircraft are described in **Section 2.3.1.2**. Noise levels due to aircraft operations within most of the airspaces were previously analyzed in the *Special Use Airspace Final EIS and ROD* (Air Force, 2021) and the *Holloman AFB Combat Air Forces Adversary Air EA* (Air Force, 2020). Onset-rate adjusted day-night average sound levels (L_{dnmr}) due to Holloman AFB F-16C aircraft operations on IR-133/142 in the Mayhill area are estimated to be <45 dB primarily due to the low number of annual operations.

3.4.3 *Environmental Consequences Evaluation Criteria*

Noise analysis typically evaluates potential changes to existing noise environments that would result from implementation of the Proposed Action and alternatives. In accordance with Air Force Handbook 32-7084, generally, all land uses are compatible with noise from aircraft operations at noise levels below 65-dBA DNL. Areas below 65-dBA DNL can also experience levels of appreciable noise depending on training intensity or weather conditions. In addition, DNL contours may vary from year to year due to fluctuations in operational tempo because of unit deployments, funding levels, and other factors.

Potential changes in the noise environment can be beneficial (if they reduce the number of sensitive receptors exposed to unacceptable noise levels), negligible (if the total area exposed to unacceptable noise levels is essentially unchanged), or adverse (if they result in increased noise exposure to unacceptable noise levels). Projected noise impacts were evaluated for Alternatives 1 and 2.

3.4.4 *Environmental Consequences – Alternative 1*

Implementation of Alternative 1 would establish the 8 FS as a permanently assigned unit at Holloman AFB. Aircraft operations at Holloman AFB would not increase; however, ROW would experience additional sorties and closed patterns due to Alternative 1.

3.4.4.1 Holloman Air Force Base

Under Alternative 1, the noise environment at Holloman AFB would be identical to the existing conditions, although the 8 FS operations would be permanent. Therefore, there would be long-term, negligible impacts caused by noise for Holloman AFB under Alternative 1.

3.4.4.2 Roswell International Air Center

Under Alternative 1, additional sorties and closed patterns would be flown at ROW compared with the existing conditions. Proposed annual departure, arrival, and closed pattern aircraft operations at ROW under Alternative 1 are listed in **Table 3-10**.

Table 3-10
Alternative 1 Annual Aircraft Operations Summary at Roswell International Air Center

Aircraft	Departures		Arrivals		Closed Patterns		Total Operations		
	Day	Night	Day	Night	Day	Night	Day	Night	Total
F-16C (311 & 314 FS)	230	0	230	0	920	0	1,380	0	1,380
F-16C (8 FS)	92	0	92	0	207	0	391	0	391
Other Military	14,976	0	14,976	0	0	0	29,953	0	29,953
Air Carrier	1,001	253	1,002	253	0	0	2,003	506	2,509
Air Taxi	1,405	43	1,406	43	0	0	2,811	86	2,897
General Aviation	4,314	891	4,314	891	0	0	8,628	1,782	10,410
Grand Total	**22,018**	**1,187**	**22,020**	**1,187**	**1,127**	**0**	**45,166**	**2,374**	**47,540**

8 FS = 8th Fighter Squadron, 311 FS = 311th Fighter Squadron, 314 FS = 314th Fighter Squadron

The resultant 65- to 85-dBA DNL contours in 5-dBA increments for the daily flight events at ROW under Alternative 1 are depicted on **Figure 3-5**. Generally, all land uses are compatible with noise from aircraft operations at noise levels below 65-dBA DNL.

The noise levels generated by the increase in sorties and closed patterns would increase the overall noise environment in the vicinity of ROW. A comparison of the DNL contours of Alternative 1 and the existing conditions is depicted on **Figure 3-6**, and the change in area within noise contours as a result of Alternative 1 is listed in **Table 3-11**.

Table 3-11
Alternative 1 Day-Night Average Sound Level Area Affected on and Surrounding Roswell International Air Center

Noise Level (dBA DNL)	Area Within Noise Contour (ac)		
	Existing	Alternative 1	Increase
>65	7,484	7,535	51
>70	3,548	3,566	18
>75	1,899	1,907	8
>80	1,071	1,074	3
>85	580	582	2

Notes: Area (on- and off-airport property) was based off the NOISEMAP-modeled noise contours and used to calculate the amount of land within each noise contour. The amounts shown are cumulative (i.e., the acreage within the >85-dBA contour is also within all the lower noise level contours).
ac = acres; dBA = A-weighted decibel; DNL = Day-Night Average Sound Level

As a result of implementation of Alternative 1, noise levels at representative POIs described in **Section 3.4.2.2** would increase by less than 1-dBA DNL. The DNL at these POIs and the surrounding areas would be long term, likely unnoticeable, and negligible under Alternative 1 for ROW.

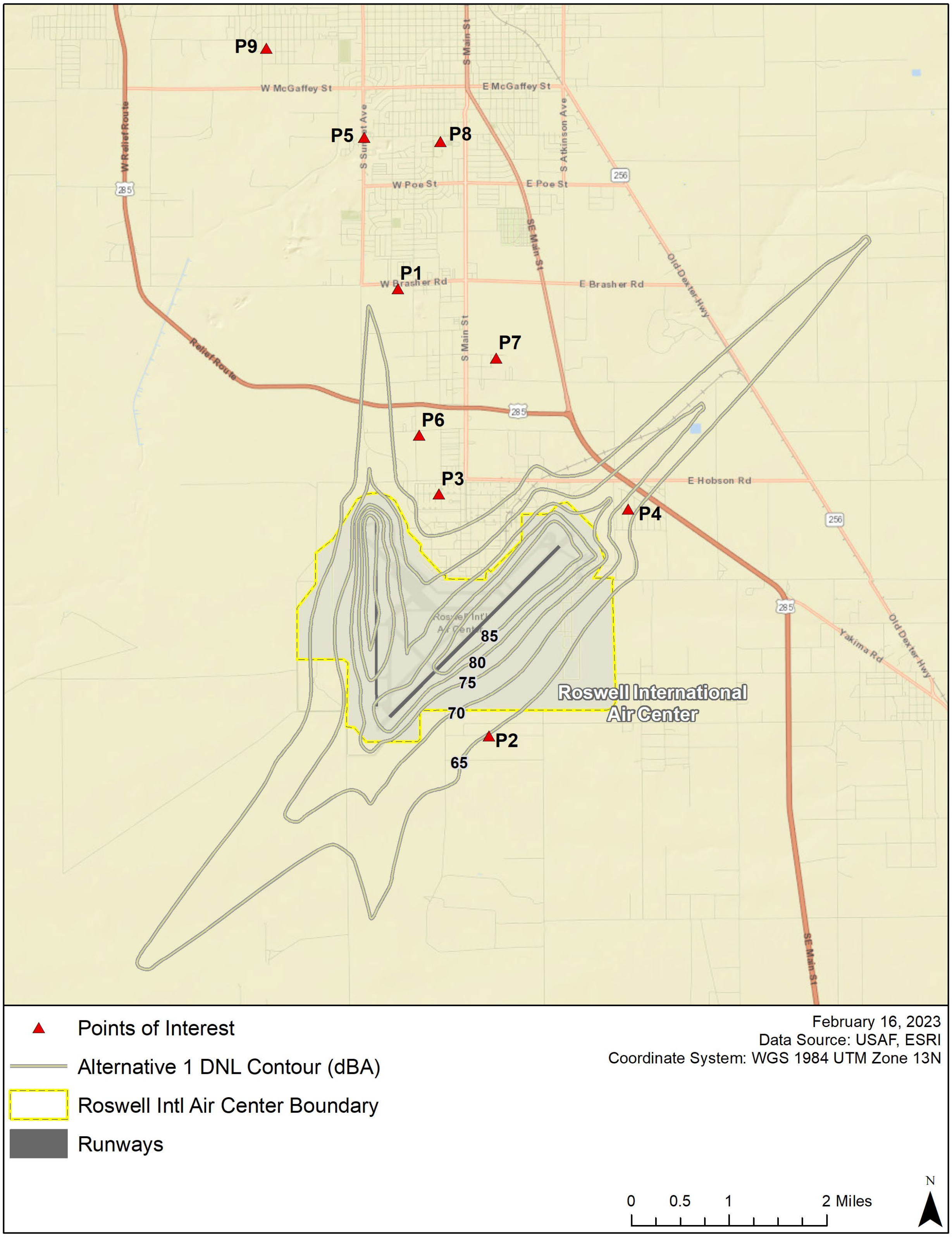

Figure 3-5. Alternative 1 Day-Night Average Sound Level Contours at Roswell International Air Center.

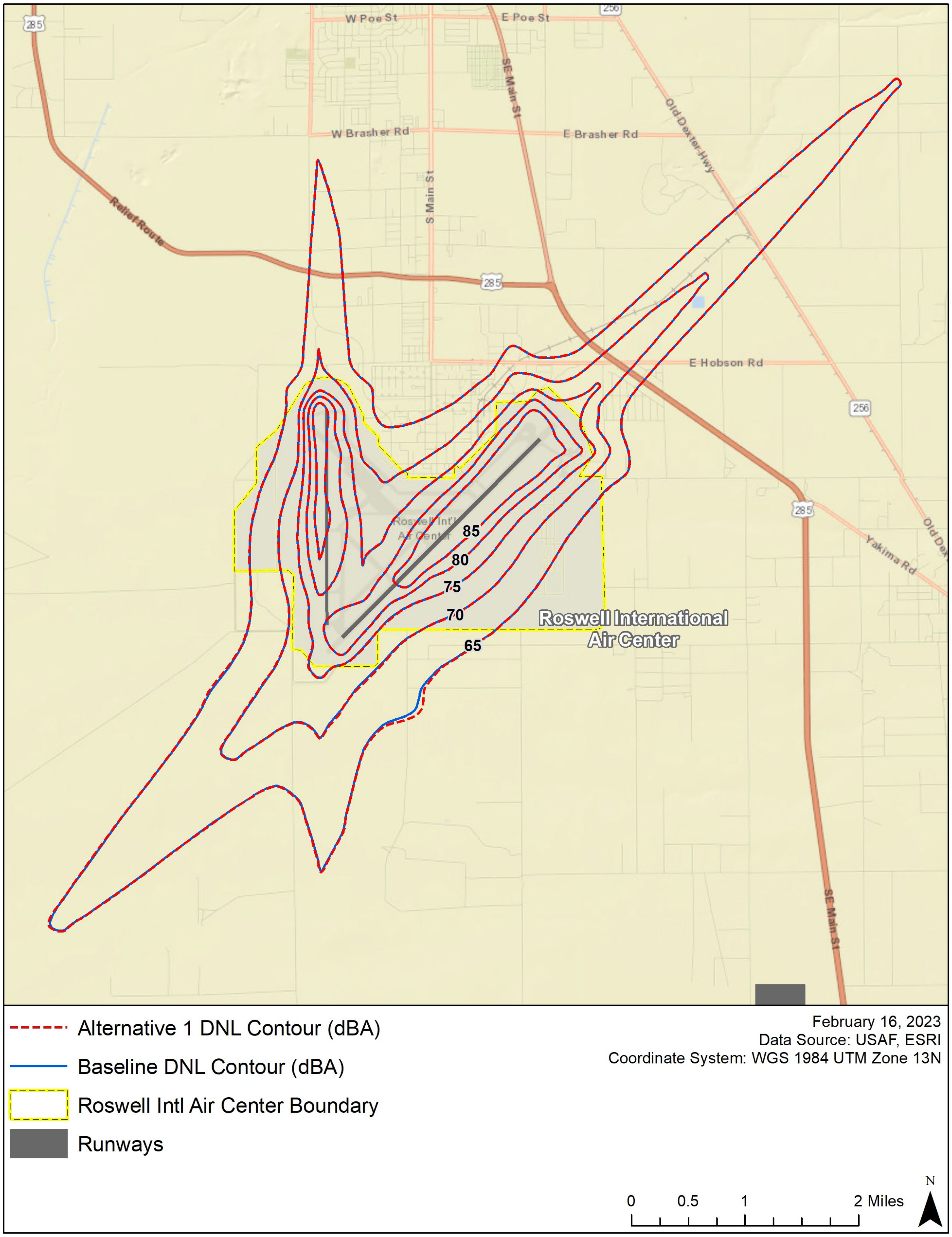

Figure 3-6. Comparison of Alternative 1 and Existing Day-Night Average Sound Level Contours at Roswell International Air Center.

3.4.4.3 Special Use Airspace

Under Alternative 1, the noise environment within SUA would be identical to the existing conditions, with operations by the 8 FS becoming permanent. Therefore, there would be long-term, negligible impacts caused by noise for airspaces under Alternative 1.

3.4.4.4 Military Training Routes

Under Alternative 1, the noise environment within the MTRs would be identical to the existing conditions, with operations by the 8 FS becoming permanent. The sorties proposed under Alternative 1 are well within the number of sorties previously analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021) for IR-192/194, IR-134/195, and VR 176 and have therefore been excluded from this analysis. Currently, less than 100 sorties a year are flown on IR-133/142. No increase in sorties is expected under Alternative 1, resulting in long-term, negligible impacts caused by noise for MTRs under Alternative 1.

3.4.5 *Environmental Consequences – Alternative 2*

Implementation of Alternative 2 would establish the 8 FS as a permanently assigned unit at Holloman AFB, and an additional F-16 FTU squadron would be permanently relocated to Holloman AFB. Aircraft operations at Holloman AFB would increase under Alternative 2. ROW would also experience additional sorties and closed patterns in Alternative 2.

3.4.5.1 Holloman Air Force Base

Under Alternative 2, additional F-16 operations would be flown at Holloman AFB compared with the existing conditions. Proposed annual departure, arrival, and closed pattern aircraft operations at Holloman AFB under Alternative 2 are listed in **Table 3-12**.

Table 3-12
Alternative 2 Annual Aircraft Operations Summary at Holloman Air Force Base

Aircraft	Departures		Arrivals		Closed Patterns		Total Operations		
	Day	Night	Day	Night	Day	Night	Day	Night	Total
F-16C (311 & 314 FS)	9,500	500	9,300	700	29,400	600	48,200	1,800	50,000
F-16C (8 FS)	4,750	250	4,650	350	14,700	300	24,100	900	25,000
F-16C (proposed)	4,750	250	4,650	350	14,700	300	24,100	900	25,000
Other Based Military	6,277	1,978	7,990	265	7,210	80	21,477	2,323	23,800
Civilian	576	0	576	0	0	0	1,152	0	1,152
Transient	1,370	0	1,370	0	0	0	2,740	0	2,740
Grand Total	**27,223**	**2,978**	**28,536**	**1,665**	**6,6011**	**1,279**	**121,770**	**5,922**	**127,692**

8 FS = 8th Fighter Squadron; 311 FS = 311th Fighter Squadron; 314 FS = 314th Fighter Squadron

The resultant 65- to 85-dBA DNL contours in 5-dBA increments for the daily flight events at Holloman AFB under Alternative 2 are depicted on **Figure 3-7** along with the representative POIs. The 65-dBA DNL is the noise level below which generally all land uses are compatible with noise from aircraft operations.

The noise levels generated by the increase in sorties and closed patterns would increase the overall noise environment in the vicinity of Holloman AFB. A comparison of the DNL contours of Alternative 2 and the existing conditions is depicted on **Figure 3-8**, and the change in area within noise contours as a result of Alternative 2 is listed in **Table 3-13**.

Table 3-13
Alternative 2 Day-Night Average Sound Level Area Affected on and Surrounding Holloman Air Force Base.

Noise Level (dBA DNL)	Area Within Noise Contour (ac)		
	Existing	Alternative 2	Increase
>65	9,537	10,062	525
>70	4,885	5,155	270
>75	2,892	3,087	195
>80	1,583	1,676	93
>85	734	840	106

Notes: Area (on- and off-airport property) was based off the NOISEMAP-modeled noise contours and used to calculate the amount of land within each noise contour. The amounts shown are cumulative (i.e., the acreage within the >85-dBA contour is also within all the lower noise level contours).
ac = acres; dBA = A-weighted decibel; DNL = Day-Night Average Sound Level

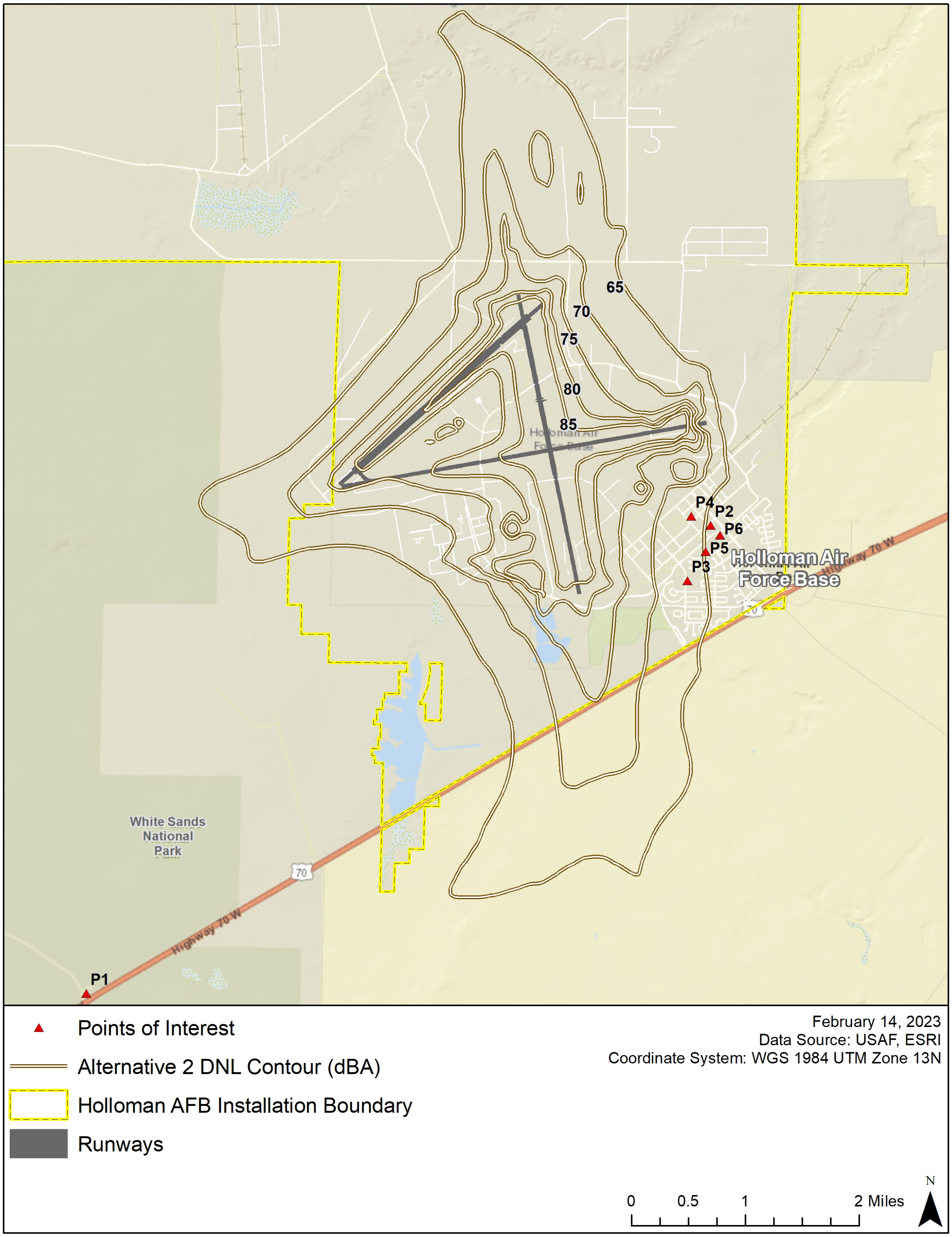

Figure 3-7. Alternative 2 Day-Night Average Sound Level Contours at Holloman Air Force Base.

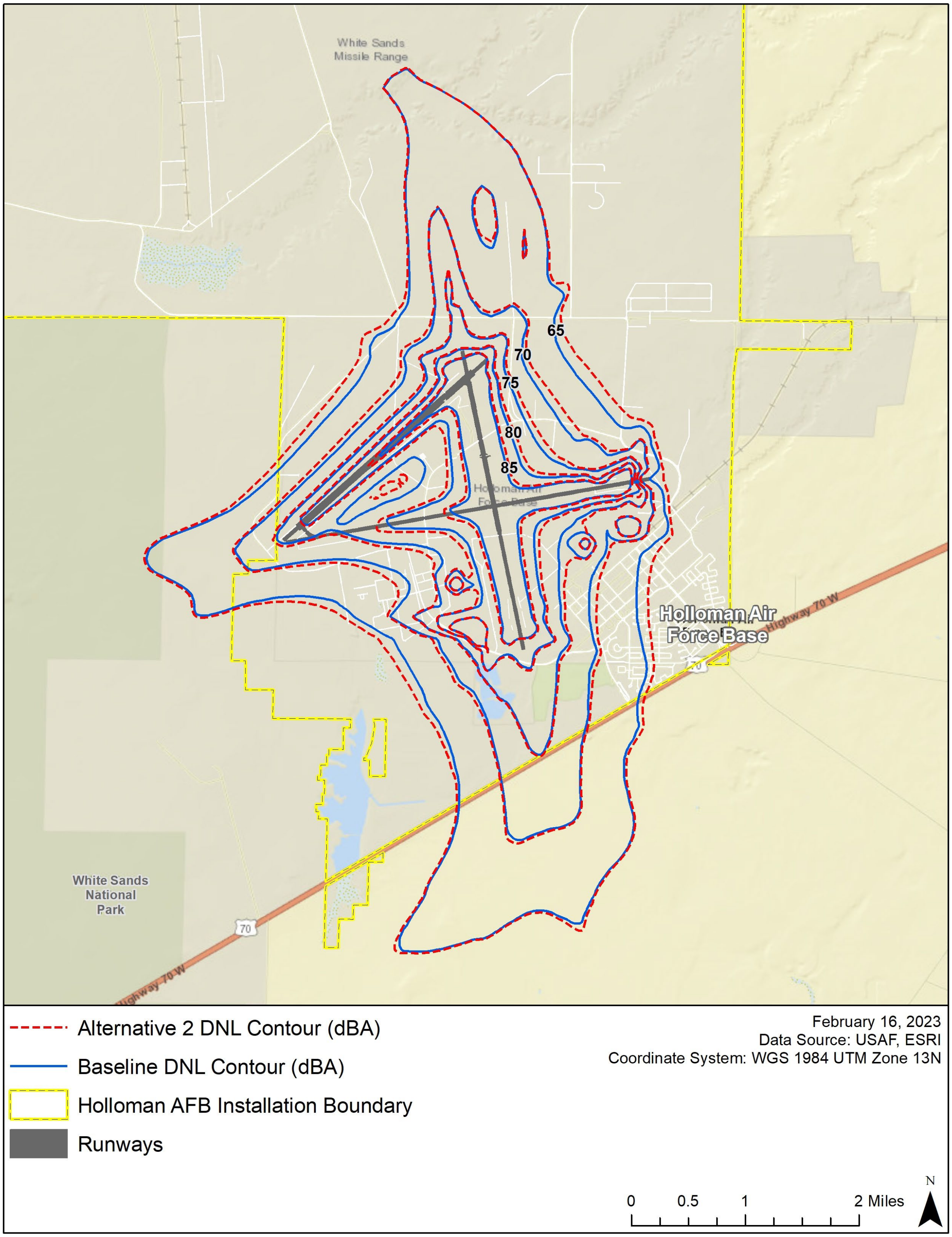

Figure 3-8. Comparison of Alternative 2 and Existing Day-Night Average Sound Level Contours at Holloman Air Force Base.

As a result of implementation of Alternative 2, noise levels at representative POIs described in **Section 3.2.2.2** would increase (**Table 3-14**). The DNL at the representative noise sensitive locations modeled would increase by an amount ranging from 0- to 1-dBA under Alternative 2. A DNL increase of greater than 3-dBA would be clearly noticeable and may increase human annoyance. The increased DNL at these POIs and the surrounding areas would be long term, likely unnoticeable, and negligible under Alternative 2 for Holloman AFB.

Table 3-14
Alternative 2 Day-Night Average Sound Level at Representative Points of Interest on and near Holloman Air Force Base

POIs		DNL (dBA)		
ID	**Description**	**Existing**	**Alternative 2**	**Increase in DNL**
P1	White Sands National Park Historic Visitor Center	49	49	0
P2	Child Development Center 1	66	66	0
P3	Child Development Center 2	64	65	1
P4	Embry-Riddle Aeronautical University	65	66	1
P5	Holloman Elementary School	64	65	1
P6	Holloman Middle School	63	64	1

Note: POI levels based on the NOISEMAP-modeled noise exposures.
dBA = A-weighted decibel; DNL = Day-Night Average Sound Level

3.4.5.2 Roswell International Air Center

Under Alternative 2, additional sorties and closed patterns would be flown at ROW compared with the existing conditions. Proposed annual departure, arrival, and closed pattern aircraft operations at ROW under Alternative 2 are listed in **Table 3-15**.

Table 3-15
Alternative 2 Annual Aircraft Operations Summary at Roswell International Air Center

Aircraft	Departures		Arrivals		Closed Patterns		Total Operations		
	Day	Night	Day	Night	Day	Night	Day	Night	Total
F-16C (311 & 314 FS)	230	0	230	0	920	0	1,380	0	1,380
F-16C (8 FS)	92	0	92	0	207	0	391	0	391
F-16C (proposed)	107	0	107	0	374	0	588	0	588
Other Military	14,976	0	14,976	0	0	0	29,953	0	29,953
Air Carrier	1,001	253	1,002	253	0	0	2,003	506	2,509
Air Taxi	1,405	43	1,406	43	0	0	2,811	86	2,897
General Aviation	4,314	891	4,314	891	0	0	8,628	1,782	10,410
Grand Total	**22,125**	**1,187**	**22,127**	**1,187**	**1,501**	**0**	**45,754**	**2,374**	**48,128**

8 FS = 8th Fighter Squadron; 311 FS = 311th Fighter Squadron; 314 FS = 314th Fighter Squadron

The resultant 65- to 85-dBA DNL contours in 5-dBA increments for the daily flight events at ROW under the proposed High Noise Scenario are depicted on **Figure 3-9** along with representative POIs. The 65-dBA DNL is the noise level below which generally all land uses are compatible with noise from aircraft operations.

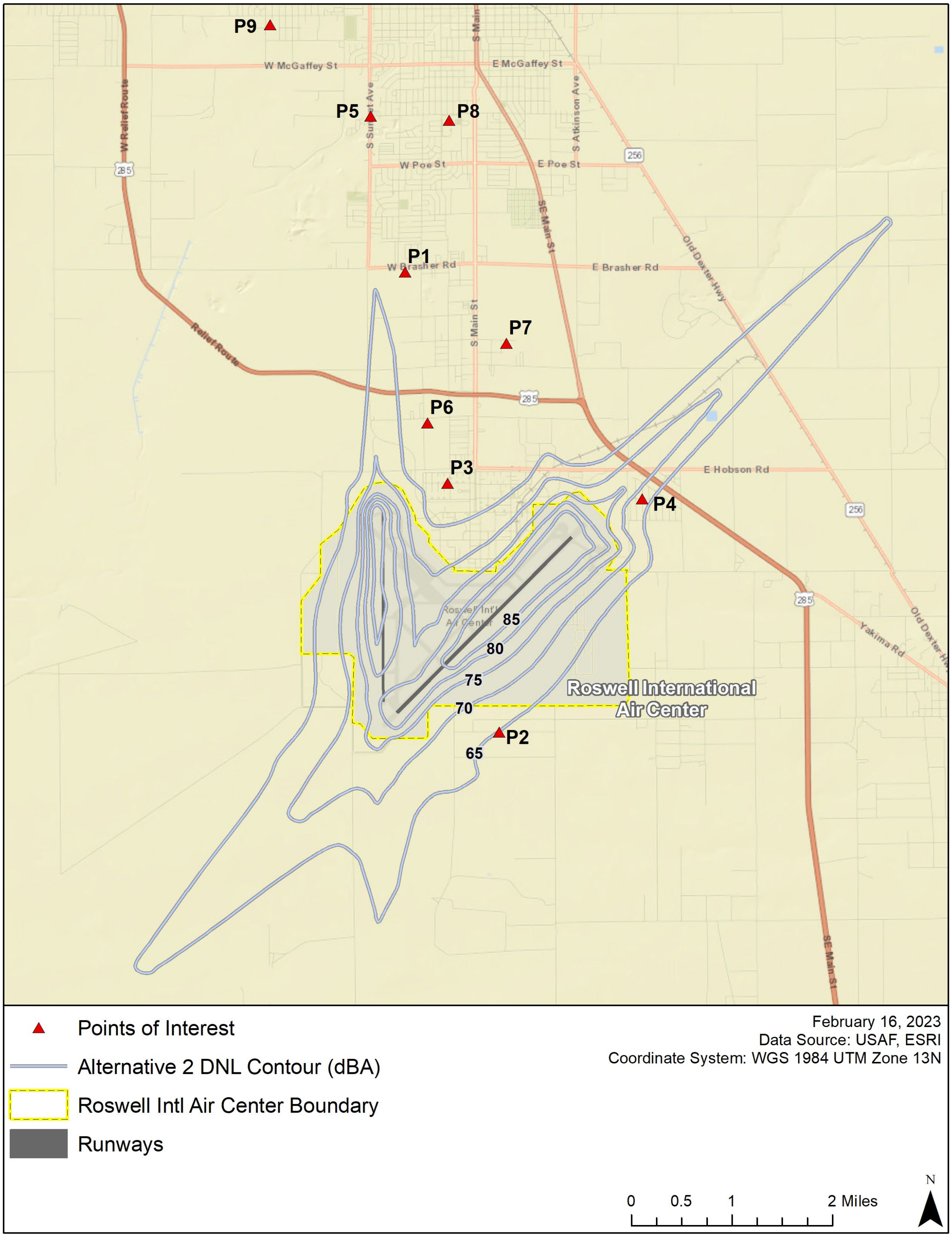

Figure 3-9. Alternative 2 Day-Night Average Sound Level Contours at Roswell International Air Center.

The noise levels generated by the increase in sorties and closed patterns would increase the overall noise environment in the vicinity of ROW. A comparison of the DNL noise contours of Alternative 2 and the existing conditions is depicted on **Figure 3-10**, and the change in area within noise contours as a result of Alternative 2 is listed in **Table 3-16**.

Table 3-16
Alternative 2 Day-Night Average Sound Level Area Affected on and Surrounding Roswell International Air Center

Noise Level (dBA DNL)	Area Within Noise Contour (ac)		
	Existing	Alternative 1	Increase
>65	7,484	7,614	130
>70	3,548	3,594	46
>75	1,899	1,920	21
>80	1,071	1,078	7
>85	580	585	5

Notes: Area (on- and off-airport property) was based off the NOISEMAP-modeled noise contours and used to calculate the amount of land within each noise contour. The amounts shown are cumulative (i.e., the acreage within the >85-dBA contour is also within all the lower noise level contours).
ac = acres; dBA = A-weighted decibel; DNL = Day-Night Average Sound Level

As a result of the implementation of Alternative 2, noise levels at representative POIs described in **Section 3.2.2.3** would increase by less than 1-dBA DNL. The DNL at these POIs and the surrounding areas would be long term, likely unnoticeable, and negligible under Alternative 2 for ROW.

3.4.5.3 Special Use Airspace

The primary SUA used by Holloman AFB F-16 aircraft is described in **Section 2.3.1.2**. Noise levels caused by aircraft operations within these airspaces under Alternative 2 conditions have previously been analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021) and the *Holloman AFB Combat Air Forces Adversary Air EA* (Air Force, 2020). Note that airspace noise was not analyzed for the Wiley ATCAA and Pecos MOAs in either the *Special Use Airspace Optimization Final EIS and ROD* or the *Holloman AFB Combat Air Forces Adversary Air EA* analyses. However, while the proposed additional FTU squadrons would use all the SUA and ATCAAs, including the Wiley ATCAA and Pecos MOAs, the net number of sorties across all proposed SUA and ATCAAs would not increase, and therefore would result in no significant change in noise levels for these airspaces.

3.4.5.4 Military Training Routes

Under Alternative 2, the sorties described in Section 2.3.1.2 represent a minor increase in annual sorties compared to the number of sorties previously analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). The increase in sorties under Alternative 2, with the relocation of an additional F-16 FTU squadron, is therefore expected to result in long-term, negligible impacts caused by noise for MTRs under Alternative 2.

3.4.6 *Environmental Consequences – No Action Alternative*

Under the No Action Alternative, additional F-16 FTU squadrons would not be permanently based at Holloman AFB. The noise environment at both Holloman AFB and ROW would remain identical to existing conditions while the Air Force considered other beddown locations and additional environmental analysis was completed.

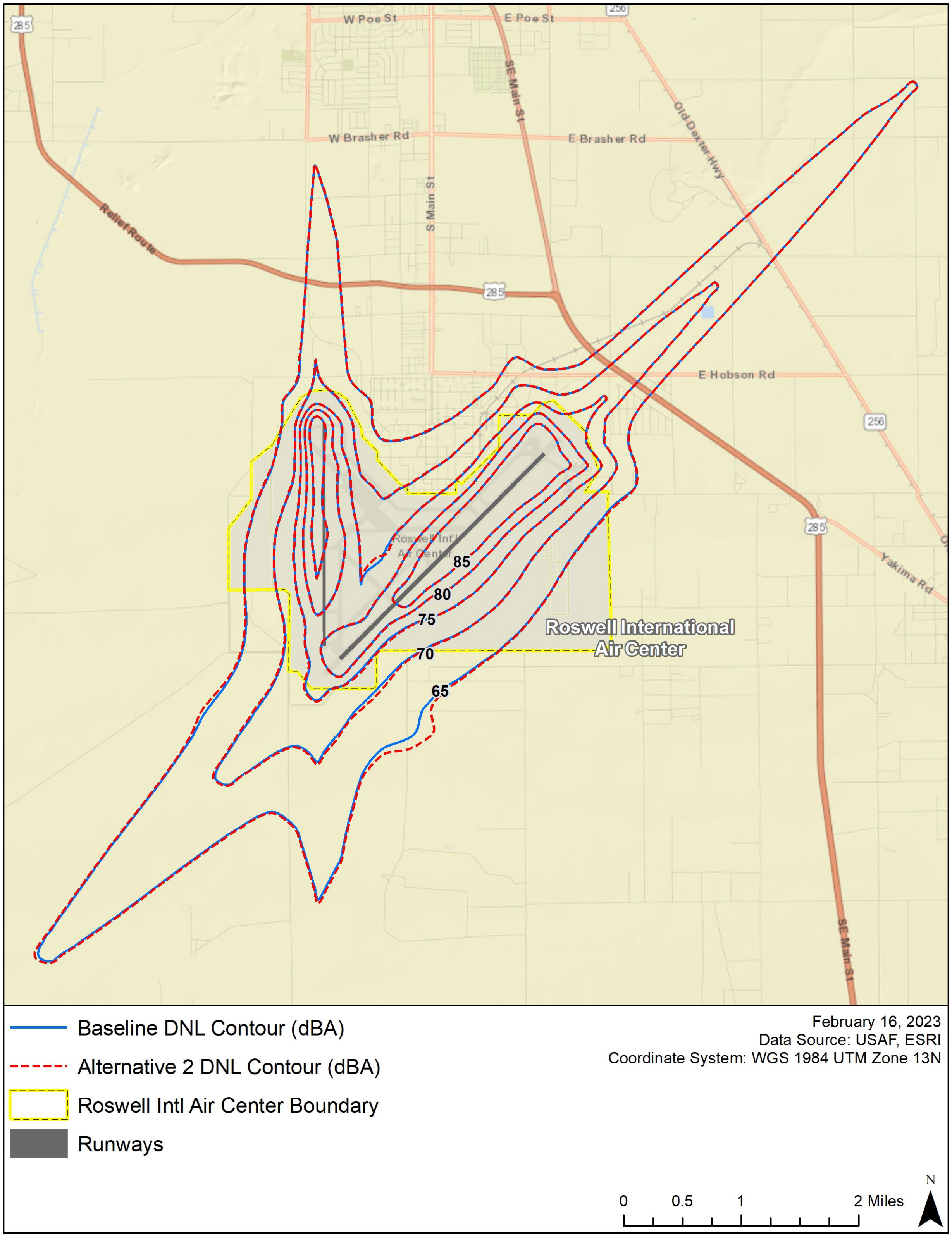

Figure 3-10. Comparison of Alternative 2 and Existing Day-Night Average Sound Level Contours at Roswell International Air Center.

3.4.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

Alternatives 1 and 2 would not result in potential increases to the noise environment in the vicinity of Holloman AFB and ROW. As part of the Highspeed Test Track Operation at Holloman AFB, a minimum of 32 hypersonic test track events are planned each year. These tests may result in sonic booms as previously analyzed in the *Highspeed Test Track Operations Final Programmatic EA* (2022). For tests involving explosive blasts, Test Track personnel conduct a computer simulation based on atmospheric conditions to determine if damage could occur in Alamogordo and Tularosa; if so, the test is not conducted until atmospheric conditions are more favorable. This test track is approximately 7 miles away laterally from WSNP Visitor Center therefore any overpressure generated from events would be negligible at WSNP Visitor Center, individually or cumulatively.

No other reasonably foreseeable future actions at Holloman AFB or ROW or in the SUA, ATCAAs, and MTRs in conjunction with the Proposed Action would have impacts to the noise environment if implemented.

3.5 SAFETY

3.5.1 *Definition of the Resource*

Safety concerns associated with occupational, explosive, and flight activities are considered in this section. Occupational safety considers issues associated with ground operations and maintenance that support civil and military operations, including jet blast/maintenance testing and safety danger. Aircraft maintenance testing occurs in designated safety zones. Explosives safety relates to the management and safe use of ordnance and munitions. Flight safety considers aircraft flight risks such as midair collision, bird/wildlife-aircraft strike hazard (BASH), and in-flight emergency.

Existing conditions and the environmental consequences are organized by occupational, explosive, and flight safety. Additional information on safety programs, as well as aircraft accident and incident notification, is provided in **Appendix C.3**. The ROIs for Holloman AFB and ROW include the airfield and areas immediately adjacent to the airbase/airport property where ground and explosive safety concerns are described, as well as the airfield and airspaces where flight safety is discussed.

3.5.2 *Existing Conditions*

3.5.2.1 Occupational Safety – Holloman Air Force Base

Occupational safety includes several categories encompassing ground and industrial operations, operational activities, and motor vehicle use. Ground mishaps can occur from use of equipment or materials and maintenance functions. Day-to-day operations and maintenance conducted by the 49 WG are performed in accordance with applicable Air Force safety regulations, published Air Force Technical Orders, and standards prescribed by Air Force Occupational Safety and Health (AFOSH) requirements identified within Air Force Instruction (AFI) 91-202 (2019) and Air Force Manual 91-203 (2018).

Emergency Response

For emergency response, the Air Force provides emergency responders trained on the applicable mission design series. For crash response, the DoD would provide on-field aircraft Crash Damaged or Disabled Aircraft Recovery (CDDAR). Because of its large size, Holloman AFB has three fire stations manned during normal fight operations to ensure responders can access any portion of the airfield quickly. Civilian authorities (city, county, or state) would be first on scene for events occurring off-base; once on scene, the Air Force would provide an Incident Commander and command staff for site management and security and safety investigation purposes.

Safety Zones

Safety zones around airfields that restrict incompatible land uses are designated to reduce exposure to aircraft safety hazards. These include the clear zones (CZs), which are areas immediately beyond the ends of a runway, and APZ I and APZ II, which are areas beyond the CZs. The standards for CZs and accident potential zones (APZs) are established by DoD Instruction 4165.57, *Air Installations Compatible Use Zones*. Within the CZs, which cover a 3,000-by 3,000-ft area at the end of each runway, the overall accident risk is the highest. APZ I, which extends for 5,000 ft beyond the CZ, is an area of reduced accident potential. Accident potential is the lowest among the three zones in APZ II, which is 7,000 ft long.

Open space (undeveloped) and agricultural uses (excluding raising livestock) are the only uses deemed compatible in a CZ. Land use within APZs is based on the concept of limiting density of land use, and uses such as residential development, educational facilities, and medical facilities are considered incompatible and are strongly discouraged. At Holloman AFB, there is no incompatible land use within the CZs or APZs (Holloman AFB, 2016a). The safety zones are shown on **Figure 3-11**.

Quantity-distance (Q-D) arcs are an additional safety zone, described in **Section 3.5.2.2** and shown on **Figure 3-11**.

Arresting Gear Capability

Per AFI 32-1043 (2012), *Managing Aircraft Arresting Systems*, criteria for siting aircraft arresting systems vary according to the type of system and operational requirement. The best location for runways used extensively during instrument meteorological conditions is 2,200 to 2,500 ft from the threshold; however, if aircraft that are not compatible with the arresting system must operate on the same runway, the installation commander may shift the installation site as close to the threshold as possible. The critical factor in this case is assurance that the runout area for an aircraft engaging the system in an aborted takeoff scenario is large enough to safely accommodate other arresting systems or equipment such as light fixtures. Holloman AFB is equipped with nine BAK-12 arresting systems and two BAK-15 net barriers. Each runway is equipped with BAK-12s approximately 1,500 ft from each runway threshold. Additionally, BAK-12s at Runway 16/34 are located approximately 60 ft into their overruns, and Runway 22 has a mid-field BAK-12. Runways 25 and 16 both have departure end BAK-15s. Cable configuration varies daily based on runways in use, but generally all three runways would have a departure end cable strung and the secondary runway (based on prevailing winds) would be configured with an approach end cable. BAK-15s are tower-controlled and raised on request.

3.5.2.2 Explosive Safety – Holloman Air Force Base

The 49 WG's Munitions Flight is assigned to the 49th Maintenance Group (49 MXG) and located at Holloman AFB. Personnel assigned to the 49 MXG Munitions Flight currently support the 49 WG flying mission with munitions support, including storage, inspection, maintenance, and accountability as well as delivery and pick-up of aircraft munitions to the airfield. Aircraft munitions include ammunition, propellants (solid and liquid), pyrotechnics, warheads, explosive devices, and chemical agent substances and associated components that present real or potential hazards to life, property, or the environment. Munitions are loaded and unloaded from aircraft by the flying squadrons Aircraft Maintenance Unit's (AMU) Weapons Load Crews. Air Force Manual (AFMAN) (2011) 91-201, *Explosives Safety Standards*, defines the guidance and procedures dealing with munition storage and handling.

Aircraft are not loaded with high-explosive ordnance during typical training operations. Training munitions usually include captive air-to-air training missiles, countermeasure chaff and flares, and 20-millimeter TP cannon ammunition with inert projectiles. All munitions are stored and maintained in the munitions storage area within facilities sited for the allowable types and amounts of explosives. All munitions are stored and handled by trained and qualified munitions systems personnel and in accordance with Air Force-approved technical orders.

Defined distances are maintained between munitions storage areas and a variety of other types of facilities. These distances, called Q-D arcs, are determined by the type and quantity of explosive material to be stored. Q-D arcs for each explosive material storage or handling facility extend outward from its sides and corners for a prescribed distance. Within these Q-D arcs, development is either restricted or prohibited altogether to ensure personnel safety and to minimize potential for damage to other facilities in the event of an accident. In accordance with AFMAN 91-201, paragraphs 12.47.2 and 12.47.3, the ramp is authorized for chaff, flare, and training munitions operations (Hazard Class 1.3). During the occasional use of high explosive bombs for training, aircraft are loaded on hot pads sited for high explosive operations (Hazard Class 1.1). The Q-D arcs on Holloman AFB are shown on **Figure 3-11**.

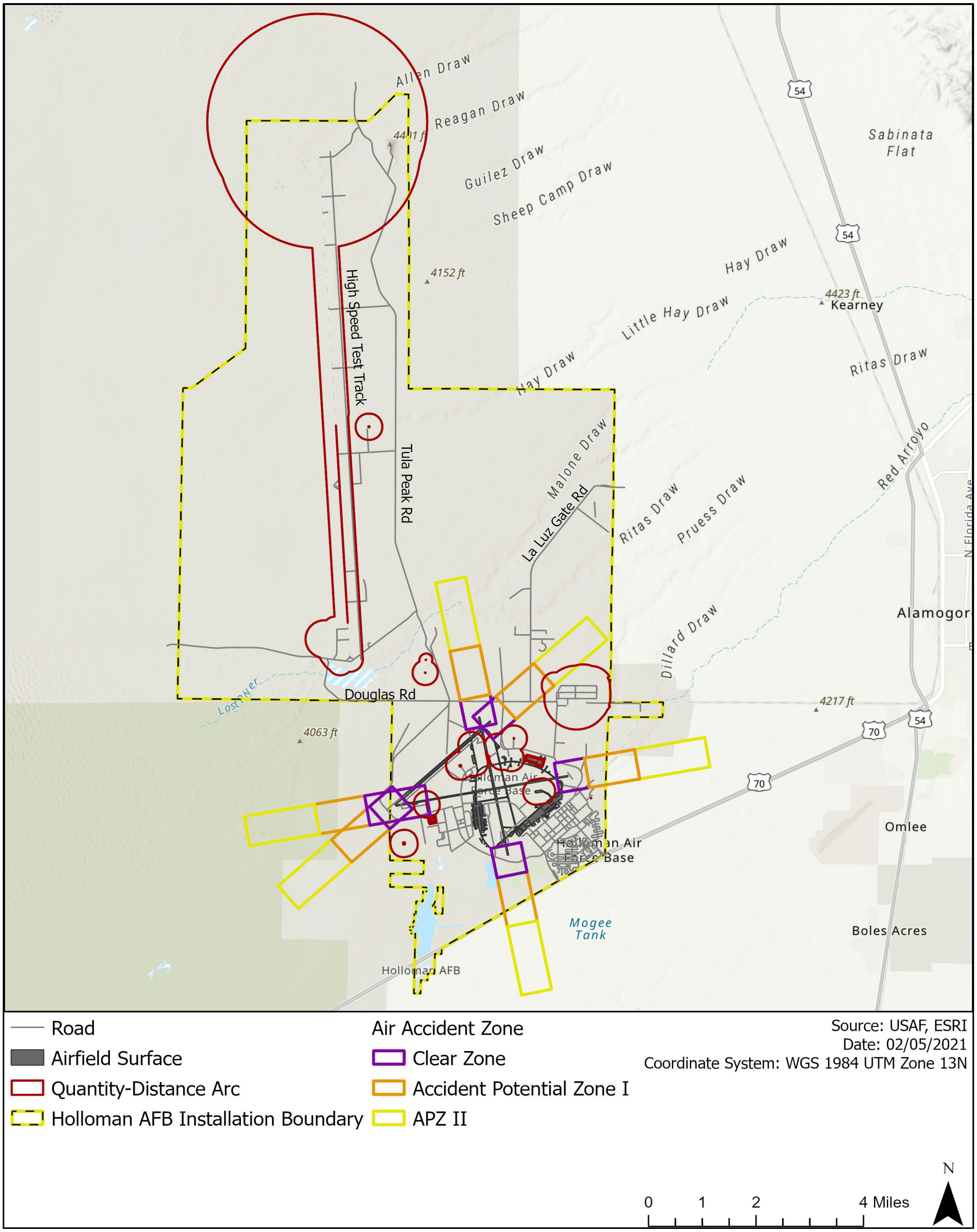

Figure 3-11. Holloman Air Force Base Clear Zones, Accident Potential Zones, and Quantity-Distance Arcs.

3.5.2.3 Flight Safety – Holloman Air Force Base

One control tower, located on the infield of Runway 22/25, supports the training and readiness of pilots of the 49 WG and other units supported by Holloman AFB including Air Force Flight Test, transient aircraft, and distinguished visitor aircraft flying missions. The control tower manages the aircraft flying within a range of 5 miles of the base; when aircraft fly beyond this range, control is transferred to terminal radar approach control. Additional personnel are typically scheduled to support wing flying exercises.

The potential for aircraft accidents is a primary public concern with regard to flight safety. Such accidents may occur as a result of mid-air collisions, collisions with manmade structures or terrain, mechanical failure, weather-related accidents, pilot error, BASH, or strikes from defensive countermeasures used during training.

Midair Collision

Midair collision accidents involve two or more aircraft that contact each other during flight. Navigation errors, miscommunications, deviations from flight plans, and lack of collision avoidance systems all increase the potential for midair collisions. Aircraft mishaps and their prevention represent a paramount concern for the Air Force. Air Force Policy Directive (AFPD) 91-2 (2019), *Safety Programs*, defines four major categories of reportable mishaps based on total cost of property damage or the degree of injury: Class A, B, C, and D mishaps. Mishap types range from loss of life or destruction of an aircraft (Class A) to a minor, reportable injury, or property damage less than $50,000 (Class D). Reporting and investigation requirements for aviation mishaps are defined in AFI 91-204 (2019), *Safety Investigation and Hazard Reporting*, and AFMAN 91-223 (2018), *Safety: Aviation Safety Investigations and Reports*.

Over the last 5 years, Holloman AFB F-16 Class A mishaps per 100,000 flight hours include: 10.8 (FY17), 0 (FY18), 0 (FY19), 7.3 (FY20), and 0 (FY21). In comparison, Class D mishaps, per 100,000 flight hours, are the highest for the F-16, including: 97.2 (FY17), 121 (FY18), 78.1 (FY19), 65.9 (FY20), and 36.4 (FY21) (Holloman AFB, 2021a).

In-Flight Emergency

Each aircraft type has different emergency procedures based on the aircraft design that are produced by the original equipment manufacturer of the aircraft. Basic airmanship procedures also exist for handling any deviations to ATC procedures posed by an in-flight emergency; these procedures are defined in AFI 11-202 (2016) (Volume 3) and established aircraft flight manuals.

Bird/Wildlife-Aircraft Strike Hazards

BASH presents a safety concern for aircraft operations because of the potential for damage to aircraft or injury to aircrews or local populations if a crash should occur. Aircraft can encounter birds at nearly all altitudes up to 30,000 ft MSL; however, most birds fly close to the ground. The Air Force BASH program was established to minimize the risk for collisions of birds/wildlife with aircraft and the subsequent loss of life and property. In accordance with AFI 91-202, each flying unit in the Air Force is required to develop a BASH plan to reduce hazardous bird/wildlife activity relative to airport flight operations. The intent of each plan is to reduce BASH issues at the airfield by creating an integrated hazard abatement program through monitoring, avoidance, and actively controlling bird and animal population movements. Holloman AFB experiences occasional runway encroachment by animals such as coyotes (*Canis latrans*), oryx, rabbits, and various reptiles such as snakes. Qualified individuals within Airfield Management personnel, Flight Safety personnel, US Department of Agriculture-Wildlife Services, and 49th Civil Engineer Squadron/Environmental Compliance (49 CES/CEIE) use screamer and sirens to scare wildlife from the airfield or would take actions as necessary to remove wildlife. In the event of a wildlife strike, after receiving notification from Maintenance Operation Control, an Air Force Form 853, *Air Force Wildlife Strike Report*, is generated, and a sample is collected and mailed to the Smithsonian's Feather Identification Laboratory for identification. Over the last five years, Holloman AFB has bird strike incidents including: 2 (FY17), 11 (FY18), 16 (FY19), 9 (FY20), and 3 (FY21) (Holloman AFB, 2021a).

3.5.2.4 Occupational Safety – Roswell International Air Center

Emergency Response

ROW has an Airport Emergency Plan (AEP) as part of the airport's CFR Part 139 Airport Certification through FAA. The AEP is compliant with CFR 14 Part 139.325 and FAA Advisory Circular 150/5200-31C (2009). ROW has Aircraft Rescue and Firefighting capability on field. As a CFR Part 139 certificated airport, the FAA conducts annual certification inspections, including an aircraft rescue and firefighting inspection.

Safety Zones

ROW complies with FAA criteria for land areas underneath aircraft approach paths, designated runway protection zones (RPZs), as outlined in FAA Advisory Circular 150/5300-13 (2014), A*irport Design*. The FAA RPZs preclude any obstructions and development in these areas must adhere to Unified Facilities Criteria 3-260-01, *Airfield and Heliport Planning and Design (DoD, 2019)*.

Arresting Gear Capability

ROW runways do not have aircraft arresting systems.

3.5.2.5 Explosive Safety – Roswell International Air Center

Airport Operations and Maintenance personnel are the only persons on field permitted to handle wildlife mitigation equipment, to include bangers and screamers. These items are located in airport offices secured behind locked doors in fire safe boxes. No other equipment is utilized.

3.5.2.6 Flight Safety – Roswell International Air Center

Roswell Tower is located at midfield, south of the terminal building. The tower is responsible for controlling ground aircraft in movement areas and flights within a 5-mile radius of the airport. Roswell Tower supports flight operations in Class D airspace from 0600-2100 Local Mountain Time, extending from the surface to and including 6,200 ft MSL. Control of flight operations beyond a 5-mile radius is transferred to ROW Terminal Radar Approach Control, co-located with Roswell Tower.

The potential for aircraft accidents is a primary public concern regarding flight safety. Such accidents may occur because of midair collisions, collisions with manmade structures or terrain, mechanical failure, weather-related accidents, pilot error, or bird/wildlife-aircraft strike hazards.

Midair Collision

Midair collision accidents involve two or more aircraft coming in contact with each other during flight. Navigation errors, miscommunications, deviations from flight plans, and lack of collision avoidance systems all increase the potential for midair collisions. Aircraft mishaps and their prevention represent a paramount concern for the FAA and airports. **Appendix C.1** defines civil aircraft accidents (49 CFR § 830.2) and serious incidents (49 CFR § 830.5) that require reporting to the National Transportation Safety Board (NTSB).

In-Flight Emergency

Each aircraft type has different emergency procedures, based on the aircraft design, which are produced by the original equipment manufacturer of the aircraft. As specified in 14 CFR § 25.1585, operating procedures must be furnished for:

1. normal procedures peculiar to the particular type or model encountered in connection with routine operations;
2. nonnormal procedures for malfunction cases and failure conditions involving the use of special systems or the alternative use of regular systems; and

3. emergency procedures for foreseeable but unusual situations when immediate and precise action by the crew may be expected to substantially reduce the risk of catastrophe.

Bird/Wildlife-Aircraft Strike Hazards

BASH presents a safety concern for aircraft operations because of the potential for damage to aircraft or injury to aircrews or local populations if a crash should occur. Aircraft can encounter birds at nearly all altitudes up to 30,000 ft MSL; however, most birds fly close to the ground. In accordance with their Airport Certification, ROW has developed a Wildlife Hazard Management Plan (WHMP) per 14 CFR § 139.337 to ensure the airport meets or exceeds all FAA wildlife-related safety regulations while insuring the safest possible environment for aircraft, crew, and passengers arriving to and departing from ROW.

Wildlife strike data for civil aircraft operating at ROW, taken from reports entered into the FAA National Wildlife Strike Database, include:

- Wildlife strikes at 1,500 ft AGL or less: 1 (2020) versus 5-year average of 0.8 (2016-2020),
- Wildlife strikes at 1,500 ft AGL or less causing adverse effect (i.e., reported strike indicating damage to aircraft or a negative effect-on-flight such as aborted take-off, precautionary/emergency landing, engine shutdown, or other): 1 (2020) versus 5-year average of 0.2 (2016-2020), and
- Wildlife strikes at greater than 1,500 ft AGL including those causing adverse effect: 0 (2020) versus 5-year average of 0.0 (2016-2020).

Aircraft movement data include itinerant air carrier, commuter, and air taxi movements and itinerant and local (i.e., aircraft takes off and lands at same airport) General Aviation movements. Military aircraft movements are excluded because military strike data are not included in these analyses (Embry-Riddle Aeronautical University, 2021).

3.5.2.7 Safety – Special Use Airspace

Safe, effective, and disciplined flying training operations are a critical priority of the 8 FS. The ROI includes the SUA, ATCAAs, and training ranges described in **Section 2.3.1.2**. Safety addresses issues related to the health and well-being of both military personnel and civilians in the vicinity of the SUAs, ATCAAs, and training ranges. Safety concerns about SUA, ATCAA, and training range flight activities are primarily the results of the hazards associated with aircraft mishaps, bird/wildlife-aircraft strikes, munitions, and obstructions to flight and the main concern is the potential for aircraft accidents. Such mishaps may occur because of mid-air collisions, collisions with terrain or manmade structures, BASH, weather-related accidents, mechanical failure, or pilot error. All impact areas on training ranges are sited for the type and Hazard Class of munitions that would be used and include Surface Danger Zones that surround impact areas, which may require the evacuation of personnel from these zones during some surface-to-surface or air-to-ground training activities. For crash response, the DoD would provide on-site aircraft CDDAR; applicable restrictions will be followed including those set forth by the Wilderness Act of 1964 should an anomaly occur in designated wilderness.

3.5.2.8 Safety – Military Training Routes

Safe operations on MTRs are a critical priority of the 8 FS. Safety concerns associated with MTR flight activities are related to the health and well-being of both military personnel operating in and civilians living under or near IR-192/194, IR-134/195, and VR 176 as well as IR-133/142 in the Mayhill area. Safety concerns about MTR flight activities are primarily the results of the hazards associated with aircraft mishaps, bird/wildlife-aircraft strikes, munitions, and obstructions to flight, and the main concern is the potential for aircraft accidents. Such mishaps may occur because of mid-air collisions, collisions with terrain or manmade structures, BASH, weather-related accidents, mechanical failure, or pilot error. For crash response, the DoD would provide on-site aircraft CDDAR as noted in **Section 3.2.5.7**.

3.5.3 *Environmental Consequences Evaluation Criteria*

Impacts from implementation of the Proposed Action are assessed according to the potential to increase or decrease safety risks to personnel, the public, property, or the environment. Adverse impacts on safety might include implementing flight procedures that result in greater safety risk or constructing new buildings within established Q-D safety arcs. For this EA, an impact is considered significant for Alternatives 1 and 2 for Holloman AFB if the proposed safety measures are not consistent with AFOSH and federal Occupational Safety and Health Administration (OSHA) standards resulting in unacceptable safety risks. Likewise, an impact is considered significant for Alternatives 1 and 2 for ROW if the proposed safety measures are not consistent with FAA, NTSB, OSHA, or other applicable standards for civil airports resulting in unacceptable safety risks as described below and in **Appendix C.3**.

Safety concerns associated with occupational, explosive, and flight activities are considered in this section. Occupational safety considers issues associated with ground operations and maintenance that support operations including jet blast/maintenance testing and safety danger zones. Occupational safety also considers the safety of personnel and facilities on the ground that may be at risk from flight operations in the vicinity of the airfield and in the airspace.

Under Alternative 1, Holloman AFB CZs and APZs around the airfield restrict the public's exposure to areas where there is a higher accident potential. Although occupational and flight safety are addressed separately, risks associated with safety-of-flight issues are interrelated with occupational safety concerns in the immediate vicinity of the runway. Explosives safety relates to management and safe use of ordnance and munitions. Flight safety considers aircraft flight risks such as midair collision, BASH, and in-flight emergency requirements. The additional squadron of F-16 planes would follow Air Force safety procedures and aircraft-specific emergency procedures based on the aircraft design. Basic airmanship procedures also exist for handling any deviations to ATC procedures posed by to an in-flight emergency; these procedures are defined in AFI 11-202 (2016) (Volume 3) and established aircraft flight manuals. The Flight Crew Information File is a safety resource for aircrew day-to-day operations, which is composed of air and ground operation rules and procedures. For ROW, the RPZs around the airport restrict the public's exposure to areas where there is a higher accident potential. The additional squadron of F-16 planes would follow safety measures consistent with FAA, NTSB, OSHA, or other applicable standards for civil airports for all other flight and ground safety procedures (see **Appendix C.1**).

Under Alternative 2, Holloman AFB, the additional two squadrons of F-16 planes would follow the same Air Force safety procedures and aircraft specific emergency procedures, as defined above, for Alternative 1. Similarly, for ROW, the additional two squadrons of F-16 planes would follow safety measures consistent with FAA, NTSB, OSHA, or other applicable standards for civil airports (see **Appendix C.3**). Additional details of the potential safety changes under Alternatives 1 and 2 are described in **Sections 3.5.4 and 3.5.5**.

3.5.4 *Environmental Consequences – Alternative 1*

3.5.4.1 Occupational Safety - Holloman Air Force Base

Under Alternative 1, one additional F-16 FTU squadron would be permanently assigned to Holloman AFB. The additional FTU squadron would fly an estimated maximum additional 5,000 sorties and 7,500 patterns annually at Holloman AFB. Under Alternative 1, additional F-16 FTU aircraft maintenance and testing would occur consistent with current aircraft maintenance on Holloman AFB. No unique maintenance would be associated with the additional F-16 FTU aircraft.

Changes to Occupational Safety, Explosives Safety, and Flight Safety are described in the following sections. Contractors involved with proposed facility modifications would be responsible for complying with applicable OSHA regulations outlined in 29 CFR §1926, *Safety and Health Regulations for Construction,* and other state and local practices.

Emergency Response

The Air Force would provide emergency responders (Airport Firefighter) trained on the applicable mission design series for initial emergency response involving F-16 FTU aircraft. For crash response, the DoD would provide on-field aircraft CDDAR. Civilian authorities (city, county, or state) would be first on scene for events occurring off-base. First responders would be responsible to cooperate with the Air Force or the NTSB investigation, depending on the circumstances of the incident.

No impacts on emergency response are anticipated to occur under Alternative 1, provided the additional F-16 FTU planes follow all applicable Air Force and civilian emergency response requirements, depending on the circumstances of the incident.

Safety Zones

Under the Proposed Action, safety zones around Holloman AFB would not change. No new facilities would be added into CZs or APZs. Only one project would occur within an APZ, which is the addition of a staging pad for R11 fuel trucks that are required for direct support to operations and are allowed to be located within an APZ. There would be no impacts to safety zones under Alternative 1.

Arresting Gear Capability

The F-16 FTU planes would be compatible with the arresting systems on Holloman AFB's airfield; or able to operate on the airfield without interference to the existing arresting system. There would be no need to change or modify the existing arresting gear at Holloman AFB. There would be no impacts on arresting gear capability for the implementation of Alternative 1.

No impacts on occupational safety are anticipated to occur under Alternative 1, provided the additional F-16 FTU planes follow all applicable AFOSH and OSHA requirements at Holloman AFB.

3.5.4.2 Explosives Safety – Holloman Air Force Base

Under Alternative 1, the 49 MXG would support daily training operations with storage, maintenance, and delivery of countermeasure chaff, flares, and other training munitions. The respective flying squadron's AMU personnel would be responsible for loading and unloading training munitions on the additional F-16 FTU aircraft. This support would be provided by trained and certified personnel following Air Force safety guidance and technical orders.

The countermeasure chaff and flares and training munitions such as 20mm TP, BDU-33s, and inert bombs would be loaded and unloaded on the aircraft parking ramp. The proposed ramp area for F-16 FTU aircraft is authorized for munitions operations (Hazard Class 1.3) in accordance with AFMAN 91-201 paragraphs 12.47.2 and 12.47.3. During the occasional use of live bombs, loading operations would take place on hot pads that are sited and have Q-D separation for high explosives (Hazard Class 1.1) operations.

No impacts on explosive safety are anticipated to occur under Alternative 1, provided trained personnel follow all applicable safety guidelines. Proposed facility modifications would not be within existing Q-D arcs, and as such these would not change.

3.5.4.3 Flight Safety – Holloman Air Force Base

The potential for aircraft accidents is a primary public concern with regard to flight safety. Such accidents may occur as a result of midair collisions, collisions with manmade structures or terrain, mechanical failure, weather-related accidents, pilot error, BASH, or strikes from defensive countermeasures used during training. Under Alternative 1, additional F-16 FTU aircraft would be required to strictly conform to the flight safety rules directed by the 8 FS.

Bird/Wildlife-Aircraft Strike Hazards

Proposed F-16 FTU aircraft operations would follow Holloman's BASH procedures specified in the 49 WG's BASH Plan (Holloman AFB 49 WG Safety, 2020). No impacts on airspace/flight safety are anticipated to occur under Alternative 1, provided that flight safety rules are followed and all applicable AFOSH and OSHA requirements are implemented.

3.5.4.4 Occupational Safety - Roswell International Air Center

Under Alternative 1, ROW would be used for additional pattern training as an emergency field. Under this alternative, the 8 FS would fly an estimated additional 92 sorties to ROW and perform an estimated 207 additional patterns per year.

Under Alternative 1, additional F-16 FTU aircraft maintenance and testing would occur consistent with current aircraft maintenance activities on Holloman AFB. No unique maintenance activities would be associated with the additional F-16 FTU aircraft at ROW. There would be no impacts to occupational safety at ROW.

Emergency Response

Civilian authorities (city, county, or state) would be first on scene for initial emergency response involving an F-16 FTU aircraft in the vicinity of ROW. First responders would be responsible to cooperate with the Air Force or the NTSB investigation, depending on the circumstances of the incident.

No impacts on emergency response are anticipated to occur under Alternative 1, provided the additional F-16 FTU planes follow all applicable Air Force and civilian emergency response requirements, depending on the circumstances of the incident.

Safety Zones

Under Alternative 1, safety zones around ROW would not change.

Arresting Gear Capability

There is no requirement for arresting gear capability at ROW, where the additional F-16 planes would only perform pattern operations. There would be no impacts on arresting gear capability for implementation of Alternative 1.

No impacts on occupational safety are anticipated under Alternative 1, provided the additional F-16 FTU planes follow all applicable civil airport requirements (FAA, NTSB, and OSHA) at ROW.

3.5.4.5 Explosives Safety - Roswell International Air Center

Under Alternative 1, there would be no operations involving countermeasure chaff and flares or training munitions at ROW. Therefore, no impacts on explosive safety are anticipated at ROW under Alternative 1.

3.5.4.6 Flight Safety - Roswell International Air Center

The potential for aircraft accidents is a primary public concern with regard to flight safety. Such accidents may occur as a result of midair collisions, collisions with manmade structures or terrain, mechanical failure, weather-related accidents, pilot error, BASH, or strikes from defensive countermeasures used during training. Under Alternative 1, additional F-16 FTU aircraft would be required to strictly conform to the flight safety rules directed by the 8 FS and follow all applicable civil airport requirements (FAA, NTSB, and OSHA) while performing pattern training operations at ROW. Flight safety would not be impacted at ROW from the implementation of Alternative 1.

Bird/Wildlife-Aircraft Strike Hazards

Proposed F-16 FTU aircraft operations would follow Holloman AFB's BASH procedures specified in the 49 WG's BASH Plan (Holloman AFB, 2020a).

No impacts on airspace/flight safety are anticipated to occur under Alternative 1, provided that flight safety rules are followed and all applicable AFOSH, OSHA, and civil airport requirements (FAA, NTSB, and OSHA) are observed while F-16 FTU aircraft perform pattern training operations at ROW.

3.5.4.7 Safety - Special Use Airspace

Analysis of SUA and ATCAA flight risks correlates mishap rates and BASH with airspace utilization; munitions, and route obstruction risks are also assessed as flight hazards. Under Alternative 1, the 8 FS would continue to use SUA, ATCAAs, and training ranges proximate to Holloman AFB and would conduct an estimated additional 5,000 annual training sorties in the Talon SUA and ATCAAs. The net number of sorties within the remaining SUA, ATCAAs, and on training ranges would not increase. The sorties proposed under Alternative 1 are well within the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). Under Alternative 1, there would be no modifications to the existing airspace.

3.5.4.8 Safety – Military Training Routes

Analysis of MTR flight risks correlates mishap rates and BASH with airspace utilization; munitions, and route obstruction risks are also assessed as flight hazards. Under Alternative 1, the 8 FS would continue to use MTRs proximate to Holloman AFB with no increase in the number of sorties. The sorties proposed under Alternative 1 are well within the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). Under Alternative 1, no significant impacts on flight safety are anticipated to occur provided strict control and use of established safety procedures continue. There would be no modifications to the existing airspace.

3.5.5 *Environmental Consequences – Alternative 2*

3.5.5.1 Safety – Holloman Air Force Base

Alternative 2 would include the permanent 5,000 annual sorties currently flown by the 8 FS and an estimated additional 5,000 annual sorties flown by proposed additional F-16 FTU squadron at Holloman AFB. The permanent beddown of 2 FTU squadrons would equates to an estimated maximum additional 10,000 permanent sorties and 15,000 patterns annually at Holloman AFB.

Safety conditions for Alternative 2, including all occupational safety, explosives safety, and flight safety conditions would be similar to what was described for Alternative 1 in **Section 3.5.4**. No impacts are expected to occur under Alternative 2 for Holloman AFB though there is potential for the safety incident rate to increase due to the increased number of sorties.

3.5.5.2 Safety – Roswell International Air Center

Under Alternative 2, ROW would be used for additional pattern training and as an emergency divert field. Under this alternative, the 8 FS and additional F-16 FTU squadrons would fly an estimated additional 199 sorties to ROW and perform an estimated additional 581 patterns per year.

Safety conditions for Alternative 2, including all occupational safety, explosives safety, and flight safety conditions would be similar to what was reported for Alternative 1 in **Section 3.5.4**. No impacts are expected to occur under Alternative 2 for ROW though there is potential for the safety incident rate to increase due to the increased number of sorties.

3.5.5.3 Safety – Special Use Airspace

Analysis of SUA and ATCAA flight risks correlates mishap rates and BASH with airspace utilization; munitions, and route obstruction risks are also assessed as flight hazards. Under Alternative 2, the additional F-16 FTU squadrons would continue to use SUA, ATCAAs, and training ranges proximate to Holloman AFB and would conduct an estimated 10,000 additional annual training sorties in the Talon SUA and ATCAAs. The net number of sorties within the remaining SUA, ATCAAs, and training ranges would not increase. The sorties proposed under Alternative 2 are well within the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). SUA and ATCAA safety conditions for Alternative 2 would be similar to what was reported for Alternative 1 in **Section 3.5.4**. Under Alternative 2, there would be no modifications to the existing airspace. No impacts are expected to occur under Alternative 2 for SUA or ATCAA safety conditions.

3.5.5.4 Safety – Military Training Routes

Analysis of MTR flight risks correlates mishap rates and BASH with airspace utilization; munitions, and route obstruction risks are also assessed as flight hazards. Under Alternative 2, the 8 FS would continue to use MTRs proximate to Holloman AFB as would an additional F-16 FTU squadron. The sorties proposed under Alternative 2 represent a minor increase in utilization of IR-192/194, IR-134/195, and IR-133/142 whereas utilization of VR-176 would remain unchanged. However, no significant impacts on flight safety are anticipated to occur provided strict control and use of established safety procedures continue; though there is potential for the safety incident rate to increase due to the small number of increased number of sorties. There would be no modifications to the existing airspace.

3.5.6 *Environmental Consequences – No Action Alternative*

Under the No Action Alternative, the F-16 FTU would not be permanently based and would remain at Holloman AFB while other beddown locations are considered and additional environmental analysis completed. Under the No Action Alternative, there would be no change to safety.

3.5.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

Alternative 1 or Alternative 2, in addition to past, present, and reasonably foreseeable future actions at Holloman AFB, would follow existing safety procedures and policies for ground and flight operations. Safety zones would not change under Alternative 1 or Alternative 2. Personnel associated with the additional F-16 FTU squadron would be required to follow safety procedures in accordance with the 8 FS and follow all applicable AFOSH and OSHA requirements at Holloman AFB. As such, no cumulative effects on flight, occupational, and explosive safety are expected with implementation of Alternative 1 or Alternative 2.

Alternative 1 or Alternative 2, in addition to past, present, and reasonably foreseeable future actions at ROW, would follow existing safety procedures and policies for ground and flight operations. Safety zones would not change under Alternative 1 or Alternative 2. Personnel associated with the additional F-16 FTU squadron would be required to follow safety procedures in accordance with the 8 FS and follow all applicable civil airport requirements (FAA, NTSB, and OSHA) while performing pattern training operations at ROW.

With the additional demand for the same airspace from the proposed additional F-16 FTU squadron, the potential for cumulative impacts on safety can be expected. As airspace demand in the region increases, the Air Force, in conjunction with other managing agencies, would continue coordination to reduce potential impacts. Cumulative effects on airspace safety from additional F-16 FTU squadron operations, when added to existing operations, are expected to be negligible.

3.6 AIR QUALITY

3.6.1 *Definition of the Resource*

Air quality in various areas of the country is affected by pollutants emitted by numerous sources, including natural and man-made sources. The USEPA was mandated under the Clean Air Act (CAA) to set air quality standards for select pollutants that are known to affect human health and the environment to manage pollutant emission levels in ambient air. The USEPA has divided the country into geographical regions known as Air Quality Control Regions (AQCRs) to evaluate compliance with the National Ambient Air Quality Standards (NAAQS) (40 CFR §50). NAAQS are currently established for six criteria air pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter (including particulates equal to or less than 10 microns in diameter [PM_{10}] and particulates equal to or less than 2.5 microns in diameter [$PM_{2.5}$]), and lead (Pb). Regulatory areas in each AQCR are designated as an attainment or nonattainment area for each of the criteria pollutants, depending on whether it meets or exceeds the NAAQS. Attainment areas that were reclassified from a previous nonattainment status to attainment are called maintenance areas and are required to prepare a maintenance plan for air quality. Holloman AFB is located in Otero County, New Mexico, and lies within the El Paso-Las Cruces-Alamogordo Interstate AQCR (40 CFR § 81.82).

Federal actions in NAAQS nonattainment and maintenance areas are also required to comply with USEPA's General Conformity Rule (40 CFR 93). These regulations are designed to ensure that federal actions do not impede local efforts to achieve or maintain attainment with the NAAQS. Federal actions are evaluated to determine if the total indirect and direct net emissions from the project are below *de minimis* levels for each of the pollutants as specified in 40 CFR § 93.153. If *de minimis* levels are not exceeded for any of the pollutants, no further evaluation is required. However, if net emissions from the project exceed the *de minimis* thresholds for one or more of the specified pollutants, a demonstration of conformity, as prescribed in the General Conformity Rule, is required.

Under the CAA, special protection for air quality is provided in pristine areas of the country known as Class 1 areas (Class 1 areas include National Parks greater than 6,000 ac, or National Wilderness Areas greater than 5,000 ac). Any significant deterioration of air quality is considered significant in Class 1 areas. USEPA has also established regional haze regulations that require states to make initial improvements in visibility within their Class 1 areas.

Greenhouse gases (GHGs) are gases, occurring from natural processes and human activities, that trap heat in the atmosphere. The accumulation of GHGs in the atmosphere helps regulate the earth's temperature and are believed to contribute to global climate change. USEPA regulates GHG emissions via permitting and reporting requirements that are applicable mainly to large stationary sources of emissions. GHG emissions are expressed in terms of the carbon dioxide equivalent emissions (CO_2e), which is a measure used to compare the emissions from various GHGs based upon their Global Warming Potential (GWP). The GWP is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO_2). The larger the GWP, the more that a given gas warms the Earth compared to CO_2 over the same time period. GWPs provide a common unit of measure, which allows analysts to add up emissions estimates of different gases.

For this EA, there are multiple ROIs for air quality. One includes the AQCRs where the airfields proposed for operations of the F-16C aircraft (including areas within their vicinities) are located. In addition, multiple AQCRs were considered that coincide with the SUAs proposed for use for the F-16C aircraft training operations. For consideration of potential air quality impacts, it is the volume of air extending up to the mixing height (3,000 ft AGL) and coinciding with the spatial distribution of the ROIs that is considered. In the vicinity of the airfield itself, it is the portions of the LTO and TGO cycles that occur at or below 3,000 ft that are analyzed. Also considered in the air quality analysis are associated activities including aerospace ground support, engine testing, surface coating, solvent cleaning, fueling activities, new personnel commute, and any proposed new construction that take place on or adjacent to the airfield.

For the SUA, are several areas are identified for air quality impact analysis after applying the 3,000-ft criterion. These areas, their underlying counties, and AQCRs are described in **Section 3.6.2.3**.

See **Appendix C.4** and **Appendix D.2** for a detailed discussion on air quality regulations, ROIs, general conformity, climate and GHGs.

3.6.2 *Existing Conditions*

3.6.2.1 Holloman Air Force Base

The regional climate of Alamogordo, New Mexico, the city where Holloman AFB is located, is classified as a tropical and subtropical steppe climate. The warmest month, on average, is July, with an average temperature of 81°F. January, with an average temperature of 41°F, is the coolest month. The wettest month by average precipitation is August, with an average of 1.9 inches of rain. The driest month is April with an average of 0.4 inches of precipitation. Overall, July, August, September, and October are the wettest months, and November through June are the driest months. The region has an average annual snowfall of 10.6 inches. The month with the most snow is February, with 3.9 inches of snow (Weatherbase, 2021a).

Holloman AFB is located within Otero County, New Mexico, which is part of the El Paso-Las Cruces-Alamogordo Interstate AQCR. Currently, Otero County is designated as an unclassifiable/attainment area for all criteria pollutant (per designations included in the Air Force's Air Conformity Applicability Model [ACAM]) and as a result are not subject to General Conformity regulations (40 CFR 51 and 93).

Holloman AFB operates under a Stationary Source Operating Permit as defined by Title V of the CAA and is a major source for CO and volatile organic compounds (VOCs). However, the installation is not classified a major source for Prevention of Significant Deterioration (PSD) and as a result potential emissions of all criteria pollutants should not exceed the 250 tons per year (tpy) major PSD source threshold. Also, Holloman AFB is not located within 10 kilometers of any of the 156 USEPA-designated Class I areas protected by the Regional Haze Rule.

3.6.2.2 Roswell International Air Center

The regional climate of Roswell, New Mexico, the city where ROW is located, is classified as tropical and subtropical steppe. The average annual temperature in Roswell is 59.0°F. The warmest month, on average, is July, with an average temperature of 77.2°F. The coolest month on average is January, with an average temperature of 39.6°F. The average amount of precipitation for the year in Roswell is 14.7 inches. The month with the most precipitation on average is September, with 2.5 inches of precipitation. The month with the least precipitation on average is January, with an average of 0.5 inches (Weatherbase, 2021b).

ROW is located within Chaves County, New Mexico, which is part of the Pecos-Permian Basin Intrastate AQCR. Currently, Chaves County is designated as an unclassifiable/attainment area for all criteria pollutant (per designations included in ACAM), and, as a result, General Conformity rule does not apply.

3.6.2.3 Special Use Airspace

Of the airspace proposed for use in **Table 2-3**, ground level air quality impacts from the F-16C operations are expected to occur in WSMR Restricted Areas, Talon MOAs, McGregor Range Restricted Areas, and Smitty and Pecos MOAs because some length of time spent training in these SUAs is proposed to occur at or below the 3,000 ft mixing height. Training operations in the remaining SUAs and all ATCAAs occurring above the 3,000 ft mixing height are not included in this analysis. Air quality analysis within Talon and Smitty MOAs have been previously analyzed in the *Environmental*

Impact Statement for Special Use Airspace Optimization to Support Existing Aircraft at Holloman Air Force Base, *New Mexico* (January 2021) and are not addressed in this EA. Air emissions resulting only from WSMR Restricted Areas, McGregor Range Restricted Areas, and Pecos MOA are included in this analysis.

WSMR is located in the northern portion of the Chihuahuan Desert. Overlying five different counties and spanning over 3,000 square miles (mi^2), WSMR SUA overlies land areas with vastly varied elevations and mountainous terrains. While temperatures and precipitation can vary widely depending on the specific location, the typical regional climate of the northern Chihuahuan Desert is characterized as arid to semi-arid desert climate where summers are hot, winters are cool in lower latitude areas, and rain falls during the summer. The average temperature of Las Cruces, New Mexico (city close to WSMR), is 62.5°F. The warmest month, on average, is July with an average temperature of 81.4°F. The coolest month on average is January, with an average temperature of 44.1°F. Average annual precipitation is approximately 6.8 inches per year (Weatherbase, 2021c).

McGregor Range Restricted Areas also overlie land areas over the northern portion of the Chihuahuan Desert and are located to the south of Holloman and WSMR. While climate would be site-specific depending on the terrain and other factors, the general weather is similar to that of WSMR as outlined above.

Pecos MOAs include all, or portions of Guadalupe, Lincoln, De Baca, Roosevelt, and Chaves Counties located in New Mexico. The general climate for Eastern New Mexico, where Pecos MOAs are located, is arid or semi-arid with an abundance of sunshine, low relative humidity, and relatively large annual and diurnal temperature ranges (Western Regional Climate Center, 2021). Temperatures in this region vary greatly based on several factors, especially with elevation, but the region generally experiences cool winters and very warm summers. The average temperature of Clovis, New Mexico in eastern New Mexico, is 58.0°F. The warmest month, on average, is July with an average temperature of 77.0°F. The coolest month on average is January, with an average temperature of 38.0°F. Average annual precipitation is approximately 17.9 inches per year (Weatherbase, 2021d).

The proposed SUAs overlie several counties spanning multiple AQCRs (**Table 3-17**). WSMR Restricted Areas lie within the El Paso-Las Cruces-Alamogordo Interstate AQCR. The entire AQCR is designated unclassifiable/attainment area for all criteria pollutants, except for two localized, non-attainment areas within Doña Ana County. The area known as Anthony, New Mexico, which lies on the border of Texas and New Mexico, is a PM_{10} nonattainment area. This area was designated nonattainment for PM_{10} by the USEPA in 1991 (40 CFR 81.332). In October of 2015, the federal government lowered the NAAQS for O_3 from 0.075 parts per million (ppm) to 0.070 ppm. Since the federal standard was lowered, the New Mexico Environmental Department (NMED) recommended that the southeastern portion of Sunland Park, New Mexico, be designated as nonattainment of the new 8-hour O_3 standard. On June 4, 2018, the USEPA designated this area as marginal nonattainment with an effective date of August 3, 2018 (83 FR 25776). For Doña Ana County, USEPA acknowledges that the southeastern portion of the county is impacted by transport of O_3 precursors from Mexico. While portions of WSMR are located within Doña Ana County, its boundaries fall outside of the nonattainment area, as specified by USEPA.

All of the other SUAs listed in the table are in AQCRs that are in areas that are unclassifiable or attainment for all criteria pollutants (per designations included in ACAM) and, as a result, the General Conformity rule does not apply to any of the airspace ROIs.

Table 3-17
Military Operations Areas and Restricted Areas by County and Air Quality Control Region

MOA/RA	County Name(s)	AQCR
WSMR RA (R-5107 & R-5111)	Lincoln, Otero, Doña Ana, Sierra, Socorro, Torrance	El Paso-Las Cruces-Alamogordo Interstate Northeastern Plains Intrastate Southwestern Mountains-Augustine Plains Intrastate
Pecos North High/Low; South MOAs	Guadalupe, Lincoln, De Baca, Roosevelt, Chaves	Northeastern Plains Intrastate El Paso-Las Cruces-Alamogordo Interstate Pecos-Permian Basin Interstate
McGregor Range RA (R-5103 A-C)	Otero	El Paso-Las Cruces-Alamogordo Interstate

AQCR = Air Quality Control Region; MOA = Military Operations Area; RA = Restricted Areas; WSMR = White Sands Missile Range

3.6.3 *Environmental Consequences Evaluation Criteria*

The project areas associated with the two airfields and SUA are in areas that are designated attainment (or unclassified) for all criteria pollutants. An air analysis would be performed without considering General Conformity for any of the proposed alternatives because these areas are designated attainment/unclassified.

Based on guidance in Chapter 4 of the *Air Force Air Quality Environmental Impact Analysis Process Guide, Volume II – Advanced Assessments*, for air quality impact analysis, project criteria pollutant emissions were compared against the insignificance indicator of 250 tpy for the PSD major source permitting threshold for actions in areas that are in attainment for all criteria pollutants (25 tpy for Pb). These "Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the NAAQS. These insignificance indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutants is considered so insignificant that the action would not cause or contribute to a pollutant that exceeds one or more NAAQSs. Although PSD and Title V are not applicable to mobile sources, the PSD major source thresholds provide a benchmark to compare air emissions against and to determine project impacts. While emissions from the Proposed Action alternatives that are in attainment areas are compared against the 250 tpy insignificance level, to be conservative, estimated emissions at WSMR airspace are also compared against 100 tpy to account for the small portion of Doña Ana County that is nonattainment for O_3 and PM_{10}.

Some areas within the SUAs proposed for use by the F-16 aircraft are close to Class 1 areas in New Mexico. These areas include the White Mountain Wilderness Area, Bosque del Apache Wilderness Area, Organ Mountains Wilderness Area, and Pecos Wilderness Area. Typically, determination of air quality impacts within Class 1 areas is conducted for stationary emission sources covered by PSD permit regulations. Mobile sources, including those from aircraft emissions, are not part of the PSD permit review process. However, emissions from the Proposed Action have the potential to impact visibility within Class 1 areas and are considered here qualitatively.

ACAM, Version 5.0.17b, was used to estimate criteria and precursor pollutant emissions for any new construction, airfield operations, maintenance activities, new personnel commutes, and flight operations in an SUA. In addition, emissions from stationary sources associated with this action, including engine test cell operations, and fueling and storage, were also estimated. By default, ACAM accounts only for aircraft emissions occurring at or below 3,000 ft (within the mixing layer); emissions are evaluated using this default, and aircraft emissions released above 3,000 ft were not included in analysis for the ROIs. Assumptions of the model are discussed in **Appendix D.2**. The air quality analysis focused on emissions associated with the airfield operations and new construction at Holloman AFB and with sorties in ROW and the SUA. As such, emissions from ACAM were estimated separately for the airfield and SUA ROIs.

ACAM documentation in the form of a Record of Air Analysis (ROAA) for action occurring in attainment area, is provided in **Appendix D.2**.

The basis for the air emissions calculations performed for the F-16C aircraft (engine F110-GE-100) are listed in **Table 3-18**.

Table 3-18
Basis of Air Emission Calculations

Location	Type of Operation	Number of Sorties per Year (Alternative 2)	Ground Operation Emission Sources
Holloman Airfield	LTO Cycles	5,000[a]	Auxiliary power unit equipment, AGE, personal vehicle use, aircraft maintenance (solvent use), fuel handling and storage, engine test cells, painting operations, aircraft trim tests (12 per aircraft)
	TGO Cycles	7,500	
ROW Airfield	LTO Cycles	107[a]	Aircraft trim tests (12 per aircraft)
	TGO Cycles	187	
WSMR Restricted Areas (R-5107 & R-5111)	Sorties at ≤3,000 ft AGL	2,811[a,b,c]	Not Applicable
McGregor Range Restricted Areas (R-5103 A-C)	Sorties at ≤3,000 ft AGL	346[a,b,c]	Not Applicable
Pecos North High/Low; South MOAs	Sorties at ≤3,000 ft AGL	15[a,b,c]	Not Applicable

Notes:
[a] Air quality impacts are assessed for the airport airfield and SUA based on the total annual sorties from the selected airfield.
[b] All sorties are low-altitude operations (≤3,000 ft AGL) and would spend the estimated time per sortie in the mixing layer.
[c] Estimated time per sortie spent at or below 3,000 ft altitude is 13.33 minutes. 88/12 split between military and afterburner mode.
AGE = aerospace ground equipment; AGL= above ground level; ft = foot (feet); LTO = landing and takeoff; SUA = special use airspace; TGO = Touch and Go

3.6.4 *Environmental Consequences – Alternative 1*

As part of Alternative 1, the 8 FS, which operates at Holloman AFB on an interim basis, would be permanently assigned to Holloman AFB. Aircraft operations at Holloman AFB would not increase or change in any way. The only new air emissions that would be associated with Alternative 1 are direct and indirect emissions sources resulting from construction and post-construction activities at Holloman AFB. Construction activities that would result in criteria and GHG emissions include fugitive dust emissions from ground disturbance operations, mobile source emissions from off-road construction equipment, on-road construction vehicles for material delivery and pickup, and vehicular emissions from commuting workers. Post-construction activities that result in direct stationary source emissions include installation of new boilers for comfort heating at the new facilities.

3.6.4.1 Holloman Air Force Base

Emissions were estimated for Alternative 1 for the proposed new projects listed in **Table 2-4**. Emissions were calculated using estimated project size and project descriptions, as provided in the table. Where necessary, best engineering judgments and mass balance were used to estimate ACAM input parameters. As a worst case, all proposed construction activities were assumed to begin in January 2023 and would be completed within 1 year of the start date. This represents a maximum emissions scenario for analysis purposes; construction is expected to take place per the timing listed in **Table 2-4**.

Table 3-19 presents emissions from three minor construction projects for Alternative 1 of the Proposed Action. The methodologies, emission factors, and assumptions used for the emission estimates are outlined in **Appendix D.2**. The project alternative's estimated emissions are compared against the 250 tpy indicator of insignificance for criteria pollutants in attainment areas.

Table 3-19
Alternative 1 Annual Emissions Estimates at Holloman Air Force Base

Activity	Pollutant Emissions (ton/year)								
	VOC	**NOx**	**CO**	**SOx**	**PM 10**	**PM 2.5**	**CO_2e**	**Pb**	**NH3**
Construction[1]	0.71	2.19	2.92	0.01	0.35	0.08	703	0.0	0.002
Operational[2]	0.01	0.10	0.09	0.001	0.01	0.01	122	0.0	0.000
Total	**0.72**	**2.29**	**3.00**	**0.01**	**0.36**	**0.09**	**825**	**0.0**	**0.002**
Insignificance Indicator (ton/year)[3]	250	250	250	250	250	250	-	25	250
Exceedance (Y/N)	N	N	N	N	N	N	-	N	N

Source: Air Conformity Applicability Model output
Notes:
1 All construction activities are assumed to occur in one year (January 2023-December 2023) to model worst-case scenario. Construction is expected to take place per the timing listed in **Table 2-4**.
2 Assumed all 3 new facilities to be equipped with natural gas boilers. Operational (steady state) emissions are for 2024 and beyond.
3 Holloman AFB is in Otero County which is not in regulatory area.
NO_x = nitrogen oxides; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; LTO = landing and takeoff; NH_3 = ammonia; Pb = lead; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SO_x = sulfur oxides; TGO = touch and go; tpy = tons per year; VOC = volatile organic compound

As shown in **Table 3-19**, all emissions are below the 250 tpy (and 25 tpy for Pb) insignificance indicator for all criteria pollutants. Emissions from construction activities can cause short-term, minor, adverse impacts to air quality. However, the annual emission increases for the criteria pollutants, as shown, would not be considered significant, as they are well below the relevant insignificant indicator values. Additionally, standard construction practices (e.g., watering) would be used to reduce dust and keep particulate matter emissions to a minimum. Annual operational emissions from heating units would be long-term, but minor. The analysis results demonstrate that, if implemented, the Alternative 1 would not interfere with the region's ability to maintain compliance with the NAAQS for criteria pollutants. Additionally, Holloman AFB is not located within 10 kilometers (6.2 miles) of any Class I area.

These emission findings are documented in the ACAM Report and ROAA (**Appendix D.2**).

Annual GHG emissions from Alternative 1 are relatively low (825 tpy CO_2e) and account for approximately 0.0014 percent of New Mexico's 2018 GHG emissions. The additional GHG emissions expected as a result of this alternative would not likely result in any climate-related impacts in a significant way. Further, most of the GHG emissions from Alternative 1 would be short term and would occur only for the duration of construction activities.

3.6.4.2 Roswell International Air Center

As part of Alternative 1, aircraft operations at ROW would not increase or change in any way from current operational levels. In addition, no new construction associated with the Proposed Action is planned at ROW. As a result, no changes to air emissions are anticipated at ROW under this alternative.

3.6.4.3 Special Use Airspace

Under Alternative 1, no changes in operations within the SUA are proposed. As a result, there would be no impacts to air quality in the airspaces used for training under this alternative.

3.6.5 *Environmental Consequences – Alternative 2*

As part of Alternative 2, the 8 FS, which operates at Holloman AFB on an interim basis, would be permanently assigned to Holloman AFB and an additional F-16 FTU squadron is proposed to be permanently relocated to the installation. In addition, an estimated additional 475 full-time personnel are proposed to be hired or relocated permanently to Holloman AFB. Some minor construction to expand existing facilities as well as interior renovations are proposed. **Table 2-4** provides a summary on the proposed projects.

Increased air emissions associated with Alternative 2 would result from increase in aircraft operations of the additional F-16 FTU squadron at Holloman AFB and ROW. Emissions from ground support activities in the vicinity of the Holloman AFB airfield, such as from aerospace ground equipment, fuel storage, aircraft maintenance, aircraft coating operations, and jet engine testing, would also increase. Additional emissions would result from proposed new construction and renovation at Holloman AFB and from proposed new personnel commuting to the installation in their vehicles.

3.6.5.1 Holloman Air Force Base

Emissions were estimated for Alternative 2 beginning in January 2023 for aircraft operations to model the maximum emissions scenario for air emissions. **Table 3-20** presents total increases in annual construction and operational emissions for the proposed activities at Holloman AFB and in its vicinity. The methodologies, emission factors, and assumptions used for the emission estimates for the related activities are outlined in **Appendix D.2**. The project alternative's estimated emissions are compared against the 250 tpy indicator of insignificance for criteria pollutants in attainment areas.

As shown in **Table 3-20**, all of the criteria pollutant emissions associated with airfield operations, new facilities construction, and new facilities operations are below the 250 tpy (and 25 tpy for Pb) insignificance indicator.

Emissions from proposed construction and renovation can cause short-term, minor, adverse impacts to air quality. However, the annual emission increases for the criteria pollutants would not be considered significant, as they are well below the relevant insignificant indicator values. Additionally, standard construction practices (e.g., watering) would be used to reduce dust and keep particulate matter emissions to a minimum. Emissions from aircraft operations are expected to increase along with the overall increase in the number of additional sorties proposed under Alternative 2, but these increases are not considered significant, as they are below the insignificant indicator levels. Increase in the levels of aircraft ground support activities along with increase in the number of new personnel would result in additional criteria pollutant emissions. These emission increases would result in long-term, moderate, adverse effects on air quality in and around the vicinity of the base. Annual operational emissions from heating units would be long-term, but minor. Total emissions from oxides of nitrogen (NO_x) and CO are predominantly from short-term construction emissions that are assumed to occur within a 1-year period and from additional flight operations during the same calendar year. The analysis results demonstrate that, if implemented, Alternative 2 would result in increased emissions, but are not likely to interfere with the region's ability to maintain compliance with the NAAQS for criteria pollutants. Additionally, Holloman AFB is not located within 10 kilometers (6.2 miles) of any Class I area; thus, regional haze or visibility would not impact the region's air quality in a significant way.

These emission findings are documented in the Detail ACAM Report and ROAA (**Appendix D.2**).

Table 3-20
Alternative 2 Annual Emissions Estimates at Holloman Air Force Base

Activity	Pollutant Emissions (ton/year)								
	VOC	NOx	CO	SOx	PM 10	PM 2.5	CO_2e	Pb	NH3
Construction[1]	2.3	7.8	10.8	0.03	0.8	0.3	2,481.1	0.0	0.01
Aircraft Operation[2,3,4]	13.1	93.7	124.8	8.4	12.1	8.2	22,128	0.0	0.1
Operational[5]	0.01	0.2	0.2	0.001	0.019	0.019	298	0.0	0.00
Total	**15.4**	**101.7**	**135.8**	**8.4**	**12.8**	**8.5**	**24,908**	**0.0**	**0.1**
Insignificance Indicator (ton/year)[6]	250	250	250	250	250	250	-	25	250
Exceedance (Y/N)	N	N	N	N	N	N	-	N	N

Source: Air Conformity Applicability Model output

Notes:
1 All construction/renovation activities assumed to occur in one year (January 2023-December 2023) to model worst-case scenario.
2 The aircraft emissions were estimated for the Proposed Action under Alternative 2 beginning in January 2023. For air quality modeling purposes, these are representative years. Construction is expected to take place per the timing listed in **Table 2-4**.
3 Represents total per year emissions for: (1) flight operations (includes trim tests and auxiliary power unit use), (2) aerospace ground equipment, (3) aircraft maintenance (parts cleaning), (4) aircraft coating operations, (5) new personnel commute and (6) Jet A fuel storage (includes fuel for LTOs, TGOs, trim tests, engine testing, airspace use, and travel to the airspace).
4 Based on 5,000 LTOs and 7,500 TGOs per year
5 Assumed new facilities to be equipped with natural gas boilers, as needed. Operational emissions are for 2024 and beyond.
6 Holloman AFB is in Otero County, which is not in a regulatory area.

NO_x = nitrogen oxides; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; LTO = landing and takeoff; NH_3 = ammonia; Pb = lead; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SO_x = sulfur oxides; TGO = touch and go; tpy = tons per year; VOC = volatile organic compound

3.6.5.2 Roswell International Air Center

Under Alternative 2, there would be additional F-16C sorties, including TGOs that would be operated from ROW. **Table 3-21** presents total annual increases in annual operational emissions for the proposed flight operations at ROW. Emissions from aircraft operations, especially annual NO_x and CO emissions, would increase as result of additional sorties and TGOs proposed under Alternative 2 and from associated ground-support activities. There would be long-term, minor, adverse effects on ambient air quality at ROW. However, all emissions are below the 250 tpy insignificant indicator levels, and therefore, if implemented, there would be no significant impacts to air quality under Alternative 2.

Table 3-21
Alternative 2 Annual Emissions Estimates at Roswell International Air Center

Activity	Pollutant Emissions (ton/year)								
	VOC	NOx	CO	SOx	PM 10	PM 2.5	CO_2e	Pb	NH3
Aircraft Operation[1,2,3]	0.45	18.54	16.60	1.24	1.47	1.05	3,653	0.00	0.00
Insignificance Indicator (ton/year)[4]	250	250	250	250	250	250	-	25	250
Exceedance (Y/N)	N	N	N	N	N	N	-	N	N

Source: Air Conformity Applicability Model output

Notes:
1 The aircraft emissions were estimated for the Proposed Action under Alternative 2 beginning in January 2023. For air quality modeling purposes, these are representative years.
2 Represents total per year emissions for: 1) flight operations (includes trim tests and auxiliary power unit use), and 2) AGE.
3 Based on 107 LTOs and 187 TGOs per year
4 ROW is in Chaves County which is not in regulatory area.

AGE = Aerospace Ground Equipment; NO_x = nitrogen oxides; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; LTO = landing and takeoff; NH_3 = ammonia; Pb = lead; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SO_x = sulfur oxides; TGO = touch and go; tpy = tons per year; VOC = volatile organic compound

3.6.5.3 Special Use Airspace

Under Alternative 2, the SUAs used by Holloman AFB would include the additional sorties at or below 3,000 ft AGL, and thus these regions are included in the air quality analysis. However, air quality analysis from aircraft operations within some of the proposed airspaces under Alternative 2 have previously been analyzed in the *Environmental Impact Statement for Special Use Airspace Optimization to Support Existing Aircraft at Holloman Air Force Base*, *New Mexico*, and as such, they have been excluded from this analysis.

Under Alternative 2, the SUA (WSMR Restricted Airspace, McGregor Range, and Pecos MOAs) would include sorties at or below 3,000 ft AGL, and thus, these regions are included in the air quality analysis. Consistent with the USEPA recommendation regarding mixing height, only those emissions that would occur within the mixing layer (at or below 3,000 ft) were analyzed. Out of the proposed additional 5,000 F-16C sorties, almost all sorties include low-altitude (less than 3,000 ft AGL) operations. Thus, it is assumed for the air quality analysis that all sorties would occur at or below the mixing height for an estimated period of time spent training in the SUA, as previously listed in **Table 3-18.** Estimated net emissions from the SUA would be entirely additive, as implementation of Alternative 2 in the SUA would not alter existing operations in the SUA.

The emissions associated with additional sorties proposed for the SUA were evaluated using ACAM for the proposed F-16C aircraft. The total flight time in the mixing layer in each SUA was estimated to be 13.3 minutes for the F-16C aircraft, of which 11 minutes is spent in military mode and 1.6 minutes is spent in afterburner mode. The 88/12 percentage split between military mode and afterburner mode is consistent with the methodology in the *Environmental Impact Statement for Special Use Airspace Optimization to Support Existing Aircraft at Holloman Air Force Base*, *New Mexico*. In addition, it was assumed the time it would take to fly from the proposed airport to and from the SUA would occur at an altitude above 3,000 ft AGL, and thus, this portion of the sortie is not included in the analysis. The methodologies, emission factors, and assumptions used for the emission estimates for each of the scenarios are outlined in **Appendix D.2**.

The SUA estimated emissions are compared against the 250 tpy indicator of insignificance for criteria pollutants in attainment areas. The estimated emissions for SUAs that underlie areas of nonattainment (or maintenance) are compared against the relevant General Conformity *de minimis* thresholds. The emissions that would result from the additional sorties in the SUA analyzed under Alternative 2 are listed in **Table 3-22**.

As shown in **Table 3-22**, the highest emission rate in WSMR Restricted airspace would be for NO_x (99.94 tpy), which would be just lower than 100 tpy insignificance indicator level (conservatively used here because of the two non-attainment areas within Doña Ana County). Emissions in this airspace would primarily occur in areas that are in attainment of all criteria pollutants. WSMR SUA overlies entirely, or partially, over five counties in New Mexico, of which Doña Ana is one. A small portion of Doña Ana County, outside the boundaries of WSMR, is in a regulatory area for PM_{10} and O_3 (VOC and NO_x are precursors). As a result, WSMR emissions were compared against the insignificance indicator level of 100 tpy for VOC and NO_x (ozone precursors) and for PM_{10}. Estimated emissions for VOC and PM_{10} in WSMR would be well below the insignificance indicator levels, and emissions for all other attainment level criteria pollutants would be safely below the 250 tpy PSD indicator levels.

There would be long-term, moderate, adverse effects on ambient air quality at WSMR airspace. Several Wilderness Areas underlie or are near WSMR and there may be some haze that would develop as the aircraft moves across its flight path. However, the haze would likely occur for a very short duration and would dissipate easily over the large areas of the SUA. Therefore, impacts on visibility from the alternative within Class 1 areas in proximity to WSMR would be short-term, adverse, but not likely to be significant based on the dispersive nature of these emissions in the vast expanses of these airspaces.

For the McGregor Range Restricted Areas, as shown in **Table 3-22**, the highest emission rate for any criteria pollutant is 16.75 tpy of NO_x from F-16C operations. The McGregor Range Restricted Areas overlie portions of Otero County in New Mexico, which is designated attainment for all criteria pollutants. The highest emissions from proposed operations in this SUA would be well below the 250 tpy insignificance indicator levels. Therefore, the air quality impacts from proposed aircraft emissions in this SUA would not cause impacts that would be considered significant. Emissions from this alternative for McGregor Range SUA would be long-term, adverse, but minor.

For Pecos MOAs, as shown in **Table 3-22**, the highest emission rate for any criteria pollutant is 0.53 tpy of NO_x from F-16C operations. Pecos MOAs overlie counties in New Mexico that are designated attainment for all criteria pollutants. The highest emissions from proposed operations in this SUA would be well below the 250 tpy insignificance indicator levels. Therefore, the air quality impacts from proposed aircraft emissions in this SUA would not cause impacts that would be considered significant. Emissions from this alternative for Pecos MOAs would be long-term, but minor.

Based on the analysis, the additional emissions created by F-16C operations in the any of the SUAs would not be considered significant with respect to air quality impacts. For WSMR, annual emissions from NO_x are almost at the insignificant indicator levels of 100 tpy, but they are still far lower than the PSD regulatory threshold of 250 tpy for NO_x. These emission findings are documented in the ROAA (**Appendix D.2**).

Table 3-22
Alternative 2 Annual Emissions Estimates at Special Use Airspace

SUA	Pollutant Emissions (ton/year)								
	VOC	NOx	CO	SOx	PM 10	PM 2.5	CO_2e	Pb	NH3
WSMR Restricted Airspace (R-5107 & R-5111)[1,2,3]	0.93	99.94	56.22	4.06	2.70	2.02	11,444	0.00	0.00
Insignificance Indicator (ton/year)[4]	100	100	250	250	100	250	-	25	250
Exceedance (Y/N)	N	N	N	N	N	N	-	N	N
McGregor Range Restricted Areas (R-5103 A-C)	0.16	16.75	9.42	0.68	0.45	0.34	1,918	0.00	0.00
Insignificance Indicator (ton/year)[5]	250	250	250	250	250	250	-	25	250
Exceedance (Y/N)	N	N	N	N	N	N	-	N	N
Pecos North High/Low; South MOAs	0.01	0.53	0.30	0.02	0.01	0.01	61	0.00	0.00
Insignificance Indicator (ton/year)[5]	250	250	250	250	250	250	-	25	250
Exceedance (Y/N)	N	N	N	N	N	N	-	N	N

Source: Air Conformity Applicability Model output

Notes:
[1] The aircraft emissions were estimated beginning in January 2023. For modeling purposes, these are representative years.
[2] Represents total per year emissions for flight operations
[3] Emissions based on 5,000 additional sorties per year and estimated time of 11.3 minutes spent in mixing layer.
[4] WSMR Restricted Range is spread over 5 counties, one of which is Doña Ana. A small portion of this county, outside the boundaries of WSMR, is in a regulatory area for PM_{10} and O_3 (VOC and NO_x are precursors); thus 100 tpy insignificance indicator levels.
[5] McGregor Range and Pecos MOAs overly areas that are not in a regulatory area.
AGE = Aerospace Ground Equipment; NO_x = nitrogen oxides; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; LTO = landing and takeoff; NH_3 = ammonia; O_3 = ozone; Pb = lead; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SO_x = sulfur oxides; TGO = touch and go; tpy = tons per year; VOC = volatile organic compound

Total projected CO_2e emissions from Alternative 2 of approximately 24,711 tpy of CO_2e were compared against New Mexico's 2018 GHG emission estimates to assess the significance of GHG emissions that would be generated due to the proposed action alternative. **Table C-6 in Appendix C** shows this analysis. Most of Alternative 2 GHG emissions would result in longer-term GHG emissions increases as they would result primarily from aircraft operations and maintenance. CO_2e emissions would fall well below the permitting thresholds and account for less than 0.042 percent of State CO_2e emissions. The additional CO_2e emissions expected as a result of this alternative would not likely result in climate-related impacts in a significant way when assessed in a regional or global context. The relative quantity of projected GHG emissions is expected to be so low that it would be cost-prohibitive to consider mitigation measures.

3.6.6 *Environmental Consequences – No Action Alternative*

Under the No Action Alternative, additional F-16 FTU squadrons would not be permanently based at Holloman AFB. Air quality at both Holloman AFB and ROW would remain identical to existing conditions while the Air Force considered other beddown locations and additional environmental analysis was completed.

3.6.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

Implementation of Alternative 1 at Holloman AFB and ROW, in addition to reasonably foreseeable future actions, would result in additional impacts on air quality, but these impacts would not be significant. PM_{10} emissions could increase with any addition of ongoing construction projects in the area; however, these increases would be short in duration and the incremental impact on air quality would be negligible.

Implementation of Alternative 2 at Holloman AFB, in addition to reasonably foreseeable future actions, would result in additional impacts on air quality in the immediate environs of the base. These impacts would result primarily from aircraft operations and associated activity emissions increases in the long term. PM_{10} emissions could increase with any addition of ongoing construction projects in the area; however, these increases would be short in duration and the incremental impact on air quality would be minor.

F-16C training for all sorties is assumed to occur at times below the mixing height (3,000 ft AGL) in the SUA proposed for training; however, the duration would be short (approximately 13.3 minutes), and therefore impacts on air quality are not likely to be significant. Overall, there would be moderate, long-term increases in air emissions from Alternative 2 in the SUAs, especially within WSMR airspace.

3.7 BIOLOGICAL RESOURCES

3.7.1 *Definition of the Resources*

Biological resources include native or invasive plants and animals; sensitive and protected floral and faunal species; and the habitats, such as wetlands, forests, and grasslands, where they exist. Habitat can be defined as the resources and conditions in an area that support a defined suite of organisms. Special status species include plant and animal species (1) listed as endangered, threatened, or proposed for listing by the United States Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) and their designated critical habitats; (2) protected by the federal Migratory Bird Treaty Act (MBTA) of 1981; (3) protected under the Bald and Golden Eagle Protection Act (BGEPA) of 1940; or (4) listed under state ESAs or similar conservation laws. The description of the primary federal statutes that form the regulatory framework for the evaluation of biological resources is provided in **Appendix C.5**.

The ROI for biological resources includes the land on Holloman AFB surrounding the facilities proposed for minor construction, the land within the airfield noise contours and safety zones on Holloman AFB and ROW (see **Section 3.4**). The ROI for biological resources includes the SUA, ATCAAs, and training ranges described in **Section 2.3.1.2.**

3.7.2 *Existing Conditions*

The information presented in this section was primarily gathered from the Holloman AFB *Integrated Natural Resources Management Plan* (INRMP) (Holloman AFB, 2018b) and from the USFWS (2023) and the New Mexico Department of Game and Fish (NMDGF) (2019, 2021).

In order to describe the vegetation common within the ROIs, ecoregion descriptions are provided. Ecoregions are used to describe areas of similar type, quality, and quantity of environmental resources (USEPA, 2022). Ecoregions are assigned hierarchical levels to delineate ecosystems spatially based on different levels of planning and reporting needs. Level I is the broadest ecoregion level, dividing North America into 15 ecological regions. Level II includes 50 ecoregions, and Level III divides the continental US into 105 ecoregions. Level IV further subdivides the Level III ecoregions (USEPA, 2022). The Level III ecoregion described in the following paragraphs provide a regional perspective and are more specifically oriented for environmental monitoring, assessment and reporting, and decision-making (Commission for Environmental Cooperation, 1997).

3.7.2.1 Holloman Air Force Base

Vegetation and Wildlife

The ecosystems represented on Holloman AFB, part of a more extensive system extending beyond the borders of the base, is the Level III Chihuahuan Desert ecoregion (NMDGF, 2019). The Chihuahuan Desert Ecoregion encompasses 26,989 mi^2 of the southern third of New Mexico and is the northern portion of contiguous warm desert extending into central Mexico (**Figure 3-12**). Elevations range from 2,800 to 8,550 ft, and the terrain consists of broad basins bordered by isolated, rugged mountains. This Ecoregion is arid, marked by hot summers and mild winters. There are 27 naturally vegetated habitat types, three unvegetated land covers, and agricultural land in the Chihuahuan Desert Ecoregion in New Mexico, mostly composed of two habitats, Chihuahuan Semi-Desert Grassland and Chihuahuan Desert Scrub (NMDGF, 2019). Holloman AFB land includes both of these upland habitats as well as dunelands (Great Plains Sand Grassland and Shrubland and Intermountain Saltbrush Shrubland), Playa (Intermountain Saltbrush Shrubland), Arroyo Riparian (Warm Desert Arroyo Riparian Scrub), and Wetlands (Holloman AFB, 2018b). Except in small patches of high elevation woodlands of oak (*Quercus* spp.) and piñon-juniper above 7,050 ft, dominant plant species are blue grama (*Bouteloua gracilis*), black grama (*Bouteloua eriopoda*), creosote (*Larrea tridentata*), American tarwort (*Flourensia cernua*), mesquite (*Prosopis* spp.), and yuccas (*Yucca* spp.). Common fauna includes prairie dogs, kit foxes, pronghorn (*Antilocapra americana*), and the black-tailed jackrabbit (*Lepus californicus*) (NMDGF, 2021).

The undeveloped areas of Holloman AFB are dominated by xerophytic shrubland and grassland communities having plant assemblages biogeographically related to the Chihuahuan Desert and Great Basin. The Administrative area contains the greatest total number of ac and continuous extent of Alkali Sacaton Grasslands within Holloman AFB. Shrublands dominated by fourwing saltbush (*Atriplex canescens*) cover approximately one-quarter of the Administrative area. Pickleweed Shrubland and Gyp Dropseed Grassland make up the majority of the remainder of undeveloped plant assemblages within the Administrative area (Holloman AFB, 2018b).

The Duneland ecosystem is primarily located in the northwestern portion of Holloman AFB. The Rosemary Mint Dune Shrubland Association occurs on slopes and summits of shifting and semi-stabilized gypsum dunes. The Barren Duneland mapping unit contains non-vegetated, shifting gypsum dunes that may have inclusions of hoary rosemary mint/sandhill muhly on semi-stabilized portions of the dune field. Within the interdune, swale grasses, small shrubs (subshrubs), and forbs create a high diversity mosaic of gypsum-tolerant plants. The Gyp Dropseed Grassland mapping unit borders the dunelands in a long, narrow band and extends to broader regions at the far northwestern corner of the base (Holloman AFB, 2018b).

Plant composition of the Arroyo Riparian Ecosystem has a high potential for flux considering the disturbances caused by seasonal flooding. Three of the pervasive vegetation mapping units represented within the draws include Pickleweed Shrubland, Semi-riparian Alkali Sacaton Grassland, and Salt Cedar Woodland. Occasional wetland plants such as inland saltgrass (*Distichlis spicata*) and Mojave seablite (*Suaeda moquinii*) are distributed within the reaches of the draw that receive more permanent ponding or may be situated closer to a high-water table. Pickleweed (*Salicornia* spp.) often occurs with fourwing saltbush within the playa-like reaches of the arroyos (Holloman AFB, 2018b).

Mixed Shrub-Grasslands North of Douglas Road are dominated by shrubland communities with extensive patches of grassland communities. Holloman AFB development, disturbance, and roads cover about eight percent of the area, with the remaining communities associated with riparian habitat within the draws or rock outcrops on Tularosa Peak (Holloman AFB, 2018b).

Fluctuating water levels, topographic variation, and proximity to military facilities have resulted in a diverse mix of natural and introduced vegetation types at the LHWC area. The Playa and Upland Ecosystem each contribute to approximately 30 percent of cover types, followed by Constructed Wetland with 16 percent. Arroyo Riparian Ecosystem, including saltcedar woodlands, development and disturbance cover, and variation in gyp dropseed grasslands comprise the remaining cover types (Holloman AFB, 2018b).

Considering its relatively small size, Holloman AFB provides a large diversity of habitats for aquatic and terrestrial species. Throughout the Tularosa Basin, suitable wildlife habitat is limited, because of ranching, farming, and urban and rural development. Within this patchwork, wildlife is typically left to survive in increasingly smaller pockets of native habitat further fragmented by roads and fences. Mammals range from small bat and rodent species to medium carnivores and large artiodactyla such as the nonnative gemsbok (*Oryx gazelle*). Common wildlife in the area includes coyote, desert cottontail (*Sylvilagus auduboni*), and black-tailed jackrabbit (*Lepus californicus*). Holloman AFB manages land used for at least 16 different species of bats, including the pale Townsend's big-eared bat *(Corynorhinus townsendii*) and spotted bat (*Euderma maculatum*). A 2011 bat survey using mist-nets and acoustic monitoring identified at least six different bat species on base, including the most commonly detected species, the Mexican free-tailed bat (*Tadarida brasiliensis*) (Holloman AFB, 2018b).

Other mammal species observed on Holloman AFB include Ord's kangaroo rat (*Dipodomys ordii*), desert pocket mouse (*Chaetodipus penicillatus*), plains pocket mouse (*Perognathus flavescens gypsi*), White Sands woodrat (*Neotoma micropus leucophaea*), porcupine (*Erethizon dorsatum*), coyote, kit fox (*Vulpes macrotis neomexicanus*), long-tailed weasel (*Mustela frenata*), ringtail (*Bassariscus astutus*), Rocky Mountain mule deer (*Odocoileus hemionus*), and the desert mule deer (*Odocoileus hemionus crooki*).

During previous surveys, at least 264 bird species have been inventoried on Holloman AFB and the Boles Wells Water System Annex, and 81 of these species are currently listed by at least one agency or organization as a species of concern (Holloman AFB, 2018b). Some species that have been more commonly observed include waterfowl such as northern shoveler (*Anas clypeata*) and ruddy duck (*Oxyura jamaicensis*), raptors such as Swainson's hawk (*Buteo swainsoni*) and prairie falcon (*Falco mexicanus*), gamebirds like Gambel's quail (*Callipepla gambelii*) and scaled quail (*Callipepla chukar*), as well as several species of passerines (commonly known as song or perching birds).

Holloman AFB manages habitat for a variety of amphibian, lizard, and snake species, and according to previous surveys, Holloman AFB is home to at least 3 amphibian, 11 lizard, and 9 snake species. This includes the desert massasauga (*Sistrurus tergeminus*) and Texas horned lizard (*Phrynosoma cornutum*) (Holloman AFB, 2018b).

The White Sands pupfish (*Cyprinodon tularosa*) is endemic to the Tularosa Basin; the two translocated populations were introduced in 1970 at Mound Springs on WSMR and Lost River on Holloman AFB. The mosquito fish (*Gambusia affinis*) is the most common fish species on base and was introduced by NMDGF into ditches, lagoons, and Lake Holloman to control mosquito populations (Holloman AFB, 2018b).

Threatened and Endangered Species and Species of Concern

A list of species that could be found on Holloman AFB and potentially affected by aircraft movement, aircraft noise, and the use of defensive countermeasures was obtained from the Holloman AFB INRMP (Holloman AFB, 2018b), USFWS Environmental Conservation Online System, Information for Planning and Consultation (IPaC) website (USFWS, 2023a, 2023b, 2023c) and the NMDGF Biota Information System of New Mexico (BISON-M) database (NMDGF, 2022).

Ten federally listed, proposed, or candidate species were identified within the IPaC for Holloman AFB (see **Appendix C.5**); none of which have been documented on base. One, the lesser prairie-chicken (*Tympanuchus pallidicinctus*), has been recorded in counties over which Beak and Talon MOAs occur, and in the county where the ROW is located. Northern aplomado falcon (*Falco femoralis*) from the nonessential experimental populations in New Mexico have the potential to occur on Holloman AFB, but numerous surveys have not documented its presence. Six state listed species have been documented on base and include five state threatened and one state endangered (least tern [*Sternula antillarum athalassos*]) birds, and one state threatened fish. Baird's sparrow (*Ammodramus bairdii*), bald eagle [*Haliaeetus leucocephalus*], and neotropic cormorant (*Phalacrocorax brasilianus*) are vagrant species. The peregrine falcon (*Falco peregrinus*) is a rare to occasional visitor. The White Sands pupfish is a known resident species with a translocated population on Holloman AFB. Numerous species considered Species of Greatest Conservation Need also occur on Holloman AFB, and while these species are not listed under the ESA or the New Mexico Wildlife Conservation Act, Holloman AFB does survey and manage for these species, including the western burrowing owl, which has the potential to be found in maintained grasslands near airfields.

Invasive Species

Saltcedar (*Tamarix* spp.) is a concern in wetland areas at Holloman AFB. It has been planted on base in the past as a wind break and for dune stabilization. Five-horn smotherweed (*Bassia hyssopifolia*) is native to Europe and Asia, has a high salinity tolerance, and has become invasive at Lagoon G and Ponds 3 and 4. Other invasive plant species such as African rue (*Peganum harmala*) and Russian thistle (*Salsola kali*) are common in grasslands on Holloman AFB and degrade habitat for native wildlife species (Holloman AFB, 2018b).

3.7.2.2 Roswell International Air Center

Vegetation and Wildlife

ROW lays within the Chihuahuan Desert Ecoregion (**Figure 3-12**). The vegetation and common wildlife within this ecoregion are the same as described for Holloman AFB.

Threatened and Endangered Species and Species of Concern

A list of species that could be found on ROW and potentially affected by aircraft movement and aircraft noise was obtained from the USFWS IPaC website and NMDGF's BISON-M database and are provided in **Appendix C.5**. The federally listed or proposed species with the potential to be impacted by aircraft operations at ROW include endangered lesser prairie-chicken, the threatened piping plover (*Charadrius melodus*) and the non-essential experimental population northern aplomado falcon. Numerous state-listed species and Species of Greatest Conservation Need occur within Chaves County. Those with the potential to be impacted by operations at ROW include 12 bird species. **Appendix C.5** provides a listing of state listed species and Species of Greatest Conservation Need found within Chaves County.

Invasive Species

While there was no information available that provided the invasive species present on ROW, no ground-disturbing activities on ROW have the potential to spread or remove invasive plants. Similarly, aircraft operations in ROW airspace would have no impact on invasive plants or wildlife. As such, potential impacts to invasive species at ROW are not described further.

3.7.2.3 Airspace Proposed for Use

Vegetation and Wildlife

Similar to describing the ecosystems on Holloman AFB, Level III Ecoregions are also used to describe the ecosystems below the SUA and ATCAAs. The SUA, ATCAAs, and training ranges are located within five Level III Ecoregions listed below and illustrated in **Figure 3-12**. Each of these ecoregions is described below. Descriptions of the Ecoregions in New Mexico were adapted from the *New Mexico State Wildlife Action Plan* (NMDGF, 2019).

Beak MOAs and ATCAA

- Arizona/New Mexico Mountains
- Chihuahuan Deserts
- Southwestern Tablelands

Talon MOAs and ATCAA

- Arizona/New Mexico Mountains
- Chihuahuan Deserts
- Southwestern Tablelands

McGregor Range Restricted Areas and Centennial Training Range

- Arizona/New Mexico Mountains
- Chihuahuan Deserts

WSMR Restricted Areas and Oscura and Red Rio Training Ranges

- Chihuahuan Deserts
- Southwestern Tablelands

Cato and Smitty MOAs

- Arizona/New Mexico Plateau
- Arizona/New Mexico Mountains

Pecos MOAs

- High Plains
- Chihuahuan Deserts
- Southwestern Tablelands

The MTRs are located within the four Level III Ecoregions listed below and illustrated in **Figure 3-12.**

IR-133/142

- Arizona/New Mexico Mountains
- Chihuahuan Deserts
- Southwestern Tablelands

IR-192/194

- Arizona/New Mexico Mountains
- Chihuahuan Deserts
- Southwestern Tablelands

IR-134/195

- Arizona/New Mexico Mountains
- Chihuahuan Deserts

VR-176

- Arizona/New Mexico Plateau
- Arizona/New Mexico Mountains
- Chihuahuan Deserts
- Southwestern Tablelands

Arizona/New Mexico Mountains. The Arizona/New Mexico Mountains Ecoregion in New Mexico is composed of nine separate mountain complexes totaling 18,097 mi^2. Elevations range from 4,300 to 12,400 ft and terrain consists of steep mountains and some deeply dissected plateaus with desert, midlatitude steppe, and subarctic climatic conditions. The Arizona/New Mexico Mountains Ecoregion supports 26 naturally vegetated habitats, four unvegetated habitats, and cultivated land. Vegetation consists of chaparral at lower elevations, piñon-juniper and oak woodlands (including Madrean Evergreen Woodland in the south) at mid-elevations, and coniferous forests of ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*) at higher elevations. Common fauna include mule deer (*Odocoileus hemionus*), mountain lions, deer mouse, the Colorado chipmunk (*Neotamias quadrivittatus quadrivittatus*), and the long-tailed vole. The Arizona/New Mexico Ecoregion also supports the southernmost extent of spruce-fir forest at elevations above 10,800 ft (NMDGF, 2019).

Arizona/New Mexico Plateau. The Arizona/New Mexico Plateau Ecoregion represents an area of 74,467 mi^2 across northern Arizona, central and northwestern New Mexico, occupying a significant portion of the southern half of the Colorado Plateau. This ecoregion is predominantly semiarid grassland and dry shrubland, but differences in regional topography causes annual precipitation to vary. There are 28 naturally vegetated habitat types, primarily composed of Intermountain Dry Shrubland and Grassland or Intermountain Juniper Woodland. At lower elevations, vegetation consists of a grass-shrub mix, composed of four-wing saltbush (*Atriplex canescens*) and greasewood (*Sarcobatus vermiculatus*). Piñon-juniper woodlands comprise the ecoregion at higher elevations, including two-needle piñon and blue grama (*Bouteloua gracilis*). Common fauna include Kaibab squirrel (*Sciurus aberti kaibabensis*), banner-tailed kangaroo rat; Bailey's subspecies (*Dipodomys spectabilis baileyi*), desert night lizard; Utah subspecies (*Xantusia vigilis utahensis*), and Gunnison sage grouse (*Centrocercus sp.*) (NMDGF, 2019).

Chihuahuan Deserts. This ecoregion is described above in **Section 3.7.2.1**.

High Plains. The High Plains Ecoregion is 39,726 mi^2 of eastern New Mexico and Colorado that extends to semi-arid prairie within northwestern Texas, southeastern Wyoming, and southern Nebraska. Elevations in New Mexico range from 2,500 ft to 6,600 ft. Terrain is smooth to slightly irregular with intermittent mesas and plateaus. The climate is marked by hot summers and cold winters, with precipitation averaging between 12 and 20 inches. This ecoregion encompasses 26 naturally vegetated habitat types, three unvegetated land covers, with Great Plains Shortgrass Prairie as the primary habitat. Characteristic species include blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), and fringed sage (*Artemisia frigida*). (NMDGF, 2019).

Southwestern Tablelands. The Southwestern Tablelands Ecoregion encompasses much of eastern New Mexico and is part of a contiguous, 382,070-mi^2 semiarid prairie that extends across most of Kansas and Oklahoma, eastern Colorado, northern and western Texas, southeastern Wyoming, and southern Nebraska. In New Mexico, elevations range from 2,500 to 6,600 ft, and the terrain is smooth to slightly irregular with intermittent mesas and plateaus. The climate is marked by hot summers and cold winters. Terrestrial habitats include 26 naturally vegetated types, three unvegetated land covers, and cultivated lands, with Great Plains Shortgrass Prairie and Rocky Mountain Piñon-Juniper Woodland the most common habitats in the Ecoregion. Common plant species of the shortgrass prairie include blue grama, buffalograss, and fringed sage; and mixed grass prairie species include sideoats grama (*Bouteloua curtipendia*), western wheatgrass (*Pascopyrum smithii*), and little bluestem (*Schizachyrium scoparium*). Common fauna include Boreal chorus frog (*Pseudacris maculata*), Juniper titmouse (*Baeolophus ridgwayi*), and the chestnut-collared longspur (*Calcarius ornatus*) (NMDGF, 2019).

Threatened and Endangered Species and Species of Concern

A list of federally listed species that could be found in the SUA, ATCAAs, MTRs or training ranges that may potentially be affected by aircraft movement, aircraft noise, and the use of defensive countermeasures and training munitions was obtained from the USFWS IPaC website. The federally listed species include threatened, endangered, proposed threatened and endangered, candidate, and nonessential experimental populations consisting of 3 mammals, 7 birds, 2 reptiles, 1 amphibian, 16 fish, 1 mollusk, 4 snails, 1 insect, 1 crustacean, and 12 plant species (**Table 3-23**). The state listed species identified within the airspace and training ranges was obtained from the New Mexico BISON-M database, Arizona Game and Fish Department, and the Texas Parks and Wildlife. **Appendix C.5** provides a more complete breakdown of species by location (i.e., installation and airspace).

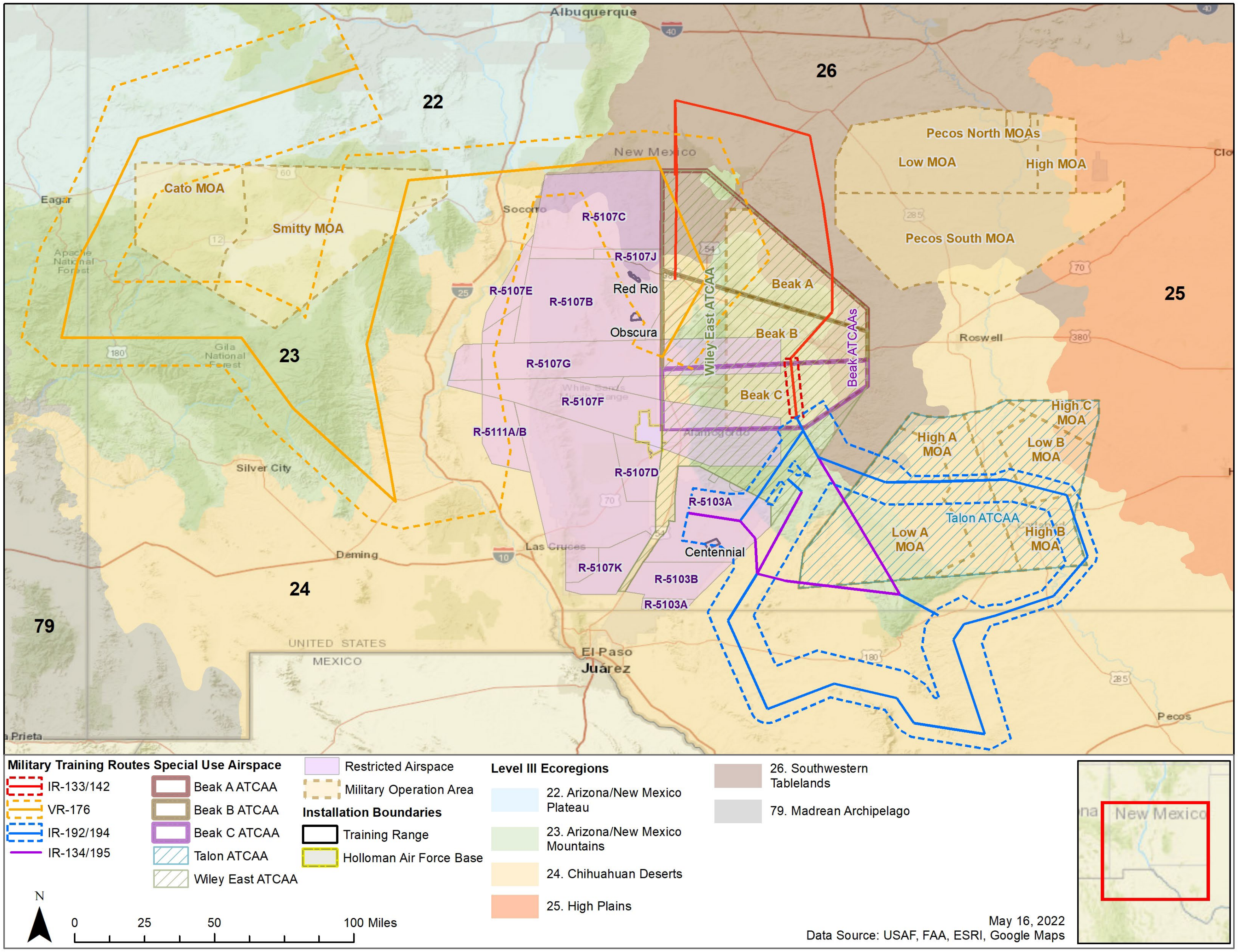

Figure 3-12. Ecoregions in the Special Use Airspace Federally Listed Species Descriptions.

There would be no ground disturbing activities within the majority of the SUA, ATCAAs and MTRs, except for the Oscura and Red Rio Training Ranges beneath the WSMR SUA and Centennial Training Range beneath the McGregor Range Restricted Areas. In addition to the bird and mammal species with the potential to be beneath the WSMR and McGregor Range Restricted Areas, an additional three state listed reptiles have the potential to be found on training range impact areas and include the gray-banded kingsnake (*Lampropeltis alterna*), mottled rock rattlesnake (*Crotalus lepidus lepidus*), and reticulated gila monster (*Heloderma suspectum suspectum*). While other federal and state listed terrestrial species have the potential to occur beneath the WSMR and McGregor Range SUA, the training range impact areas are well maintained with little to no vegetation that do not provide habitat for other species.

Designated Critical Habitat for several federally listed species is located beneath some sections of SUA, ATCAAs, and MTRs (**Table 3-24** and **Figure 3-13**). There is no designated critical habitat within the Oscura, Red Rio, or Centennial Training Ranges.

Table 3-23
Federally Listed Species within the Airspace and Training Ranges Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base

Common Name	Scientific Name	Federal Status	NM[1]	TX[2]	AZ[2]
Mammals					
Mexican gray wolf	*Canis lupus baileyi*	E			1A
Mexican gray wolf	*Canis lupus baileyi*	EXPN	X		1A
New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	E	X		1A
Peñasco least chipmunk	*Tamias minimus atristriatus*	PE	E	X	
Birds					
Lesser prairie-chicken	*Tympanuchus pallidicinctus*	E	X	X	
Mexican spotted owl	*Strix occidentalis lucida*	T	X	T	1A
Northern aplomado falcon	Falco *femoralis septentrionalis*	EXPN	X	X	
Northern aplomado falcon	*Falco femoralis septentrionalis*	E	E	X	
Piping plover	*Charadrius melodus*	T	T	X	
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	X	E	1A
Yellow-billed cuckoo	*Coccyzus americanus*	T	X	X	1A
Reptiles					
Narrow-headed gartersnake	*Thamnophis rufipunctatus*	T	X		1A
Northern Mexican gartersnake	*Thamnophis eques megalops*	T	X		X
Amphibians					
Chiricahua leopard frog	*Rana chiricahuensis*	T	X		1A
Fishes					
Apache trout	*Oncorhynchus apache*	T			1A
Beautiful shiner	*Cyprinella formosa*	T	X		

Table 3-23
Federally Listed Species within the Airspace and Training Ranges Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base

Common Name	Scientific Name	Federal Status	NM[1]	TX[2]	AZ[2]
Chihuahua chub	*Gila nigrescens*	T	E		
Gila chub	*Gila intermedia*	E	X		X
Gila topminnow (incl. Yaqui)	*Poeciliopsis occidentalis*	E	X		
Gila trout	*Oncorhynchus gilae*	T	T		1A
Little Colorado spinedace	*Lepidomeda vittata*	T			1A
Loach minnow	*Tiaroga cobitis*	E	X		1A
Pecos bluntnose shiner	*Notropis simus pecosensis*	T	X	X	
Pecos gambusia	*Gambusia nobilis*	E	E	X	
Razorback sucker	*Xyrauchen texanus*	E			1A
Rio Grande cutthroat trout	*Oncorhynchus clarkii virginalis*	C	X	X	
Rio Grande silvery minnow	*Hybognathus amarus*	EXPN		X	
Rio Grande silvery minnow	*Hybognathus amarus*	E	E		
Spikedace	*Meda fulgida*	E	X		1A
Zuni bluehead sucker	*Catostomus discobolus yarrow*	E	E		
Clams					
Texas hornshell	*Popenaias popeii*	E	E	X	
Snails					
Alamosa springsnail	*Tryonia alamosae*	E	E		
Chupadera springsnail	*Pyrgulopsis chupaderae*	E	X		
Socorro springsnail	*Pyrgulopsis neomexicana*	E	E		
Three forks springsnail	*Pyrgulopsis trivialis*	E			1A
Insects					
Monarch butterfly	*Danaus plexippus*	C	X	X	X
Crustaceans					
Socorro isopod	*Thermosphaeroma thermophilus*	E	E		
Flowering plants					
Guadalupe fescue	*Festuca ligulata*	E		E	
Gypsum wild buckwheat	*Eriogonum gypsophilum*	T	E	X	
Kuenzler hedgehog cactus	*Echinocereus fendleri* var. *kuenzleri*	T	E		
Lee pincushion cactus	*Coryphantha sneedii* var. *leei*	T	E	X	
Pecos (=puzzle, =paradox) Sunflower	*Helianthus paradoxus*	T	X		
Sacramento mountains thistle	*Cirsium vinaceum*	T	E	X	

Table 3-23
Federally Listed Species within the Airspace and Training Ranges Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base

Common Name	Scientific Name	Federal Status	NM[1]	TX[2]	AZ[2]
Sacramento prickly poppy	*Argemone pleiacantha* ssp. *pinnatisecta*	E	E	X	
Sneed pincushion cactus	*Coryphantha sneedii* var. *sneedii*	E	E	X	
Todsen's pennyroyal	*Hedeoma todsenii*	E	E	X	
Wright's marsh thistle	*Cirsium wrightii*	PT	E	X	
Zuni fleabane	*Erigeron rhizomatus*	T	X		X
Ferns and Allies					
American Hart's-tongue fern	*Asplenium scolopendrium* var. *americanum*	T	X		

Source: USFWS, 2023a, 2023b, 2023c
Notes:
1. Only includes the species identified in the US Fish and Wildlife Service Information for Planning and Consultation listing (Project Codes 2022-0006775, 2023-0027029, and 2023-0027024).
2. Only identifies the species that may be located within the portions of Military Training Routes for Arizona and Texas

E = Endangered; C = Candidate; EXPN = Nonessential Experimental Population; PE = Proposed Endangered; PT = Proposed Threatened; T = Threatened

Table 3-24
Designated Critical Habitat Located Beneath Proposed Special Use Airspace, Air Traffic Control Assigned Airspace, and Military Training Routes

Common Name	Scientific Name	Airspace										
		Beak ATCAA and MOAs	Wiley ATCAA	Talon ATCAA and MOAs	Pecos MOAs	Smitty and Cato MOAs	WSMR Restricted Areas	McGregor Range Restricted Areas	IR-192/194	IR-134/195	VR-176	IR-133/142
New Mexico Meadow Jumping Mouse	*Zapus hudsonius luteus*		X								X	
Mexican spotted owl	*Strix occidentalis lucida*	X	X			X		X	X		X	
Southwestern willow flycatcher	*Empidonax traillii extimus*										X	
Yellow-billed Cuckoo	*Coccyzus americanus*										X	
Chiricahua leopard frog	*Lithobates chiricahuensis*										X	
Narrow-headed gartersnake	*Thamnophis rufipunctatus*					X					X	
Pecos bluntnose shiner	*Notropis simus pecosensis*			X	X							

Table 3-24
Designated Critical Habitat Located Beneath Proposed Special Use Airspace, Air Traffic Control Assigned Airspace, and Military Training Routes

Common Name	Scientific Name	Airspace										
		Beak ATCAA and MOAs	Wiley ATCAA	Talon ATCAA and MOAs	Pecos MOAs	Smitty and Cato MOAs	WSMR Restricted Areas	McGregor Range Restricted Areas	IR-192/194	IR-134/195	VR-176	IR-133/142
Rio Grande silvery minnow	*Hybognathus amarus*										X	
Gila chub	*Gila intermedia*										X	
Little Colorado Spinedace	*Lepidomeda vittata*										X	
Loach Minnow	*Tiaroga cobitis*					X					X	
Spikedace	*Meda fulgida*										X	
Chupadera springsnail	*Pyrgulopsis chupaderae*										X	
Three Forks springsnail	*Pyrgulopsis trivialis*										X	
Texas hornshell	*Popenaias popeii*			X					X			
Todsen's pennyroyal	*Hedeoma todsenii*						X					
Gypsum Wild-buckwheat	*Eriogonum gypsophilum*								X			

Source: Includes the species identified in the US Fish and Wildlife Service Information for Planning and Consultation listing (Project Codes 2022-0006775, 2023-0027024, 2023-0027029).
ATCAA = Air Traffic Control Assigned Airspace; MOA = Military Operations Area; WSMR = White Sands Missile Range

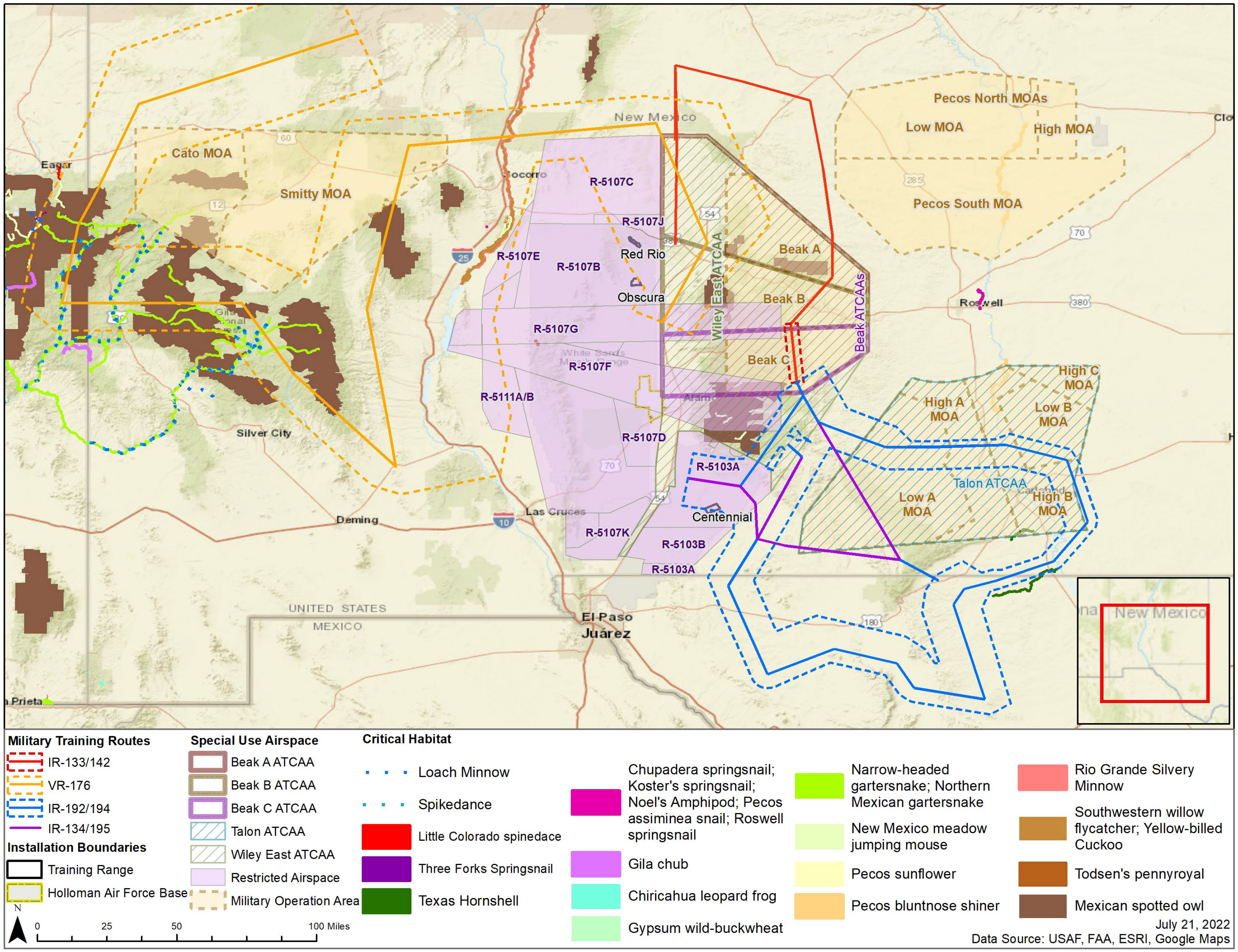

Figure 3-13. Designated Critical Habitat beneath the Special Use Airspace, Air Traffic Control Assigned Airspace, and Military Training Routes.

Invasive Species

There would be no ground-disturbing activities beneath the majority of the SUA and ATCAAs, except for the Oscura, Red Rio, and Centennial Training Ranges, nor within MTRs, that would have the potential to spread or remove invasive plants. Aircraft operations in the airspace would have no impact on invasive plants or wildlife. As such, potential impacts to invasive species beneath the airspace where only aerial operations would occur are not described further. On WSMR, which the Oscura and Red Rio Training Ranges are located, 155 exotic plants have been identified, with eight of these considered invasive with the potential to threaten habitats on WSMR (US Army, 2009). Fort Bliss, where the Centennial Training Range is located, lists the occurrence of seven invasive plant species (US Army, 2016).

3.7.3 *Environmental Consequences Evaluation Criteria*

The level of impact on biological resources is based on the:

- importance (i.e., legal, commercial, recreational, ecological, or scientific) of the resource;
- proportion of the resource that would be affected relative to its occurrence in the region;
- sensitivity of the resource to the proposed activities; and,
- duration of potential ecological ramifications.

Impacts on biological resources are adverse if species or habitats of high concern are negatively affected over relatively large areas. Impacts are also considered adverse if disturbances cause reductions in population size or distribution of a species of high concern.

As a requirement under the ESA, federal agencies must provide documentation that ensures that agency actions do not adversely affect the existence of any threatened or endangered species. The ESA requires that all federal agencies avoid “taking” federally threatened or endangered species (which includes jeopardizing threatened or endangered species habitat). Section 7 of the ESA establishes the requirement to consult with the USFWS and 50 CFR 402 establishes a consultation process with the USFWS that ends with USFWS concurrence or a determination of the risk of jeopardy from a federal agency project.

3.7.4 *Environmental Consequences – Alternative 1*

3.7.4.1 Holloman Air Force Base

Vegetation and Wildlife

On Holloman AFB, under Alternative 1, ground disturbing activities would be limited to minor construction of additions onto two existing facilities and installation of a pre-engineered metal building adjacent to a hangar (see **Table 2-4**). These areas are either improved or previously disturbed, and prior to the start of construction, the contractor would be required to implement pre-construction BMPs and obtain permits to limit the disturbance to native plants. As such, there would be no impact to native vegetation from construction. In addition, there would be no potential impacts to vegetation associated with the permanent aircraft operations of the 8 FS at Holloman AFB.

Potential impacts to wildlife would be associated with the short-term presence of heavy equipment and noise associated with construction. The potential short-term impacts would not jeopardize the continued existence of a species or result in an overall decrease in population diversity, abundance, or fitness.

The number of aircraft and operations at Holloman AFB would not change under this alternative, so that the airfield operations and noise environment would remain unchanged from existing conditions. Under Alternative 1, however, the estimated 5,000 annual sorties and 7,500 patterns currently flown by the 8 FS would be permanent, thus increasing the potential for long-term impacts to birds and other wildlife. While aircraft operations have the potential for bird and other wildlife strikes, continued adherence to the BASH prevention program as discussed in **Section 3.5.4**, which implements measures increase pilot safety, would reduce the likelihood for bird and wildlife aircraft strikes. Moreover, the rate of BASH incidents at Holloman AFB is low

(Holloman AFB, 2018b). The permanent beddown of the 8 FS would result in potential long-term, minor impacts to wildlife at Holloman AFB.

Threatened and Endangered Species

As discussed above, the proposed minor construction on Holloman AFB would occur at locations that are improved or have been previously disturbed and, in addition, do not provide optimal habitat for federal or state listed species. Therefore, the proposed construction under Alternative 1 would have no impact on listed species.

Under Alternative 1, the estimated 5,000 annual sorties and 7,500 patterns currently flown by the 8 FS would be permanent and the airfield operations and noise environment would not change from the existing conditions. As previously stated, none of the federally listed species identified in the IPaC report have been documented on Holloman AFB and therefore the continued operations on base from the permanently assigned F-16 FTU would not impact federal listed species. While potential monarch butterfly mortality from aircraft strikes and jet blast has not been quantified, there is no evidence to suggest that this is a major threat to monarch butterflies. The Air Force Pollinator Conservation Reference Guide does not identify increased flight levels as threats to monarch butterflies, and there are no management recommendations related to flight activities identified in the guide, as most of the recommendations are focused on protecting or increasing habitat, and reducing pesticide use (USFWS, 2017). As such, the Air Force has made a “may affect, but not likely to adversely affect” determination for the federal candidate monarch butterfly at Holloman AFB from implementation of Alternative 1.

The state listed Baird’s sparrow, bald eagle, least tern, neotropic cormorant, and peregrine falcon are known to occur only as transient species on Holloman AFB and would not be present on habitats adjacent to the airfield; therefore, they would not be impacted by the permanent operations of the 8 FS.

Invasive Species

While some ground-disturbing activities would be associated with minor construction on some facilities, these actions would all occur on improved or previously disturbed land. If required, some vegetation may need to be removed and would likely consist of landscaping and ornamental plants and may also include invasive species. When construction is complete, disturbed areas would be revegetated to stabilize the soil and affected areas would be maintained to help prevent nonnative, invasive plant growth. Aircraft operations on the airfield or in the airspace would have no impact on invasive plants or wildlife under Alternative 1.

3.7.4.2 Roswell International Air Center

Vegetation and Wildlife

On ROW, under Alternative 1, there would be no ground disturbing activities and aircraft operations within the ROW airspace would not impact vegetation. As such, there would be no potential impacts to vegetation or wildlife associated with implementation of Alternative 1. While proposed additional 391 annual operations by the 8 FS at ROW may increase bird and wildlife strikes, aircrews would continue to adhere to the BASH reduction measures outlined in the BASH prevention program. Potential impacts on birds and other wildlife from aircraft strikes during air operations within ROW airspace would be long-term and minor as discussed in **Section 3.5.4**.

Threatened and Endangered Species

As with Holloman AFB, there would be no ground disturbing activities at ROW and, as such, there would be no impacts to federally or state listed amphibians, fish, mollusks, crustaceans, or plants. Aircraft movement and aircraft noise would not interact with the listed species documented or with the potential to occur on or near ROW, especially considering there is no substantial change in the noise emissions from current conditions. While piping plover have been documented in Chaves County, they are rare migrants and are typically observed on sandflats and shorelines of reservoirs (NMDGF, 2019). Habitat for piping plover is not located near ROW; as such, it is very unlikely the piping plover would be present within habitats adjacent to ROW. As with Holloman AFB, the monarch butterfly has the potential to occur on ROW, and while no habitat would be impacted from the additional patterns, there is a potential for direct impacts from strikes and jet blast. One of the ten federally listed species identified in the IPaC report has been documented in Chaves County, the lesser prairie-chicken. Similar to impacts on other birds, the lesser prairie-chicken would not experience any change in existing noise levels, therefore, the Proposed Action would not be expected to adversely affect the lesser prairie-chicken or its habitat under the airspace. As such, the Air Force has made a "no effect" determination for the lesser prairie-chicken, piping plover and a "may affect, but not likely to adversely affect" determination for the monarch butterfly at ROW from implementation of Alternative 1. Impacts to state listed birds and mammals would be long term, yet minor due to the limited number of additional annual sorties that would be flown at ROW and the measures outlined in the BASH prevention program.

Invasive Species

The additional aircraft operations within the ROW airspace would have no impact on invasive plants or wildlife under Alternative 1.

3.7.4.3 Special Use Airspace

Under Alternative 1, the estimated 5,000 annual training sorties currently flown by the 8 FS in the proposed SUA and ATCAAs would be permanent. While the 8 FS would use all the SUA and ATCAAs, the net number of sorties, except for the Talon ATCAA and MOAs, would not increase from the current conditions. The number of sorties that would be flown by Holloman AFB within the Talon ATCAA and MOAs would not exceed the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). In addition, the number of operations on the training ranges and in the MTRs would not increase under Alternative 1. The noise environment and ground disturbing activities would not change from the current conditions. Moreover, the amount of training munitions such as chaff and flares, 20mm TP, and inert or live bombs would not change from amount currently used.

Vegetation and Wildlife

There would be no ground-disturbing activities from the Proposed Action in the majority of SUA and ATCAAs, with the exception of the Oscura, Red Rio, and Centennial Training Ranges, nor within MTRs (see **Figure 3-13**). There would be no impacts on plants, aquatic species (e.g., fish, mollusks, and crustaceans), reptiles, or amphibians because the proposed activities in the airspace would be limited to aircraft overflights where noise and visual cues could cause behavioral changes in birds and mammals, as well as the use of defensive countermeasures, in the airspace.

Potential impacts on vegetation from countermeasure chaff and flare constituents may include toxicity or accumulation of chemical compounds. Additional information regarding the biological effects of chaff and flares is provided in **Appendix C.5**. Studies have determined that chaff deposition onto soils does not lead to a significant increase of concentrations of chaff or flare chemical constituents in soil and has not been found to be toxic to plants or soil fauna (Air Force, 1997). Damage to vegetation from wildland fire from the use of flares would be greatly reduced as seasonal restrictions and altitudes would be followed for their use.

In approved areas of SUA and ATCAAs, the use of chaff and flares (types similar to RR-188 chaff and M206 flares) by the 8 FS would be permanent. Chaff and flares would not be used within MTRs. Potential long-term impacts on wildlife from the continued use of chaff and flare in the SUA and ATCAAs would be limited to a startle effect from chaff and flare deployment, inhalation of chaff fibers or flare combustion products, and ingestion of plastic caps from chaff and flare deployment. The potential of being struck by debris, given the small amount, or a dud flare is remote. Startle effects from release of chaff and flares would be minimal relative to the noise of the aircraft. The potential for wildlife to be startled from flare deployment at night when flares would be most visible would be minimal because of the short burn time of the flare. It is highly unlikely that birds would remain in the area during active military training to be adversely impacted by chaff and flares deployment. Furthermore, because of the small size of chaff and flare components, it is highly unlikely that a small amount of lightweight material ejected during their deployment would have an adverse impact on birds or that the material would reach the ground level and have an impact on mammals. Lastly, an evaluation of the potential for chaff to be inhaled by humans and large wildlife found that the fibers are too large to be inhaled into the lungs and that chaff material is made of silicon and aluminum that has been shown to have low toxicity (Air Force, 1997). The use of flares in the SUA and ATCAAs is subject to altitude and seasonal restrictions based on specific location and the fire danger level, which greatly reduce the risk of wildland fires. The continued use of chaff and flares by the 8 FS would have long-term and minor impact on wildlife under Alternative 1. A more detailed description of the potential impacts from chaff and flares is provided in **Appendix C.5**.

The impact areas within the Oscura, Red Rio, and Centennial Training Ranges are designed for the use of training munitions. The impact areas within the ranges are cleared of vegetation, graded, and are regularly cleaned and cleared of unexploded ordnance. As such, there would be no potential for impacts to vegetation or habitats from the operations from the Proposed Action.

Threatened and Endangered Species

Of the 43 federally listed species potentially occurring in the SUA, ATCAAs and MTRS, 7 birds, 3 mammals, and 1 insect could potentially be affected from long-term aircraft movement and noise (see **Table 3-23**). **Appendix C.5** provides a table that lists all federally listed species that have the potential to be found in or near the SUA, ATCAAs, MTRs and training ranges as well as a description of the listed birds, mammals, and insects with the potential to be impacted. The aircraft movement, aircraft noise, and the use of defensive countermeasures associated with the permanent operations of the 8 FS in the SUA, ATCAAs, MTRs, and training ranges would have no effect on federally listed amphibians, crustaceans, fish, mollusks, plants and reptiles, especially considering there is no change in the number of operations or noise emissions in the SUA, ATCAAs, or MTRs; and the continued use of chaff and flare in the SUA and ATCAAs would not impact species or habitat as described above. In addition, the listed amphibians, fish, mollusks, and reptiles, as well as the federally listed New Mexico meadow jumping mouse and Peñasco least chipmunk would not be startled by occasional low-altitude F-16 flights, as aircraft movement would be obscured by vegetation, woody debris, and rocks for these species. While the federally threatened reptiles and amphibians may be present beneath the SUA, ATCAAs and MTRs, they would not be found on training range impact areas due to the lack of habitat, therefore, would not be affected from use of the training ranges. The Air Force has also made a "no effect" determination for federally listed amphibians, fish, mollusks, plants and reptiles, as well as for the New Mexico meadow jumping mouse and Peñasco least chipmunk.

The potential impacts from low-flying aircraft during training to the listed lesser prairie-chicken, northern aplomado falcon, Mexican spotted owl, piping plover, southwestern willow flycatcher, yellow-billed cuckoo, Mexican gray wolf, and monarch butterfly include aircraft strikes or breeding and foraging birds and mammals that would be startled. Aircraft training has occurred in these airspaces for decades, and most wildlife has likely become habituated to aircraft movement and noise. Past research on raptors found few adverse reactions to overflights and that most negative responses were primarily associated with rotor-winged aircraft or jet aircraft that repeatedly passed within 0.5 miles of a nest (Manci et al., 1988). In addition, reoccupancy and productivity of various species of nesting raptors were not adversely affected when exposed to low-level military jet aircraft (Ellis et al., 1991). Unconfined wildlife responds to aircraft overflight differently and the response depends on the type, duration, and the source of noise and, under most circumstances, has minimal biological significance (Manci et al., 1988; Radle, 2007; NPS, 2011). Sonic booms from supersonic flights within authorized areas of the SUA and ATCAAs (see **Table 2-3**) could cause startle effects on avian and mammal species on or near the ground level; however, the sonic boom and post-boom rumbling sounds that would be experienced by wildlife do not differ substantially from thunder, which is commonly experienced by wildlife during relatively frequent thunderstorms in the region. Furthermore, the sonic boom events would be highly isolated and rare occurrences in the SUAs and ATCAAs and would occur in areas where supersonic flights currently happen with military training activities. As such, continued sonic booms from 8 FS supersonic flights would have no impact on wildlife, including birds breeding and foraging beneath the SUAs and ATCAAs. Although the overall number of annual operations and noise in SUA, ATCAAs, and MTRs is not increasing under Alternative 1, these potential impacts would be long-term and minor based on the continued use of the airspace by the 8 FS.

The Mexican gray wolf would not be startled by continued high-altitude training activities where most training by the 8 FS would occur; however, low-altitude training flights would occur in the SUA and MTRs (see **Section 2.3.1.2)** and could startle the Mexican gray wolf or their prey species during foraging if they are present in the area at the time of the training flights. While wolves were found to be frightened by low-altitude flights ranging from 25 to 1,000 ft AGL, wolves were found to adapt to the overflights and associated noise if they were not hunted from aircraft (Dufour, 1980). Moreover, other observations indicate that wolves exposed to fixed-wing aircraft and helicopters have a stronger reaction to helicopters (Manci et al., 1988). Bowles (1995) did not find a correlation between fright and the rate of abortions in clinical studies involving thousands of animals. Some studies have documented increases in activity after aircraft approaches, although the reaction was considered mild and included reactions such as starting a few steps or walking away slowly from the site of the disturbance (Bowles, 1995). The potential impact on the Mexican gray wolf from the continued operations of the 8 FS would be minor.

There would be no ground-disturbing activities from the permanent operations in the airspace and there is no critical habitat on training ranges; therefore, there would be no effect to critical habitat beneath the SUA, ATCAAs, or MTRs. Moreover, as discussed above, the use of defensive countermeasures and aircraft overflights would not alter the physical or biological features of designated critical habitat beneath the SUA, ATCAAs, and MTRs.

In summary, for Alternative 1 the Air Force has made a “no effect” determination on federally listed amphibians, crustaceans, fish, mollusks, plant species, and reptiles in the SUA, ATCAA, and MTR ROI listed in **Appendix C.5**, as well as for the Mexico meadow jumping mouse and Peñasco least chipmunk. The Air Force has made a “may affect, not likely to jeopardize the continued existence” determination for northern aplomado falcon, Mexican gray wolf, and the monarch butterfly. The Air Force has made a “may affect, but not likely to adversely affect” determination for the lesser prairie-chicken, Mexican spotted owl, piping plover, southwestern willow flycatcher, and yellow-billed cuckoo. A “no effect” determination has also been made for designated critical habitat located within the SUA, ATCAAs, and MTRs. A letter requesting concurrence with these determinations was sent to the lead USFWS Field Office and was received (**Appendix A**).

Similar to the federally listed species, the Proposed Action would not impact state listed amphibians, crustaceans, fish, mollusks, or plants in the SUA, ATCAA, and MTR ROI. In addition, potential impacts to state listed birds would be long term and minor as described above for federally listed birds. The proposed nighttime operations within low-level SUA and MTRs would create a noise disturbance for the spotted bats, however, the disturbance is expected to be minor. Within the MTRs, potential impacts to the Arizona state listed bald eagle winter population and Texas state listed zone-tailed hawk (*Buteo albonotatus*) would be the same as that described above for raptors, with potential long-term, minor impacts from the infrequent low-level operations within the VR-176 and IR-192/194 respectively.

While the training range impact areas have little to no optimal habitat for most state listed species, three reptiles (gray-banded kingsnake, mottled rock rattlesnake, and reticulated Gila monster) have the potential to use these areas. The impact areas, however, lack several common key habitat components such as cavities and crevices and rocky terrain and, therefore, the potential for impacts to these species from the continued use of training ranges by the 8 FS would be negligible.

There would be no potential impacts to the state listed fossorial mammals by occasional low-altitude F-16 flights, as aircraft movement would be obscured by vegetation, woody debris, and rocks for these species. The spotted bat (*Euderma maculatum*) is a state threatened species that has the potential to occur in the Talon and McGregor Range SUA and the IR-192/194 and IR-133/195 MTRs in which low-level flights could occur (see **Table 2-3**). Potential impacts to spotted bat would be long-term and minor. The response of bats to noise has been found to be similar that described for other mammals such as startle and alert to the noise source (Dufour, 1980). In addition, aircraft noise could disrupt bats’ echolocation, masking the pulses during flight and foraging. However, a study by Le Roux and Waas (2012) found that low-level aircraft activity did not mask echolocation pulses on New Zealand long-tailed bats. Aircraft noise was found to be most intense at less than 10 kilohertz (kHz) while bat echolocation pulses are 40 kHz. Moreover, no statistically significant differences in mean bat activity during and after overflights were found when compared with pre-aircraft activity. The foraging activity of the spotted may temporally overlap slightly during nighttime operations since only an estimated 10 percent of the annual proposed operations would occur after dark, including low-level operations within the SUA and MTRs. Impacts to the Texas state listed black bear (*Ursus americanus*) within the IR-192/194 MTR would be the same as those described above for the Mexican gray wolf, with potential long-term, minor impacts due to noise and visual disturbance from low-level flights.

Invasive Species

The permanent 8 FS operations within the SUA, ATCAAs, and MTRs would have no impact on invasive plants or wildlife under Alternative 1. The continued use by the 8 FS would not change the potential to impact invasive plants or wildlife because the impact areas of the training ranges are well maintained and contain very little vegetation.

3.7.5 *Environmental Consequences - Alternative 2*

3.7.5.1 Holloman Air Force Base

Vegetation and Wildlife

Under Alternative 2, ground disturbing activities would be limited to minor construction (see **Table 2-4**). As with Alternative 1, these areas are either improved or previously disturbed; the same actions would be taken as previously described and there would be no impacts to vegetation or wildlife under Alternative 2.

Under Alternative 2, the estimated 5,000 annual sorties and 7,500 patterns currently flown by the 8 FS would be permanent and an estimated additional 5,000 annual sorties and 7,500 patterns would be flown by the proposed additional F-16 FTU, thus slightly increasing the noise environment and the potential for long-term impacts to birds and other wildlife. Annual flights within the MTRs would increase somewhat, with IR-192/194 increasing by 34 sorties, IR-134/195 increasing by 7 sorties, and IR-133/142 increasing by 24 sorties. **Section 3.5.4** describes the noise impacts at Holloman AFB under Alternative 2. As described in Alternative 1, some suitable habitat for wildlife may be on disturbed areas of Holloman AFB, although these habitats support only relatively common wildlife species. The species utilizing these areas for foraging and breeding would normally be sensitive to increased noise impacts from military aircraft; however, many birds and wildlife have the ability to habituate to noise and movement from military aircraft (Grubb et al., 2010), and military aircraft operations have been ongoing at Holloman AFB for decades. The noise and movement from increased aircraft operations are anticipated to have negligible, short- and long-term impacts on wildlife, including birds breeding and foraging in nearby habitats, under Alternative 2.

Aircraft operations always have the potential for bird and other wildlife strikes. They can occur during takeoff and landing on and near active runways, as well as during flight at altitude; however, a minimal BASH risk exists at Holloman AFB and its vicinity based on the low populations of resident and migratory bird species and the distribution patterns of those species. The trend of BASH strikes shows a slow decline despite increased flying hours. BASH incidents are so rare on Holloman AFB that little bird control has been needed near the runways (Holloman AFB, 2018b). With an increase in air operations associated with Alternative 2, there is an increased risk of BASH; however, Holloman AFB maintains a BASH prevention program specifically to manage BASH risk and implement measures to greatly reduce the likelihood for BASH incidents (see **Section 3.5.4**). The outcome of the BASH prevention program is both increased safety for pilots and military aircraft as well as to decrease incidents of injury or death to birds and other wildlife. Continued adherence with the airfield management and risk reduction implementation measures of the Holloman AFB BASH prevention program would minimize impacts on birds and other wildlife from aircraft strikes during air operations at Holloman AFB.

Threatened and Endangered Species

As discussed above, the proposed minor construction on Holloman would occur at locations that are improved or have been previously disturbed. There is no habitat ideal for federal or state listed species adjacent to the buildings proposed for renovation or additions. Therefore, the proposed construction under Alternative 2 would have no impact on listed species.

The additional operations at the airfield at Holloman AFB would have no effect on listed reptiles, amphibians, fish, mollusks, or plants. Aircraft movement and aircraft noise would not interact with the listed species documented or with the potential to occur on Holloman AFB, especially considering there is no substantial change in the noise emissions from current operations. Because of the increased additional operations proposed under Alternative 2, the potential for long-term direct impacts from airstrikes may increase.

Like Alternative 1, there would be no impact to Baird's sparrow, bald eagle, neotropic cormorant, and peregrine falcon from implementation of Alternative 2. Moreover, implementation of Alternative 2 at Holloman AFB would not impact monarch butterfly habitat but may increase the potential for direct impacts from aircraft strikes and jet blast. The Air Force has made a "may affect, but not likely to adversely affect" determination for the federal candidate monarch butterfly at Holloman AFB from implementation of Alternative 2.

Invasive Species

Under Alternative 2, minor construction on some facilities would all occur on improved or previously disturbed land that may require some vegetation to be removed, including invasive species. The activities that would be taken after construction to stabilize the soil of affected areas would help prevent nonnative, invasive plant growth. Aircraft operations on the airfield or in the airspace would have no impact on invasive plants or wildlife under Alternative 2.

3.7.5.2 Roswell International Air Center

Vegetation and Wildlife

Under this alternative, there would be no ground disturbing activities on ROW and aircraft operations within the ROW airspace would not impact vegetation. As such, no potential impacts to vegetation would be associated with the implementation of Alternative 2. As previously described, aircraft operations have the potential for bird and wildlife strikes. An additional 780 annual operations would occur at ROW under Alternative 2; aircrews from the 8 FS and additional F-16 FTU would adhere to the BASH prevention program measures. Potential impacts on birds and other wildlife from aircraft strikes during air operations within ROW airspace would be long-term and minor, as discussed in **Section 3.5.4**.

Threatened and Endangered Species

The additional operations proposed at ROW under Alternative 2 would have no effect on listed reptiles, amphibians, fish, mollusks, or plants. Aircraft movement and aircraft noise would not interact with the listed species documented or with the potential to occur on or near ROW, especially considering there is no change in the noise emissions from the additional FTU operations. As previously discussed in Alternative 1, the piping plover is highly unlikely to be present in habitats adjacent to ROW. Additionally, while no monarch butterfly habitat would be impacted from the additional operations, there is an increased potential for direct impacts from strikes and jet blast. The slightly increased noise environment is not expected to affect the lesser prairie-chicken given their presence in the counties over which Beak and Talon MOAs occur, and in the county where the ROW is located. In addition, lesser prairie-chickens have been documented on the 30,493 ac conservation easement adjacent to the Melrose Air Force Range, which is part of the Cannon Air Force Base. As such, the Air Force has made a "no effect" determination for the lesser prairie-chicken and piping plover and a "may affect, but not likely to adversely affect" determination for the monarch butterfly at ROW from implementation of Alternative 2.

3.7.5.3 Special Use Airspace and Training Ranges

Under Alternative 2, the estimated 5,000 annual training sorties currently flown by the 8 FS in the proposed SUA and ATCAAs would be permanent and an estimated additional 5,000 sorties would be flown by the proposed additional F-16 FTU. While the 8 FS would use all the SUA and ATCAAs, the net number of sorties, except for the Talon ATCAA and MOAs, would not increase from the current conditions. The number of total sorties that would be flown by the 8 FS and additional F-16 FTU within the Talon ATCAA and MOAs would not exceed the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021) and the *Holloman AFB Combat Air Forces Adversary Air EA* (Air Force, 2020). In addition, the total number of sorties in the IR-192/194, IR-134/195, and IR-133/142 MTRs would increase from 67 to 125 sorties annually (see **Section 2.3.1.2**). The number of operations on the training ranges would not increase under Alternative 2. The noise environment and ground disturbing activities would not change from the current conditions. With the addition of the F-16 FTU, the amount of training munitions such as chaff and flares, 20mm TP, and inert or live bombs would increase from amount currently used.

Vegetation and Wildlife

The potential impacts to vegetation and wildlife under Alternative 2 would be similar to those described under Alternative 1. There would be no ground-disturbing activities beneath the majority of the SUA, ATCAAs, except for on the Oscura, Red Rio, and Centennial Training Ranges, nor beneath the MTRs that would disturb vegetation or habitats. Similarly, proposed activities under Alternative 2 would also be limited to aircraft overflights and the use of defensive countermeasures for operations in the SUA and ATCAAs. As described under Alternative 1, while noise and visual cues could cause behavioral changes in birds and mammals, there would be no impacts on listed plants, aquatic species (fish, mollusks, and crustaceans), reptiles, or amphibians. Similarly, the use of countermeasure chaff and flares would not impact vegetation or wildlife.

The impact areas within the Oscura, Red Rio, and Centennial Training Ranges are designed for the use of training munitions. The impact areas within the training ranges are cleared of vegetation, graded, and are regularly cleaned and cleared of unexploded ordnance. As such, there would be no potential for impacts to vegetation or habitats from the operations of the additional F-16 FTU squadron.

Threatened and Endangered Species

Under Alternative 2, there would be an increase of an estimated 10,000 permanent annual training sorties in the affected SUA and ATCAAs. While the 8 FS and proposed additional FTU squadron would use all the SUA and ATCAAs, the net number of sorties, except for the Talon ATCAA and MOAs, would not increase. The number of total sorties that would be flown by Holloman AFB within the Talon ATCAA and MOAs would not exceed the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). The aircraft movement, aircraft noise, and the use of defensive countermeasures associated with the permanent operations of the 8 FS and additional F-16 FTU in the SUA, ATCAAs, MTRs, and training ranges would have no effect on listed amphibians, fish, mollusks, plants, and most reptiles. Within the Talon SUA, aircraft noise would increase to 58-dBA DNL, as analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). The potential increase in noise in the IR-192/194, IR-134/195, and IR-133/142 MTRs would be long term and negligible. This potential increase in noise level was found to still be below the levels associated with disturbance of wildlife. In addition, the increased use of chaff and flare in the SUA and ATCAAs under Alternative 2 would have the same impact to species or habitat as described in Alternative 1. Similarly, the potential impacts from the sonic booms by the 8 FS and additional F-16 FTU in the SUA and ATCAAs would also be the same as that described for Alternative 1. Supersonic flights are not authorized in the Talon SUA; therefore, the increased operations by the additional F-16 FTU squadron would not increase the number of sonic booms.

The potential impacts from low-level training to the northern aplomado falcon, Mexican spotted owl, piping plover, southwestern willow flycatcher, yellow-billed cuckoo, Mexican gray wolf, New Mexico meadow jumping mouse, Peñasco least chipmunk, and monarch butterfly would be the same as those described under Alternative 1. The increased number of sorties within the Talon MOAs and MTRs would not increase the potential for the disturbance to breeding or foraging for the reasons discussed in Alternative 1. Potential impacts from increased number of flights above Mexican spotted owl designated critical habitat below the IR-192/194 MTR would be minimal due to the small portion of critical habitat beneath the MTR (see **Figure 3-13**), limited number of additional annual sorties (34), and that all sorties would occur at elevations at or above 500 ft AGL. The increased operations in the Talon SUA and MTRs may increase the potential for aircraft strikes to birds and the monarch butterfly, but this increase is not expected to be significant. In addition, the increased flights in the Talon SUA and MTRs would not impact monarch butterfly habitat.

The use of training ranges may increase as a result of the additional sorties that would be flown by the additional F-16 FTU squadron. Potential impacts to listed species, however, would be the same as those discussed under Alternative 1 since federally listed species would likely not be found in the impact areas. In addition, the potential impacts to the state listed gray-banded kingsnake, mottled rock rattlesnake, and reticulated Gila monster would be the same as Alternative 1.

For Alternative 2, the Air Force has made a “no effect” determination on federally listed amphibians, fish, mollusks, plant species, and reptiles in the SUA, ATCAA, and MTR ROI listed in **Appendix C.5**, as well as for the Mexico meadow jumping mouse and Peñasco least chipmunk. The Air Force has made a “may affect, not likely to jeopardize the continued existence’ determination for northern aplomado falcon, Mexican gray wolf, and the monarch butterfly. The Air Force has made a “may affect, but not likely to adversely affect” determination for lesser prairie-chicken, Mexican spotted owl, piping plover, southwestern willow flycatcher, and yellow-billed cuckoo. A "no effect" determination has also been made for designated critical habitat located within the SUA and ATCAAs. A letter requesting concurrence with these determinations was sent to the lead USFWS Field Office and was received (**Appendix A**).

Potential impacts to state listed birds, amphibians, crustaceans, fish, fossorial mammals, mollusks, reptiles, or plants in the SUA, ATCAA, and MTR ROI. Similarly, impacts to spotted bats from aircraft noise would be similar as those described in Alternative 1. Because the number of flights within the Talon airspace would increase, there is an increased potential for impacts to the spotted bat. In total, 500 annual additional night flights within the Talon SUA may occur while bats are active because an estimated 10 percent of the proposed annual sorties from the additional F-16 FTU may occur after dark. Similarly, there would be a limited number of increased flights in the IR-192/194, IR-134/195, and IR 133/142 MTRs. However, not all these operations would occur at altitudes where bats forage, typically at altitudes up to 10,000 ft (McCracken, 1996). Within the Talon SUA, low-level flights are allowed only in the Talon Low A and B MOAs. As such, the potential impacts from increased low-level flights to spotted bats are expected to be minor.

Invasive Species

The permanent operations of the 8 FS and additional F-16 FTU within the SUA and ATCAAs would have no impact on invasive plants or wildlife under Alternative 2. Because training range impact areas are well maintained and contain very little vegetation, the continued use by the 8 FS and operations by the additional F-16 FTU would not change the potential to impact invasive plants or wildlife.

3.7.6 *Environmental Consequences - No Action Alternative*

Under the No Action Alternative, additional F-16 FTU squadrons would not be permanently based at Holloman AFB. The 8 FS would continue to fly the current number of operations at Holloman, ROW, and within the SUA and ATCAAs while the Air Force considers other beddown locations and additional environmental analysis is completed. As such, there would be no impact to biological resources.

3.7.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

The Proposed Action and alternatives, in addition to the reasonably foreseeable future actions summarized in **Appendix B**, would result in long-term, negligible to minor impacts on biological resources. There are no impacts on threatened and endangered species on Holloman AFB, when taken in conjunction with reasonably foreseeable future actions, from the proposed minor construction and renovation projects. The additional operations at ROW, when added to reasonably foreseeable actions, would potentially have negligible impacts on threatened and endangered species. The long-term use of chaff and flares within the SUA and ATCAAs and use of training munitions on training ranges would have a minor impact on listed birds, mammals, and insects. When added to reasonably foreseeable future actions, the Proposed Action would result in long-term risk of aircraft bird and other wildlife strikes. Compliance with the Holloman AFB BASH prevention program would reduce the potential cumulative risk of contracted sortie operations associated with aircraft bird and other wildlife conflicts. No significant reasonably foreseeable effects on biological resources would be expected.

3.8 CULTURAL RESOURCES

3.8.1 *Definition of Resource*

Cultural resources are any prehistoric or historic district, site, building, structure, or object considered important to a culture or community for scientific, traditional, religious, or other purposes.

Cultural Resources include the following subcategories:

- Archaeological (i.e., prehistoric or historic sites where human activity has left physical evidence of that activity, but no structures remain standing);

- Architectural (i.e., buildings or other structures or groups of structures, or designed landscapes that are of historic or aesthetic significance); and
- Traditional Cultural Properties (resources of traditional, religious, or cultural significance to Native American tribes and other communities).

Significant cultural resources are called historic properties and are listed on the National Register of Historic Places (NRHP) or have been determined to be eligible for listing on the register. To be eligible for the NRHP, historic properties must be 50 years old and have national, state, or local significance in American history, architecture, archaeology, engineering, or culture. They must possess sufficient integrity of location, design, setting, materials, workmanship, feeling, and association to convey their historical significance, and meet at least one of four criteria (NPS, 2002):

- Associated with events that have made a significant contribution to the broad patterns of our history (Criterion A);
- Associated with the lives of persons significant in our past (Criterion B);
- Embody distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C); and/or
- Have yielded or be likely to yield information important in prehistory or history (Criterion D)

Properties that are less than 50 years old can be considered eligible for the NRHP under Criterion Consideration G if they possess exceptional historical importance. Those properties must also retain historic integrity and meet at least one of the four NRHP Criteria for Evaluation (Criterion A, B, C, or D). The term “Historic Property” refers to National Historic Landmarks, NRHP-listed, and NRHP-eligible cultural resources.

Federal laws protecting cultural resources include the Archaeological and Historic Preservation Act of 1960 as amended, the American Indian Religious Freedom Act of 1978, the Archaeological Resources Protection Act of 1979, the Native American Graves Protection and Repatriation Act of 1990, and the National Historic Preservation Act (NHPA), as amended through 2016, and associated regulations (36 CFR Part 800). The NHPA requires federal agencies to consider effects of federal undertakings on historic properties prior to making a decision or taking an action and to integrate historic preservation values into their decision-making process. Federal agencies fulfill this requirement by completing the Section 106 consultation process, as set forth in 36 CFR Part 800. Section 106 of the NHPA also requires agencies to consult with federally recognized Indian tribes with a vested interest in the undertaking.

Section 106 of the NHPA requires all federal agencies to seek to avoid, minimize, or mitigate adverse effects on historic properties (36 CFR § 800.1[a]). For cultural resource analysis, the Area of Potential Effects (APE) is used as the ROI. APE is defined as the “geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist,” (36 CFR § 800.16[d]) and thereby diminish their historic integrity.

Three APEs are defined for analyzing historic properties in this EA including, the buildings and 50-foot buffer identified for construction and renovation projects as part of the Proposed Action within the main cantonment of Holloman AFB (**Figure 3-14**), ROW, and the SUA, ATCAAs, and training ranges as depicted on **Figure 2-5.** Per 36 CFR § 800.4[a], the Air Force consulted with the New Mexico State Historic Preservation Officer (SHPO) on APE definition and identification of historic properties of concern. No response has been received to date (see **Appendix A**).

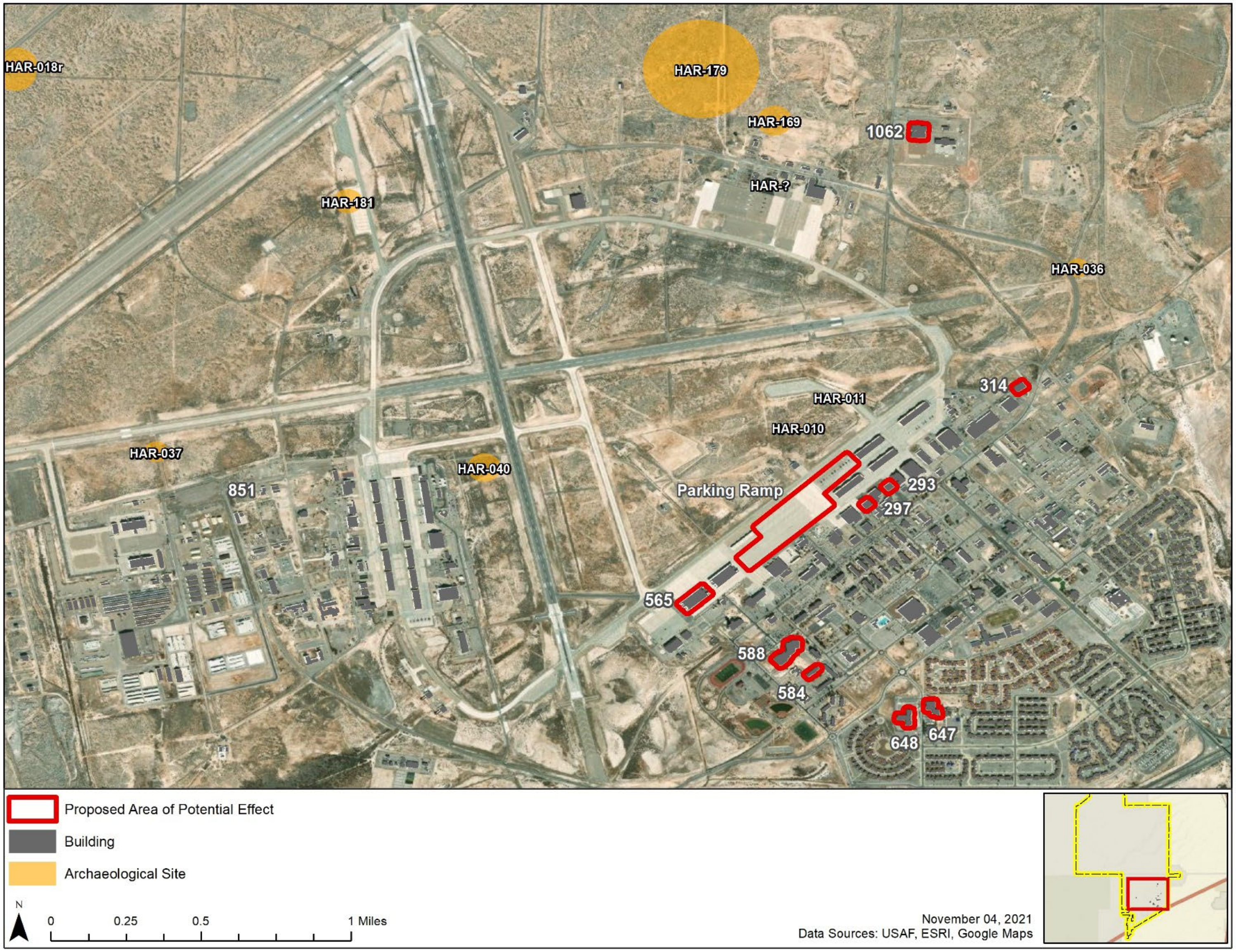

Figure 3-14. Area of Potential Effect for Facility Improvements for the Permanent Beddown of F-16 Formal Training Unit Squadrons at Holloman Air Force Base.

3.8.2 *Existing Conditions*

3.8.2.1 Holloman Air Force Base

Holloman AFB is located in the Tularosa Basin of south-central New Mexico, approximately 7 miles southwest of Alamogordo. The Main Cantonment covers 51,813 ac. Holloman AFB is bounded by WSMR to the north, south, and west and by White Sands National Park to the south. Private, state, and Bureau of Land Management (BLM) federal lands lie to the east of Holloman AFB.

Archaeological and Traditional Cultural Properties

Archaeological sites on Holloman AFB cover more than 10,000 years of human occupation and represent a wide range of site types, including unique prehistoric “hearth mounds” as well as ranching and military-era sites. Since 1979, a total of 262 sites have been identified and recorded including 135 prehistoric sites, 24 historical sites, 50 military-era sites, 44 multicomponent sites, and 9 recent or undated sites. There are no archaeological sites or traditional cultural properties (TCPs) within or adjacent to the APE as defined for Holloman AFB (Holloman, 2017).

The Mescalero Apache have shown consistent interest in base activities. Though consultation with the Mescalero Apache has involved visits to and tours of the base, no TCPs or other significant resources have been identified as a result on Holloman AFB. The Fort Sill Apache Tribe, Ysleta del Sur Pueblo, and the Pueblo of Zuni have asked to be notified of major actions taken on Holloman AFB, and access procedures and agreements have been established to facilitate this request (Holloman AFB, 2017). Tribal consultation associated with the Proposed Action is ongoing. For a complete list of tribes consulted as part of this EA, refer to **Appendix A.**

Architectural Properties

There are no historic districts within the Holloman AFB Main Cantonment. The only Holloman AFB districts considered eligible for inclusion in the NRHP are the High-Speed Test Track Historic District and the Missile Test Stands Historic District — both of which are located several miles from the main cantonment area (Holloman AFB, 2017; O’Leary, 1994). None of the buildings within the APE identified for construction and renovation at Holloman AFB are eligible for listing on the NRHP.

3.8.2.2 Roswell International Air Center

ROW was established in 1941 as an Army Air Corps flying school. It was renamed Walker AFB in 1948 honoring Brigadier General Kenneth N. Walker, a New Mexico native killed during a bombing mission over Rabaul, Papua New Guinea, in 1943. The base remained active into the Cold War era. In 1966, the Air Force announced that Walker AFB would close as part of a program of base closings tied to budgetary limits set by Congress and the expense of the Vietnam War. When it formally closed in 1967, the base was the largest of the Air Force Strategic Air Command. The U.S. Government and the City of Roswell entered into an Indenture Agreement in 1968 for the property and the former Walker AFB became ROW (Fuentes, 2019; News Editor and Partners, 2015; City of Roswell, no date).

A review of the New Mexico Historic Preservation Division’s online Cultural Resources Information System (NMCRIS), indicated there are no archaeological sites within or immediately adjacent to the ROW APE.

During the lifespan of the military use of ROW, many facilities, buildings, and housing units were constructed to support personnel and operations. A recent study was completed by the City of Roswell to investigate potential privatization (Fuentes, 2019). The study indicated that the Indenture Agreement transferring ROW from federal to municipal ownership included number of buildings such as warehouses, hangars, barracks, shops, and other facilities as well as taxiways, runways, aprons, and utility systems. Several inventories of the assets at ROW were consolidated and included as an appendix to the privatization study. Though the information is somewhat dated (the first inventory being completed in 1988), it indicates more than 50 buildings dating to the World War

II and Cold War eras may be extant; however, it is not known if they have been formally recorded or evaluated for potential significance.

3.8.2.3 Special Use Airspace

To provide a representative sample of types of archaeological sites and architectural resource located beneath the SUA and ATCAAs, National Register-listed properties under the airspace are identified below. Based on the nature of the Proposed Action, the fact that no airspace modifications are included, and that airspace use was previously considered in the *Special Use Airspace Optimization Final EIS and ROD* and the *Holloman AFB Combat Air Forces Adversary Air EA*, cultural resources under the airspace APE are not individually identified and analyzed in this EA. In addition to the historic properties listed, however, it is acknowledged that hundreds of unevaluated and NRHP-eligible archaeological sites (remains of pueblos, pithouse villages, burned rock middens, rock cairns, ranch headquarters, line camps, early homesteads, railroad stations and work camps, and rock art sites), and architectural resources (homes, ranches, churches, hotels, schools, and other municipal and commercial buildings and districts) are likely located under the airspace. Though no known TCPs were identified under the SUA or ATCAAs during tribal consultation conducted as part of this EA, sites of traditional cultural or religious importance may lie under the airspace as well.

National Register of Historic Places Listed Historic Properties

Approximately 60 NRHP-listed archaeological sites, including prehistoric resource gathering sites, Pueblos, kivas, rock shelters, middens, military battle sites, and historic sites associated with ranching and logging, are located within the counties below the SUA and ATCAAs.

There are 47 architectural resources beneath the airspace APE listed in the NRHP, including a National Park and National Monument (**Table 3-25**) (NPS, n.d.). White Sands National Park and Historic District are located adjacent to Holloman AFB. The district includes the Visitor Center building and seven additional structures constructed during the Great Depression by the Works Progress Administration (and other government agencies). This complex is considered an excellent example of the Spanish pueblo-adobe (Pueblo-Revival) architectural style. It retains integrity of place, is set in a landscape of native plants, and preserves a unique architectural style that is a tribute to the plans of the architects and the fine craftsmanship of the Works Progress Administration workers (NPS, 2017). Salina Pueblo Missions National Monument is located north of Holloman AFB, along the north-northeastern limits of the restricted use airspace. It encompasses the structural and archaeological remains of the missions, Pueblos, Kivas, and homesteads associated with Ancestral Puebloan and Jumano groups, 17th century Spanish Franciscan missionaries, and ranchers of the nineteenth and twentieth centuries (NPS, 2018). In addition to the National Park and Monument and their associated resources, a wide range of structures, complexes, and infrastructure-related resources are located beneath the airspace.

Table 3-25
National Register of Historic Places Listed Architectural Resources under the Airspace

Resource	Reference No.
Acord, John, House	84002891
Administration Building	88001564
Alamogordo Woman's Club	03000734
Armandine	03000418
Atkeson, Willie D., House	84002894
Auditorium and Recreation Building	88001565
Baskin Building	90000599
Baskin, William, House	84002898
Bentley, L.B., General Merchandise	06000155
Bluewater Lookout Complex	87002486
CA Bar Ranch	85003634
Carlsbad Irrigation District	66000476

Table 3-25
National Register of Historic Places Listed Architectural Resources under the Airspace

Resource	Reference No.
Carrisa Lookout Complex	87002488
Carrizozo Woman's Club	03000995
Central Receiving Building	88001566
Dam--Sitting Bull Falls Recreation Area	93001420
First National Bank of Eddy	76001196
Garcia, Juan, House	80002559
Gesler, Edward R., House	84002924
Group Picnic Shelter--Sitting Bull Falls Recreation Area	93001419
Hodges-Runyan-Brainard House	84002925
Hodges-Sipple House	84002926
Infirmary Building	88001567
Jackson House	03001511
Jicarilla Schoolhouse	83001623
La Luz Pottery Factory	79001544
Launch Complex 33	85003541
Lukins, F. L., House	84002928
Mauldin-Hall House	84002930
Mayhill Administrative Site	89000476
Mexican Canyon Trestle	79001543
Monjeau Lookout	87002483
Moore-Ward Cobblestone House	84002932
New Mexico Military Institute Summer Camp, Main Building	83001622
Ozark Trails Marker at Lake Arthur	04000702
Paden's Drug Store	05000204
Picnic Shelter--Sitting Bull Falls Recreation Area	93001418
Queen Anne House	80002561
Robert, Sallie Chisum, House	84002939
Ross, Dr. Robert M., House	84002936
Ruidoso Lookout Tower	87002485
Salinas Pueblo Missions National Monument	66000494
St. Joseph Apache Mission Church	04001588
Sutherland, D. H., House	80002562
Tansill, Rober Weems and Mary E., House	02001111
US Post Office—Alamogordo	00000510
Weed Lookout Tower	87002487

Tribal Lands

Currently seven federally recognized Native American tribes are located in New Mexico, Arizona, and Oklahoma, with possible historic ties to the lands comprising Holloman AFB and the lands beneath the SUA and ATCAAs: the Comanche Nation, Apache Tribe of Oklahoma, Mescalero Apache Tribe of the Mescalero Reservation, White Mountain Apache Tribe of the Fort Apache Reservation, Fort Sill Apache Tribe of Oklahoma, Navajo Nation, and Pueblo of Acoma (US Department of Housing and Urban Development, 2019). The Mescalaro Apache Reservation in the Sacramento Mountains falls under the Beak B/C MOAs and Wiley East ATCAA/Beak C ATCAA.

Government-to-government consultation to date has not identified TCPs, sacred sites, or physical resources of concern or interest on lands beneath the SUA and ATCAAs.

3.8.2.4 Military Training Routes

The primary military training routes used by Holloman AFB F-16C aircraft are described in **Section 2.3.1.2**. Cultural resources associated with the MTRs were previously analyzed in the *Special Use Airspace Final EIS and ROD* (Air Force, 2021) and the *Holloman AFB Combat Air Forces Adversary Air EA* (Air Force, 2020).

Approximately 71 NRHP-listed archaeological sites, including prehistoric resource gathering sites, Pueblos, kivas, rock shelters, middens, military battle sites, and historic sites associated with ranching and logging, are located within the counties below the MTRs.

There are also 71 architectural resources beneath the airspace APE listed in the NRHP (Table 3-26).

Table 3-26
National Register of Historic Places Listed Architectural Resources under the Military Training Routes

Resource	Reference No.
Abo	66000497
Acklin Store	88000502
Alert--Hatcher Building	95000460
Alpine Elementary School	97000369
Aragon House	82003327
Atchison, Topeka, and Santa Fe Railway Depot	78001829
Baca, A. B., House	91000036
Bank of Magdalena	82003328
Bear Mountain Lookout Complex	87002452
Bearwallow Mountain Lookout Cabins and Shed	87002473
Black Mountain Lookout Cabin	87002474
Bluewater Lookout Complex	87002486
Brown Hall	88001550
Bucher, William H., House	95000461
Bursum House	75001172
CA Bar Ranch	85003634
Carrizozo Woman's Club	03000995
Clemens Ranchhouse	79001557
Cooney, Captain Michael, House	91000029
Cortesy, Anthony, House	91000033
Eaton, Nestor P., House	91000034
Fitch Hall	88001551
Fitch, James Gurden, House	91000035
Garcia Opera House	74001210
Garcia, Juan Nepomuceno, House	91000027
Grijalva, Luciana B., House	88000499
Gutierrez House	82003329
Hall Hotel	82003330
Hillsboro High School	93000254

Table 3-26
National Register of Historic Places Listed Architectural Resources under the Military Training Routes

Resource	Reference No.
Hillsboro Peak Lookout Tower and Cabin	87002475
Hilton House	82003331
Hilton, August Holver, House	91000031
Hooks--Moore Store	88000490
House at 303 Eaton Avenue	91000032
House at 405 Park Street	91000030
Huechling, Otto, House	88000496
Ilfeld Warehouse	82003332
Illinois Brewery	75001173
Jicarilla Schoolhouse	83001623
Lewellen House	82003333
MacDonald Merchandise Building	80002573
MacTavish House	82003334
Magdaline House	82003335
Main Street Commercial Building	82003336
Menard--Galaz House	88000503
Meyers House	95000463
Miller, George Tambling and Ninette Stocker, House	95000465
Mimbres School	88000491
Mogollon Baldy Lookout Cabin	87002470
Paden's Drug Store	05000204
Percha Creek Bridge	97000731
Percha Diversion Dam	79001555
Portillo, Mauricio, House	88000504
Redding, William, House	88000483
Reeds Peak Lookout Tower	87002472
Robins, Will M., House	95000462
Sagrada Familia de Lemitar Church, Los Dulces Nombres	83001631
Salinas Pueblo Missions National Monument	66000494
Salome Store	82003337
Salome Warehouse	82003338
Sibole, George, Store	88000482
Sullivan, Cornelius, House	95000459
Torres, Antonio, House	88000505
US Post Office--Truth or Consequences Main	90000141
Val Verde Hotel	77000930
Valencia, Jesus, House	88000506
Valencia, Ysabel, House	88000493
Vigil, Rufina, House	91000028
Webster, John M., House	95000464
Wofford Lookout Complex	87002484

Table 3-26
National Register of Historic Places Listed Architectural Resources under the Military Training Routes

Resource	Reference No.
Wood, Dr. Granville, House	88000498

Tribal associations with the land under the MTRs are the same as those for the SUA described above. Government-to-government consultation to date has not identified TCPs, sacred sites, or physical resources of concern or interest on lands beneath the MTRs.

3.8.3 *Environmental Consequences Evaluation Criteria*

Adverse effects on cultural resources might include physically altering, damaging, or destroying all or part of a resource or altering characteristics of the resource that make it eligible for listing in the NRHP. Those effects can include introducing visual or audible elements that are out of character with the property or its setting; neglecting the resource to the extent that it deteriorates or is destroyed; or the sale, transfer, or lease of the property out of agency ownership (or control) without adequate enforceable restrictions or conditions to ensure preservation of the property's historic significance. For this EA, an effect is considered adverse if it alters the integrity of a NRHP-listed or eligible resource or if it has the potential to adversely affect TCPs and the practices associated with the property.

3.8.4 *Environmental Consequences – Alternative 1*

3.8.4.1 Holloman Air Force Base

Under Alternative 1, ground disturbing activities within the Holloman APE would be limited to minor construction (see **Table 2-4** and **Figure 3-14**) in areas that are improved or previously disturbed. No significant archaeological sites or TCPs are located within or adjacent to these areas. The only architectural resources recommended eligible for inclusion in the NRHP are several miles away. Therefore, per 36 CFR § 800.5, it is determined that implementation of Alternative 1 would result in no adverse effects to historic properties within the Holloman APE. Concurrence with this determination was received from the New Mexico SHPO.

3.8.4.2 Roswell International Air Center

Under Alternative 1, ROW would be used for additional pattern training as an emergency field, flying an estimated additional 92 sorties and performing an estimated 207 additional patterns per year. No ground disturbance, construction, renovation, or demolition is included in the Proposed Action. Therefore, per 36 CFR § 800.5, it is determined that implementation of Alternative 1 would result in no adverse effects to potential historic properties within the ROW. Concurrence with this determination was received from the New Mexico SHPO.

3.8.4.3 Special Use Airspace

Under Alternative 1, the estimated 5,000 annual training sorties currently flown by the 8 FS in the proposed SUA and ATCAAs would be permanent and the Oscura and Red Rio Training Ranges located beneath the WSMR SUA, and the Centennial Training Range located beneath the R-5103 restricted areas of the McGregor Range would continue to be used.

Forty-seven architectural historic properties listed in the NRHP are located beneath the airspace APE, including the White Sands Historic District, located within White Sands National Park and Gran Quivira Mission Complex, part of Salina Pueblo Missions National Monument. Both the White Sands Historic District and the Gran Quivira Mission Complex are located under WSMR no fly zones. In addition to these resources, approximately 60 significant archaeological sites (both subsurface and those with surface remains), whose specific locations are protected, lie under the airspace. Current data indicate no known TCPs are located under the airspace.

Because Alternative 1 is limited to making interim training sorties in existing airspace permanent, and ground disturbance would be limited to existing ranges, per 36 CFR § 800.5 it is determined that implementation of Alternative 1 would result in no adverse effects to historic properties under the SUA and ATCAAs. Concurrence with this determination was received from the New Mexico SHPO.

3.8.4.4 Military Training Routes

Seventy-one architectural historic properties listed in the NRHP are located beneath the MTRs. In addition to these resources, approximately 60 significant archaeological sites (both subsurface and those with surface remains), whose specific locations are protected, lie under the airspace. Current data indicate no known TCPs are located under the airspace.

Cultural resources associated with the MTRs were previously analyzed in the *Special Use Airspace Final EIS and ROD* (Air Force, 2021) and the *Holloman AFB Combat Air Forces Adversary Air EA* (Air Force, 2020). Because Alternative 1 is limited to using previously established and analyzed MTRs and would not include any ground disturbance, per 36 CFR § 800.5 it is determined that implementation of Alternative 1 would result in no adverse effects to historic properties under the MTRs. Concurrence with this determination was received from the New Mexico SHPO.

3.8.5 *Environmental Consequences – Alternative 2*

3.8.5.1 Holloman Air Force Base

Under Alternative 2, impacts to historic properties would be the same at Holloman AFB as those described under Alternative 1.

3.8.5.2 Roswell International Air Center

Under Alternative 2, impacts to historic properties at ROW would be the same as those described under Alternative 1.

3.8.5.3 Special Use Airspace

Under Alternative 2, the estimated 5,000 annual training sorties currently flown by the 8 FS in the proposed SUA and ATCAAs would be permanent, an estimated additional 5,000 sorties would be flown by a proposed additional F-16 FTU, and the Oscura and Red Rio Training Ranges located beneath the WSMR SUA, and the Centennial Training Range located beneath the R-5103 restricted areas of the McGregor Range would continue to be used.

Under Alternative 2, impacts to historic properties under the SUA and ATCAAs would be the same as those described under Alternative 1.

As impacts to the noise environment associated with increased use of the SUA and ATCAAs would be negligible, and ground disturbance would be limited to existing ranges, per 36 CFR § 800.5 it is determined that implementation of Alternative 2 would result in no adverse effects to historic properties under the SUA and ATCAAs. Concurrence with this determination was received from the New Mexico SHPO.

3.8.5.4 Military Training Routes

Under Alternative 2, impacts to historic properties under the MTRs would be the same as those described under Alternative 1.

3.8.6 *Environmental Consequences - No Action Alternative*

Under the No Action Alternative, additional F-16 FTU squadrons would not be permanently based at Holloman AFB. The 8 FS would continue to fly the current number of operations at Holloman, ROW, and within the SUA and ATCAAs while the Air Force considers other beddown locations and additional environmental analysis is completed. As such, there would be no effects to historic properties.

3.8.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

The Proposed Action and alternatives, in addition to reasonably foreseeable future actions summarized in **Appendix B** are not anticipated to result in incremental or cumulative effects to historic properties, including archaeological sites, TCPs, or architectural resources.

3.9 LAND USE

3.9.1 *Definition of Resource*

The term "land use" refers to real property classifications that indicate either natural conditions or the types of human activity occurring on a parcel. In many cases, land use descriptions are codified in local zoning laws; however, no nationally recognized convention or uniform terminology has been adopted for describing land use categories. As a result, the meanings of various land use descriptions, labels, and definitions vary among jurisdictions. This section addresses potential land use impacts from implementation of the Proposed Action on Holloman AFB and ROW.

The locations and extent of the Proposed Action are evaluated for potential effects on the proposed sites and land uses adjacent to project areas on Holloman AFB and ROW as well as beneath the airspace that would be used for training. The foremost factor affecting a proposed action in terms of land use is its compliance with any applicable land use or zoning regulations. Other relevant factors include existing land use at the project site, the types of land use on adjacent properties and their proximity to a proposed action, the duration of a proposed activity, and its "permanence." The ROI for land use on the installation includes the land surrounding the facilities proposed for use, and the land within the airfield noise contours and safety zones.

The primary SUA used by Holloman AFB F-16 aircraft are described in **Section 2.3.1.2**. Aircraft operations within these airspaces have previously been analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021) and the *Holloman AFB Combat Air Forces Adversary Air EA* (Air Force, 2020), except for the Wiley ATCAA and Pecos MOAs. However, while the proposed additional FTU squadrons would use all the SUA and ATCAAs, including the Wiley ATCAA and Pecos MOAs, the net number of sorties across all proposed SUA and ATCAAs would not increase. Because there would be no increase in operations from past analyses, no additional analysis of potential impacts to land use within the SUA is included in this EA.

Holloman AFB F-16 aircraft would also use existing MTRs IR-192/194, IR-134/195, IR-133/142 and VR-176. Use of these routes is generally covered under previous NEPA analyses. Additionally, all the MTRs would be used for a small number of sorties with IR-192/194, IR-134/195, and IR-133/142 being utilized for well below 100 sorties per year. Given that the current and proposed use of the MTRs by Holloman AFB F-16 aircraft is very low, there would be no impact to land use. Therefore, the land use analysis in this EA focuses only on Holloman AFB and ROW.

3.9.2 *Existing Conditions*

3.9.2.1 Holloman Air Force Base

Holloman AFB is located in southern New Mexico, southwest of Alamogordo in Otero County, New Mexico. The base encompasses approximately 51,813 ac; it is bounded to the east by the White Sands National Park and to the south by Highway 70 and supports about 21,000 active-duty Air Force, Air National Guard, Air Force Reserve, retirees, DoD civilians, and their family members.

There are 11 on-base land use categories identified at Holloman AFB (**Table 3-26**). Land use categories identified on the base:

- Administrative – headquarters, security operations, offices

- Airfield pavements – runways, taxiways, aprons, overruns
- Aircraft operations and maintenance – hangars, aircraft maintenance units, squadron operations
- Community (commercial) – commissary, base exchange, dining
- Community (service) – gym, recreation center, theater
- Housing (accompanied) – family housing
- Housing (unaccompanied) – airman housing, visitor housing, temporary lodging
- Manufacturing and production
- Medical/Dental – healthcare facilities, doctor, and dentist offices
- Open space – conservation area, buffer space
- Outdoor recreation – ballfields, outdoor courts, and golf course

Most of the land use is categorized as manufacturing and production (31,001.6 ac). Airfield pavement, aircraft operations and maintenance, administration, community (commercial and service, housing (accompanied and unaccompanied), medical/dental, and outdoor recreation comprise the remaining land uses. Approximately 13,054 ac have been categorized as open space land use. On-base land uses are consolidated and depicted on **Figure 3-15**.

Table 3-27
Land Use Summary of Holloman Air Force Base

Category	Acreage
Administration	60.6
Aircraft Operations and Maintenance	321.1
Airfield Pavement	5,192.6
Community Commercial	108.7
Community Service	44.8
Housing Accompanied	467.0
Housing Unaccompanied	55.0
Manufacturing and Production	31,001.6
Medical/Dental	21.5
Open space	13,054.8
Outdoor Recreation	276.9
Total	**50,604.5**

Source: Holloman 2016c.

Off-base land within the Holloman AFB noise contours account for approximately 3,837 ac. Off-base land use is defined by land ownership because there is no comprehensive land use data or zoning ordinances for Otero County. Off-base land ownership is depicted on **Figure 3-15**. Most of this land is classified as public lands managed by the BLM (approximately 69 percent), DoD lands (approximately 21 percent), private land (6 percent) and New Mexico state land comprises 3 percent. National Park Service (NPS) lands make up the remaining 1 percent. Approximately 3,079 ac of off-base land is located within airfield safety zones. Of the 3,079 ac, approximately 272 ac are within the CZ. All of the off-base land within the CZ is classified as DoD lands (Missile Range). Approximately 1,045 ac of off-base land is within APZ I. Most of the land use within the APZ I, approximately 540 ac, are DoD lands (Missile Range), with approximately 150 ac being NPS lands (White Sands National Park), and 127 ac are BLM lands. Almost 181 ac in the APZ I zone represent private lands and approximately 47 ac represents State lands. Approximately 1,928 ac of off-base land lays within the APZ II. Off-base lands within the APZ II zone consist of 402 ac of DoD lands (Missile Range), 563 ac of NPS lands (White Sands National Park), 474 ac BLM land, 162 ac of State of New Mexico Trust lands, and 161 ac of private lands. Approximately 162 ac of unclassified lands are within the APZ II. Additional information regarding safety zones can be found in **Section 3.5.2.**

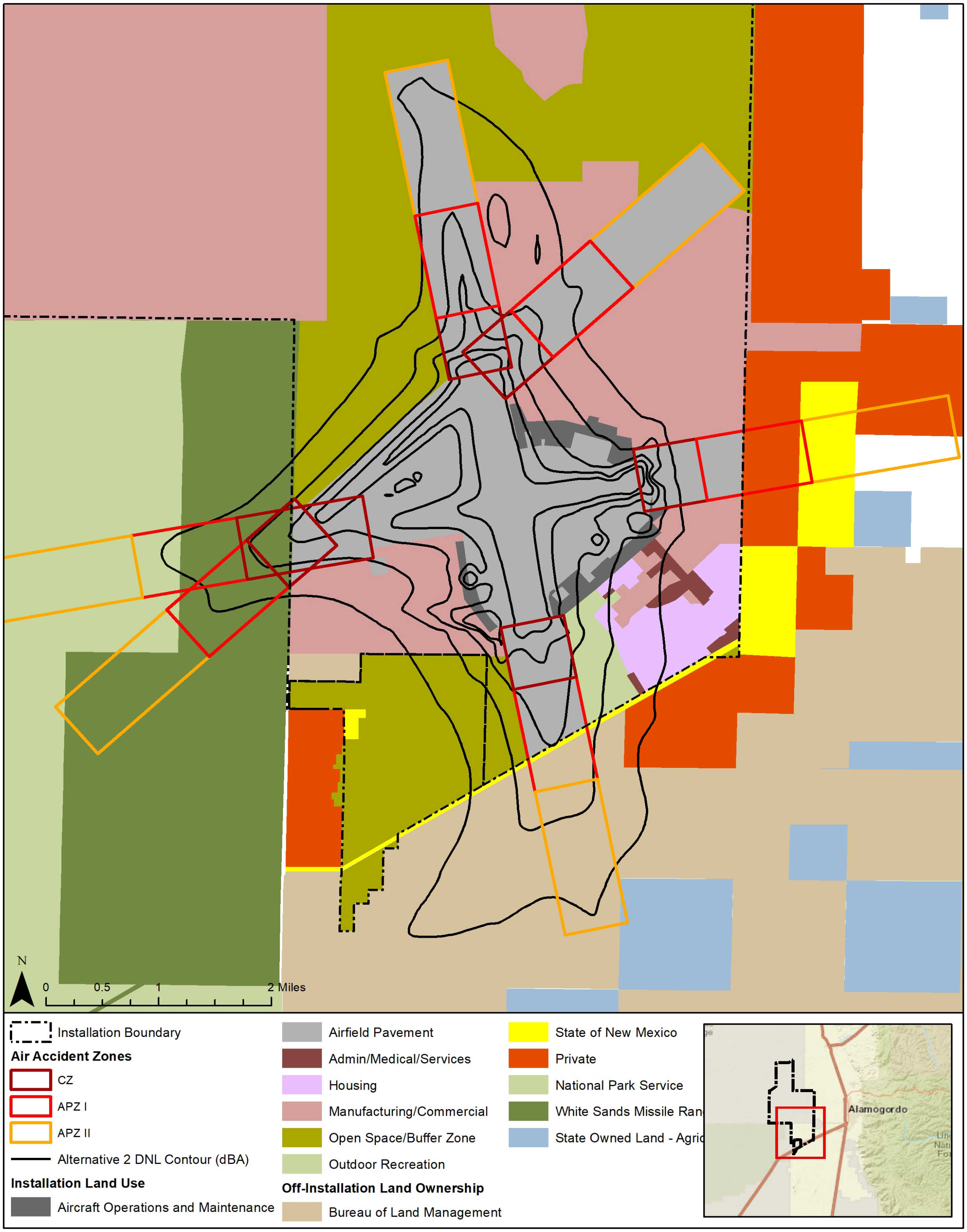

Figure 3-15. On- and Off-Base Land Uses at Holloman Air Force Base.

3.9.2.2 Roswell International Air Center

ROW is located along and south of Main Street in the City of Roswell, New Mexico, encompassing 5,029 ac. The regional airport is a small, non-hub commercial airport with two paved runways. As described in **Section 3.8.2.2**, the City of Roswell owns and operates the ROW. In addition to providing commercial aviation services, the airport supports general aviation, military training, and aerial firefighting services (City of Roswell, 2016).

The Industrial land use category makes up the highest proportion (approximately 26 percent) of land in the City of Roswell, including ROW at approximately 5,000 ac. The Eastern New Mexico University – Roswell campus is located on the northern portion of the ROW property on lands classified as institutional. The campus includes student housing and educational facilities. Just north of the campus and entrance to the ROW, lands are designated as single-family residential. Off-airport lands within the noise contours include lands within the jurisdiction of the City of Roswell and Chaves County. Geographic Information System and other planning data were not available when this EA was published.

3.9.3 *Environmental Consequences Evaluation Criteria*

Potential impacts on land use are based on the level of land use sensitivity in areas potentially affected by the Proposed Action as well as compatibility of those actions with existing conditions. In general, a land use impact would be adverse if it met one of the following criteria:

- inconsistency or noncompliance with existing land use plans or policies
- precluded the viability of existing land use
- precluded continued use or occupation of an area
- incompatibility with adjacent land use to the extent that public health or safety is threatened
- conflict with planning criteria established to ensure the safety and protection of human life and property

3.9.4 *Environmental Consequences – Alternative 1*

3.9.4.1 Holloman Air Force Base

Changes in the noise setting can affect land use compatibility resulting in increased noise exposure. Under Alternative 1, there would be no change in the noise environment from its current conditions, including the representative POIs. Therefore, no impacts to land use are expected under Alternative 1 at Holloman AFB.

3.9.4.2 Roswell International Air Center

Under Alternative 1, the noise level in the greater than 65-dBA DNL noise contour increased from 7,484 ac to 7,535 ac, an approximate increase of 51 ac. Noise levels at the POIs would increase by less than 1-dBA DNL. All the POIs are zoned as residential land under either the City of Roswell or Chaves County (City of Roswell, 2016). The increase of these POIs and the surrounding areas would be long-term and likely unnoticeable; therefore, impacts to land use under Alternative 1 would be long-term, but negligible.

3.9.5 *Environmental Consequences – Alternative 2*

3.9.5.1 Holloman Air Force Base

Under Alternative 2, the noise level in the greater than 65-dBA DNL noise contour increased from 11,291 ac to 11,824 ac, approximately 533 ac. Noise levels at representative POIs would increase by a range from 0- to 1-dBA and while long term, this change would likely be unnoticeable. The change in the noise environment under Alternative 2 would result in long-term, negligible impacts to land use.

3.9.5.2 Roswell International Air Center

Under Alternative 2, the noise level in the greater than 65-dBA DNL noise contour increased from 7,484 ac to 7,614 ac, approximately 130 ac at ROW. Noise levels at the POIs would increase by less than 1-dBA DNL. All the POIs are zoned as residential land under either the City of Roswell or Chaves County (City of Roswell, 2016). While the increase of these POIs and the surrounding areas would be long-term, the change in noise level would likely not be noticeable. Therefore, impacts to land use under Alternative 1 would be long-term, but negligible.

3.9.6 *Environmental Consequences - No Action Alternative*

Under the No Action Alternative, the 8 FS would continue to fly the current number of operations at Holloman and ROW while the Air Force considers other beddown locations and additional environmental analysis is completed. No changes to land use would occur under the No Action Alternative.

3.9.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

The Proposed Action and alternatives, in addition to reasonably foreseeable future actions described in **Appendix B**, would not result in an adverse incremental impact to land use.

3.10 INFRASTRUCTURE, TRANSPORTATION, AND UTILITIES

3.10.1 *Definition of Resource*

Infrastructure consists of the systems and structures that enable a population in a specified area to function. Infrastructure is wholly man-made, with a high correlation between the type and extent of infrastructure and the degree an area is characterized as developed. The availability of infrastructure and its capacity to support more users, including residential and commercial expansion, are generally regarded as essential to the economic growth of an area. The infrastructure information was primarily obtained from the Holloman AFB Installation Development Plan (Holloman AFB, 2016c) and the City of Roswell Comprehensive Plan (City of Roswell, 2016), which each provide a brief overview of each infrastructure component at Holloman AFB and ROW.

The infrastructure components include solid waste management, sanitary and storm sewers, transportation, and utilities. Solid waste management primarily relates to the availability of landfills to support a population’s residential, commercial, and industrial needs. Sanitary and storm sewers (also considered utilities) include those systems that collect, move, treat, and discharge liquid waste and stormwater. Transportation is defined as the system of roadways, highways, and transit services that are in the vicinity of the installation, which could be potentially affected by the Proposed Action. Utilities include electrical, natural gas, water supply, and wastewater. The ROI for this resource is Holloman AFB and ROW.

3.10.2 *Existing Conditions*

3.10.2.1 Holloman Air Force Base

Holloman AFB covers more than 50,000 ac of land located in southwestern New Mexico in Otero County. The main base portion of the cantonment area is located on the southern portion of the base and covers approximately 8,000 ac. There are approximately 11,964 personnel on base, which includes active and reserve duty military and dependents, civilian, and contractor personnel. Holloman AFB operates three active runways. The primary runway is 12,132 ft long; the remaining two runways are 12,911 and 10,580 ft long each.

Solid Waste Management

Solid waste generated at Holloman AFB is disposed at the Lincoln/ Otero County Regional Landfill, a licensed and secure landfill, located about 40 miles south of Holloman AFB on Highway 54 south in Otero County (Holloman AFB, n.d.).

Wastewater and Storm Sewer Systems

Wastewater generated from domestic and industrial use on Holloman AFB is discharged to an on-base wastewater treatment plant (WWTP) through a gravity system. The wastewater collection and treatment system at Holloman AFB includes 35 lift stations, 37 septic tanks, and 66 miles of pipeline collection. Reclaimed water from the WWTP is used to irrigate the on-base golf course. The remaining effluent is discharged to Lake Holloman, Lagoon G, and the wetlands complex on the southern end of the installation. The Holloman AFB WWTP currently operates at 30 percent peak capacity, and therefore, has significant additional capacity for future requirements (Holloman AFB, 2016c).

Stormwater generated by industrial and construction activities as well as municipal uses on Holloman AFB flows through natural drainages primarily to the south. Stormwater flows generated from municipal uses flow into municipal stormwater collection systems. Retention basins are installed in various areas, where required, to maintain and collect stormwater for peak stormwater flow events. Stormwater on Holloman AFB is regulated under CWA NNPDES permit program (Holloman AFB, 2016c).

Transportation

The primary access to Holloman AFB from the south is US 70. Holloman AFB has three vehicular access gates. The Main Gate is the primary gate from Highway 70 on the south side of the installation. It is the only 24-hour, 7 days a week gate access to the base. As such, the Main Gate experiences heavy traffic volumes during peak demand hours. Commercial vehicles access Holloman AFB via the West Gate located on the southwest side of the installation with a direct connection from Highway 70. Access from Alamogordo is via the La Luz Gate from State Road 545/La Luz Gate Road on the northeast side of the installation (Holloman AFB, 2016c).

There is an expansive roadway system on Holloman AFB, with approximately 84 miles of paved roads and approximately 7 miles of unpaved roads. Arizona Avenue is the primary east/west roadway with First Street, Eleventh Street, and Delaware Avenue providing additional transportation routes around the cantonment area. On the northern portion of the installation, major arterial roadways include Vandergrift Road, Douglas Road, Tulapeak Road, Test Track Road, and the La Luz Gate Road. Many of the roads in the northern portion are unpaved and beyond their service life. No recent traffic study or on-base road assessment report has been conducted; however, based on site inspections, roadway conditions are satisfactory around the cantonment area (Holloman AFB, 2016c).

Utilities

Electricity is provided to Holloman AFB by El Paso Electric Company and supplied through a 115 kilovolt (kV) switching station located near the Main Gate. The system includes three 115 kV lines and three 13.2 kV substations (Main, North, and Atlas) that extend throughout the installation to supply electrical power. The electrical power system has the capacity to support existing and new or expanded missions at Holloman AFB with approximately 65 megavolt amperes (MVAs). The historical peak use average on Holloman AFB is approximately 21 MVAs. Currently, the electrical system lacks redundancy, and the main substation is not sufficiently secure (Holloman AFB, 2016c).

Natural gas is provided to Holloman AFB by the New Mexico Gas Company. Gas is supplied to the installation via two feeder lines located at Wright Station, creating a single point of entry to the installation. There is no on-base natural gas storage. The natural gas system provides adequate supply and distribution to meet the demand for existing and future development on Holloman AFB (Holloman AFB, 2016c).

Drinking water is supplied on base by the Hollman AFB public water system. This system is a community water system, registered with the New Mexico Environment Department – Drinking Water Bureau, PWS#NM3562719, which serves approximately 13,000 residents. Hollman AFB has historically relied on a combination of surface water, supplied, and treated by the City of Alamogordo (40 percent), and groundwater, supplied by Holloman AFB owned wells (60 percent). However, due to the 2012 Little Bear Forest fire, the surface water source has been unavailable, and will remain so, until mid-2022. Therefore, Holloman AFB currently relies solely on the production of groundwater via multiple wells located between 8 and 25 miles from the base, near the foothills of the Sacramento Mountains (Holloman AFB, 2021b).

Groundwater is drawn from a total of 15 wells with an average depth of 450 to 550 feet. There are five well fields in operation, Boles, Escondido, San Andres, Frenchy, and Douglas. Groundwater extracted from the well fields is transported via pipeline to two ground level storage tanks located in Boles and San Andres well fields, with a total capacity of 0.9 MG (million gallons) (Holloman AFB, 2020b). These water storage tanks are constantly being filled to prevent water deficits from occurring on-base. The source of water for all wells is the Bolson Aquifer located in the Tularosa Basin. Most fresh groundwater (with total dissolved solids of <1,000 mg/L) in the Tularosa Basin is located south of Alamogordo in alluvial fan deposits at the base of the Sacramento Mountains. The well fields utilized by Holloman AFB are located in the fresh groundwater areas of the Tularosa Basin (Newton and Land, 2016).

The average daily water demand on-base for 2020 was about 1.2 MGD (million gallons per day) or 427 MG per year (Holloman AFB, 2020b). The water system has a total storage capacity of 3.45 MG over 4 tanks on base and an additional 0.9 MG of off-base storage within 2 tanks. The total pumping capacity of the system is 2,000 gallons per minute (Holloman AFB, 2021b). In the winter months, water from the City of Alamogordo is available and the La Luz Water Treatment Plant provides up to 2.5 MGD to the base at no charge. Water is treated at the Civil Engineering Water Treatment Plant and is stored in two main storage tanks (1.0 MG and 1.5 MG). The water is then distributed out to the water system to include two potable tanks (Eagle Tower with a capacity of 0.3 MG and North Area Tower with a capacity of 0.25 MG, having a total capacity of 0.55 MG). These tanks also serve to keep pressure in pipelines serving the base and are constantly filled (Holloman AFB, 2021b).

Holloman AFB has been identified in the following reports as a government site with concerns for water scarcity and water availability: *the Water Scarcity: DoD Has Not Always Followed Leading Practices to Identify At-Risk Installations* report (2019), the *Department of Defense Climate-Related Risk to DoD Infrastructure Initial Vulnerability Assessment Survey* report, and *the Department of Defense Annual Energy Management and Resilience Report for Fiscal Year 2017*. In response to water scarcity concerns, Holloman AFB contracted the development of a *Water Resources Sustainability Analysis* in 2010 to determine the long-term availability of water supply from existing water sources. The report concluded that the water supply capacity of the fifteen wells operational at the time of the report was 10.1 MGD which was more than the current and projected 2030 maximum day demand of 5.5 MGD. However, the report also concluded that continued rapid development within the Tularosa Basin warrants significant concern for the future sustainability of the groundwater and surface water supplies for the region. There could be conflicts over water available to supply the Alamogordo area if predictions of regional growth are fully realized. That could mean reductions in aquifer and surface water supplies to Holloman AFB or at a minimum, potential conflicts with the City and nearby residents (AECOM, 2010).

Holloman AFB also developed a *Water Contingency Response Plan*, which contains both a Water Demand Reduction Plan and a Priority Return-to-Service Plan. The Water Demand Reduction Plan outlines a logical process for reducing water usage when water production rates are insufficient to meet normal demands. The Priority-Return-to-Service Plan is essentially the reverse of the Demand Reduction Plan. When water production rates begin to increase following a period of water supply shortfall, the Priority-Return-to-Service Plan outlines the sequence in which water service should be restored to users.

Roswell International Air Center

ROW is located along and south of Main Street in the City of Roswell, New Mexico, encompassing 5,029 ac. The regional airport is a small, non-hub commercial airport with two paved runways. The City of Roswell owns and operates the ROW. In addition to providing commercial aviation services, the airport supports general aviation, military training, and aerial firefighting services (City of Roswell, 2016). Under the Proposed Action, the ROW would be used for pattern training as an emergency field.

Solid Waste Management

The sanitary sewage system for ROW is owned and operated by the City of Roswell. Sanitary waste is collected through a network of 250 miles of sewer lines, transporting sewage to the WWTP owned and operated by the City of Roswell. The system includes four lift stations, two of which are located at the ROW. The ROW has a complex solid waste system, originally constructed by the Air Force as part of the Walker AFB. The system supports not only commercial and industrial uses, but also nearby residential areas. From the east side of the ROW, the system collects sewage at a lift station, and from there flows into additional sewer lines before arriving at the wastewater treatment plant. Sewer transmission flows are currently low and are not hydraulically overloaded; therefore, the system has capacity for additional flow. The system upholds to all USEPA and NMED regulations (City of Rowell, 2016).

Wastewater and Storm Sewer Systems

Storm flow and natural runoff within the City of Roswell consists of underground storm drain systems, open channel, and overland flow into one of four ephemeral creeks or rivers that cross the city from west to east. There is a complex underground storm drainage system on the east side of the ROW, which drains the majority of the airport's runoff. Runoff outflows into the South Cahoon Detention Pond on the northeast side of the airport. Areas north of the ROW have historically experienced localized flooding; however, the city's future plans include the construction of an underground storm drainage system from the South Cahoon Detention Pond. Stormwater structures, drainpipes, and open channel structures are located on the northeast portion of the ROW for stormwater management at the airport (City of Roswell, 2016).

Transportation

Two major highways cross the City of Roswell: US 285 that runs north and south and U.S. 70/380 that extends east and west. US 285 is a primary arterial (North and South Main Streets and Southwest Main Street). South Main Street, south the McGaffey/S Main Street/S.E. Main Street intersection provides access to the ROW. Pecos Trails Transit provides public transportation to the ROW and the Eastern New Mexico University located on ROW property.

Utilities

Excel Energy provides electric service to the City of Roswell, including the ROW. System expansion and upgrades are currently underway to meet the increasing demand fueled by industrial development and the associated residential and business growth in southeastern New Mexico (City of Roswell, 2016). Across the region, plans include 400 miles of new high-voltage transmission lines, upgrades to nine existing substations, and 12 new substations. In Roswell, plans provide for grid reliability and capacity improvements. Additionally, a 140-megawatt solar system is planned just outside Roswell to increase generation capacity. Future electrical capacity for the City of Roswell should be adequate to meet the growing demand.

The New Mexico Gas Company provides natural gas service to the City of Roswell as well as the ROW. No gas transmission pipelines cross the City of Roswell; gas is delivered through the city's local distribution network including transmission to the ROW.

The City of Roswell provides potable water to the ROW through its system of 366 miles of water transmission lines, two pumping stations and six potable water reservoirs. One elevated storage tank, the Kerr Reservoir, and five production wells/pumps located at the ROW property. The city has 26,189 acre-feet of water rights available for consumption per year with approximately 13,000 acre-feet currently pumped. The remaining water rights are held in reserve. Additional water rights are secured by return flow credit for effluent discharged to the Rio Hondo (City of Roswell, 2016).

3.10.3 *Environmental Consequences Evaluation Criteria*

Impacts on infrastructure from the Proposed Action are evaluated for their potential to disrupt or improve existing levels of service in the ROI as well as to generate additional requirements for energy or water consumption and impacts to resources such as sanitary sewer systems and waste management.

The Proposed Action would result in transportation impacts if it resulted in a substantial increase in traffic generation that would cause a decrease in the level of service, a substantial increase in the use of the connecting street systems or mass transit, or if on-site parking demand would not be met by projected supply.

The Proposed Action would result in an adverse impact on utilities or services if the project required more than the existing infrastructure could provide or required services in conflict with adopted plans and policies for the area.

3.10.4 *Environmental Consequences – Alternative 1*

3.10.4.1 Holloman Air Force Base

Under Alternative 1, there would be no additional demand on infrastructure, transportation, or utilities on Holloman AFB. No major construction is proposed, with the exception of some minor new construction for expansion and renovation of existing facilities. Existing facilities are fully serviced by utilities such as gas, electric, water/wastewater, and solid waste. Utilities have existing capacity to support the proposed permanent increase in the number of personnel. Increased traffic is not expected; therefore, no impacts to access at installation gates or on base are anticipated. As such, no impacts are expected to infrastructure, transportation, or utilities on Holloman AFB under Alternative 1.

3.10.4.2 Roswell International Air Center

Under Alternative 1, no additional demand on infrastructure, transportation, and utilities is expected. As such, there would be no impacts to infrastructure, transportation, or utilities at the ROW under Alternative 1.

3.10.5 *Environmental Consequences – Alternative 2*

3.10.5.1 Holloman Air Force Base

The additional 475 personnel under Alternative 2 would result in increased vehicular traffic at Holloman AFB, both from staff members and their families. The additional FTU squadron may also result in an increase in the number FTU students that would also increase traffic. The additional traffic on the installation is not anticipated to reduce the level of service, as the roadway network on the installation is expansive and provides for additional capacity. Vehicular access would increase and could cause additional congestion at the Main Gate, particularly during peak traffic times. However, a project currently under environmental review is proposed to modify the Main Gate (refer to **Appendix B**) which would reduce congestion and relieve traffic backups on US 70.

The additional 475 personnel would increase the use of the installation’s electric, natural gas, water/wastewater, and solid waste management systems by an approximate 3 percent in users. Electrical power usages would increase approximately 8 MVAs decreasing the current headspace capacity of 44 MVA to 36 MVA. Likewise, the water and wastewater systems are currently operating at 30 percent peak capacity, representing a small decrease to the current headspace capacity of 70 percent. Regarding potable water usage, the addition of 475 personnel would increase the number of users on Holloman’s community water system to 13,475, an increase of 3.7 percent. This small increase in users is not expected to significantly increase water usage on base. In fact, the average day water demand reported in the *Water Resources Sustainability Analysis* was estimated to be 1.96 MGD in 2010, compared to the 2020 estimate of 1.2 MGD, a decrease of 39 percent, demonstrating that Holloman AFB has found ways to significantly decrease water usage on installation. All water systems have adequate capacity to support the additional 475 personnel in existing facilities proposed for use. The additional personnel and family members would also increase the use of the installation's electric, natural gas, water/wastewater, and solid waste management systems. Given the high capacities in these systems and the lack of capacity issues identified in these systems, the impacts from additional people on infrastructure and utilities would be minor. The direct, long-term, adverse impact on infrastructure from the increased use of utilities and additional traffic would be minor under Alternative 2.

3.10.5.2 Roswell International Air Center

Potential impacts to infrastructure, transportation, and utilities would be the same under Alternative 2 as described in Alternative 1 for the ROW.

3.10.6 *Environmental Consequences - No Action Alternative*

Under the No Action Alternative, the 8 FS would continue to fly the current number of operations while the Air Force considers other beddown locations and additional environmental analysis is completed. No changes to infrastructure, transportation, or utilities would occur under the No Action Alternative at Holloman AFB or ROW.

3.10.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

The Proposed Action and alternatives, in additional to reasonably foreseeable future actions described in **Appendix B**, would not significantly change the demand on infrastructure, transportation, or utilities.

3.11 HAZARDOUS MATERIALS AND WASTES, CONTAMINATED SITES, AND TOXIC SUBSTANCES

3.11.1 *Definition of Resource*

Activities discussed under this resource section include the use, handling, and disposal of hazardous materials and wastes, which occur at Holloman AFB and ROW. Hazardous materials and wastes, the Environmental Restoration Program (ERP), and toxic substances are defined and described in detail in **Appendix C.6.** The ROI for this resource area is Holloman AFB and ROW.

3.11.2 *Existing Conditions*

3.11.2.1 Holloman Air Force Base

The information below was summarized from several documents, including management plans, material surveys, the NMED, and other State of New Mexico records, and related documentation. Some alternatives include minor construction, therefore asbestos, lead-based paint (LBP), radon, and polychlorinated biphenyls (PCBs) are addressed in this section.

Hazardous Materials and Wastes

Hazardous and toxic material procurements at Holloman AFB are approved and tracked by the Holloman AFB Environmental Section (49 CES/CEIE), which has overall management responsibility of the installation environmental program. 49 CES/CEIE supports and monitors environmental permits, hazardous materials, and hazardous waste storage, spill prevention and response, and participation on the Environmental Safety and Occupational Health Council (ESOHC) (Holloman AFB, 2018a).

The ESOHC is a network of safety, environmental, and logistics experts who work with hazardous materials Managers, Unit Environmental Coordinators, and other hazardous materials users to ensure safe and compliant hazardous materials management throughout the base. A privately contracted hazardous material pharmacy ensures that only the smallest quantities of hazardous materials necessary to accomplish the mission are purchased and used.

The 49 CES/CEIE maintains the Hazardous Waste Management Plan (Holloman AFB, 2018b) as directed by AFI 32-7042, Waste Management, which complies with 40 CFR Parts 260 to 272. This plan prescribes the roles and responsibilities of all members of the ESOHC with respect to the waste stream inventory, waste analysis plan, hazardous waste management procedures, training, emergency response, and pollution prevention. The Holloman AFB Hazardous Waste Management Plan establishes the procedures to comply with applicable federal, state, and local standards for solid waste and hazardous waste management. The plan outlines procedures for transport, storage, and disposal of hazardous wastes.

Hazardous materials at Holloman AFB are managed by the hazardous material pharmacy. The Enterprise Environmental, Safety, and Occupational Health Management Information System tracks acquisition and inventory control of hazardous materials. Hazardous materials and petroleum products such as fuels, flammable solvents, paints, corrosives, pesticides, deicing fluid, refrigerants, and cleaners are used throughout Holloman AFB for various functions including aircraft maintenance; aircraft ground equipment maintenance; and ground vehicles, communications infrastructure, and facilities maintenance (Holloman AFB, 2011).

Hazardous wastes generated at Holloman AFB include waste flammable solvents, contaminated fuels and lubricants, paint/coating, stripping chemicals, waste oils, waste paint-related materials, mixed-solid waste, and other miscellaneous wastes. Certain types of hazardous wastes are subject to special management provisions intended to ease the management burden and facilitate the recycling of such materials. These are called “Universal Wastes,” and their associated regulatory requirements are specified in 40 CFR Part 273. Types of waste currently covered under the universal waste regulations include fluorescent light tubes, hazardous waste batteries, hazardous waste thermostats, and hazardous waste lamps. Holloman AFB recycles all lubricating fluids, batteries, and shop rags and hazardous wastes are managed in accordance with the Holloman AFB Hazardous Waste Management Plan.

Holloman AFB is classified as a Large-Quantity hazardous waste generator as defined by the USEPA (40 CFR § 260.10), generating more than 2,200 pounds of nonacute hazardous waste per month. Holloman AFB operates approximately 39 initial accumulation points (IAPs), where up to 55 gallons of “total regulated hazardous wastes” or up to 1 quart of “acutely hazardous wastes” are accumulated. IAP managers are responsible for properly segregating, storing, characterizing, labeling, marking, packaging, and transferring all hazardous wastes for disposal from the IAP to the established 90-day storage area according to federal, state, local, and Air Force regulations. The Hazardous Waste Program Manager is responsible for characterizing and profiling each waste stream. The installation operates one 90-day accumulation site, located at Building 149, 241 Delaware Street, where hazardous waste accumulates before transfer to the Defense Logistics Agency Disposition Services for transportation off-installation for ultimate disposal (Holloman AFB, 2018a). Wastes generated on base are managed under regulations set forth in the Holloman AFB Resource Conservation and Recovery Act (RCRA) Part B permit. Holloman AFB also holds a RCRA permit for handling the disposal and treatment of waste munitions.

An inventory of aboveground storage tanks (ASTs) is maintained by Holloman AFB within the Spill Prevention Control and Countermeasures Plan (SPCCP). The SPCCP includes the location, contents, capacity, containment measures, status, and installation dates (Holloman AFB, 2014). Storage tanks at Holloman AFB contain jet fuel, diesel fuel, used cooking oil, used oil, and unleaded gasoline. Building 1062 is reported to have a 500-gallon emergency backup diesel generator AST, which was installed in 2007, and a 231-gallon emergency backup diesel generator AST, which was installed in 1992 (Holloman AFB, 2014). Building 1062 is reported to also have a 10,000-gallon oil/water separator at the wash rack. There are no underground storage tanks at Holloman AFB.

Environmental Restoration Program Sites

Holloman AFB began its Installation Restoration Program in 1983 with the investigation of possible locations of various Areas of Concern (AOC) and Solid Waste Management Units for hazardous waste contamination. The RCRA Facility Assessment was completed in 1987 (URS Group, Inc., 2015). Currently, there are 217 ERP sites identified at Holloman AFB: the closed site total equals 181 while 36 remain open (Holloman AFB, 2016a). Additionally, there are 23 Military Munitions Response Program (MMRP) sites: 11 are closed and 12 are open (Holloman AFB, 2016a). None of the facilities identified for construction or renovation are within an active ERP or MMRP site nor have any been identified as AOC.

Asbestos and Lead-Based Paint

The 49 CES/CEIE developed the Asbestos Management Plan for Holloman AFB, which includes program administration, organizational roles and responsibilities, standard work practices, and documentation (Holloman AFB, 2017). A complete asbestos survey was done for all Holloman AFB buildings in the early 1990s. Sampling was done in many buildings to identify locations with asbestos-containing material (ACM). The 49th CES/CEIE Structures Shop maintains an inventory of the ACM locations at Holloman AFB identified during the comprehensive base-wide survey (Holloman AFB, 2017). The inventory contains information on the location, quantity, and type of ACM. This inventory was not available for review.

Comprehensive information or records on the presence or absence of LBP in the buildings identified for construction and renovation is not available. Holloman AFB has not developed an LBP Management Plan at this time.

Radon

The USEPA and the US Geological Survey have evaluated the radon potential around the country to organize and assist building code officials in deciding whether radon-resistant features are applicable in new construction. Radon zones can range from 1.0 (high) to 3.0 (low). The USEPA radon zone for Otero County, New Mexico, is Zone 2 (Moderate Potential, predicted indoor average level between 2 and 4 picoCuries per liter [pCi/L]); however, radon potential throughout Otero County can vary (USEPA, 2018). The New Mexico Radiation Control Bureau (2021) indicates that radon levels in Otero County vary from under 2.0 pCi/L (76 percent of reported results in Zone 3), to 15 percent of results between 2.0 and 3.9 pCi/L (Zone 2), and to 9 percent] greater than 4.0 pCi/L (Zone 1). Each zone designation reflects the average short-term radon measurement that can be expected in a building without the implementation of radon control methods.

Polychlorinated Biphenyls

Specific PCB materials at the installation have not been identified. Note that ballasts and starters from light fixtures could contain PCB-containing material. The disposal of these materials is regulated. If the ballasts are not plainly marked as “Non-PCB”, the material must be treated as PCB-containing (or be tested and proven to be non-PCB containing). As facility repairs and demolition occur, the suspected ballasts should be removed and disposed of. No PCB spills have been identified within the installation. Comprehensive information or records on the presence or absence of PCBs in buildings identified for construction and renovation is not available. Holloman AFB has not developed a PCB Management Plan at this time.

3.11.2.2 Roswell International Air Center

Hazardous Materials and Wastes

Aviation-related services at ROW are provided by AvFlight, a fixed-base operator (FBO). The FBO is required to comply with all applicable local, state, and federal environmental statutes and regulations, including, but not limited to, requirements for ASTs and piping, for the disposal of waste oil and other potentially hazardous substances, and for the refueling of aircraft and vehicles. The FBO provides aviation fuels, including Jet A and 100LL octane aviation gasoline, in sufficient quantities to meet the needs of the aviation customers at ROW. The ROW is listed as a very small quantity generator of hazardous waste (USEPA, 2008).

Existing facilities at ROW would be used for additional pattern training as an emergency field. It is not anticipated that any construction or renovation would be required that could disturb ACM, LBP, or radon; therefore, these elements are not described in existing conditions or environmental consequences. Should construction or renovation be proposed, the potential to disturb ACM, LBP, and radon would be analyzed in separate environmental analysis, as required.

Environmental Restoration Program Sites

ROW does not have any Superfund sites on the National Priorities List (NPL). One NPL site is located about 3 miles away from the airport boundary. This site is the McGaffey and Main Groundwater Plume (Site ID NM0000605386). The Superfund site is a perchloroethylene plume in groundwater from a former dry-cleaning business (USEPA, 2021).

An NMED Ground Water Quality Bureau State Cleanup Program (SCP) site is located within the boundaries of ROW. The SCP site is named Walker AFB and was marked for cleanup because it exceeds screening levels for the trichloroethene (TCE) standard in two shallow alluvial aquifers. No action is being taken by NMED at this time because of active litigation (City of Roswell, 2019).

3.11.3 *Environmental Consequences Evaluation Criteria*

Impacts on hazardous materials management would be considered adverse if the federal action resulted in noncompliance with applicable federal, state, and local regulations or increased the amounts generated or procured beyond waste management procedures and capacities at Holloman AFB or ROW. Impacts on ERP sites would be considered adverse if the federal action disturbed or created contaminated sites resulting in negative effects on human health or the environment.

3.11.4 *Environmental Consequences – Alternative 1*

3.11.4.1 Holloman Air Force Base

Hazardous Materials and Wastes

Implementation of Alternative 1 would establish the 8 FS as a permanently assigned unit at Holloman AFB. Aircraft operations at Holloman AFB would not increase, and the only operations undertaken would be three minor construction/renovations projects. Short-term, negligible adverse impacts on hazardous materials, petroleum products, and hazardous wastes could occur from these minor construction/renovation projects. These projects could employ paints, solvents, liquid descalers, hydrochloric acid, glycol, and sealants. Hydraulic fluids and petroleum products, such as diesel and gasoline, would be used in vehicles and equipment for construction activities. Hazardous materials could be used for minor equipment servicing and repair. Hazardous materials and petroleum products would be contained, stored, and managed appropriately in accordance with AFMAN 32-7002, Environmental Compliance and Pollution Prevention, and the Holloman AFB SPCCP and Emergency Response procedures to minimize the potential for release. Significant impacts on hazardous materials and petroleum products would not be expected.

Short-term, negligible adverse impacts would occur from generating hazardous and petroleum wastes during renovation and construction. Petroleum products and hydraulic fluids would be used in construction equipment to support renovation operations, which would produce waste products. Handling of waste products is covered under the Holloman AFB Hazardous Waste Management Plan as well as federal, state, and local regulations. The implementation of BMPs would reduce the potential for an accidental release of hazardous and petroleum wastes.

Significant ground-disturbing activities are not expected from the planned construction and renovation projects. However, if digging occurs and unknown contamination is discovered or unearthed, the construction contractor would immediately stop work, contact the appropriate installation personnel, and implement the appropriate safety measures. Sampling and analysis would be conducted, as necessary, and construction would not resume until the concern is investigated and resolved. Any soils determined to be contaminated or hazardous would be managed or disposed of in accordance with applicable federal, state, and local laws and regulations.

Environmental Restoration Program Sites

There are no ERP sites located proximate to the facilities identified for construction and renovation under Alternative 1. No environmental contamination is known to occur within the project areas, and no impact on contaminated sites would occur from implementation of Alternative 1.

Asbestos and Lead-Based Paint

No asbestos survey information is available for the buildings identified for construction and renovation. According to the Holloman AFB Asbestos Management and Operations Plan, before any interior renovations or modifications occur to these buildings, a facility work request (AF Form 332) must be created. The 49th CES/CEIE Structures Shop reviews all work requests for potential impacts to ACM. If the facility contains ACM, the ACM would be avoided or remediated in accordance with the Holloman AFB Asbestos Management and Operations Plan (Holloman AFB, 2017).

LBP could be present in the buildings identified for construction and renovation that were built prior to 1978. Interior renovations in older buildings would require that materials to be altered would be tested for LBP, and any LBP found would be properly handled by a certified contractor and disposed of in accordance with federal, state, and local laws. Any LBP areas that are disturbed require a Pb inspection. All Pb samples must be analyzed by an NMED-approved laboratory.

No ACM or LBP impacts would be expected during renovations and construction with adherence to the Holloman AFB Asbestos Management and Operations Plan (Holloman AFB, 2017) and the BMPs described above.

Radon

Based on elevated radon levels reported in some parts of Otero County, any building constructed on the site could have elevated levels of radon above 4 pCi/L. Should levels of radon above 4 pCi/L be detected during construction or renovation projects, the Installation Radiation Safety Officer would work with Installation civil engineering personnel to develop an interim mitigation plan and a long-term mitigation plan to bring the radon levels down below 4 pCi/L. No environmental impacts from radon are expected.

Polychlorinated Biphenyls

Removal of any light fixtures has the potential to disturb PCBs. If renovations of any facility require the removal of fluorescent lighting fixtures where the ballasts and starters could contain PCBs, fixtures would be disposed in accordance with AFI 32-7086, Hazardous Material Management. The removal and proper disposal of light fixtures containing PCBs is a long-term, negligible beneficial impact.

3.11.4.2 Roswell International Air Center

Hazardous Materials and Wastes

In the event of an emergency divert, pilots may need to refuel at ROW. Any other materials required for maintenance would be brought by the Holloman maintenance team. Given the fact that ROW is already an emergency divert location and that re-fueling would be infrequent, there would be no impact on hazardous materials. The additional F-16 sorties would not change the status of ROW as a very small quantity generator of hazardous waste. In the rare case that hazardous waste is generated it would be managed by the FBO according to all federal, state, and local laws and regulations. There would be no impact to the storage and disposal of hazardous waste at ROW.

Environmental Restoration Program Sites

The McGaffey and Main Groundwater Plume is located about 3 miles away from the boundaries of ROW. From this distance, the groundwater plume would not impact ROW operations. Additionally, any site activity at ROW would not impact the existing groundwater plume.

The underground TCE contamination would not be affected by the additional sorties at ROW. Therefore, there are no impacts to ERP sites at ROW from Alternative 1.

3.11.5 *Environmental Consequences – Alternative 2*

3.11.5.1 Holloman Air Force Base

Hazardous Materials and Wastes

Implementation of Alternative 2 would establish the 8 FS as a permanently assigned unit at Holloman AFB, and an additional F-16 FTU squadron would be permanently relocated to Holloman AFB. Minor construction to support the F-16 FTU squadrons would be required. The impacts from construction activities on hazardous materials/waste would be the same as those described in Alternative 1. Adverse impacts to hazardous materials and waste from construction would be short-term and negligible.

The quantity of hazardous materials such as oil, Jet-A fuel, hydrazine, hydraulic fluid, solvents, sealants, and antifreeze would increase with the operations and maintenance of F-16 aircraft at Holloman AFB. It is anticipated that ASTs that would be used to support F-16 operations would be stored in Facility 702 – Petroleum, Oils, and Lubricants Yard. The Petroleum, Oils, and Lubricants Yard is a controlled area surrounded by a security fence. A video surveillance camera covers the entrance gate and the parking area. The access gate is locked when the site is unattended. The entire yard has adequate lighting to prevent vandalism and allow discovery of a possible spill. There are no storage tanks at or near Building 578. There is fuel storage at Building 1062. There are two emergency backup generators at Building 1062; one AST has a capacity of 500 gallons and the second AST has a capacity of 231 gallons. All facilities are included in the Holloman AFB SPCCP (Holloman AFB, 2014). No release of contaminants has been reported at these facilities. The existing hydrazine storage/servicing facility at Holloman AFB has the capacity to handle the needs of the F-16 FTUs.

Hazardous materials required for the F-16 aircraft would be tracked through the 49 CES/CEIE following established Holloman AFB procedures. Tracking would ensure that only hazardous materials needed for operations and maintenance at the smallest quantities would be used and that all hazardous materials would be properly tracked and remain compliant at the base. There would potentially be a minor, long-term impact from tracking and handling the increased hazardous materials to support the additional F-16 sorties at Holloman AFB under Alternative 2.

The quantity of hazardous wastes generated would increase as a result of the additional F-16 operations at Holloman AFB; however, this increase would not change the status of Holloman AFB as a large quantity generator. Additionally, all hazardous waste generated would be properly handled, stored, and disposed of following the Holloman AFB Hazardous Waste Management Plan (Holloman AFB, 2018b). These procedures ensure that hazardous waste is managed according to all federal, state, and local laws and regulations. As such, there would be no impact from procurement and use of hazardous materials or the storage and disposal of hazardous waste.

Environmental Restoration Program Sites

There are no ERP (formally known as Installation Restoration Program) sites located within the facilities identified for construction and renovation. The main ramp area of Holloman AFB is flanked by a number of ERP sites (see **Figure 3-16)**. Avoidance of these sites would result in no impact on contaminated sites from implementation of Alternative 2.

Asbestos and Lead-Based Paint

Potential impacts associated with asbestos and LBP would be the same as stated in Alternative 1.

Radon

Potential impacts associated with radon would be the same as stated in Alternative 1.

Polychlorinated Biphenyls

Potential impacts to PCBs would be the same as stated in Alternative 1.

3.11.5.2 Roswell International Air Center

Hazardous Materials and Wastes

Potential impacts to hazardous materials and wastes would be the same as stated in Alternative 1.

Environmental Restoration Program Sites

Potential impacts to ERP sites would be the same as stated in Alternative 1.

3.11.6 *Environmental Consequences - No Action Alternative*

Implementation of the No Action Alternative would result in no change to baseline conditions. Therefore, there would be no potential impacts associated with hazardous materials and wastes, contaminated sites, and toxic substances.

3.11.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

Alternatives 1 and 2, when added to reasonably foreseeable future actions at Holloman AFB and ROW, are not anticipated to result in significant cumulative impacts on the management of hazardous materials and wastes, and toxic substances. Storage and quantity of jet fuels, solvents, oil, and other hazardous materials supporting the F-16 FTU operations would increase in addition to reasonably foreseeable future projects; however, this increase would result in a minor cumulative effect.

At Holloman AFB, all proposed and reasonably foreseeable future projects would require compliance with the Holloman AFB Hazardous Waste Management Plan. The plan ensures that procedures for managing hazardous waste are in accordance with federal, state, and local regulations; therefore, no cumulative impacts on the storage and disposal of hazardous waste is expected. Similarly, all proposed and reasonably foreseeable future projects would be required to adhere to the Holloman AFB Asbestos Management and Operations Plan for any modifications to existing structures. No significant adverse cumulative impacts on hazardous materials and wastes, contaminated sites, and toxic substances are expected from either Alternative at either location.

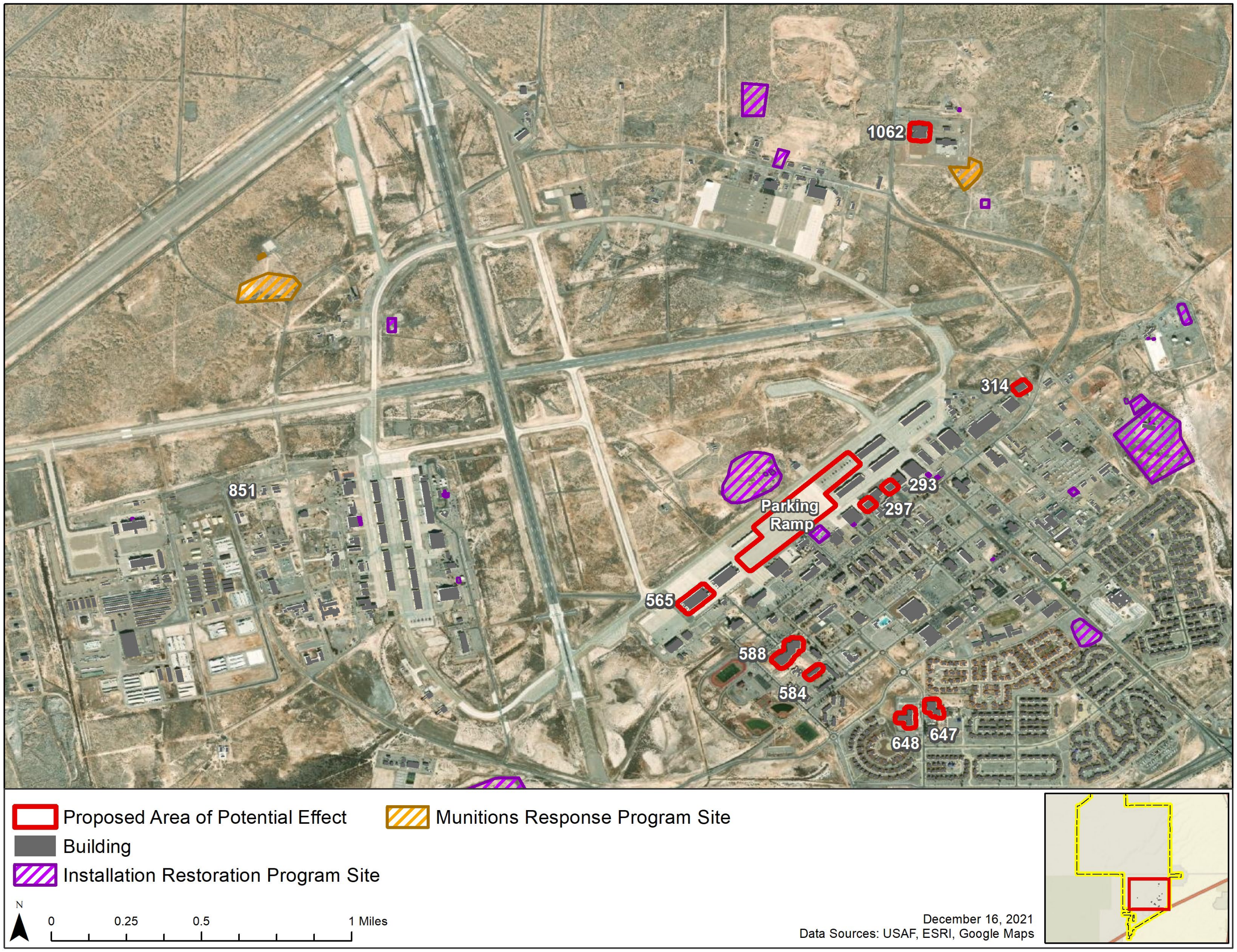

Figure 3-16. Location of Environmental Restoration Program Sites and Project Areas.

3.12 SOCIOECONOMICS

3.12.1 *Definition of Resource*

Socioeconomics is the relationship between economics and social elements, such as population levels and economic activity. There are several factors that can be used as indicators of economic conditions for a geographic area, such as demographics, median household income, unemployment rates, percentage of families living below the poverty level, employment, and housing data. Data on employment identify gross numbers of employees, employment by industry or trade, and unemployment trends. Data on industrial, commercial, and other sectors of the economy provide baseline information about the economic health of a region. Economic data are typically presented at county, state, and US levels to characterize baseline socioeconomic conditions in the context of regional, state, and national trends.

The ROI for socioeconomics is Otero County, New Mexico, for Holloman AFB and Chaves County, New Mexico, for ROW. The proposed use of SUA and ATCAAs for F-16 operations under both Alternatives 1 and 2 would be within the number of sorties analyzed in the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). That EIS found that there would be no impact on population in the ROI and no quantifiable impact on housing values from the Proposed Action. Furthermore, there would be no significant impact from aircraft noise on visitation of National Forests and National Parks located in the vicinity of the SUA and ATCAAs proposed for use. Note that socioeconomics was not analyzed for the Wiley ATCAA and Pecos MOAs in either the *Special Use Airspace Optimization Final EIS and ROD* or the *Holloman AFB Combat Air Forces Adversary Air EA* analyses. However, while the proposed additional FTU squadrons would use all the SUA and ATCAAs, including the Wiley ATCAA and Pecos MOAs, the net number of sorties across all proposed SUA and ATCAAs would not increase, and therefore would result in no significant impact on socioeconomics for these airspaces. Therefore, socioeconomics for areas beneath the SUA and ATCAAs are not discussed further.

Holloman AFB F-16 aircraft would also use existing MTRs IR-192/194, IR-134/195, IR-133/142 and VR-176. Use of these routes is generally covered under previous NEPA analyses. Additionally, all the MTRs would be used for a small number of sorties with IR-192/194, IR-134/195, and IR-133/142 being utilized for well below 100 sorties per year. Given that the current and proposed use of the MTRs by Holloman AFB F-16 aircraft is very low, there would be no impact to socioeconomics. Therefore, socioeconomics for areas beneath the MTRs are not discussed further.

3.12.2 *Existing Conditions*

3.12.2.1 Holloman Air Force Base

Otero County had an estimated population of about 67,490 persons in 2019 (US Census Bureau, 2021). The annual average unemployment rate for Otero County in 2020 was 8.3 percent (BLS, 2020a). This rate is slightly higher than the 2020 national average unemployment rate of 8.1 percent and slightly lower than the State of New Mexico’s 2020 annual average unemployment rate of 8.4 percent (BLS, 2020b). The most current rates available, from September 2021, reflect an unemployment rate of 5.8 percent for New Mexico and 5.4 percent for Otero County (BLS, 2021). The median household income in 2019 dollars was $41,988 for Otero County, $49,754 for New Mexico, and $62,843 for the US (US Census Bureau, 2021). In 2019, an estimated 20.1 percent of persons in Otero County were living in poverty, compared with 18.2 percent for New Mexico and 11.4 percent for the US (US Census Bureau, 2021).

Information on housing availability and housing values was also collected. In the 2020 Census, Otero County was found to have 25,932 occupied housing units and 6,278 vacant housing units (US Census Bureau, 2020). The median value of owner-occupied housing units based on the 2015-2019

American Community Survey (ACS) was $112,400 for Otero County, $171,400 for New Mexico, and $217,500 for the US (US Census Bureau, 2021).

In 2016, Holloman AFB was estimated to have a total economic impact of approximately $412 million on the local economy from payroll ($213 million), local contract expenditures for construction and other services ($121 million), and the estimated value of jobs created in the region ($77 million). Holloman AFB is Otero County's largest employer, employing 3,720 military personnel and 1,651 civilian personnel in 2016 (Holloman AFB, 2016b). Other major employers in Otero County include Alamogordo Public Schools with 661 employees and the Gerald Champion Medical Center with 651 employees (New Mexico Partnership, 2022).

3.12.2.2 Roswell International Air Center

Chaves County had an estimated population of about 64,615 persons in 2019 (US Census Bureau, 2021). The annual average unemployment rate for Chaves County in 2020 was 8.1 percent (BLS, 2020a). This rate is the same as the 2020 national average unemployment rate of 8.1 percent and slightly lower than the State of New Mexico's 2020 annual average unemployment rate of 8.4 percent (BLS, 2020b). The most current rates available, from September 2021, reflect an unemployment rate of 5.8 percent for New Mexico, and 5.9 percent for Chaves County (BLS, 2021). The median household income in 2019 dollars was $43,359 for Chaves County, $49,754 for New Mexico, and $62,843 for the US (US Census Bureau, 2021). In 2019, an estimated 18.1 percent of persons in Chaves County were living in poverty, compared with 18.2 percent for New Mexico and 11.4 percent for the US (US Census Bureau, 2021).

In the 2020 Census, Chaves County was found to have 23,521 occupied housing units and 3,137 vacant housing units (US Census Bureau, 2020). The median value of owner-occupied housing units based on the 2015-2019 ACS was $108,700 for Chaves County, $171,400 for New Mexico, and $217,500 for the US (US Census Bureau, 2021).

ROW is a non-hub commercial service airport. The total economic impact of ROW in 2017 was $96 million, which included a total payroll of $45 million. ROW employed 830 personnel directly and 236 personnel indirectly in 2017 (NMDOT, 2017). Other major employers in Chaves County include Roswell Public Schools with 1,030 employees, Leprino Foods with 600 employees, and Eastern New Mexico Medical Center with 522 employees (New Mexico Partnership, 2022).

3.12.3 *Environmental Consequences Evaluation Criteria*

Consequences to socioeconomic resources were assessed in terms of the potential impacts on the local economy from the Proposed Action. The level of impacts is assessed in terms of direct impacts on the local economy and related impacts on other socioeconomic resources such as employment. The magnitude of potential impacts can vary greatly, depending on the location of an action. For example, implementation of an action that creates ten employment positions might be unnoticed in an urban area but might have significant impacts in a rural region. In addition, if potential socioeconomic changes resulting from other factors were to result in substantial shifts in population trends or in adverse impacts on regional spending and earning patterns, they may be considered adverse.

3.12.4 *Environmental Consequences – Alternative 1*

3.12.4.1 Holloman Air Force Base

Under Alternative 1, approximately 400 RegAF personnel composed of instructor pilots and support personnel, as well as contracted logistics support personnel currently based at Holloman AFB, would remain and become permanent staff. There would be no economic impact from converting 400 staff from temporary to permanent and no additional economic impact from continued F-16 FTU squadron operations.

Minor construction projects would be required under Alternative 1, which would result in beneficial but short-term negligible impacts to the local economy through increases in payroll taxes, employment rates, and local sales volumes.

3.12.4.2 Roswell International Air Center

Under Alternative 1 at ROW, the 8 FS would fly an estimated additional 92 sorties to ROW and perform an estimated 207 additional patterns per year. The existing annual military flights made from ROW is over 30,000 total operations (**see Table 3-4**). An increase of 92 sorties is a small increase in the total military flights that would not require an increase in staffing or support services at ROW. No increase in expenditures in the ROW region would be expected from the additional sorties. The increase in noise from Alternative 1 at POIs and surrounding areas at ROW would be long-term, likely unnoticeable, and not significant. This increase in noise would be expected to have no impact on housing values and recreational opportunities around ROW.

3.12.5 *Environmental Consequences – Alternative 2*

3.12.5.1 Holloman Air Force Base

Under Alternative 2, the permanent beddown of two squadrons would include approximately 875 personnel comprised of 175 RegAF personnel and the contractor equivalent of approximately 700 personnel to fill direct and indirect support functions. The addition of 875 permanent personnel would increase staffing levels 16 percent above those reported in 2016, prior to the interim F-16 FTU squadron beddown at Holloman AFB (Holloman AFB, 2016b). An unknown number of additional family members and FTU students would also increase the population on base and within Otero County. It is anticipated that the City of Alamogordo and Otero County would have the resources to accommodate the population change and continue to provide public services such as schools, law enforcement, firefighting, and medical services with no significant impacts. Additionally, there is no indication that there would be inadequate housing in the region for the additional personnel, their families, and potential additional FTU students.

Minor construction projects would be required, which would result in beneficial but short-term negligible impacts to the local economy due to increases in payroll taxes, employment rates, and local sales volumes.

It is estimated that the permanent beddown of an additional F-16 FTU squadron would potentially increase annual expenditures in the region from the 475 additional personnel and their families. These expenditures would be in the form of purchasing fuel, equipment, and materials as well as the employment of highly skilled personnel (maintainers and pilots). These increased expenditures would provide a long-term, minor beneficial impact on the ROI under Alternative 2.

The increase in noise from Alternative 2 at POIs and surrounding areas at Holloman AFB would be long term, likely unnoticeable, and not significant. This increase in noise would be expected to have no impact on housing values and recreational opportunities around the Base.

3.12.5.2 Roswell International Air Center

Under Alternative 2 at ROW, the 8 FS would fly an estimated additional 199 sorties to ROW and perform an estimated 581 additional patterns per year. The existing annual military flights made from ROW is more than 30,000 total operations (**see Table 3-4**). Therefore, an increase of 199 sorties is still a very small increase in the total military flights that would not require an increase in staffing or support services at ROW. No increases in expenditures in the ROW region would be expected from the additional sorties.

The increase in noise from Alternative 2 at POIs and surrounding areas at ROW would be long-term, likely unnoticeable, and not significant. This increase in noise would be expected to have no impact on housing values and recreational opportunities around ROW.

3.12.6 *Environmental Consequences - No Action Alternative*

Under the No Action Alternative, the existing F-16 FTU squadron would not be permanently based and would remain at Holloman AFB while other beddown locations are considered. Current socioeconomic conditions would continue until a final beddown decision is made.

3.12.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

The Proposed Action alternatives in addition to reasonably foreseeable future actions at Holloman AFB and ROW would not result in an adverse impact on the Otero County or Chaves County socioeconomic conditions. Construction projects would result in short-term beneficial impacts, as local sales and payroll taxes would increase. The Proposed Action at Holloman AFB would increase annual expenditures in the local economy by up to approximately $67 million. This action, along with other proposed projects at Holloman AFB or ROW, and by local governments (described in **Appendix B**), would create an economic boost to southern New Mexico and represent a long-term, minor beneficial impact on the local economy.

3.13 Environmental Justice and the Protection of Children

3.13.1 *Definition of Resource*

Federal agencies, through Executive Orders (EOs), are required to address the potential disproportionate environmental and human health effects in minority and low-income communities and to identify and assess environmental health and safety risks to children and the elderly. For this analysis, minority populations are defined as Alaska Natives and American Indians, Asians, Blacks or African Americans, Native Hawaiians, and Pacific Islanders or persons of Hispanic origin (of any race); low-income populations include persons living below the poverty threshold as determined by the US Census Bureau; youth populations are children under the age of 18 years; and the elderly populations are persons 65 and older.

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, pertains to environmental justice issues and relates to various socioeconomic groups and disproportionate impacts that could be imposed on them. This EO requires that federal agencies' actions substantially affecting human health, or the environment do not exclude persons, deny persons benefits, or subject persons to discrimination because of their race, color, or national origin. EO 12898 was promulgated to ensure the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Consideration of environmental justice concerns includes race, ethnicity, and the poverty status of populations in the vicinity of a proposed action.

EO 13045, Protection of Children from Environmental Health Risks and Safety Risks, states that each federal agency "(a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks."

The ROI for this environmental justice analysis is Otero County for Holloman AFB and Chaves County for the Roswell International Air Center. The proposed use of SUA and ATCAAs for F-16 operations was covered by the *Special Use Airspace Optimization Final EIS and ROD* (Air Force, 2021). That EIS found that there would be no disproportionate impacts to environmental justice communities. Note that environmental justice was not analyzed for the Wiley ATCAA and Pecos MOAs in either the *Special Use Airspace Optimization Final EIS and ROD* or the *Holloman AFB Combat Air Forces Adversary Air EA* (Air Force, 2020). However, while the proposed additional FTU squadrons would use all the SUA and ATCAAs, including the Wiley ATCAA and Pecos MOAs, the net number of sorties across all proposed SUA and ATCAAs would not increase, and therefore would result in no significant impacts on environmental justice. Therefore, environmental justice concerns for areas beneath the SUA and ATCAAs are not discussed further.

Holloman AFB F-16 aircraft would also use existing MTRs IR-192/194, IR-134/195, IR-133/142 and VR-176. Use of these routes is generally covered under previous NEPA analyses. Additionally, all the MTRs would be used for a small number of sorties with IR-192/194, IR-134/195, and IR-133/142 being utilized for well below 100 sorties per year. Given that the current and proposed use of the MTRs by Holloman AFB F-16 aircraft is very low, there would be no impact to environmental justice. Therefore, environmental justice concerns for areas beneath the MTRs are not discussed further.

3.13.2 *Existing Conditions*

3.13.2.1 Holloman Air Force Base

Per CEQ guidance (CEQ, 1997), minority populations are identified where either the minority population of the affected area exceeds 50 percent, or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ, 1997). Low-income populations are persons below the poverty level as defined by the US Census Bureau. Following the Office of Management and Budget's Statistical Policy Directive 14, the Census Bureau uses a set of money income thresholds that vary by family size and composition to identify who is in poverty. If a family's total income is less than the family's threshold, then that family and every individual in it is considered in poverty.

To determine if minority, low-income, and youth populations exist in the project area, the ROI must be compared to a larger regional area that includes the affected area and serves as a Community of Comparison (COC). The State of New Mexico is the COC under this environmental justice analysis.

As of 2019, 38.6 percent of the ROI population was of Hispanic or Latino origin, which is lower than the State of New Mexico at 49.3 percent (US Census Bureau, 2021). The percentage of persons with a race of Alaska Natives and American Indians, Asians, Blacks or African Americans, Native Hawaiians, and Pacific Islanders or persons is 14.4 percent, which is lower than the State of New Mexico at 15.6 percent (US Census Bureau, 2021). The average poverty rate of 20.1 percent for ROI residents is slightly higher than the New Mexico poverty rate of 18.2 percent (US Census Bureau, 2021). There is no substantial difference between the percent of the 2019 population that were children in the ROI (22.9 percent) and the State of New Mexico (22.7 percent) (US Census Bureau, 2021). There is no substantial difference between the percent of the 2019 population that were elderly in the ROI (17.3 percent) and the State of New Mexico (18 percent) (US Census Bureau, 2021). Compared to New Mexico, the COC, Otero County, does not have a significantly higher proportion of minorities, children, or elderly persons.

3.13.2.2 Roswell International Air Center

The ROI for ROW is Chaves County. The State of New Mexico is the COC for this environmental justice analysis.

As of 2019, 57.8 percent of the ROI population was of Hispanic or Latino origin, which is higher than the State of New Mexico at 49.3 percent (US Census Bureau, 2021). The percentage of persons with a race of Alaska Natives and American Indians, Asians, Blacks or African Americans, Native Hawaiians, and Pacific Islanders or persons is 6.3 percent, which is lower than the state of New Mexico at 15.6 percent (US Census Bureau, 2021). The average poverty rate of 18.1 percent for ROI residents is nearly identical to the New Mexico poverty rate of 18.2 percent (US Census Bureau, 2021). There is no substantial difference between the percent of the 2019 population that were children in the ROI (26 percent) and the State of New Mexico (22.7 percent) (US Census Bureau, 2021). There is no substantial difference between the percent of the 2019 population that were elderly in the ROI (16.1 percent) and the State of New Mexico (18 percent) (US Census Bureau, 2021). Compared with New Mexico, the COC, Chaves County does have a higher proportion of Hispanic or Latino persons and children and a lower proportion of elderly persons.

3.13.3 *Environmental Consequences Evaluation Criteria*

Potential effects from the Proposed Action were evaluated by evaluating whether the proposed changes would result in disproportionate human health or environmental effects on minority or low-income populations, and whether the proximity and risk of exposure to environmental hazards would be greater than that of the general population; and whether the action would result in disproportionate environmental health or safety risks to children or the elderly.

3.13.4 *Environmental Consequences – Alternative 1*

3.13.4.1 Holloman Air Force Base

Based on the analysis conducted in this EA, there are no minority or low-income populations in the project area, therefore there is no potential for disproportionate impacts to minority or low-income populations. Implementation of Alternative 1 would establish the 8 FS as a permanently assigned unit at Holloman AFB. Aircraft operations at Holloman AFB would not increase and only minor construction projects would occur. These actions would not result in any significant (major) adverse environmental impacts. Therefore, this alternative would not result in environmental health or safety risks to children or the elderly.

3.13.4.2 Roswell International Air Center

Based on the analysis conducted in this EA, implementation of Alternative 1 at ROW would result in some negligible to minor adverse impacts. These adverse impacts do not rise to the level of major (significant) and would generally be felt equally by all populations within the ROI, therefore there would be no disproportionate impact to minority or low-income populations. This alternative would not result in disproportionate environmental health or safety risks to children or the elderly.

Alternative 1 at ROW would not substantially affect populations covered by EO 12898 or 13405 by excluding persons, denying persons benefits, or subjecting persons to discrimination or disproportionate environmental or human health risks.

3.13.5 *Environmental Consequences – Alternative 2*

3.13.5.1 Holloman Air Force Base

Based on the analysis conducted in this EA, there are no minority, low-income, or elderly populations in the project area, therefore there is no potential for disproportionate impacts to these groups. The representative POIs identified for Holloman AFB include two daycare centers and two schools. At those POIs, the increase in DNL is 1-dBA, which would likely be unnoticeable and would not increase human annoyance. This alternative would not result in disproportionate environmental health or safety risks to children.

Alternative 2 at Holloman AFB would not substantially affect populations covered by EO 12898 or 13405 by excluding persons, denying persons benefits, or subjecting persons to discrimination or disproportionate environmental or human health risks.

3.13.5.2 Roswell International Air Center

Based on the analysis conducted in this EA, implementation of Alternative 2 at ROW would result in some negligible to minor adverse impacts. These adverse impacts do not rise to the level of major (significant) and would generally be felt equally by all populations within the ROI, therefore there would be no disproportionate impact to any populations, including minority and low-income populations. The representative POIs identified for ROW include four schools. At those POIs, the increase in DNL is less than 1-dBA, which would likely be unnoticeable and would not increase human annoyance. Therefore, this alternative would not result in disproportionate environmental health or safety risks to children.

Alternative 2 at ROW would not substantially affect populations covered by EO 12898 or 13405 by excluding persons, denying persons benefits, or subjecting persons to discrimination or disproportionate environmental or human health risks.

3.13.6 *Environmental Consequences - No Action Alternative*

Under the No Action Alternative, there would be no changes to the existing F-16 operations and implementation of this alternative would not result in disproportionate adverse environmental or health effects on low-income or minority populations, children, or the elderly. The No Action Alternative would not substantially affect populations covered by EO 12898 or 13405 by excluding persons, denying persons benefits, or subjecting persons to discrimination or disproportionate environmental or human health risks.

3.13.7 *Reasonably Foreseeable Future Actions and Other Environmental Considerations*

Alternatives 1 and 2 would not result in significant long-term increases in any environmental impact and would not disproportionately affect low-income, minority populations, children, or the elderly. Any environmental impacts from the alternatives are negligible on their own and when added to other reasonably foreseeable future actions.

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APPENDICES

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APPENDIX A
INTERAGENCY AND INTERGOVERNMENTAL COORDINATION AND CONSULTATIONS

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A.1 INTRODUCTION

Scoping is an early and open process for developing the breadth of issues to be addressed in an Environmental Assessment (EA) and for identifying significant concerns related to an action. Per the requirements of Executive Order (EO) 12372, *Intergovernmental Review of Federal Programs*, as amended by EO 12416, federal, state, and local agencies with jurisdiction that could potentially be affected by the Proposed Action or alternatives were notified during the development of this EA.

A.2 INTERAGENCY AND INTERGOVERNMENTAL COORDINATION AND CONSULTATIONS

The environmental analysis process, in compliance with National Environmental Policy Act (NEPA) guidance, includes public and agency review of information pertinent to the Proposed Action and alternatives. Furthermore, compliance with Section 7 of the Endangered Species Act (ESA) and Section 106 of the National Historic Preservation Act (NHPA) require consultation with the US Fish and Wildlife Service (USFWS) and the State Historic Preservation Office (SHPO). Tribal consultation is also required under the NHPA. The consultations performed for this EA are described in the sub-sections below.

A.2.1 Agency Consultations

Implementation of the Proposed Action involves coordination with several organizations and agencies. Compliance with Section 7 of the ESA and implementing regulations (50 Code of Federal Regulations [CFR] Part 402), requires communication with the USFWS in cases where a federal action could affect listed threatened or endangered species, species proposed for listing, or candidates for listing. The primary focus of this consultation is to request a determination of whether any of these species occur in the proposal area. If any of these species is present, a determination would be made of any potential adverse effects on the species. Should no species protected by the ESA be affected by the Proposed Action or alternatives, no additional consultation is required. Letters would be sent to the appropriate USFWS offices as well as relevant state agencies informing them of the proposal and requesting data regarding applicable protected species.

Coordination with appropriate New Mexico state government agencies and planning districts is ongoing. In compliance with Section 106 of the National Historic Preservation Act (NHPA) and implementing regulations (36 CFR Part 800) consultation with the New Mexico State Historic Preservation Office has been initiated. Similarly, the New Mexico Environment Department is being consulted with for air quality, and coordination with the New Mexico State Parks Division and the Department of Game and Fish is ongoing regarding sensitive habitats and species of concern.

A.2.2 Government-to-Government Consultation

The NHPA and its regulations in 36 CFR Part 800 direct federal agencies to consult with federally recognized Indian tribes when a proposed or alternative action has the potential to affect tribal lands or properties of religious and cultural significance to a tribe. Consistent with the NHPA, Department of Defense Instruction 4710.02, *DoD Interactions with Federally-Recognized Tribes*, and Department of Air Force Instruction 90-2002, *Interactions with Federally Recognized Tribes*, federally recognized tribes that are historically affiliated with lands in the vicinity of the Proposed Action or alternatives have been invited to consult on all proposed undertakings that have a potential to affect properties of cultural, historical, or religious significance to the tribes. The tribal consultation process is distinct from the National Environmental Policy Act (NEPA) consultation or the interagency coordination process, and it requires separate notification of all relevant tribes. The timelines for tribal consultation are also distinct from those of other consultations. The Holloman Air Force Base (AFB) point of contact for Native American tribes is the Base Commander. The point of contact for consultation with the Tribal Historic Preservation Officer and the Advisory Council on Historic Preservation is the Holloman AFB Installation Support Team Cultural Resources Manager. Government-to-government consultation is included in this appendix.

A.3 APPLICABLE LAWS AND ENVIRONMENTAL REGULATIONS

Implementation of the Proposed Action would involve coordination with several organizations and agencies. Adherence to the requirements of specific laws, regulations, best management practices, and necessary permits is described in detail in each resource section in Chapter 3.

A.3.1 National Environmental Policy Act

NEPA requires that federal agencies consider potential environmental consequences of proposed actions. The law's intent is to protect, restore, or enhance the environment through well-informed federal decisions. The Council on Environmental Quality (CEQ) was established under NEPA for the purpose of implementing and overseeing federal policies as they relate to this process. In 1978, the CEQ issued Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 Code of Federal Regulations [CFR] Parts 1500 through 1508 [CEQ 1978]. On 14 September 2020, CEQ updated NEPA rules, subject to congressional review (85 Federal Register 43304 through 43376), which are being followed for this EA. CEQ regulations specify that an EA be prepared to:

- briefly provide sufficient analysis and evidence for determining whether to prepare an environmental impact statement (EIS) or a Finding of No Significant Impact (FONSI);
- aid in an agency's compliance with NEPA when no EIS is necessary; and
- facilitate preparation of an EIS when one is necessary.

The Air Force's implementing regulation is 32 CFR §989, which provides a framework for how the Air Force implements CEQ regulations and achieves the goals set forth by NEPA. Known as the Environmental Impact Analysis Process, it allows the Department of the Air Force (DAF) to thoroughly examine the Proposed Action and alternatives to identify potential issues affecting the environment during the decision-making process.

A.4 SCOPE OF THE ENVIRONMENTAL ANALYSIS

This EA analyzes the potential environmental consequences associated with the permanent beddown of additional F-16 squadrons at Holloman AFB. This EA has been prepared in accordance with NEPA (42 US Code §§ 4321 through 4347), the CEQ Regulations (40 CFR Parts 1500 through 1508), and 32 CFR Part 989 et seq., *Environmental Impact Analysis Process*. NEPA ensures that environmental information, including the anticipated environmental consequences of a proposed action, is available to the public, federal and state agencies, and the decision-maker before decisions are made and before actions are taken. The National Park Service (NPS) is a cooperating agency as defined in 40 CFR 1508.5. The NPS has provided subject matter expertise during the development of the EA and participated in document reviews. During the course of this collaboration, NPS expressed concerns about aircraft noise. The Air Force invites anyone with noise concerns to contact 49 WG Public Affairs at (575) 572-1824/7381 or 49WG.PAOffice@us.af.mil.

A.5 PUBLIC AND AGENCY REVIEW OF ENVIRONMENTAL ASSESSMENT

A Notice of Availability of the Draft EA and Proposed Finding of No Significant Impact (FONSI) was published in the *Alamogordo Daily News* and *Las Cruces Sun-News* inviting the public to review and comment on the Draft EA during the 30-day review period.

Copies of the Draft EA and proposed FONSI are available for review at https://www.holloman.af.mil/Environmental-Information/.

Those who were unable to access these documents online are asked to call Public Affairs at 575-572-7381 or send us an e-mail at 49wg.paoffice@us.af.mil to arrange alternate access.

A.6 INTERGOVERNMENTAL AND STAKEHOLDER COORDINATION

A.6.1 Sample Agency Scoping Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (AETC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

January 31, 2022

Colonel Ryan P. Keeney, USAF
Commander, 49th Wing
490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

Dr. Jeff Pappas
State Historic Preservation Officer
NM Historic Preservation Division
407 Galisteo Street, Suite 236
Santa Fe, NM 87501

Dear Dr. Pappas

The United States Air Force (USAF) is proposing to permanently beddown and relocate additional F-16 Formal Training Unit squadrons at Holloman Air Force Base (AFB), New Mexico (Attachment 1). To take into account various environmental concerns, the Air Force is engaging early with the appropriate resource and regulatory agencies as it formulates the undertaking. The Air Force is also preparing an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) to evaluate potential environmental impacts associated with the permanent beddown of F-16 FTU squadrons.

In accordance with Section 306108 of the National Historic Preservation Act (NHPA) and its implementing regulations at 36 CFR Part 800, the Air Force, Holloman AFB, is advising you of a proposed undertaking that has the potential to affect historic properties. The undertaking would require infrastructure/facilities/airfield operations/training activities/personnel to support the Holloman AFB mission.

As part of the proposed undertaking, the USAF would permanently relocate F-16 aircraft and associated pilot, maintenance, and support personnel and support vehicles and equipment. Holloman AFB currently has two permanent F-16 squadrons and one F-16 squadron on an interim basis. Under the Proposed Action, the current interim-based F-16 squadron, comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory, would be permanently relocated to Holloman AFB. Moreover, one additional F-16 squadron, comprised of 25 PAA F-16s, would also be considered for permanent relocation to Holloman AFB. The permanently relocated F-16 squadrons would use existing special use airspace and training ranges currently used by Holloman AFB. The beddown and relocation may require minor construction and

COMBAT AIRPOWER STARTS HERE

interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities. In addition, the USAF is considering using Roswell International Air Center as an auxiliary airfield to support pilot training and serve as an emergency divert field.

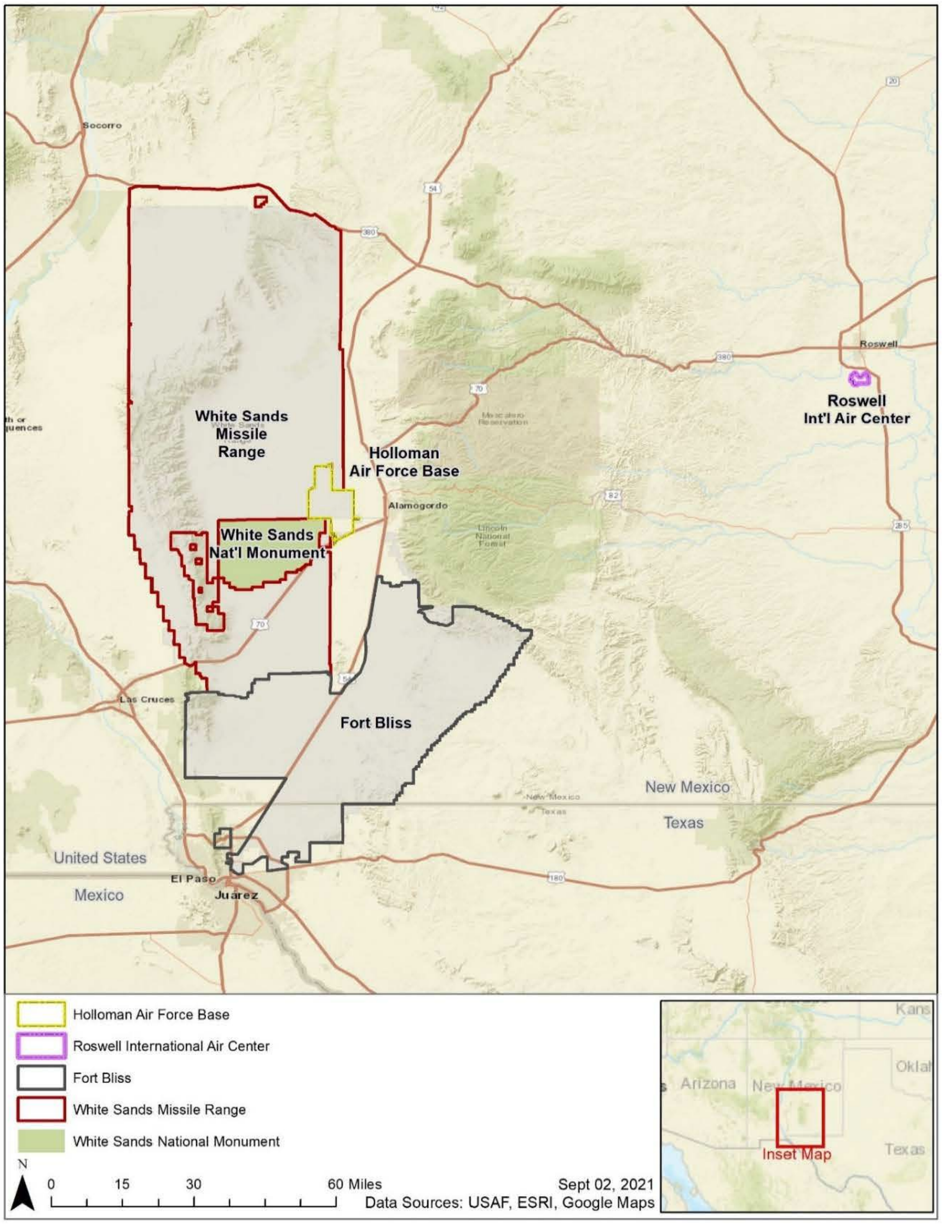
Per 36 CFR800.4(a) we are requesting your concurrence with the Area of Potential Effect (APE) for this undertaking. The proposed APE encompasses the facilities on Holloman AFB proposed for alterations (i.e., additions or renovation), Roswell International Air Center, and areas below the special use airspace. None of the buildings at Holloman AFB included in the proposed undertaking are eligible for inclusion in the National Register of Historic Places. These buildings, as well as archaeological sites located relative to the APE are identified in Attachment 2. The APE for Roswell International Air Center is illustrated in Attachment 3; no ground disturbance is included in the proposed undertaking and a records search of the New Mexico Cultural Resource Information System (NMCRIS) indicated there are no historic properties within, or immediately adjacent to, the Roswell airport. The proposed APE for areas below the special use airspace is illustrated in Attachment 4. We request your review of the proposed APE and invite your consultation regarding whether or not the APE as shown in Attachment 4 adequately encompasses both potential direct and indirect effects.

To ensure the Air Force has sufficient time to consider your input in the preparation of the Draft EA, and for compliance with Section 106 of the NHPA, please forward your written comments or requests for additional information Mr. Spencer Robison, Holloman NEPA Program Manager, 49 CES/CEIE, 550 Tabosa Ave, Holloman AFB NM 88330 or via email to spencer.robison@us.af.mil within 30 days of receipt of this letter. Thank you for your assistance.

Sincerely

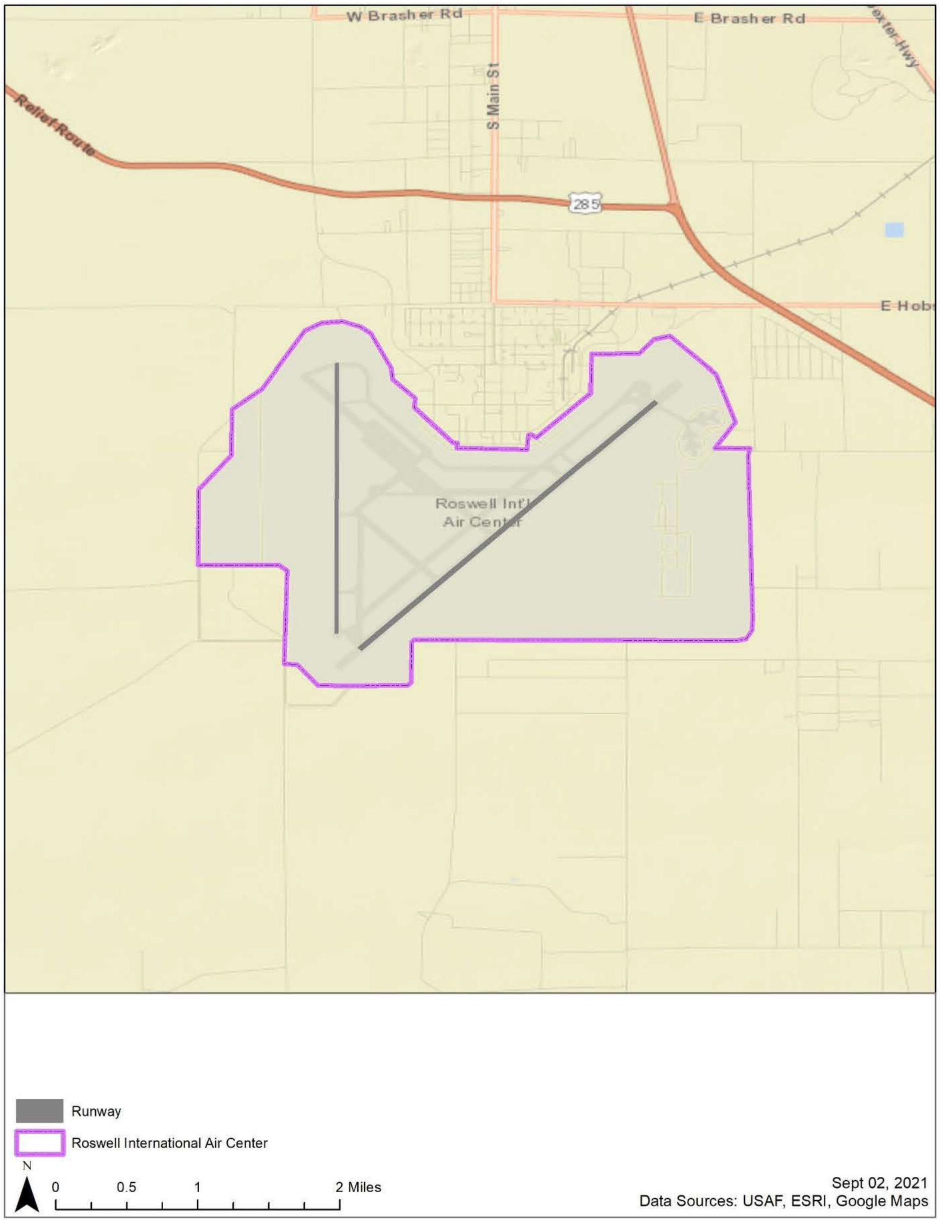
RYAN P. KEENEY, Colonel, USAF
Commander

4 Attachments:
1. Location of the Proposed Action - Holloman Air Force Base and Roswell International Air Center
2. Proposed Area of Potential Effect for Facility Improvements for the Permanent Beddown of F-16 Formal Training Unit Squadrons at Holloman AFB
3. Proposed Area of Potential Effect for Roswell International Air Center for the Permanent Beddown of F-16 Formal Training Unit Squadrons at Holloman AFB
4. Proposed Area of Potential Effect for Special Use Airspace and Training Ranges for the Permanent Beddown of F-16 Formal Training Unit Squadrons at Holloman AFB

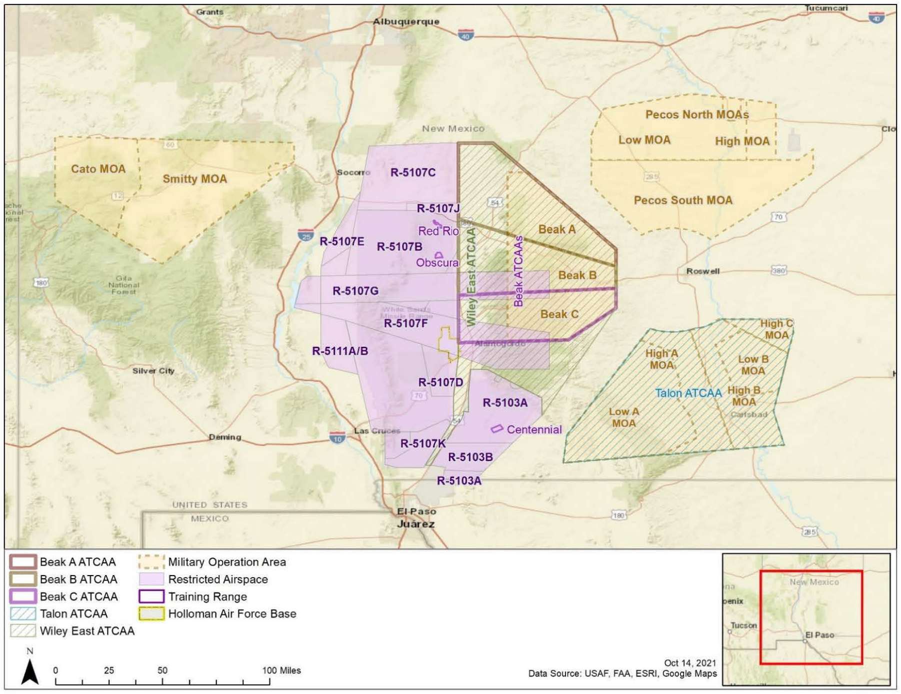


Attachment 1. Location of the Proposed Action - Holloman Air Force Base and Roswell International Air Center

Attachment 2. Proposed Area of Potential Effect for Facility Improvements for the Permanent Beddown of F-16 Formal Training Unit Squadrons at Holloman AFB



Attachment 3. Proposed Area of Potential Effect for Roswell International Air Center for the Permanent Beddown of F-16 Formal Training Unit Squadrons at Holloman AFB



Attachment 4. Proposed Area of Potential Effect for Location of Special Use Airspace and Training Ranges and Proposed Area of Potential Effect for the Permanent Beddown of F-1 16 Formal Training Unit Squadrons at Holloman AFB

A.6.2 Sample Government to Government Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (AETC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

January 31, 2022

Colonel Ryan P. Keeney, USAF
Commander, 49th Wing
490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

Brian Vallo
Governor
Pueblo of Acoma
PO Box 309
Acoma Pueblo, NM 87034-0309

Dear Governor Vallo:

The purpose of this letter is twofold: to give you an opportunity to review and comment on a proposed action in which you may have an interest; and to invite you to participate in government-to-government consultation with the US Air Force (USAF).

The USAF is preparing an Environmental Assessment (EA) under the National Environmental Policy Act to evaluate potential environmental impacts associated with the F-16 Formal Training Unit Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico. Per Section 306108 of the National Historic Preservation Act (NHPA) of 1966, as amended, and 36 CFR Part 800, *Protection of Historic Properties*, the Air Force is engaging early with tribal governments as it formulates the undertaking.

As part of the proposed undertaking, the USAF would permanently relocate F-16 aircraft and associated pilot, maintenance, and support personnel and support vehicles and equipment. Holloman AFB currently has two permanent F-16 squadrons and one F-16 squadron on an interim basis. Under the Proposed Action, the current interim-based F-16 squadron, comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory, would be permanently relocated to Holloman AFB. Moreover, one additional F-16 squadron, comprised of 25 PAA F-16s, would also be considered for permanent relocation to Holloman AFB. The permanently relocated F-16 squadrons would use existing special use airspace and training ranges currently used by Holloman AFB. The Proposed Action would include the continued use of the airspace by the 8 Fighter Squadron and an estimated additional 5,000 sorties for the beddown of the fourth F-16 Formal Training Unit squadron.

The beddown and relocation may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities. In addition, the USAF is considering using Roswell International Air Center as an auxiliary airfield

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to support pilot training and serve as an emergency divert field. The Area of Potential Effect would include land located on Holloman AFB, as well as land under the existing airspaces and training areas, as shown in Attachments 1 and 2.

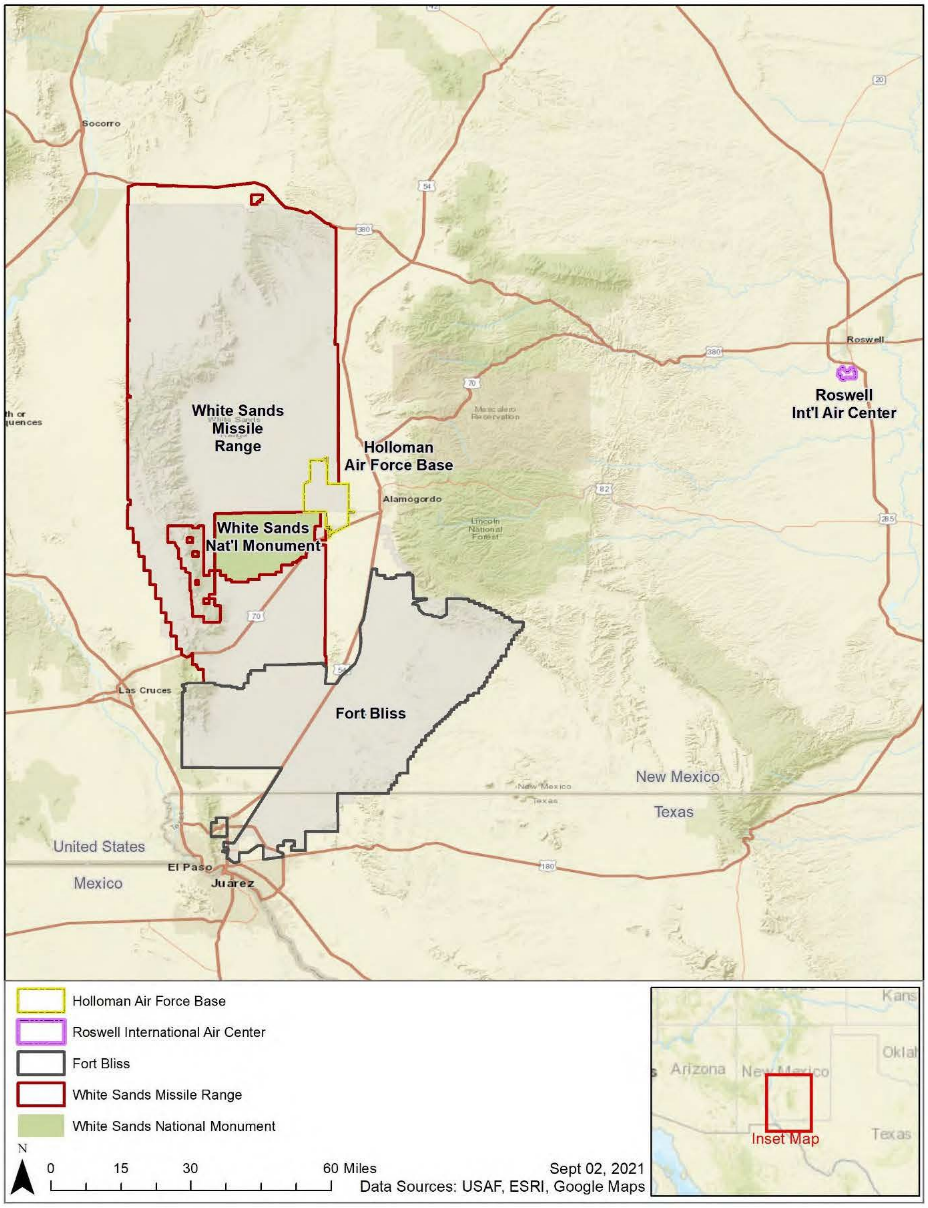
In accordance with the NHPA, the USAF requests government-to-government consultation regarding the F-16 Formal Training Unit Permanent Beddown and Relocation project. In particular, we invite you, pursuant to 36 CFR Section 800.4(a)(4), to provide information on any properties of historic, religious, or cultural significance that may be affected by our proposed undertaking. Regardless of whether the Tribe chooses to consult on this project, the USAF will comply with the Native American Graves Protection and Repatriation Act by informing you of any inadvertent discovery of archaeological or human remains and consulting on their disposition. Being defined as a federal undertaking, we will be seeking input and inviting other potential consulting parties, such as the New Mexico State Historic Preservation Office.

At your earliest convenience, please provide any information, comments, or requests for additional information to Mr. Spencer Robison, Holloman NEPA Program Manager, 49 CES/CEIE, 550 Tabosa Ave, Holloman AFB NM 88330 or via email to spencer.robison@us.af.mil. This will ensure we can address them during the environmental impact analysis process. Thank you for your assistance.

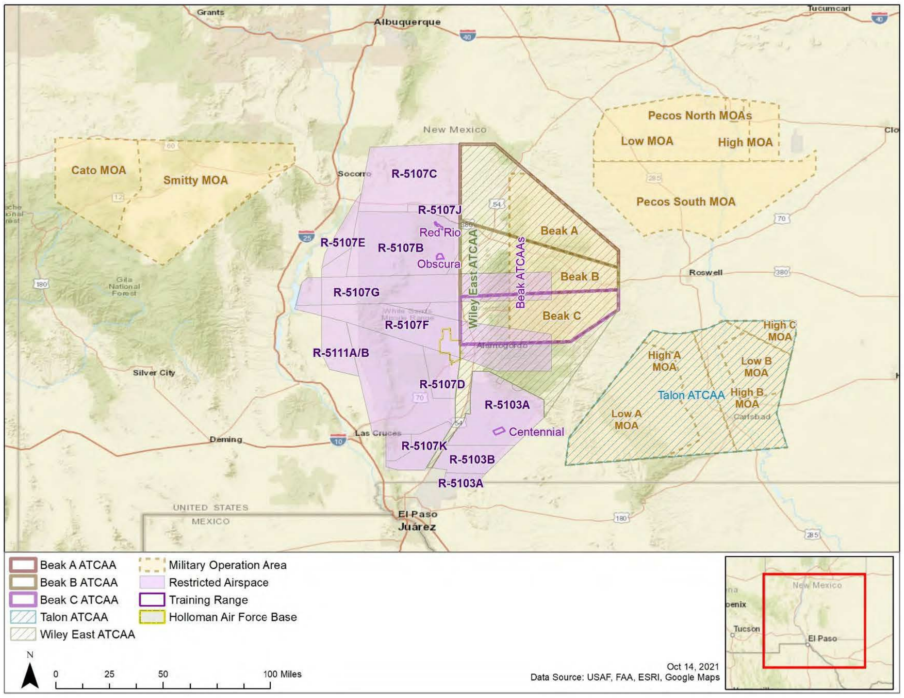
Sincerely,

RYAN P. KEENEY, Colonel, USAF
Commander

Attachments:
1. Location of the Proposed Action - Holloman Air Force Base and Roswell International Air Center
2. Location of Special Use Airspace and Training Ranges Used by F-16 Formal Training Unit Squadrons at Holloman AFB



Attachment 1. Location of the Proposed Action - Holloman Air Force Base and Roswell International Air Center



Attachment 2. Location of Special Use Airspace and Training Ranges Used by F-16 Formal Training Unit Squadrons at Holloman AFB

A.6.3 Sample General Scoping Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (AETC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

January 31, 2022

Colonel Ryan P. Keeney, USAF
Commander, 49th Wing
490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

Jennifer Montoya
Planning and Environmental Coordinator
Bureau of Land Management, Las Cruces District Office
1800 Marquess Street
Las Cruces, NM 88005

Dear Ms. Montoya:

In accordance with the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality regulations, and the Department of Defense NEPA regulations, the United States Air Force (USAF) is preparing an Environmental Assessment (EA) to evaluate the environmental impacts associated with the F-16 Formal Training Unit Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico.

As part of the proposed project, the USAF would permanently relocate F-16 aircraft and associated pilot, maintenance, and support personnel and support vehicles and equipment. Holloman AFB currently has two permanent F-16 squadrons and one F-16 squadron on an interim basis. Under the Proposed Action, the current interim-based F-16 squadron, comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory, would be permanently relocated to Holloman AFB. Moreover, one additional F-16 squadron, comprised of 25 PAA F-16s, would also be considered for permanent relocation to Holloman AFB. The permanently relocated F-16 squadrons would use existing special use airspace and training ranges currently used by Holloman AFB as shown in Attachment 1. The beddown and relocation may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities. In addition, the USAF is considering using Roswell International Air Center as an auxiliary airfield to support pilot training and serve as an emergency divert field.

If you have information regarding potential impacts of the Proposed Action on the environmental aspects of which we are unaware, we would appreciate receiving such information for inclusion and consideration during the NEPA compliance process. Please respond within 30 days of receipt of this letter to ensure your concerns are adequately addressed in the EA.

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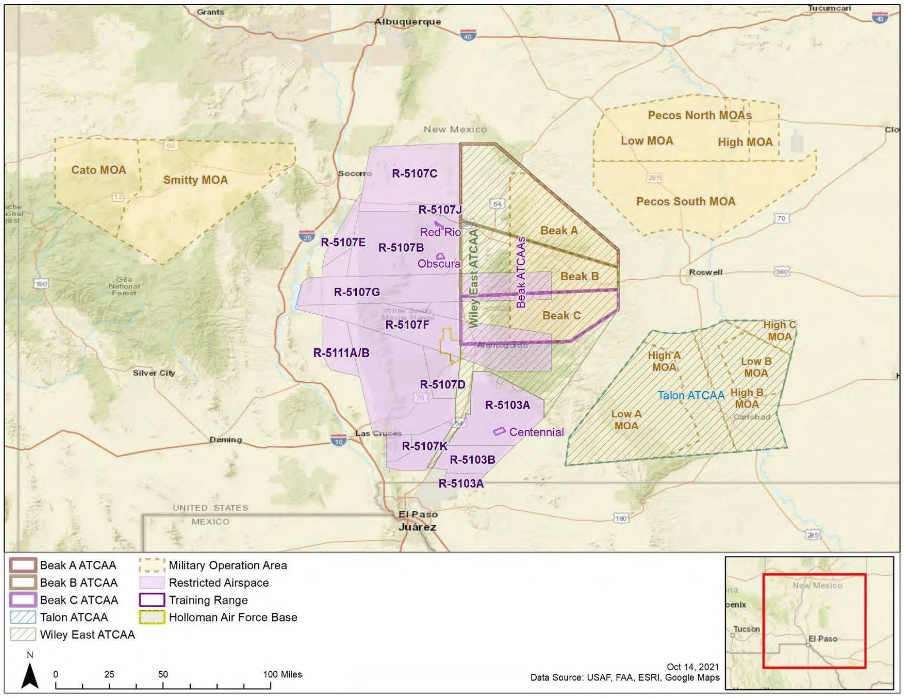
Please send your written responses and any questions to Mr. Spencer Robison, Holloman NEPA Program Manager, 49 CES/CEIE, 550 Tabosa Ave, Holloman AFB NM 88330 or via email to spencer.robison@us.af.mil. Thank you in advance for your assistance in this effort.

Sincerely

RYAN P. KEENEY, Colonel, USAF
Commander

1 Attachment:
1. Location of Special Use Airspace and Training Ranges Used by F-16 Formal Training Unit Squadrons at Holloman AFB



Attachment 1. Location of Special Use Airspace and Training Ranges Used by F-16 Formal Training Unit Squadrons at Holloman AFB

A.6.4 Sample Tribal Scoping Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (AETC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

January 31, 2022

Colonel Ryan P. Keeney, USAF
Commander, 49th Wing
490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

Mr. Todd Scissons
Tribal Historic Preservation Officer
Pueblo of Acoma
PO Box 309
Acoma Pueblo, NM 87034-0309

Dear Mr. Todd Scissons:

The purpose of this letter is twofold: to give you an opportunity to review and comment on a proposed action in which you may have an interest; and to invite you to participate in government-to-government consultation with the US Air Force (USAF).

The USAF is preparing an Environmental Assessment (EA) under the National Environmental Policy Act to evaluate potential environmental impacts associated with the F-16 Formal Training Unit Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico. Per Section 306108 of the National Historic Preservation Act (NHPA) of 1966, as amended, and 36 CFR Part 800, *Protection of Historic Properties*, the Air Force is engaging early with tribal governments as it formulates the undertaking.

As part of the proposed undertaking, the USAF would permanently relocate F-16 aircraft and associated pilot, maintenance, and support personnel and support vehicles and equipment. Holloman AFB currently has two permanent F-16 squadrons and one F-16 squadron on an interim basis. Under the Proposed Action, the current interim-based F-16 squadron, comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory, would be permanently relocated to Holloman AFB. Moreover, one additional F-16 squadron, comprised of 25 PAA F-16s, would also be considered for permanent relocation to Holloman AFB. The permanently relocated F-16 squadrons would use existing special use airspace and training ranges currently used by Holloman AFB. The Proposed Action would include the continued use of the airspace by the 8 Fighter Squadron and an estimated additional 5,000 sorties for the beddown of the fourth F-16 Formal Training Unit squadron.

The beddown and relocation may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities. In

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addition, the USAF is considering using Roswell International Air Center as an auxiliary airfield to support pilot training and serve as an emergency divert field. The Area of Potential Effect would include land located on Holloman AFB, as well as land under the existing airspaces and training areas, as shown in Attachments 1 and 2.

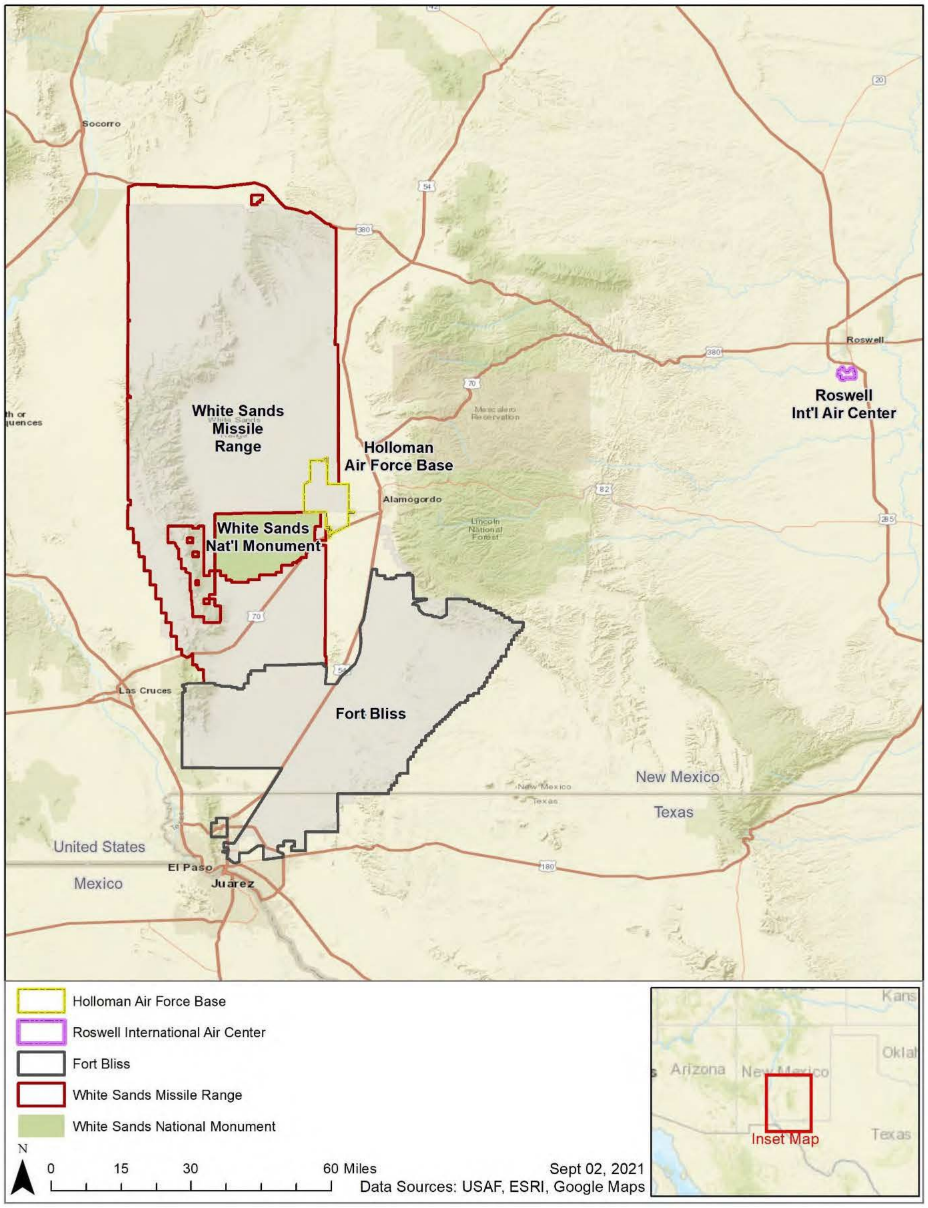
In accordance with the NHPA, the USAF requests government-to-government consultation regarding the F-16 Formal Training Unit Permanent Beddown and Relocation project. In particular, we invite you, pursuant to 36 CFR Section 800.4(a)(4), to provide information on any properties of historic, religious, or cultural significance that may be affected by our proposed undertaking. Regardless of whether the Tribe chooses to consult on this project, the USAF will comply with the Native American Graves Protection and Repatriation Act by informing you of any inadvertent discovery of archaeological or human remains and consulting on their disposition. Being defined as a federal undertaking, we will be seeking input and inviting other potential consulting parties, such as the New Mexico State Historic Preservation Office.

At your earliest convenience, please provide any information, comments, or requests for additional information to Mr. Spencer Robison, Holloman NEPA Program Manager, 49 CES/CEIE, 550 Tabosa Ave, Holloman AFB NM 88330 or via email to spencer.robison@us.af.mil. This will ensure we can address them during the environmental impact analysis process. Thank you for your assistance.

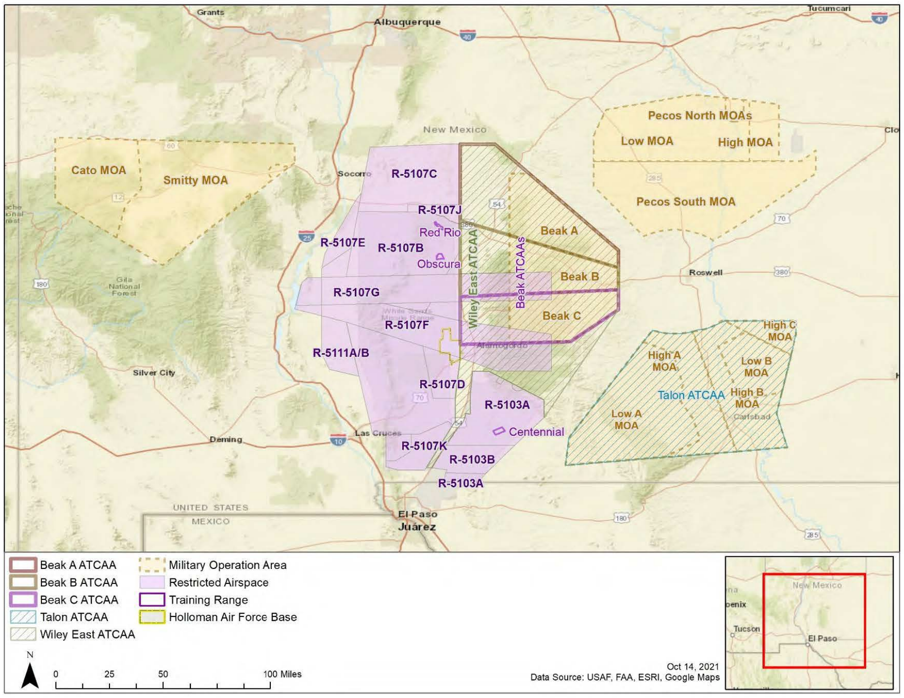
Sincerely,

RYAN P. KEENEY, Colonel, USAF
Commander

Attachments:
1. Location of the Proposed Action - Holloman Air Force Base and Roswell International Air Center
2. Location of Special Use Airspace and Training Ranges Used by F-16 Formal Training Unit Squadrons at Holloman AFB



Attachment 1. Location of the Proposed Action - Holloman Air Force Base and Roswell International Air Center



Attachment 2. Location of Special Use Airspace and Training Ranges Used by F-16 Formal Training Unit Squadrons at Holloman AFB

A.6.5 Sample USFWS Scoping Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (AETC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

January 31, 2022

Colonel Ryan P. Keeney, USAF
Commander, 49th Wing
490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

Ms. Amy Lueders
Regional Director
U.S. Fish and Wildlife Service, Southwest Region
500 Gold Avenue SW
Albuquerque, NM 87102

Dear Ms. Lueders,

In accordance with the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality regulations, and the Department of Defense NEPA regulations, the United States Air Force (USAF) is preparing an Environmental Assessment (EA) to evaluate the environmental impact associated with the F-16 Formal Training Unit Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico.

As part of the proposed undertaking, the USAF would permanently relocate F-16 aircraft and associated pilot, maintenance, and support personnel and support vehicles and equipment. Holloman AFB currently has two permanent F-16 squadrons and one F-16 squadron on an interim basis. Under the Proposed Action, the current interim-based F-16 squadron, comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory, would be permanently relocated to Holloman AFB. Moreover, one additional F-16 squadron, comprised of 25 PAA F-16s, would also be considered for permanent relocation to Holloman AFB. The permanently relocated F-16 squadrons would use existing special use airspace and training ranges currently used by Holloman AFB. The beddown and relocation may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities. In addition, the USAF is considering using Roswell International Air Center as an auxiliary airfield to support pilot training and serve as an emergency divert field.

The Proposed Action areas would include land located on Holloman AFB, as well as land under the existing airspaces and training areas, as shown in Attachments 1 and 2. Information on the listed, proposed, and candidate species or designated or proposed critical habitat in the Proposed Action areas will be obtained from the US Fish and Wildlife Service Environmental Conservation Online System, Information for Planning and Consultation. Pursuant to Section 7 of the Endangered Species Act, we request additional information or any comments that may be beneficial in the development of the EA and determination of potential impacts to listed species

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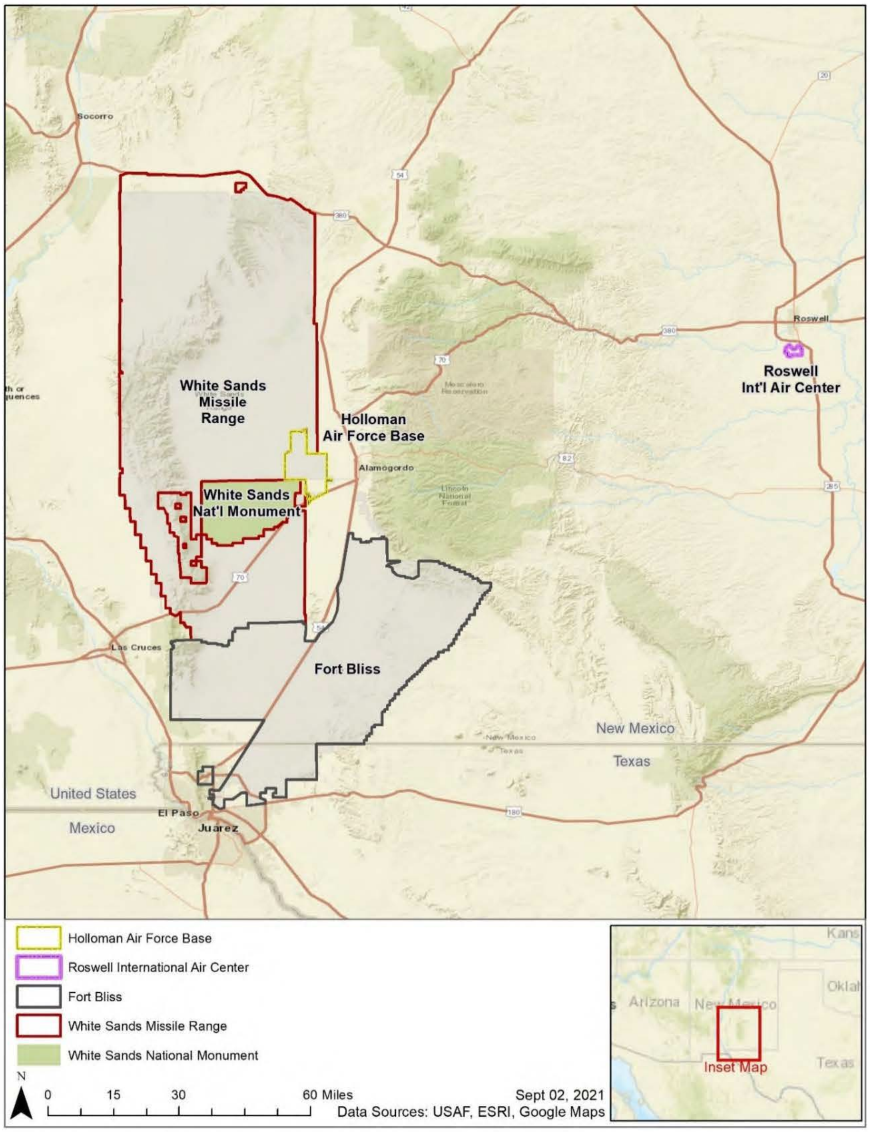
or critical habitat. This information and your comments on the Proposed Action will help us develop the scope of our environmental review.

Please respond within 30 days of receipt of this letter to ensure your concerns are adequately addressed in the EA. We intend to provide you with access to the Draft EA when the document is completed. Please inform us if someone else with your agency other than you should be notified of the availability of the Draft EA. Please send your written responses and any questions to Mr. Spencer Robison, Holloman NEPA Program Manager, 49 CES/CEIE, 550 Tabosa Ave, Holloman AFB NM 88330 or via email to spencer.robison@us.af.mil. Thank you in advance for your assistance in this effort.

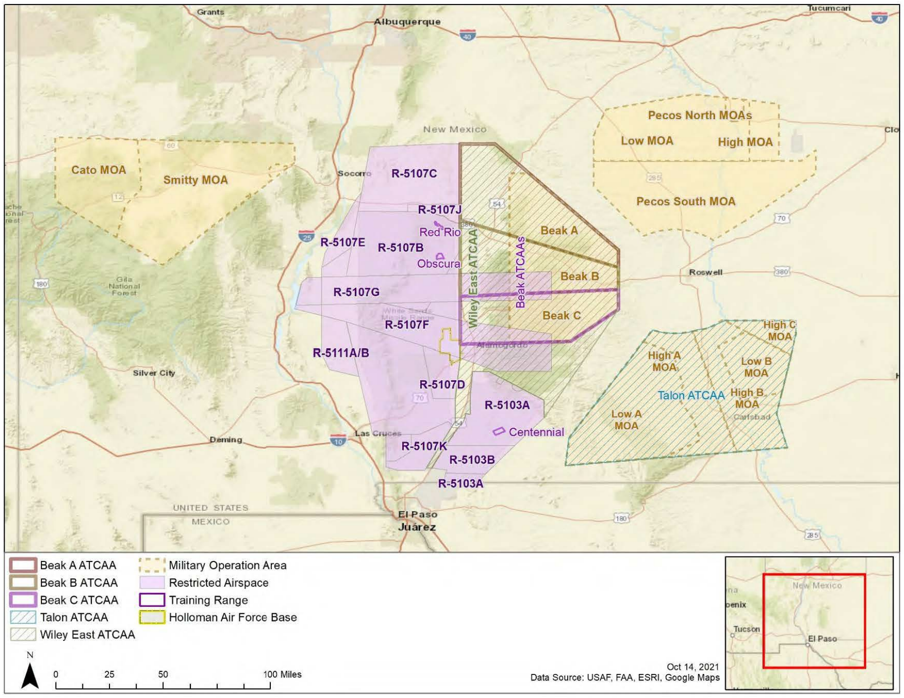
Sincerely,

RYAN P. KEENEY, Colonel, USAF
Commander

2 Attachments:
1. Location of the Proposed Action - Holloman Air Force Base and Roswell International Air Center
2. Location of Special Use Airspace and Training Ranges Used by F-16 Formal Training Unit Squadrons at Holloman AFB



Attachment 1. Location of the Proposed Action - Holloman Air Force Base and Roswell International Air Center



Attachment 2. Location of Special Use Airspace and Training Ranges Used by F-16 Formal Training Unit Squadrons at Holloman AFB

A.6.6 Mailing List

Jeff Pappas
State Historic Preservation Officer
NM Historic Preservation Division
407 Galisteo Street
Suite 236
Santa Fe, NM 87501

Amy Lueders
Regional Director
U.S. Fish and Wildlife Service
Southwest Region
500 Gold Avenue SW
Albuquerque, NM 87102

Jennifer Montoya
Planning and Environmental Coordinator
Bureau of Land Management
Las Cruces District Office
1800 Marquess Street
Las Cruces, NM 88005

Robert Houston
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City Manager
Alamogordo City Commission
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Richard Boss
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Alamogordo, NM 88310

Sandy Whitehead
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Truth or Consequences, NM 87901

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Manuel Sanchez
Chair
Dona Ana County Commissioners
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Las Cruces, NM 88007

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Bureau of Land Management
Roswell Field Office
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Roswell, NM 88201

Mark Matthews
Field Manager
Bureau of Land Management
Socorro Field Office
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Socorro, NM 87801

Marie Sauter
Superintendent
White Sands National Park
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Ray Dean
Mayor
Town of Carrizozo
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Ken Miyagishima
Mayor
City of Las Cruces
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Las Cruces, NM 88004

Lynn D. Crawford
Mayor
Village of Ruidoso
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Ruidoso, NM 88345

Lori Henry
Mayor
City of Roswell
425 N. Richardson Avenue
Roswell, NM 88291

Dean Holman
Mayor
City of Ruidoso Downs
123 Downs Drive
Ruidoso Downs, NM 88346

Thomas F. Stewart
Chairman
Lincoln County Board of Commissioners
300 Central Avenue
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Carrizozo, NM 88301

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Executive Director
Cloudcroft Chamber of Commerce
P.O. Box 1291
Cloudcroft, NM 88317

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President and CEO
Las Cruces Chamber of Commerce
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Las Cruces, NM 88001

Deborah Douds
Executive Director and CEO
Ruidoso Valley Chamber of Commerce
720 Sudderth Drive
Ruidoso, NM 88345

Travis Moseley
Superintendent
Lincoln National Forest
3463 Las Palomas
Alamogoro, NM 88310

Dara Dana
Commissioner
Chaves County
1 Saint Mary's Place
Roswell, NM 88203

Bill Williams
County Manager
Chaves County
1 Saint Mary's Place
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Pamela Heltner
County Manager
Otero County
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Room 106
Alamogordo, NM 88310

Greg Byus
Air Traffic Controller
Federal Aviation Administration
8000 Louisiana Boulevard NE
Albuquerque, NM 87109

Michelle Lujan Grisham
Governor
State of New Mexico
490 Old Santa Fe Trail
Room 400
Santa Fe, NM 87501

Louise Martinez
Division Director, Energy, Minerals and Natural Resources Department
New Mexico Department of Energy
1220 St. Francis Drive
Santa Fe, NM 87505

Bill Green
Commissioner
Catron County
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Reserve, NM 87830

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County Manager
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Santa Rosa, NM 88435

Leon Moya
County Coordinator
DeBaca County
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Fort Sumner, NM 88119

Amber Hamilton
County Manager
Roosevelt County
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Portales, NM 88130

Allen R. Davis
County Manager
Eddy County
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Carlsbad, NM 88220

Kathryn Leonard
Arizona State Historic Preservation Office
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Phoenix, AZ 85085

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Senator
United States Senate
Dirksen Senate Office Building, Suite B40
Washington, DC 20515

Kyrsten Sinema
Senator
United States Senate
United States Senate
Washington, DC 20515

Ann Kirkpatrick
Representative
U.S. House of Representatives
309 Cannon House Office Building
Washington, DC 20515

Doug Ducey
Governor
Governor of Arizona
1700 W. Washington St.
Phoenix, AZ 85007

Jasmine Blackwater-Nygren
Representative
Arizona House of Represenatives
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Room 126
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Gail Griffin
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Arizona House of Represenatives
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Jamescita Peshlakai
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Arizona Senate
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Room 314
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David Gowan
Senator
Arizona Senate
1700 W. Washington St.
Room 200
Phoenix, AZ 85007

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Mayor
Mayor of Clifton
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Clifton, AZ 85533

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Apache County
75 W. Cleveland Street
St. Johns, AZ 85936

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County Supervisor District 1
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253 5th Street
Clifton, AZ 85533

Ron Campbell
County Supervisor District 2
Greenlee County
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Phoenix, AZ 85086

Misael Cabrera
Director
Arizona Department of Environmental Quality
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Rebecca Chu
Environmental Review Branch
75 Hawthorne St.
Mail Code: TIP-2
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Aeronautics Group Manager
Arizona Department of Transportation
1801 W. Jefferson St.
MD 426M / P.O. Box 13588
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Ed Holloway, Jr.
District Ranger-Alpine
Apache-Sitgreaves National Forests
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BOR Phoenix Area Office
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Glendale, AZ 85306

Leslie Meyers
Area Manager
BOR Phoenix Area Office
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Glendale, AZ 85306

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Gila Box Riparian National Conservation Area
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Springerville, AZ 85938

Wendy Jo
Duputy Forest Supervisor
Apache-Sitgreaves National Forests
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Associate State Director
BLM Arizona State Office
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Joseph Vieth
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A.6.7 NPS Request Letter

United States Department of the Interior

NATIONAL PARK SERVICE
INTERMOUNTAIN REGION
12795 West Alameda Parkway
P.O. Box 25287
Denver, Colorado 80225-0287

IN REPLY REFER TO:
IMDO-RSS-EQ (1248)

April 4, 2022

VIA ELECTRONIC MAIL: NO HARD COPY TO FOLLOW

Memorandum

To: Ryan P. Keeney, Colonel, USAF
Commander
490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

From: Regional Director, Michael T. Reynolds
Intermountain Regional Office, National Park Service
Department of Interior Regions 6, 7, & 8

MICHAEL REYNOLDS
Digitally signed by MICHAEL REYNOLDS
Date: 2022.04.07 11:11:30 -06'00'

Subject: National Park Service Requests Cooperating Agency Status on the U.S. Air Force (USAF) Environmental Assessment (EA) for the *F-16 Formal Training Unit Permanent Beddown and Relocation at Holloman Air Force Base (AFB)*

The National Park Service (NPS) requests the opportunity to become a Cooperating Agency under the National Environmental Policy Act (NEPA) on the USAF EA to analyze environmental impacts associated with the F-16 Formal Training Unit Permanent Beddown and Relocation at Holloman AFB, New Mexico (NM).

Through the 1916 Organic Act the NPS is charged with protecting park resources for the enjoyment of future generations. This project has the potential to impact resources at White Sands National Park, Gila Cliff Dwellings National Park, Carlsbad Caverns National Park, and Guadalupe Mountains National Park. Because of special expertise in visitor use and natural and cultural resource management in the proposed project area, NPS staff may be able to share relevant data, participate in discussions to identify significant issues for analysis, and to identify mitigation measures as the EA progresses. Marie Frias Sauter, Superintendent of White Sands National Park, will serve as the NPS point of contact for this process and may be reached at [redacted]

Michael T. Reynolds
Regional Director

DEPARTMENT OF THE AIR FORCE
WASHINGTON, DC 20330-1000

OFFICE OF THE ASSISTANT SECRETARY

SAF/IEI
1665 Air Force Pentagon
Washington DC 20330-1665

Regional Director, Michael T. Reynolds
Intermountain Regional Office, National Park Service
Department of Interior Region 6, 7, & 8
12795 West Alameda Pkwy
Denver CO 80228

Dear Mr. Reynolds:

In response to your letter, the Air Force accepts the United States Department of the Interior National Park Services's (NPS) request to become a cooperating agency (CA) in the preparation of the environmental assessment (EA) on the impacts associated with the F-16 Formal Training Unit Permanent Beddown and Relocation at Holloman AFB, New Mexico (NM).

This CA arrangement is established pursuant to 40 C.F.R. §1501.8, Cooperating Agencies. As the lead, the DAF requests the NPS CA support by:

- Participating in the scoping process;
- Assuming responsibility, upon request by the DAF, for developing information and preparing analyses, including portions of the EIS, on issues for which the NPS has special expertise;
- Making staff support available to enhance interdisciplinary review capability and provide specific comments;
- Providing review and comments within the timelines prescribed in the program milestone schedule; and
- Responding, in writing, to this request.

The DAF will act as the Lead Agency for purposes of compliance with §7, Endangered Species Act (Title 16 United States Code [USC] §1536); §106, National Historic Preservation Act (54 USC §300101 *et seq.*); and similar regulatory consultation or coordination requirements. Should you or your staff have questions regarding the proposed action or this request, our point of contact at Headquarters Air Force is Mr. Jack Bush, at [redacted]

Sincerely

MORIARTY.ROBERT.E.1013267584 Digitally signed by MORIARTY.ROBERT.E.1013267584 Date: 2022.05.23 14:29:58 -04'00'

ROBERT E. MORIARTY, P.E., SES
Deputy Assistant Secretary of the Air Force
(Installations)

A.6.8 Sample Agency Draft EA Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (AETC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

12 February 2023

Colonel Justin B. Spears, USAF
Commander
49th Wing
490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

Dr. Jeff Pappas
State Historic Preservation Officer
New Mexico Historic Preservation Division
407 Galisteo Street, Suite 236
Santa Fe, NM 87501

Dear Dr. Pappas

In January 2021, I sent you a letter describing the Air Force's proposal to pursue the F-16 Formal Training Unit (FTU) Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico. The United States Air Force (Air Force), with the National Park Service as a cooperating agency, has prepared a Draft Environmental Assessment (EA) and Proposed Finding of No Significant Impact (FONSI) to evaluate potential environmental impacts associated with this action. Now, I would like to provide documentation of our finding of ***no adverse effect*** to historic properties and respectfully request your concurrence with this determination.

Holloman AFB currently has two permanent F-16 squadrons and one F-16 squadron on an interim basis. Under the Proposed Action, the current interim-based F-16 squadron, comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory, would be permanently relocated to Holloman AFB. Moreover, one additional F-16 squadron, comprised of 25 PAA F-16s, would also be considered for permanent relocation to Holloman AFB. The permanently relocated F-16 squadrons would use existing special use airspace (SUA), military training routes (MTRs), Air Traffic Control Assigned Airspace (ATCAA), and training ranges currently used by Holloman AFB. The beddown and relocation may require minor construction and interior modifications of facilities on Holloman AFB selected for use for aircraft and back-shop maintenance and support activities. In addition, the Air Force is proposing to use Roswell International Air Center as an auxiliary airfield to support pilot training and serve as an emergency divert field.

Under the Proposed Action, ground disturbing activities within the Holloman Area of Potential Effect (APE) would be limited to minor construction in areas that are improved or previously disturbed. No significant archaeological sites or traditional cultural properties (TCPs)

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are located within or adjacent to these areas. The only architectural resources recommended eligible for inclusion in the National Register of Historic Places (NRHP) are several miles away.

Under the Proposed Action, Roswell International Air Center (ROW) would be used for additional pattern training as an emergency field, flying additional sorties and performing additional patterns. No ground disturbance, construction, renovation, or demolition is included in the Proposed Action.

Forty-seven historic properties listed in the NRHP are located beneath the airspace APE, including the White Sands Historic District, located within White Sands National Park and Gran Quivira Mission Complex, part of Salina Pueblo Missions National Monument. Both the White Sands Historic District and the Gran Quivira Mission Complex are located under White Sands Missile Range (WSMR) no fly zones. In addition to these resources, approximately 60 significant archaeological sites (both subsurface and those with surface remains) lie under the airspace. Current data indicate no known TCPs are located under the airspace. Under the Proposed Action, any potential impacts to the noise environment associated with use of the SUA, MTRs, and ATCAAs would result in no change to a negligible increase and ground disturbance would be limited to existing ranges.

The Draft EA and the Proposed FONSI are available for download at the link provided below. Cultural Resources are discussed in Section 3.8 of this document. Per 36 CFR § 800.5, the Air Force has determined that implementation of the Proposed Action will result in ***no adverse effect*** to historic properties. We request your concurrence with this determination. To ensure we have sufficient time to consider your input, and in compliance with Section 106 of the National Historic Preservation Act, please provide any written comments on the Draft EA and Proposed FONSI 30 days from receipt of this letter and send your written concurrence and any comments to Mr. Spencer Robison, Holloman NEPA Program Manager, 49 CES/CEIE, 550 Tabosa Ave, Holloman AFB NM 88330 or via email to spencer.robison@us.af.mil.

https://www.holloman.af.mil/Environmental-Information/.

Sincerely

JUSTIN B. SPEARS, Colonel, USAF

A.6.9 Sample Government to Government Draft EA Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (AETC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

12 February 2023

Colonel Justin B. Spears, USAF
Commander
49th Wing
490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

The Honorable Brian Vallo
Governor
Pueblo of Acoma
PO Box 309
Acoma Pueblo, NM 87034-0309

Dear Governor Vallo

In January 2021, I sent you a letter describing the Air Force's proposal to pursue the F-16 Formal Training Unit (FTU) Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico and inviting you to engage in government-to government consultation regarding our proposal. The United States Air Force (Air Force), with the National Park Service as a cooperating agency, has prepared a Draft Environmental Assessment (EA) and Proposed Finding of No Significant Impact (FONSI) to evaluate potential environmental impacts associated with this action. Now, I would like to provide documentation of our finding of *no adverse effect* to historic properties.

Holloman AFB currently has two permanent F-16 squadrons and one F-16 squadron on an interim basis. Under the Proposed Action, the current interim-based F-16 squadron, comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory, would be permanently relocated to Holloman AFB. Moreover, one additional F-16 squadron, comprised of 25 PAA F-16s, would also be considered for permanent relocation to Holloman AFB. The permanently relocated F-16 squadrons would use existing special use airspace (SUA), military training routes (MTRs), Air Traffic Control Assigned Airspace (ATCAA), and training ranges currently used by Holloman AFB. The beddown and relocation may require minor construction and interior modifications of facilities on Holloman AFB selected for use for aircraft and back-shop maintenance and support activities. In addition, the Air Force is proposing to use Roswell International Air Center as an auxiliary airfield to support pilot training and serve as an emergency divert field.

Under the Proposed Action, ground disturbing activities within the Holloman Area of Potential Effect (APE) would be limited to minor construction in areas that are improved or previously disturbed. No significant archaeological sites are located within or adjacent to these

COMBAT AIRPOWER STARTS HERE

areas. The only architectural resources recommended eligible for inclusion in the National Register of Historic Places (NRHP) are several miles away.

Under the Proposed Action, Roswell International Air Center (ROW) would be used for additional pattern training as an emergency field, flying additional sorties and performing additional patterns. No ground disturbance, construction, renovation, or demolition is included in the Proposed Action.

Forty-seven historic properties listed in the NRHP are located beneath the airspace APE, including the White Sands Historic District, located within White Sands National Park and Gran Quivira Mission Complex, part of Salina Pueblo Missions National Monument. Both the White Sands Historic District and the Gran Quivira Mission Complex are located under White Sands Missile Range no fly zones. In addition to these resources, approximately 60 significant archaeological sites (both subsurface and those with surface remains) lie under the airspace. Under the Proposed Action, any potential impacts to the noise environment associated with use of the SUA, MTRs, and ATCAAs would result in no change to a negligible increase and ground disturbance would be limited to existing ranges.

To date, Holloman AFB has not received any comments or concerns regarding properties of religious or cultural significance at Holloman AFB, ROW, or under the special use airspace. Please let us know any of these sites are present, along with any supporting information you are able and willing to share on their significance. If detailed disclosure is not appropriate, in-person confidential consultations can be arranged. To ensure that we can make full use of any information you provide, it would be helpful to hear back from you within 30 days of receipt of this letter.

The Draft EA and the Proposed FONSI are available for download at the link provided below. Cultural Resources are discussed in Section 3.8 of this document. Per 36 CFR § 800.5, the Air Force has determined that implementation of the Proposed Action will result in ***no adverse effect*** to historic properties given the data collected and provided to date as part of this analysis. We respectfully request your concurrence with this determination. I have designated Colonel Nicholas R. Pederson as my point of contact for this intergovernmental consultation. Colonel Pederson can be reached by electronic mail at [redacted] or by phone at [redacted] Thank you in advance for your consideration.

https://www.holloman.af.mil/Environmental-Information/.

Sincerely

Justin B. Spears

JUSTIN B. SPEARS, Colonel, USAF

A.6.10 Sample General Draft EA Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (AETC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

December 30, 2022

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49th Wing 490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

Jennifer Montoya
Planning and Environmental Coordinator
Bureau of Land Management, Las Cruces District Office
1800 Marquess Street
Las Cruces, NM 88005

Dear Ms. Montoya

The United States Air Force (Air Force) has prepared a Draft Environmental Assessment (EA) and Proposed Finding of No Significant Impact (FONSI) to evaluate potential environmental impacts associated with the F-16 Formal Training Unit (FTU) Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico. The National Park Service is a cooperating agency on the project. The need for the Proposed Action is to permanently base the F-16 FTU. Increasingly, fighter pilots of the Combat Air Forces have been operating at degraded levels of proficiency and training readiness resulting from diminishing fiscal resources. Air Force readiness is currently affected by several issues, including training, weapon system sustainment, and facilities. Training in particular has become an increasing concern as worldwide commitments, high operations tempo, and fiscal and manpower limitations detract from available training resources. The Proposed Action would facilitate the Air Education and Training Command's (AETC) ability to fulfill its training mission.

Holloman AFB currently has two permanent F-16 squadrons and one F-16 squadron on an interim basis. Under the Proposed Action, the current interim-based F-16 squadron, comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory, would be permanently relocated to Holloman AFB. Moreover, one additional F-16 squadron, comprised of 25 PAA F-16s, would also be considered for permanent relocation to Holloman AFB. The permanently relocated F-16 squadrons would use existing special use airspace, military training routes, Air Traffic Control Assigned Airspace, and training ranges currently used by Holloman AFB. The beddown and relocation may require minor construction and interior modifications of facilities on Holloman AFB selected for use for aircraft and back-shop maintenance and support activities. In addition, the Air Force is proposing to use Roswell International Air Center as an auxiliary airfield to support pilot training and serve as an emergency divert field.

COMBAT AIRPOWER STARTS HERE

Executive Order 12372, Intergovernmental Review of Federal Programs, requires federal agencies to solicit federal agency as well as state and local government participation in the NEPA process. We are requesting your participation in the review and comment process. The Draft EA and the Proposed FONSI are available for download at the link provided below. Those who were unable to access these documents online are asked to call Public Affairs at 575-572-7381 or send us an e-mail at 49wg.paoffice@us.af.mil to arrange alternate access.

https://www.holloman.af.mil/Environmental-Information/

Please provide comments on the Draft EA and proposed FONSI within 30 days of receipt of this memorandum to Mr. Spencer Robison, Holloman NEPA Program Manager, 49 CES/CEIE, 550 Tabosa Ave, Holloman AFB NM 88330 or via email to spencer.robison@us.af.mil.

Sincerely

JUSTIN B. SPEARS, Colonel, USAF

A.6.11 Sample Tribal Draft EA Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (AETC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

12 February 2023

Colonel Justin B. Spears, USAF
Commander
49th Wing
490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

Amy Lueders
Regional Director
U.S. Fish and Wildlife Service, Southwest Region
500 Gold Avenue SW
Albuquerque NM 87102

Dear Ms. Lueders

The United States Air Force (Air Force) has prepared a Draft Environmental Assessment (EA) and Proposed Finding of No Significant Impact (FONSI) to evaluate potential environmental impacts associated with the F-16 Formal Training Unit (FTU) Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico. The National Park Service is a cooperating agency on the project. The need for the Proposed Action is to permanently base the F-16 FTU. Increasingly, fighter pilots of the Combat Air Forces have been operating at degraded levels of proficiency and training readiness resulting from diminishing fiscal resources. Air Force readiness is currently affected by several issues, including training, weapon system sustainment, and facilities. Training in particular has become an increasing concern as worldwide commitments, high operations tempo, and fiscal and manpower limitations detract from available training resources. The Proposed Action would facilitate the Air Education and Training Command's (AETC) ability to fulfill its training mission.

Holloman AFB currently has two permanent F-16 squadrons and one F-16 squadron on an interim basis. Under the Proposed Action, the current interim-based F-16 squadron, comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory, would be permanently relocated to Holloman AFB. Moreover, one additional F-16 squadron, comprised of 25 PAA F-16s, would also be considered for permanent relocation to Holloman AFB. The permanently relocated F-16 squadrons would use existing special use airspace, military training routes, Air Traffic Control Assigned Airspace, and training ranges currently used by Holloman AFB. The beddown and relocation may require minor construction and interior modifications of facilities on Holloman AFB selected for use for aircraft and back-shop maintenance and support activities. In addition, the Air Force is proposing to use Roswell International Air Center as an auxiliary airfield to support pilot training and serve as an emergency divert field.

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Please provide comments on the Draft EA and proposed FONSI within 30 days of receipt of this memorandum to Mr. Spencer Robison, Holloman NEPA Program Manager, 49 CES/CEIE, 550 Tabosa Ave, Holloman AFB NM 88330 or via email to spencer.robison@us.af.mil.

Sincerely

Justin B. Spears

JUSTIN B. SPEARS, Colonel, USAF

A.6.12 Draft EA Notice of Availability

Alamogordo Daily News

Affidavit of Publication
Ad # 0005697933
This is not an invoice

JESSICA BOTTE / VERS AR
[redacted]

I, being duly sworn, on my oath say that I am the Legal Coordinator of the **Alamogordo Daily News**, a newspaper of daily circulation,published and printed in the English language at the City of Alamogordo, Otero County, and State of New Mexico. That the Alamogordo Daily News has been regularly published and issued for more than nine months prior to the date of the first publication hereinafter mentioned.

05/21/2023

Legal Clerk

Subscribed and sworn before me this May 21, 2023:

State of WI, County of Brown
NOTARY PUBLIC

1-7-25
My commission expires

KATHLEEN ALLEN
Notary Public
State of Wisconsin

Ad # 0005697933
PO #: 0005697933
# of Affidavits 1
This is not an invoice

NOTICE OF AVAILABILITY

Draft Environmental Assessment for the F-16 Formal Training Unit Permanent Beddown and Relocation Holloman Air Force Base, New Mexico

A Draft Environmental Assessment (EA) and Proposed Finding of No Significant Impact (FONSI) have been prepared by the United States Air Force to analyze the impacts associated with the F-16 Formal Training Unit (FTU) Permanent Beddown and Relocation at Holloman Air Force Base (AFB).

The Proposed Action would permanently relocate F-16 aircraft and associated pilot, maintenance, and support personnel, and support vehicles and equipment. Holloman AFB currently has two permanent F-16 squadrons and one F-16 squadron on an interim basis. Under the Proposed Action, the current interim-based F-16 squadron, comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory, would be permanently relocated to Holloman AFB. Moreover, one additional F-16 squadron, comprised of 25 PAA F-16s, would also be considered for permanent relocation to Holloman AFB. The permanently relocated F-16 squadrons would use existing special use airspace, Air Traffic Controlled Assigned Airspace, and training ranges currently used by Holloman AFB. The beddown and relocation may require minor construction and interior modifications of facilities on Holloman AFB selected for use for aircraft and back--shop maintenance and support activities. In addition, the Air Force is proposing to use the Roswell International Air Center as an auxiliary airfield to support pilot training and serve as an emergency divert.

The Draft EA and Proposed FONSI are available for review at the Alamogordo Public Library and online at the Holloman AFB website: https://www.holloman.af.mil/Environmental-Information Please provide any comments within 30 days from the date of this Notice of Availability. Please note that in accordance with Privacy Act provisions, the Air Force will not publish personal information of commenters, such as home addresses, e--mail addresses, or phone numbers. Please mail or e--mail comments or requests for information to:

Mr. Spencer Robison
Holloman NEPA Program Manager
49 CES/CEIE
550 Tabosa Avenue
Holloman AFB, NM 88330
spencer.robison@us.af.mil

Public Affairs

Public Affairs
(575) 572-7381
49wg.paoffice@us.af.mil
#5697933, Daily News, May 21, 2023

Las Cruces Sun News.
PART OF THE USA TODAY NETWORK

Affidavit of Publication

Ad # 0005697638

This is not an invoice

JESSICA BOTTE / VERS AR

[redacted]

I, a legal clerk of the **Las Cruces Sun News**, a newspaper published daily at the county of Dona Ana, state of New Mexico and of general paid circulation in said county; that the same is a duly qualified newspaper under the laws of the State wherein legal notices and advertisements may be published; that the printed notice attached hereto was published in the regular and entire edition of said newspaper and not in supplement thereof in editions dated as follows:

05/21/2023

Despondent further states this newspaper is duly qualified to publish legal notice or advertisements within the meaning of Sec. Chapter 167, Laws of 1937.

Legal Clerk

Subscribed and sworn before me this May 21, 2023:

State of WI, County of Brown
NOTARY PUBLIC

1-7-26

My commission expires

KATHLEEN ALLEN
Notary Public
State of Wisconsin

Ad # 0005697638
PO #:
\# of Affidavits 1

This is not an invoice

NOTICE OF AVAILABILITY
Draft Environmental Assessment for the F-16 Formal Training Unit Permanent Beddown and Relocation Holloman Air Force Base, New Mexico

A Draft Environmental Assessment (EA) and Proposed Finding of No Significant Impact (FONSI) have been prepared by the United States Air Force to analyze the impacts associated with the F-16 Formal Training Unit (FTU) Permanent Beddown and Relocation at Holloman Air Force Base (AFB).
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The Draft EA and Proposed FONSI are available for review at the Alamogordo Public Library and online at the Holloman AFB website: https://www.holloman.af.mil/Environmental-Information
Please provide any comments within 30 days from the date of this Notice of Availability. Please note that in accordance with Privacy Act provisions, the Air Force will not publish personal information of commenters, such as home addresses, e-mail addresses, or phone numbers. Please mail or e-mail comments or requests for information to:

Mr. Spencer Robison
Holloman NEPA Program Manager
49 CES/CEIE
550 Tabosa Avenue
Holloman AFB, NM 88330
spencer.robison@us.af.mil

Public Affairs
(575) 572-7381
49wg.paoffice@us.af.mil

\#5697638, Sun-News, May 21, 2023

A.6.13 Draft EA Comment Letters

From: Jessica Schmerler [redacted]
Sent: Thursday, June 15, 2023 4:06 PM
To: ROBISON, SPENCER R CIV USAF AETC 49 CES/CEIE [redacted]
Subject: [Non-DoD Source] TPWD Response: Draft EA and FONSI Holloman AFB Project, New Mexico

Hi Spencer,

TPWD Environmental Review Team has reviewed the Draft EA and Proposed FONSI to evaluate potential environmental impacts associated with the F-16 Formal Training Unit (FTU) Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico. Based on a review of the documentation and description provided, the Environmental Review Team does not anticipate significant adverse impacts to rare, threatened, or endangered species, or other fish and wildlife resources. However, please note it is the responsibility of the project proponent to comply with all federal, state, and local laws that protect fish and wildlife. Provided the project plans do not change, TPWD considers coordination to be complete.

We appreciate the opportunity to review and comment on this project. If you have any questions, please contact me at [redacted] or [redacted]

Thanks!
Jessica

Jessica E. Schmerler, CWB
Environmental Review Biologist
Ecological & Environmental Planning Program
Texas Parks and Wildlife Department

From: Nethers, Deborah L (Debbie) CIV USARMY USAG (USA) [redacted]
Sent: Friday, June 30, 2023 4:20 PM
To: ROBISON, SPENCER R CIV USAF AETC 49 CES/CEIE [redacted]
Subject: Environmental Assessment F-16 Formal Training Unit Bed down & Relocation @ HAFB

Mr. Robinson

The draft environmental assessment was shared with stakeholders representing various units within White Sands Missile Range to include the Garrison, Test Center, Defense Threat Reduction Agency, and the Navy. These representatives did not include Air Space Management. The absence of feedback may suggest there was not enough time to review. Feedback received suggests there are no known conflicts with operations at White Sands Missile Range.

Thank you for the opportunity to review the document and contribute to the NEPA process.

Debbie

Debbie Nethers
Ecologist
Branch Chief, Customer Support
Environmental Division
Directorate Public Works
USAG White Sands Missile Range

Building 163, Springfield Ave.
AMIM-WSP-E-CS
White Sands Missile Range, NM 88002
[redacted] office

Michelle Lujan Grisham
Governor

STATE OF NEW MEXICO
DEPARTMENT OF CULTURAL AFFAIRS
HISTORIC PRESERVATION DIVISION

BATAAN MEMORIAL BUILDING
407 GALISTEO STREET, SUITE 236
SANTA FE, NEW MEXICO 87501
PHONE (505) 827-6320 – NM.SHPO@state.nm.us

June 1, 2023

Colonel Justin Spears, USAF
Commander
49th Wing
490 First Street, Suite 1700
Holloman Air Force Base NM 88330-8277

Colonel Spears:

Thank you for submitting the proposal to pursue the F-16 Formal Training Unit Permanent Beddown and Relocation at Holloman Air Force base, New Mexico.

The New Mexico State Historic Preservation Office concurs with your finding of no adverse effect. Please feel free to contact me at the email address below if you have questions.

Best regards,
Steven

Steven Moffson
State and National Register Coordinator
New Mexico Historic Preservation Division
407 Galisteo Street, Suite 236
Santa Fe, New Mexico 87501
[redacted]

Please note new email:
[redacted]

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

June 6, 2023

Spencer Robison
Holloman NEPA Program Manager
49 CES/CEIE
550 Tabosa Ave.
Holloman AFB, NM 88330

Via: E-mail

Re: TCEQ NEPA Request #2023-100. F-16 Formal Training Unit Permanent Beddown and Relocation at Holloman Air Force Base (AFB), New Mexico. Culberson and Hudspeth Counties.

Dear Mr. Robison,

The Texas Commission on Environmental Quality (TCEQ) has reviewed the above-referenced project and offers the following comments:

The proposed action is located in Culberson and Hudspeth Counties, which are currently designated attainment/unclassifiable for the National Ambient Air Quality Standards for all six criteria air pollutants. Federal Clean Air Act, §176(c) general conformity requirements do not apply for this action.

We are in support of the project. The environmental assessment addresses issues related to surface and groundwater quality.

The management of industrial and hazardous waste at the site including waste treatment, processing, storage and/or disposal is subject to state and federal regulations. Construction and Demolition waste must be sent for recycling or disposal at a facility authorized by the TCEQ. Special waste authorization may be required for the disposal of asbestos containing material.

Thank you for the opportunity to review this project. If you have any questions, please contact the agency NEPA coordinator at (512) 239-2619 or NEPA@tceq.texas.gov

Sincerely,

Ryan Vise,
Division Director
External Relations

P.O. Box 13087 • Austin, Texas 78711-3087 • 512-239-0010 • tceq.texas.gov

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Mexico Ecological Services Field Office
2105 Osuna Road NE
Albuquerque, New Mexico 87113
Telephone 505-346-2525 Fax 505-346-2542
www.fws.gov/southwest/es/newmexico/

August 30, 2023

Cons. # 2023-0061959

David Martin
Program Manager, AFCEC/CZN
United States Air Force
3515 S General McMullen
San Antonio TX 78226

Dear Mr. Martin:

Thank you for your letter received July 17, 2023, requesting informal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act (Act) of 1973 (16 U.S.C. § 1531 *et seq.*), as amended, for the permanent F-16 Formal Training Units (FTU) beddown and relocation at Holloman Air Force Base (AFB) in Alamogordo, New Mexico. Your letter was accompanied by an environmental assessment and an attachment which included effect determinations for federally listed species. We reached out to you for clarification regarding the proposed action and your effect determinations, and received a response on August 15, 2023. Your environmental assessment, the accompanying attachment, and your email providing clarification are hereby incorporated by reference. Your environmental assessment included two alternatives, Alternative 1 (the preferred alternative), which includes the permanent relocation of an F-16 squadron, comprised of 25 F-16s and two Backup Aircraft Inventory, currently located at Holloman AFB; and Alternative 2, which is the same as Alternative 1, but also includes the permanent relocation of one additional F-16 squadron to Holloman AFB. Both alternatives include the permanent relocation of associated pilot, maintenance, and support personnel, and support vehicles and equipment to Holloman AFB.

The permanent beddown and relocation of F-16 Formal Training Units at Holloman AFB may require construction and modification of existing facilities. Alternative 1 would require the construction (additions to) and renovation of two existing buildings and one existing hangar, and Alternative 2 would require the construction (additions to) and renovation of eight existing buildings, one existing hangar, and an existing aircraft parking ramp. F-16 Formal Training Unit squadrons will continue to use Special Use Airspace (SUA) (including Military Operation Areas and Restricted Areas), Air Traffic Controlled Assigned Airspace (ATCAAs), Military Training Routes (MTRs), and training ranges currently used for training by Holloman AFB. Under both alternatives the Roswell

David Martin, Program Manager, U.S. Air Force

International Air Center would be used as an auxiliary airfield to support pilot training and serve as an emergency divert field.

You determined the proposed action "may affect, is not likely to adversely affect" the endangered southwestern willow flycatcher (*Empidonax traillii extimus*), the southern distinct population segment of the lesser prairie-chicken (*Tympanuchus pallidicinctus*) and the threatened Mexican spotted owl (*Strix occidentalis lucida*), piping plover (*Charadrius melodus*), and the western yellow-billed cuckoo (*Coccyzus americanus*). In your request, you also determined the proposed action "may affect, is not likely to jeopardize the continued existence of" the northern aplomado falcon (*Falco femoralis septentrionalis)* and the Mexican gray wolf (*Canis lupus baileyi*), which are both considered nonessential experimental populations under section 10(j) of the Act. Additionally, you determined that the proposed action "may affect, is not likely to jeopardize the continued existence of" the monarch butterfly (*Danaus plexippus*), which is a candidate species under the Act.

You also determined that the proposed action would have no effect on several other species listed under the Act. Although the Act does not require Federal agencies to consult with the Service if the action agency determines their action will have "no effect" on threatened or endangered species or designated critical habitat (50 CFR 402.12), we appreciate notification of your determinations.

We concur with your determination of "may affect, is not likely to adversely affect" for the southwestern willow flycatcher, lesser prairie-chicken, Mexican spotted owl, piping plover, and western yellow-billed cuckoo. We also concur with your determination of "may affect, is not likely to jeopardize the continued existence of" the northern aplomado falcon, Mexican gray wolf, and monarch butterfly. We concur with these determinations based on the rationale provided below:

- **Activities within Holloman AFB:** Holloman AFB would limit ground disturbing activities would be limited to improved and previously disturbed land, and the number of aircraft and operations at Holloman AFB would not change. Therefore, existing noise conditions will not change.
- **Activities within Roswell International Air Center:** Under the proposed action existing noise conditions will not change, compared to existing conditions within the Roswell International Air Center.
- **Activities within SUA, ATCAAs, MOAs, and training areas:** Aircraft training has occurred in these airspaces for decades, and most wildlife has likely become habituated to aircraft movement and noise. Holloman AFB is proposing no ground-disturbing activities within the SUA and ATCAAs, and proposed activities are limited to aircraft overflights and use of defensive countermeasures in the airspace. Under the proposed action, the number of operations or noise within the SUA or ATCAAs will not increase compared to existing conditions. Sonic booms from supersonic flights within authorized areas of the SUA and ATCAAs could cause startle effects on or near the ground level; however, these sounds do not differ substantially from thunder. Furthermore, the sonic boom events would be highly isolated and rare occurrences and would occur in areas where supersonic flights currently happen with military training activities. The net number of sorties, except for the Talon ATCAA and MOAs, would not increase from the current conditions. The number of sorties that would be flown by Holloman AFB within the Talon ATCAA and MOAs would not

David Martin, Program Manager, U.S. Air Force

exceed the number of sorties analyzed in the Special Use Airspace Optimization Final Environmental Impact Statement and Record of Decision, which has previously been consulted on (02ENNM00-2020-I-0781). The amount of training munitions used would not change from amount currently used. The use of flares in the SUA and ATCAAs is subject to altitude and seasonal restrictions based on specific location and the fire danger level, which greatly reduces the risk of wildland fires. Additionally, the potential for animals to come into contact with or ingest chaff and flare materials such as plastic caps is low and insignificant.

Additionally, prior consultation with the Holloman AFB in 2018 (#02-ENNM00-2012-1-0065-R001) on the effects of low-altitude military jet aircraft, including the F-16, on the occupancy and nesting success of the owl in New Mexico resulted in implementation of seasonal altitude restrictions of 200 feet above ground level (AGL) for spotted owl habitat. We determined in that consultation that the impacts to the owl from overflights under this restriction were "insignificant and discountable".

- **Activities across the entire action area:** Aircrews would continue to adhere to the Bird Aircraft Strike Hazard (BASH) reduction measures outlined in the BASH prevention program to reduce the likelihood for bird and wildlife aircraft strikes. Northern aplomado falcon and piping plover are not anticipated to be present within the action area. There would be no impacts to monarch butterfly habitat, and projected mortality from strikes and jet blasts is negligible.

This concludes informal section 7 consultation for the F-16 formal training unit permanent beddown and relocation to Holloman Air Force Base in Alamogordo, New Mexico. Please contact the Service if: 1) new information reveals effects of the action that may affect listed species or critical habitat in any way not considered in this analysis, 2) if the action is modified in a manner that causes an effect to listed species or critical habitat not considered in this analysis, or 3) if a new species is listed or critical habitat is designated that may be affected by the proposed project

Thank you for your interest in conserving listed species and New Mexico's fish and wildlife resources. In future communications regarding this letter or the project, please contact Lauren Rangel of my staff at (505) 761-4745 or lauren_rangel@fws.gov.

Sincerely,

SHAWN SARTORIUS
Digitally signed by SHAWN SARTORIUS
Date: 2023.08.20 11:54:14 -06'00'

Shawn Sartorius
Field Supervisor

David Martin, Program Manager, U.S. Air Force

cc (electronic):
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division, Santa Fe, New Mexico
Biological Scientist, Holloman Air Force Base, U.S. Air Force
State Species Lead Biologist (Lesser Prairie-Chicken), U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, Albuquerque, New Mexico

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APPENDIX B
REASONABLY FORESEEABLE FUTURE ACTIONS

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Table B-1
Reasonably Foreseeable Future Projects at Holloman Air Force Base and Roswell International Air Center

Scheduled Project	Project Summary	Implementation Date	Relevance to Proposed Action	Interaction with Resources
Holloman Air Force Base				
NC3 Shipping/Storage Facility	MILCON project includes a 67,000-square-foot warehouse in Basic Expeditionary Airfield Resources Base.	Construction anticipated 2021	Potential construction overlap with the Proposed Action	Noise, Air Quality, Land Use
Airfield and Access Control Points Improvements EA	Project at Holloman AFB includes the construction, renovation, infrastructure, and demolition over a 3-year phased approach. Improvements include projects on the airfield and access control points	Anticipated 2025	Potential construction overlap with the Proposed Action	Infrastructure, Safety, Transportation, Air Quality
High Speed Test Track Operations Final Programmatic EA	Continued operations at the Holloman High Speed Test Track and minor modifications with the existing built environment and processes.	Ongoing and future	Potential overlap with the Proposed Action	Noise, Air Quality, Land Use
Special Use Airspace Optimization Final EIS	Proposal to optimize existing MOAs in Arizona to include Sunny, Bagdad, Gladden, Outlaw, Jackal, Reserve, Morenci, Tombstone, Ruby, Fuzzy, and Sells.	EIS is under development	Reserve and Morenci MOAs are adjacent to proposed MOAs	Airspace Management, Air Quality
Roswell International Air Center				
Small Community Air Service Development Grant	Roswell International Air Center received $750,000 grant from the US DOT for expansion of commercial air service. Includes the expansion of air service and the potential for construction of a new facility.	Ongoing and future	Additional flights could overlap with the Proposed Action	Airspace Management, Air Quality, Noise

Notes:
A review of resources from Alamogordo, Roswell, and Chavez and Otero Counties found no infrastructure projects that would result in a measurable incremental impact when added to the Proposed Action.
EA = Environmental Assessment; EIS = Environmental Impact Statement; MOA = Military Operations Area; MILCON = military construction; US DOT = US Department of Transportation

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APPENDIX C
DEFINITION OF RESOURCES

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C.1 AIRSPACE MANAGEMENT AND USE

C.1.1 Definition of the Resource

Airspace management involves the direction, control, and handling of flight operations in the airspace that overlies the borders of the United States and its territories. Under Title 49, U.S.C. § 40103, *Sovereignty and Use of Airspace*, and Public Law No. 103-272, the US government has exclusive sovereignty over the nation's airspace. The Federal Aviation Administration (FAA) has the responsibility to plan, manage, and control the structure and use of all airspace over the United States. FAA rules govern the national airspace system, and FAA regulations establish how and where aircraft may fly. Collectively, the FAA uses these rules and regulations to make airspace use as safe, effective, and compatible as possible for all types of aircraft, from private propeller-driven planes to large, high-speed commercial and military jets.

Terminal airspace around civil airports is defined by the terminal airspace area designations for each airport (FAA Order Job Order 7400.11F, *Air Traffic Organization Policy, Airspace Designations and Reporting Points*). These airspace designations include Class A through G, which specify the airspace within which all aircraft operators are subject to operating rules and equipment requirements of Part 91 of the Federal Aviation Regulations (see 14 CFR § 91.130). General descriptions of the airspace classifications common to civil airports, including Class C, D, and E airspace, are described following. More specific rules may apply to Roswell International Air Center (ROW).

Class C. Generally, this is the airspace from the surface to 4,000 feet (ft) above the airport elevation (charted in mean sea level [MSL]) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and have a certain number of Instrument Flight Rules (IFR) operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually consists of a surface area with a 5-nautical mile (NM) radius, an outer circle with a 10-NM radius that extends from 1,200 to 4,000 ft above the airport elevation, and an outer area. Each aircraft must establish two-way radio communications with the Air Traffic Control (ATC) facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace.

Class D. Generally, this is the airspace from the surface to 2,500 ft above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures. Arrival extensions for instrument approach procedures may be Class D or Class E airspace. Unless otherwise authorized, each aircraft must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace.

Class E. Generally, if the airspace is not Class A, B, C, or D and is controlled airspace, then it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Also, in this class are federal airways, airspace beginning at either 700 or 1,200 ft above ground level (AGL) used to transition to and from the terminal or en route environment and en route domestic and offshore airspace areas designated below 18,000 ft MSL. Unless designated at a lower altitude, Class E airspace begins at 14,500 ft MSL over the United States, including that airspace overlying the waters within 12 NM of the coast of the 48 contiguous states and Alaska, up to but not including 18,000 ft MSL, and the airspace above flight level 600.

Aircraft use different kinds of airspace according to the specific rules and procedures defined by the FAA for each type of airspace. For the Proposed Action, F-16 Formal Training Unit (FTU) activities would utilize special use airspace (SUA) and Military Training Routes (MTRs) proximate to Holloman AFB. Special use airspace includes Military Operations Areas (MOAs), Restricted Areas, and Air Traffic Control Assigned Airspace (ATCAAs). A MOA is designated airspace outside of Class A airspace used to separate or segregate certain nonhazardous military activities from IFR traffic and to identify for Visual Flight Rules (VFR) traffic where these activities are conducted (14 CFR § 1.1). Activities in MOAs include, but are not limited to, air combat maneuvers, air intercepts, and low-altitude tactics. The defined vertical and lateral limits vary for each MOA. While MOAs generally extend from 1,200 ft AGL to 18,000 ft above MSL, the floor may extend below 1,200 ft AGL if there is a mission requirement and minimal adverse aeronautical effect. MOAs allow military aircraft to practice maneuvers and tactical flight training at airspeeds in excess of 250 knots indicated airspeed (approximately 285 miles [mi] per hour). The FAA requires publication of the hours of operation for any MOA so that all pilots, both military and civilian, are aware of when other aircraft could be in the airspace. Each military organization responsible for a MOA develops a daily use schedule. Although the FAA designates MOAs for military use, other pilots may transit the airspace under VFR. MOAs exist to notify civil pilots under VFR where heavy volumes of military training exist which increases the chance of conflict and are generally avoided by VFR traffic. MOAs in the vicinity of busy airports may have specific avoidance procedures that also apply to small private and municipal airports. Such avoidance procedures are maintained for each MOA, and both civil and military aircrews build them into daily flight plans. Restricted areas are typically used by the military due to safety or security concerns. Hazards include existence of unusual and often invisible threats from artillery use, aerial gunnery, or guided missiles. An ATCAA is an airspace of defined vertical/lateral limits assigned by FAA ATC for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic. Typically, these blocks of airspace start at flight level 180 or 18,000 ft MSL and, in some cases, are contoured to the dimensions of the MOAs beneath them. MTRs are aerial corridors in which military aircraft generally operate below 10,000 ft MSL at airspeeds exceeding 250 kn, the airspeed limit for other aircraft flying below 10,000 ft MSL. MTRs are divided into three sub-types: visual routes (VRs), instrument routes (IRs), and slow-speed low-altitude routes (SRs). Operations on VRs are conducted only when the weather is at or above VFR minimums of five miles or more visibility and a weather ceiling of 3,000 ft or more. Operations on IRs are flown under IFR conditions where pilots use instruments without the aid of ground-based visual cues and may fly during periods of reduced visibility.

Each military organization responsible for special use airspace develops a daily use schedule. Although the FAA designates special use airspace and MTRs for military use, other pilots may transit the airspace. Avoidance procedures are maintained for each special use airspace and military training route, and military aircrews build them into daily flight plans.

C.1.2 References

14 CFR §91.130 – Operations in Class C Airspace.

14 CFR §1.1 – General Definitions.

49 U.S. Code §40103. Sovereignty and Use of Airspace.

Public Law No. 103-272, 1994.

USDOT, FAA. 2021. Order JO 7400.11F, *Air Traffic Organization Policy*, *Airspace Designations and Reporting Points*.

C.2 SOUND, NOISE, AND POTENTIAL EFFECTS

C.2.1 Introduction

This appendix discusses sound and noise and their potential effects on the human and natural environment. **Section C.2.2** provides an overview of the basics of sound and noise. **Section C.2.3** defines and describes the different metrics used to describe noise. The largest section, **Section C.2.4**, reviews the potential effects of noise, focusing on effects on humans but also addressing effects on property values, terrain, structures, and animals. **Section C.2.5** contains the list of references cited. **Appendix C.2** contains data used in the noise modeling process. A number of noise metrics are defined and described in this appendix. Some metrics are included for the sake of completeness when discussing each metric and to provide a comparison of cumulative noise metrics.

C.2.2 Basics of Sound

C.2.2.1 Sound Waves and Decibels

Sound consists of minute vibrations in the air that travel through the air and are sensed by the human ear. **Figure C-1** is a sketch of sound waves from a tuning fork. The waves move outward as a series of crests where the air is compressed and troughs where the air is expanded. The height of the crests and the depth of the troughs are the amplitude or sound pressure of the wave. The pressure determines its energy or intensity. The number of crests or troughs that pass a given point each second is called the frequency of the sound wave.

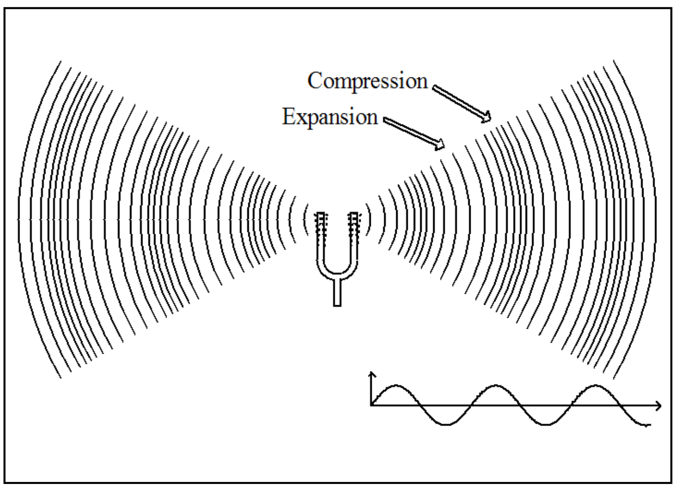


Figure C-1. Sound Waves from a Vibrating Tuning Fork.

The measurement and human perception of sound involves three basic physical characteristics: intensity, frequency, and duration.

- Intensity is a measure of the acoustic energy of the sound and related to sound pressure. The greater the sound pressure, the more energy carried by the sound and the louder the perception of that sound.
- Frequency determines how the pitch of the sound is perceived. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches.
- Duration or the length of time the sound can be detected.

The loudest sounds that can be comfortably heard by the human ear have intensities a trillion times higher than those of sounds barely heard. Because of this vast range, it is unwieldy to use a linear scale to represent the intensity of sound. As a result, a logarithmic unit known as the decibel (abbreviated dB) is used to represent the intensity of a sound. Such a representation is called a sound level. A sound level of

0 dB is approximately the threshold of human hearing and barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above 120 dB begin to be felt inside the human ear as discomfort. Sound levels between 130 and 140 dB are felt as pain (Berglund and Lindvall, 1995).

As shown on **Figure C-1**, the sound from a tuning fork spreads out uniformly as it travels from the source. The spreading causes the sound's intensity to decrease with increasing distance from the source. For a source such as an aircraft in flight, the sound level will decrease by about 6 dB for every doubling of the distance. For a busy highway, the sound level will decrease by 3 to 4.5 dB for every doubling of distance.

As sound travels from the source, it also is absorbed by the air. The amount of absorption depends on the frequency composition of the sound, temperature, and humidity conditions. Sound with high frequency content gets absorbed by the air more than sound with low frequency content. More sound is absorbed in colder and drier conditions than in hot and wet conditions. Sound is also affected by wind and temperature gradients, terrain (elevation and ground cover), and structures.

Because of the logarithmic nature of the decibel unit, sound levels cannot simply be added or subtracted and are somewhat cumbersome to handle mathematically; however, some simple rules are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. For example:

60 dB + 60 dB = 63 dB, and
80 dB + 80 dB = 83 dB.

Second, the total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

60.0 dB + 70.0 dB = 70.4 dB.

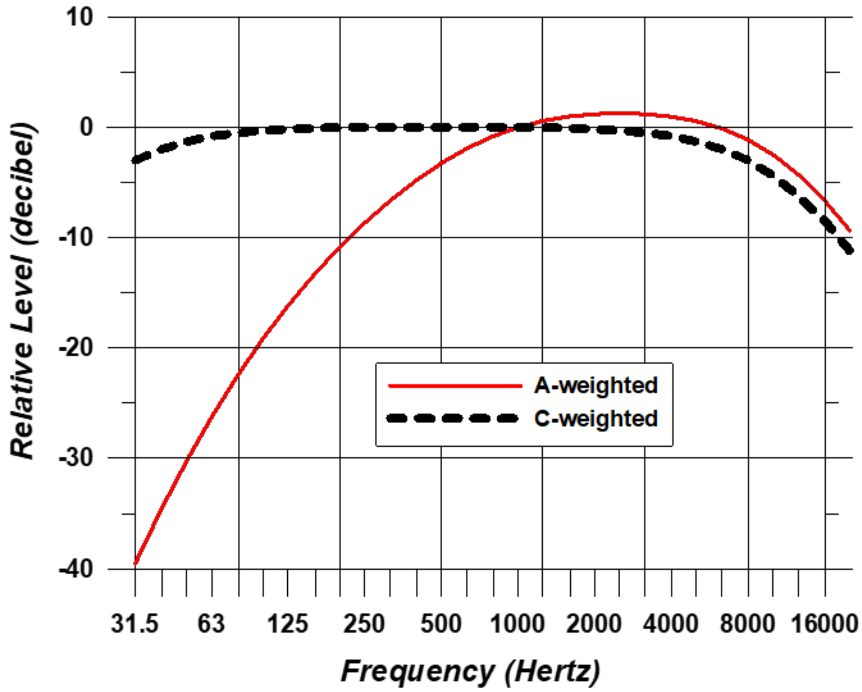
Because the addition of sound levels is different than that of ordinary numbers, this process is often referred to as "decibel addition."

The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. On average, a person perceives a change in sound level of about 10 dB as a doubling (or halving) of the sound's loudness. This relation holds true for loud and quiet sounds. A decrease in sound level of 10 dB actually represents a 90 percent decrease in sound intensity but only a 50 percent decrease in perceived loudness because the human ear does not respond linearly.

Sound frequency is measured in terms of cycles per second or hertz (Hz). The normal ear of a young person can detect sounds that range in frequency from about 20 to 20,000 Hz. As we get older, we lose the ability to hear high frequency sounds. Not all sounds in this wide range of frequencies are heard equally. Human hearing is most sensitive to frequencies in the 1,000 to 4,000 Hz range. The notes on a piano range from just over 27 to 4,186 Hz, with middle C equal to 261.6 Hz. Most sounds (including a single note on a piano) are not simple pure tones like the tuning fork on **Figure C-1** but contain a mix, or spectrum, of many frequencies.

Sounds with different spectra are perceived differently even if the sound levels are the same. Weighting curves have been developed to correspond to the sensitivity and perception of different types of sound. A-weighting and C-weighting are the two most common weightings. These two curves, shown on **Figure C-2**, are adequate to quantify most environmental noises. A-weighting puts emphasis on the 1,000- to 4,000-Hz range where human hearing is most sensitive.

Very loud or impulsive sounds, such as explosions or sonic booms, can sometimes be felt and cause secondary effects, such as shaking of a structure or rattling of windows. These types of sounds can add to annoyance and are best measured by C-weighted sound levels, denoted dBC. C-weighting is nearly flat throughout the audible frequency range and includes low frequencies that may not be heard but cause shaking or rattling. C-weighting approximates the human ear's sensitivity to higher intensity sounds.



Source: ANSI S1.4A -1985 "Specification of Sound Level Meters"

Figure C-2. Frequency Characteristics of A- and C-Weighting.

C.2.2.2 Sound Levels and Types of Sounds

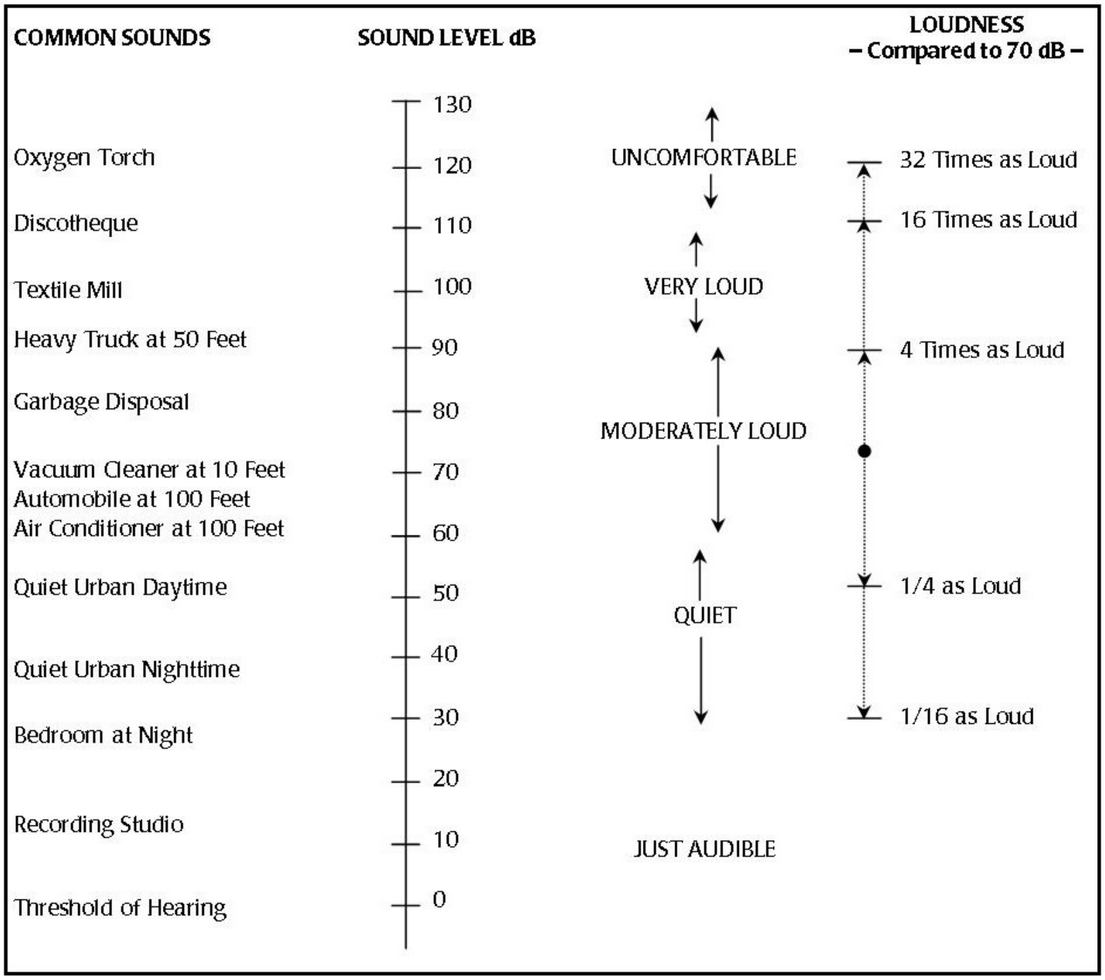
Most environmental sounds are measured using A-weighting. They are called A-weighted sound levels and sometimes use the unit dBA or dB(A) rather than dB. When the use of A-weighting is understood, the term "A-weighted" is often omitted and the unit dB is used. Unless otherwise stated, dB units refer to A-weighted sound levels.

Sound becomes noise when it is unwelcome and interferes with normal activities, such as sleep or conversation. Noise is unwanted sound. Noise can become an issue when its level exceeds the ambient or background sound level. Ambient noise in urban areas typically varies from 60 to 70 dB but can be as high as 80 dB in the center of a large city. Quiet suburban neighborhoods experience ambient noise levels around 45 to 50 dB (United States Environmental Protection Agency [USEPA], 1978).

Figure C-3 shows A-weighted sound levels from common sources. Some sources, like the air conditioner and vacuum cleaner, are continuous sounds whose levels are constant for some time. Some sources, like the automobile and heavy truck, are the maximum sound during an intermittent event like a vehicle pass-by. Some sources like "urban daytime" and "urban nighttime" are averages over extended periods. A variety of noise metrics have been developed to describe noise over different time periods. These are discussed in detail in **Section C.2.3**.

Aircraft noise consists of two major types of sound events: flight (including takeoffs, landings, and flyovers) and stationary, such as engine maintenance run-ups. The former is intermittent and the latter primarily continuous. Noise from aircraft overflights typically occurs beneath main approach and departure paths, in local air traffic patterns around the airfield, and in areas near aircraft parking ramps and staging areas. As aircraft climb, the noise received on the ground drops to lower levels, eventually fading into the background or ambient levels.

Impulsive noises are generally short, loud events. Their single-event duration is usually less than 1 second. Examples of impulsive noises are small-arms gunfire, hammering, pile driving, metal impacts during rail-yard shunting operations, and riveting. Examples of high-energy impulsive sounds are quarry/mining explosions, sonic booms, demolition, and industrial processes that use high explosives, military ordnance (e.g., armor, artillery and mortar fire, and bombs), explosive ignition of rockets and missiles, and any other explosive source where the equivalent mass of dynamite exceeds 25 grams (American National Standards Institute [ANSI], 1996).



Source: Harris, 1979

Figure C-3. Typical A-weighted Sound Levels of Common Sounds.

C.2.3 Noise Metrics

Noise metrics quantify sounds so they can be compared with each other and, with their effects, in a standard way. There are a number of metrics that can be used to describe a range of situations, from a particular individual event to the cumulative effect of all noise events over a long time. This section describes the metrics relevant to environmental noise analysis.

C.2.3.1 Single Events

Maximum Sound Level

The highest A-weighted sound level measured during a single event in which the sound changes with time is called the maximum A-weighted sound level or Maximum Sound Level and abbreviated L_{max}. The L_{max} is depicted for a sample event in **Figure C-4**.

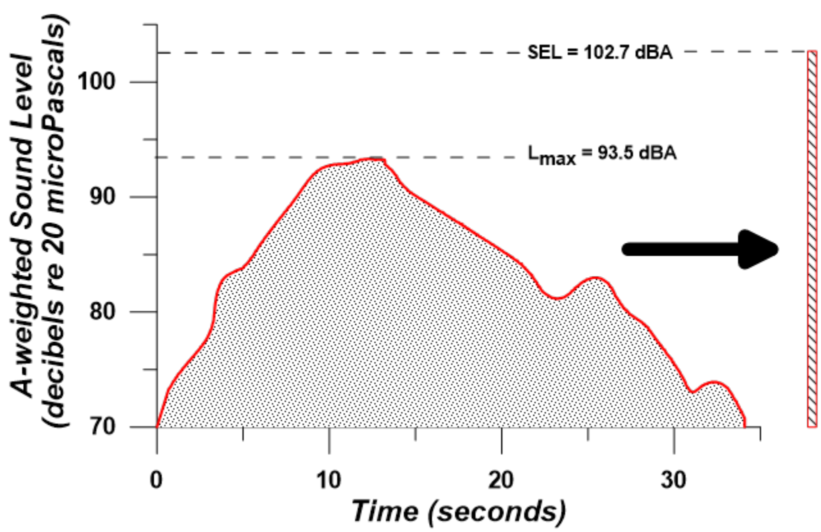
L_{max} is the maximum level that occurs over a fraction of a second. For aircraft noise, the "fraction of a second" is one-eighth of a second, denoted as "fast" response on a sound level measuring meter (ANSI, 1988). Slowly varying or steady sounds are generally measured over 1 second, denoted as "slow" response. L_{max} is important in judging if a noise event will interfere with conversation, television or radio listening, or other common activities. Although it provides some measure of the event, it does not fully describe the noise because it does not account for how long the sound is heard.

Peak Sound Pressure Level

The Peak Sound Pressure Level (L_{pk}) is the highest instantaneous level measured by a sound level measurement meter. L_{pk} is typically measured every 20 microseconds and usually based on unweighted or linear response of the meter. It is used to describe individual impulsive events such as blast noise. Because blast noise varies from shot to shot and varies with meteorological (weather) conditions, the US Department of Defense (DOD) usually characterizes L_{pk} by the metric PK 15(met), which is the L_{pk} exceeded 15 percent of the time. The "met" notation refers to the metric accounting for varied meteorological or weather conditions.

Sound Exposure Level

Sound Exposure Level (SEL) combines both the intensity of a sound and its duration. For an aircraft flyover, SEL includes the maximum and all lower noise levels produced as part of the overflight, together with how long each part lasts. It represents the total sound energy in the event. **Figure C-4** indicates the SEL for an example event, representing it as if all the sound energy were contained within 1 second.



Source: Wyle Laboratories

Figure C-4. Example Time History of Aircraft Noise Flyover.

Aircraft noise varies with time. During an aircraft overflight, noise starts at the background level, rises to a maximum level as the aircraft flies close to the observer, then returns to the background as the aircraft recedes into the distance. This is sketched on **Figure C-4**, which also indicates two metrics (L_{max} and SEL) that are described above. Over time there can be a number of events, not all the same. Because aircraft noise events last more than a few seconds, the SEL value is larger than L_{max}. It does not directly represent the sound level heard at any given time but rather the entire event. SEL provides a much better measure of aircraft flyover noise exposure than L_{max} alone.

Overpressure

The single event metrics commonly used to assess supersonic noise from sonic booms are overpressure in pound(s) per square foot and C-Weighted Sound Exposure Level (CSEL). Overpressure is the peak pressure at any location within the sonic boom footprint. When sonic booms reach the ground, they impact an area that is referred to as a “carpet.” The size of the carpet depends on the supersonic flight path and on atmospheric conditions. The width of the boom carpet beneath the aircraft is about 1 mi for each 1,000 ft of altitude (National Aeronautics and Space Administration [NASA], 2017). Sonic booms are loudest near the center of the carpet, under the flight path for steady, level flight conditions, having a sharp “bang-bang” sound. Near the edges, they are weak and have a rumbling sounding like distant thunder. The location of these booms will vary with changing flight paths and weather conditions, so it is unlikely that any given location will experience these undertrack levels more than once over multiple events. Public reaction is expected to occur with overpressures above 1 psf, and in rare instances, damage to structures have occurred at overpressures between 2 and 5 psf (NASA, 2017).

C-Weighted Sound Exposure Level

CSEL is SEL computed with C frequency weighting, which is similar to A-Weighting (discussed in **Section B.1.2.2**) except that C-weighting places more emphasis on low frequencies below 1,000 Hz.

C.2.3.2 Cumulative Events

Equivalent Sound Level

Equivalent Sound Level (L_{eq}) is a “cumulative” metric that combines a series of noise events over a period of time. L_{eq} is the sound level that represents the decibel average SEL of all sounds in the time period. Just as SEL has proven to be a good measure of a single event, L_{eq} has proven to be a good measure of series of events during a given time period.

The time period of an L_{eq} measurement is usually related to some activity and given along with the value. The time period is often shown in parenthesis (e.g., L_{eq}[24] for 24 hours). The L_{eq} from 7:00 a.m. to 3:00 p.m. may give exposure of noise for a school day.

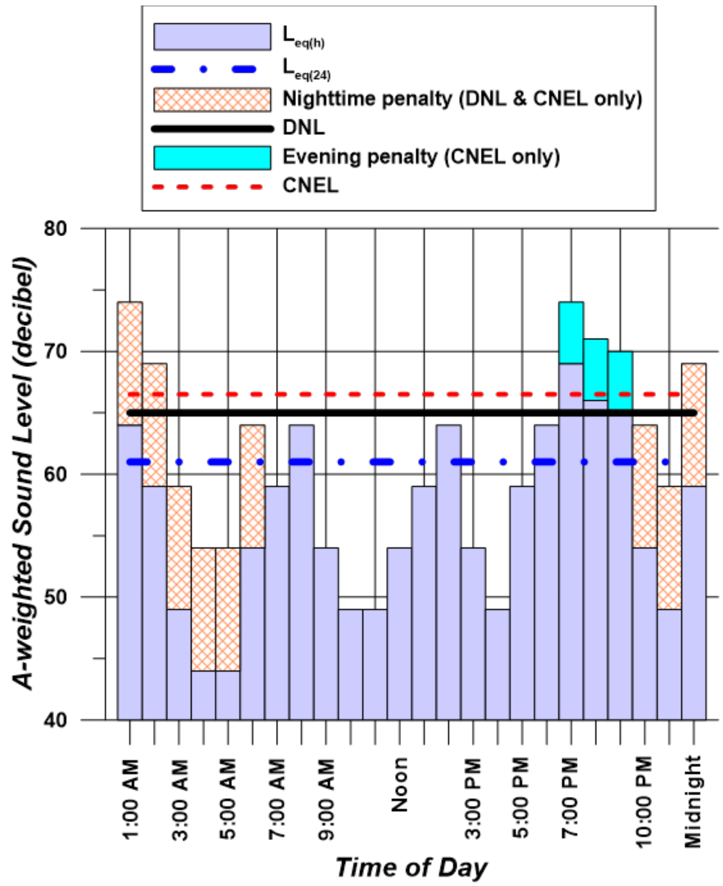
Figure C-5 gives an example of L_{eq}(24) using notional hourly average noise levels (L_{eq}[h]) for each hour of the day as an example. The L_{eq}(24) for this example is 61 dB.

Day-Night Average Sound Level and Community Noise Equivalent Level

Day-Night Average Sound Level (DNL or L_{dn}) is a cumulative metric that accounts for all noise events in a 24-hour period. However, unlike L_{eq}(24), DNL contains a nighttime noise penalty. To account for our increased sensitivity to noise at night, DNL applies a 10-dB penalty to events during the nighttime period, defined as 10:00 p.m. to 7:00 a.m. The notations DNL and L_{dn} are both used for Day-Night Average Sound Level and are equivalent.

Community Noise Equivalent Level (CNEL) is a variation of DNL specified by law in California (California Code of Regulations Title 21, Public Works) (Wyle Laboratories, 1971). CNEL has the 10-dB nighttime penalty for events between 10:00 p.m. and 7:00 a.m. but also includes a 4.8-dB penalty for events during the evening period of 7:00 p.m. to 10:00 p.m. The evening penalty in CNEL accounts for the added intrusiveness of sounds during that period. For airports and military airfields, DNL and CNEL represent the average sound level for annual average daily aircraft events.

Figure C-5 gives an example of DNL and CNEL using notional hourly average noise levels (L_{eq}[h]) for each hour of the day as an example. Note the L_{eq}(h) for the hours between 10:00 p.m. and 7:00 a.m. have a 10-dB penalty assigned. For CNEL, the hours between 7:00 p.m. and 10:00 p.m. have a 4.8-dB penalty assigned. The DNL for this example is 65 dB. The CNEL for this example is 66 dB.



Source: Wyle Laboratories

Figure C-5. Example of Equivalent Sound Level over 24 hours, Day-Night Average Sound Level, and Community Noise Equivalent Level Computed from Hourly Equivalent Sound Levels.

Figure C-6 shows the ranges of DNL or CNEL that occur in various types of communities. Under a flight path at a major airport, the DNL may exceed 80 dB while rural areas may experience DNL less than 45 dB. The decibel summation nature of these metrics causes the noise levels of the loudest events to control the 24-hour average. As a simple example, consider a case in which only one aircraft overflight occurs during the daytime over a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23 hours, 59 minutes, and 30 seconds of the day, the ambient sound level is 50 dB. The DNL for this 24-hour period is 65.9 dB. Assume, as a second example that 10 such 30-second overflights occur during daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23 hours and 55 minutes of the day. The DNL for this 24-hour period is 75.5 dB. Clearly, the averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events.

A feature of the DNL metric is that a given DNL value could result from a very few noisy events or a large number of quieter events. For example, one overflight at 90 dB creates the same DNL as 10 overflights at 80 dB.

DNL or CNEL does not represent a level heard at any given time but represent long-term exposure. Scientific studies have found good correlation between the percentages of groups of people highly annoyed and the level of average noise exposure measured in DNL (Schultz, 1978; USEPA, 1978).

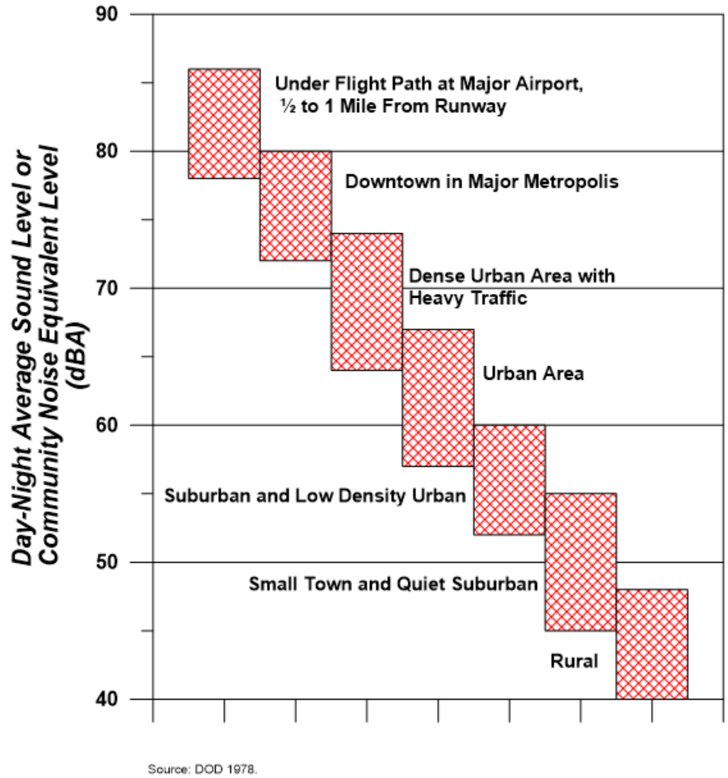


Figure C-6. Typical Day-Night Average Sound Level or Community Noise Equivalent Level Ranges in Various Types of Communities.

Onset-Rate Adjusted Monthly Day-Night Average Sound Level and Onset-Rate Adjusted Monthly Community Noise Equivalent Level

Military aircraft utilizing special use airspace such as MTRs, MOAs, and restricted areas generate a noise environment that is somewhat different from that around airfields. Rather than regularly occurring operations like at airfields, activity in special use airspace is highly sporadic. It is often seasonal, ranging from 10 per hour to less than 1 per week. Individual military overflight events also differ from typical community noise events in that noise from a low-altitude, high-airspeed flyover can have a rather sudden onset, with rates of up to 150 dB per second.

The cumulative daily noise metric devised to account for the “surprise” effect of the sudden onset of aircraft noise events on humans and the sporadic nature of special use airspace activity is the Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}). Onset rates between 15 and 150 dB per second require an adjustment of 0 to 11 dB to the event’s SEL while onset rates below 15 dB per second require no adjustment to the event’s SEL (Stusnick et al., 1992). The term ‘monthly’ in L_{dnmr} refers to the noise assessment being conducted for the month with the most operations or sorties -- the so-called busiest month.

In California, a variant of the L_{dnmr} includes a penalty for evening operations (7:00 p.m. to 10:00 p.m.) and is denoted Onset-Rate Adjusted Monthly Community Noise Equivalent Level ($CNEL_{mr}$).

C.2.3.3 Supplemental Metrics

Number-of-Events Above a Threshold Level

The Number-of-Events Above (NA) metric gives the total number of events that exceed a noise level threshold (L) during a specified period of time. Combined with the selected threshold, the metric is denoted

NAL. The threshold can be either SEL or L_{max}, and it is important that this selection is shown in the nomenclature. When labeling a contour line or point of interest, NAL is followed by the number of events in parentheses. For example, where 10 events exceed an SEL of 90 dB over a given period of time, the nomenclature would be NA90SEL(10). Similarly, for L_{max} it would be NA90L_{max}(10). The period of time can be an average 24-hour day, daytime, nighttime, school day, or any other time period appropriate to the nature and application of the analysis.

NA is a supplemental metric valuable in helping to describe noise to the community. A threshold level and metric are selected that best meet the need for each situation. An L_{max} threshold is normally selected to analyze speech interference, while an SEL threshold is normally selected for analysis of sleep disturbance.

The NA metric is the only supplemental metric that combines single-event noise levels with the number of aircraft operations. In essence, it answers the question of how many aircraft (or range of aircraft) fly over a given location or area at or above a selected threshold noise level.

Time Above a Specified Level

The Time Above (TA) metric is the total time, in minutes, that the A-weighted noise level is at or above a threshold. Combined with the threshold level (L), it is denoted TAL. TA can be calculated over a full 24-hour annual average day, the 15-hour daytime and 9-hour nighttime periods, a school day, or any other time period of interest, provided there is operational data for that time.

TA is a supplemental metric, used to help understand noise exposure. It is useful for describing the noise environment in schools, particularly when assessing classroom or other noise sensitive areas for various scenarios. TA can be shown as contours on a map similar to the way DNL contours are drawn.

TA helps describe the noise exposure of an individual event or many events occurring over a given time period. When computed for a full day, the TA can be compared alongside the DNL in order to determine the sound levels and total duration of events that contribute to the DNL. TA analysis is usually conducted along with NA analysis, so the results show not only how many events occur, but also the total duration of those events above the threshold.

C.2.4 Noise Effects

Noise is of concern because of potential adverse effects. The following subsections describe how noise can affect communities and the environment and how those effects are quantified. The specific topics discussed are:

- annoyance;
- speech interference;
- sleep disturbance;
- noise effects on children; and
- noise effects on domestic animals and wildlife.

C.2.4.1 Annoyance

With the introduction of jet aircraft in the 1950s, it became clear that aircraft noise annoyed people and was a significant problem around airports. Early studies, such as those of Rosenblith et al. (1953) and Stevens et al. (1953) showed that effects depended on the quality of the sound, its level, and the number of flights. Over the next 20 years considerable research was performed refining this understanding and setting guidelines for noise exposure. In the early 1970s, the USEPA published its "Levels Document" (USEPA, 1974) that reviewed the factors that affected communities. DNL (still known as L_{dn} at the time) was identified as an appropriate noise metric, and threshold criteria were recommended.

Threshold criteria for annoyance were identified from social surveys, where people exposed to noise were asked how noise affects them. Surveys provide direct real-world data on how noise affects actual residents.

Surveys in the early years had a range of designs and formats and needed some interpretation to find common ground. In 1978, Schultz showed that the common ground was the number of people "highly annoyed," defined as the upper 28 percent range of whatever response scale a survey used (Schultz, 1978). With that definition, he was able to show a remarkable consistency among the majority of the surveys for which data were available. **Figure C-7** shows the result of his study relating DNL to individual annoyance measured by percent highly annoyed (%HA).

Schultz's original synthesis included 161 data points. **Figure C-8** shows a comparison of the predicted response of the Schultz data set with an expanded set of 400 data points collected through 1989 (Finegold et al., 1994). The new form is the preferred form in the United States, endorsed by the Federal Interagency Committee on Aviation Noise (FICAN, 1997). Other forms have been proposed, such as that of Fidell and Silvati (2004) but have not gained widespread acceptance.

When the goodness of fit of the Schultz curve is examined, the correlation between groups of people is high, in the range of 85 to 90 percent; however, the correlation between individuals is much lower, at 50 percent or less. This is not surprising, given the personal differences between individuals. The surveys underlying the Schultz curve include results that show that annoyance to noise is also affected by nonacoustical factors. Newman and Beattie (1985) divided the nonacoustic factors into the emotional and physical variables shown in **Table C-1**.

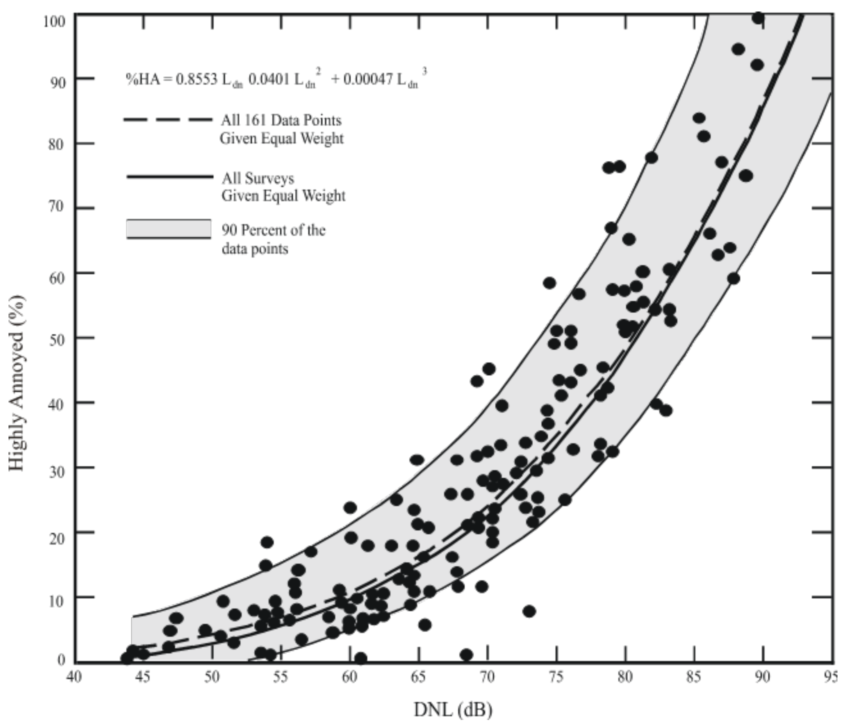


Figure C-7. Schultz Curve Relating Noise Annoyance to Day-Night Average Sound Level (Schultz, 1978).

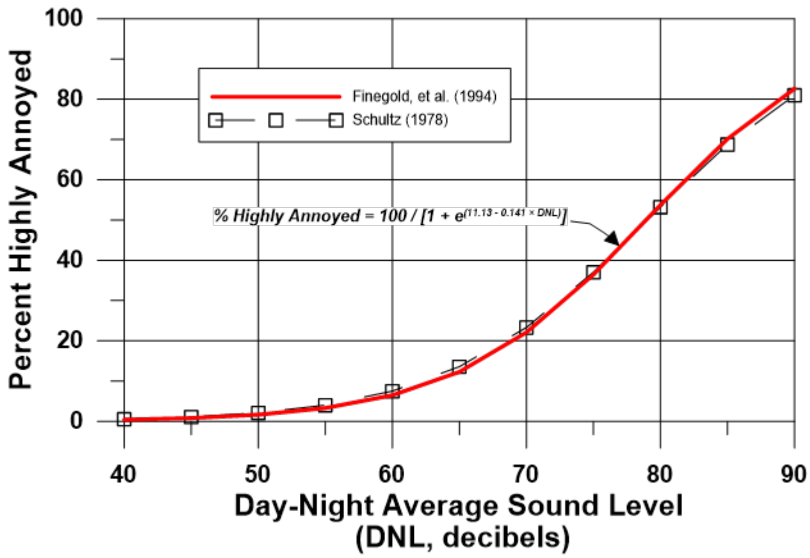


Figure C-8. Response of Communities to Noise; Comparison of Original Schultz (1978) with Finegold et al. (1994).

Table C-1
Nonacoustic Variables Influencing Aircraft Noise Annoyance

Emotional Variables
Feeling about the necessity or preventability of the noise
Judgement of the importance and value of the activity that is producing the noise
Activity at the time an individual hears the noise
Attitude about the environment
General sensitivity to noise
Belief about the effect of noise on health
Feeling of fear associated with the noise

Physical Variables
Type of neighborhood
Time of day
Season
Predictability of the noise
Control over the noise source
Length of time individual is exposed to a noise

Schreckenberg and Schuemer (2010) recently examined the importance of some of these factors on short term annoyance. Attitudinal factors were identified as having an effect on annoyance. In formal regression analysis, however, sound level (L_{eq}) was found to be more important than attitude. A series of studies at three European airports showed that less than 20 percent of the variance in annoyance can be explained by noise alone (Márki, 2013).

A recent study by Plotkin et al. (2011) examined updating DNL to account for these factors. It was concluded that the data requirements for a general analysis were much greater than are available from most existing studies. It was noted that the most significant issue with DNL is that it is not readily understood by the public and that supplemental metrics such as TA and NA were valuable in addressing attitude when communicating noise analysis to communities (DOD, 2009a).

A factor that is partially nonacoustical is the source of the noise. Miedema and Vos (1998) presented synthesis curves for the relationship between DNL and percentage “Annoyed” and percentage “Highly Annoyed” for three transportation noise sources. Different curves were found for aircraft, road traffic, and railway noise. **Table C-2** summarizes their results. Comparing the updated Schultz curve suggests that the percentage of people highly annoyed by aircraft noise may be higher than previously thought. Miedema and Oudshoorn (2001) authors supplemented that investigation with further derivation of percent of population highly annoyed as a function of either DNL or DENL along with the corresponding 95 percent confidence intervals with similar results.

Table C-2
Percent Highly Annoyed for Different Transportation Noise Sources

Day-Night Average Sound Level (decibels)	Percent Highly Annoyed (%HA)			
	Miedema and Vos			Schultz Combined
	Air	Road	Rail	
55	12	7	4	3
60	19	12	7	6
65	28	18	11	12
70	37	29	16	22
75	48	40	22	36

Source: Miedema and Vos, 1998

As noted by the World Health Organization (WHO), however, even though aircraft noise seems to produce a stronger annoyance response than road traffic, caution should be exercised when interpreting synthesized data from different studies (WHO, 1999).

Consistent with WHO's recommendations, the Federal Interagency Committee on Noise (FICON, 1992) considered the Schultz curve to be the best source of dose information to predict community response to noise but recommended further research to investigate the differences in perception of noise from different sources.

The International Standard (ISO 1996:1-2016) update introduced the concept of Community Tolerance Level (L_{ct}) as the day-night sound level at which 50 percent of the people in a particular community are predicted to be highly annoyed by noise exposure. L_{ct} accounts for differences between sources and/or communities when predicting the percentage highly annoyed by noise exposure. ISO also recommended a change to the adjustment range used when comparing aircraft noise to road noise. The previous edition suggested +3 to +6 dB for aircraft noise relative to road noise while the latest editions recommend an adjustment range of +5 to +8 dB. This adjustment range allows DNL to be correlated to consistent annoyance rates when originating from different noise sources (i.e., road traffic, aircraft, or railroad). This change to the adjustment range would increase the calculated percent highly annoyed at the 65-dB DNL by approximately 2 to 5 percent greater than the previous ISO definition. **Figure C-9** depicts the estimated percentage of people highly annoyed for a given DNL using both the ISO 1996-1 estimation and the older FICON 1992 method. The results suggest that the percentage of people highly annoyed may be greater than previous thought and reliance solely on DNL for impact analysis may be insufficient if utilizing the FICON 1992 method.

The US Federal Aviation Administration (FAA) is currently conducting a major airport community noise survey at approximately 20 US airports in order to update the relationship between aircraft noise and annoyance. Results from this study are expected to be released in 2018.

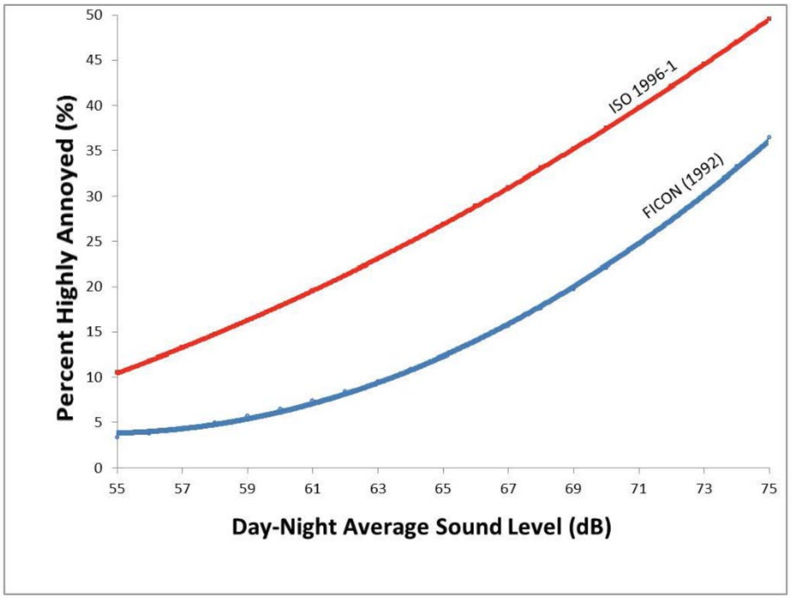


Figure C-9. Percent Highly Annoyed Comparison of International Standard 1996-1 to Federal Interagency Committee on Noise (1992).

C.2.4.2 Speech Interference

Speech interference from noise is a primary cause of annoyance for communities. Disruption of routine activities such as radio or television listening, telephone use, or conversation leads to frustration and annoyance. The quality of speech communication is important in classrooms and offices. In the workplace, speech interference from noise can cause fatigue and vocal strain in those who attempt to talk over the noise. In schools it can impair learning.

There are two measures of speech comprehension:

1. Word Intelligibility - the percent of words spoken and understood. This might be important for students in the lower grades who are learning the English language and particularly for students who have English as a Second Language.
2. Sentence Intelligibility – the percent of sentences spoken and understood. This might be important for high-school students and adults who are familiar with the language and who do not necessarily have to understand each word in order to understand sentences.

__United States Federal Criteria for Interior Noise__

In 1974, the USEPA identified a goal of an indoor L_{eq}(24) of 45 dB to minimize speech interference based on sentence intelligibility and the presence of steady noise (USEPA, 1974). **Figure C-10** shows the effect of steady indoor background sound levels on sentence intelligibility. For an average adult with normal hearing and fluency in the language, steady background indoor sound levels of less than the 45-dB L_{eq} are expected to allow 100 percent sentence intelligibility.

The curve on **Figure C-10** shows 99 percent intelligibility at L_{eq} below 54 dB and less than 10 percent above 73 dB. Recalling that L_{eq} is dominated by louder noise events, the USEPA L_{eq}(24) goal of 45 dB generally ensures that sentence intelligibility will be high most of the time.

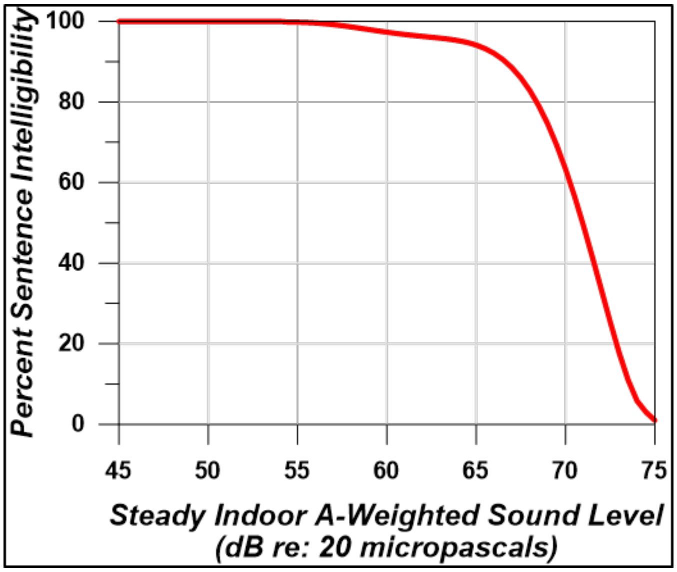


Figure C-10. Speech Intelligibility Curve (digitized from USEPA, 1974).

Classroom Criteria

For teachers to be understood, their regular voice must be clear and uninterrupted. Background noise has to be below the teacher's voice level. Intermittent noise events that momentarily drown out the teacher's voice need to be kept to a minimum. It is therefore important to evaluate the steady background level, level of voice communication, and single-event level due to aircraft overflights that might interfere with speech.

Lazarus (1990) found that for listeners with normal hearing and fluency in the language, complete sentence intelligibility can be achieved when the signal-to-noise ratio (i.e., a comparison of the level of the sound to the level of background noise) is in the range of 15 to 18 dB. The initial ANSI (2002) classroom noise standard and American Speech-Language-Hearing Association (2005) guidelines concur, recommending at least a 15-dB signal-to-noise ratio in classrooms. If the teacher's voice level is at least 50 dB, the background noise level must not exceed an average of 35 dB. The National Research Council of Canada (Bradley, 1993) and WHO (1999) agree with this criterion for background noise.

For eligibility for noise insulation funding, the FAA guidelines state that the design objective for a classroom environment is the 45-dB L_{eq} during normal school hours (FAA, 1985).

Most aircraft noise is not continuous. It consists of individual events like the one sketched on **Figure C-4**. Since speech interference in the presence of aircraft noise is caused by individual aircraft flyover events, a time-averaged metric alone, such as L_{eq}, is not necessarily appropriate. In addition to the background level criteria described above, single-event criteria that account for those noisy events are also needed.

A 1984 study by Wyle for the Port Authority of New York and New Jersey recommended using Speech Interference Level (SIL) for classroom noise criteria (Sharp and Plotkin, 1984). SIL is based on the maximum sound levels in the frequency range that most affects speech communication (500 to 2,000 Hz). The study identified an SIL of 45 dB as the goal. This would provide 90 percent word intelligibility for the short time periods during aircraft overflights. While SIL is technically the best metric for speech interference, it can be approximated by an L_{max} value. An SIL of 45 dB is equivalent to an A-weighted L_{max} of 50 dB for aircraft noise (Wesler, 1986).

Lind et al. (1998) also concluded that an L_{max} criterion of 50 dB would result in 90 percent word intelligibility. Bradley (1985) recommends SEL as a better indicator. His work indicates that 95 percent word intelligibility would be achieved when indoor SEL did not exceed 60 dB. For typical flyover noise, this corresponds to an L_{max} of 50 dB. While WHO (1999) only specifies a background L_{max} criterion, they also note the SIL frequencies, and that interference can begin at around 50 dB.

The United Kingdom Department for Education and Skills (UKDfES) established in its classroom acoustics guide a 30-minute time-averaged metric of L_{eq}(30min) for background levels and the metric of LA1,30min for intermittent noises, at thresholds of 30 to 35 dB and 55 dB, respectively. LA1,30min represents the A-weighted sound level that is exceeded 1 percent of the time (in this case, during a 30-minute teaching session) and is generally equivalent to the L_{max} metric (UKDfES, 2003).

Table C-3 summarizes the criteria discussed. Other than the FAA (1985) 45 dB L_{max} criterion, they are consistent with a limit on indoor background noise of 35 to 40 dB L_{eq} and a single event limit of 50 dB L_{max}. It should be noted that these limits were set based on students with normal hearing and no special needs. At-risk students may be adversely affected at lower sound levels.

Table C-3
Indoor Noise Level Criteria Based on Speech Intelligibility

Source	Metric/Level (dB)	Effects and Notes
Federal Aviation Administration (1985)	$L_{eq(during\ school\ hours)}$ = 45 dB	Federal assistance criteria for school sound insulation; supplemental single-event criteria may be used.
Lind et al. (1998), Sharp and Plotkin (1984), Wesler (1986)	L_{max} = 50 dB / Speech Interference Level 45	Single event level permissible in the classroom.
World Health Organization (1999)	L_{eq} = 35 dB L_{max} = 50 dB	Assumes average speech level of 50 dB and recommends signal to noise ratio of 15 dB.
American National Standards Institute (2010)	L_{eq} = 35 dB, based on Room Volume (e.g., cubic feet)	Acceptable background level for continuous and intermittent noise.
United Kingdom Department for Education and Skills (2003)	$L_{eq(30min)}$ = 30-35 dB L_{max} = 55 dB	Minimum acceptable in classroom and most other learning environs.

Notes:
dB = decibels; L_{eq} = Equivalent Sound Level; L_{max} = Maximum Sound Level

C.2.4.3 Sleep Disturbance

Sleep disturbance is a major concern for communities exposed to aircraft noise at night. A number of studies have attempted to quantify the effects of noise on sleep. This section provides an overview of the major noise-induced sleep disturbance studies. Emphasis is on studies that have influenced US federal noise policy. The studies have been separated into two groups:

1. Initial studies performed in the 1960s and 1970s, where the research was focused on sleep observations performed under laboratory conditions.
2. Later studies performed in the 1990s up to the present, where the research was focused on field observations.

<u>Initial Studies</u>

The relation between noise and sleep disturbance is complex and not fully understood. The disturbance depends not only on the depth of sleep and the noise level but also on the nonacoustic factors cited for annoyance. The easiest effect to measure is the number of arousals or awakenings from noise events. Much of the literature has therefore focused on predicting the percentage of the population that will be awakened at various noise levels.

FICON's 1992 review of airport noise issues (FICON, 1992) included an overview of relevant research conducted through the 1970s. Literature reviews and analyses were conducted from 1978 through 1989 using existing data (Griefahn, 1978; Lukas, 1978; Pearsons et al., 1989). Because of large variability in the data, FICON did not endorse the reliability of those results.

FICON did, however, recommend an interim dose-response curve, awaiting future research. That curve predicted the percent of the population expected to be awakened as a function of the exposure to SEL. This curve was based on research conducted for the US Air Force (Finegold, 1994). The data included most of the research performed up to that point and predicted a 10 percent probability of awakening when exposed to an interior SEL of 58 dB. The data used to derive this curve were primarily from controlled laboratory studies.

Recent Sleep Disturbance Research – Field and Laboratory Studies

It was noted that early sleep laboratory studies did not account for some important factors. These included habituation to the laboratory, previous exposure to noise, and awakenings from noise other than aircraft. In the early 1990s, field studies in people's homes were conducted to validate the earlier laboratory work conducted in the 1960s and 1970s. The field studies of the 1990s (e.g., Horne, 1994) found that 80 to 90 percent of sleep disturbances were not related to outdoor noise events but rather to indoor noises and nonnoise factors. The results showed that, in real life conditions, there was less of an effect of noise on sleep than had been previously reported from laboratory studies. Laboratory sleep studies tend to show more sleep disturbance than field studies because people who sleep in their own homes are used to their environment and, therefore, do not wake up as easily (FICAN, 1997).

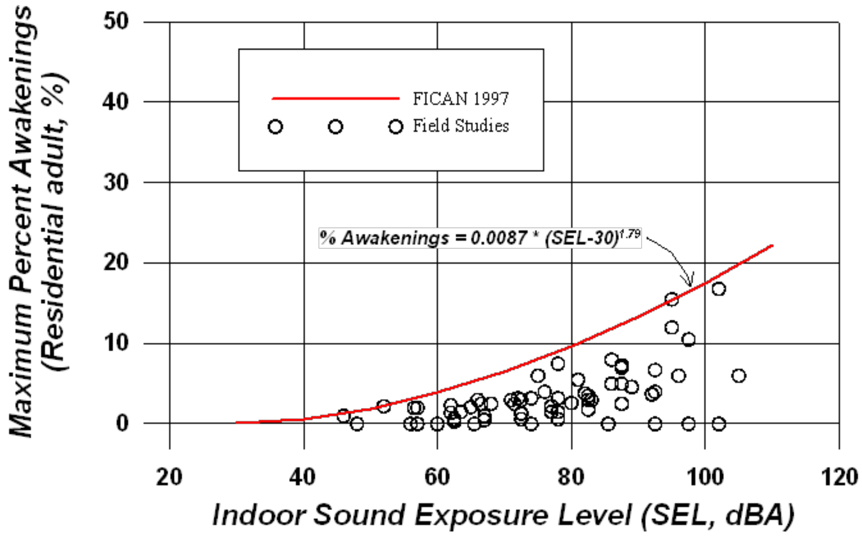
FICAN

Based on this new information, in 1997 FICAN recommended a dose-response curve to use instead of the earlier 1992 FICON curve (FICAN, 1997). **Figure C-11** shows FICAN's curve, the red line, which is based on the results of three field studies shown in the figure (Ollerhead et al., 1992; Fidell et al., 1994, 1995a, 1995b), along with the data from six previous field studies.

The 1997 FICAN curve represents the upper envelope of the latest field data. It predicts the maximum percent awakened for a given residential population. According to this curve, a maximum of 3 percent of people would be awakened at an indoor SEL of 58 dB. An indoor SEL of 58 dB is equivalent to an outdoor SEL of about 83 dB, with the windows closed (73 dB with windows open).

Number of Events and Awakenings

It is reasonable to expect that sleep disturbance is affected by the number of events. The German Aerospace Center (DLR Laboratory) conducted an extensive study focused on the effects of nighttime aircraft noise on sleep and related factors (Basner et al., 2004). The DLR Laboratory study was one of the largest studies to examine the link between aircraft noise and sleep disturbance. It involved both laboratory and in-home field research phases. The DLR Laboratory investigators developed a dose-response curve that predicts the number of aircraft events at various values of L_{max} expected to produce one additional awakening over the course of a night. The dose-effect curve was based on the relationships found in the field studies.



Source: FICAN 1997

Figure C-11. Federal Interagency Committee on Aviation Noise 1997 Recommended Sleep Disturbance Dose-Response Relationship.

Later studies by DLR Laboratory conducted in the laboratory comparing the probability of awakenings from different modes of transportation showed that aircraft noise led to significantly lower awakening probabilities than either road or rail noise (Basner et al., 2011). Furthermore, it was noted that the probability of awakening, per noise event, decreased as the number of noise events increased. The authors concluded that by far the majority of awakenings from noise events merely replaced awakenings that would have occurred spontaneously anyway.

A different approach was taken by an ANSI standards committee (ANSI, 2008). The committee used the average of the data shown on **Figure C-10** rather than the upper envelope to predict average awakening from one event. Probability theory is then used to project the awakening from multiple noise events.

Currently, there are no established criteria for evaluating sleep disturbance from aircraft noise although recent studies have suggested a benchmark of an outdoor SEL of 90 dB as an appropriate tentative criterion when comparing the effects of different operational alternatives. The corresponding indoor SEL would be approximately 25 dB lower (at 65 dB) with doors and windows closed and approximately 15 dB lower (at 75 dB) with doors or windows open. According to the ANSI (2008) standard, the probability of awakening from a single aircraft event at this level is between 1 and 2 percent for people habituated to the noise sleeping in bedrooms with windows closed and 2 to 3 percent with windows open. The probability of the exposed population awakening at least once from multiple aircraft events at the 90-dB SEL is shown in **Table C-4**.

In December 2008, FICAN recommended the use of this new standard. FICAN also recognized that more research is underway by various organizations, and that work may result in changes to FICAN's position. Until that time, FICAN recommends the use of the ANSI (2008) standard (FICAN, 2008).

Table C-4
Probability of Awakening from NA90SEL

Number of Aircraft Events at the 90-decibel Sound Exposure Level for Average 9-Hour Night	Minimum Probability of Awakening at Least Once	
	Windows Closed	Windows Open
1	1%	2%
3	4%	6%
5	7%	10%
9 (1 per hour)	12%	18%
18 (2 per hour)	22%	33%
27 (3 per hour)	32%	45%

Source: DOD, 2009b

Summary

Sleep disturbance research still lacks the details to accurately estimate the population awakened for a given noise exposure. The procedure described in the ANSI (2008) Standard and endorsed by FICAN is based on probability calculations that have not yet been scientifically validated. While this procedure certainly provides a much better method for evaluating sleep awakenings from multiple aircraft noise events, the estimated probability of awakenings can only be considered approximate.

C.2.4.4 Noise Effects on Children

Recent studies on school children indicate a potential link between aircraft noise and both reading comprehension and learning motivation. The effects may be small but may be of particular concern for children who are already scholastically challenged.

Effects on Learning and Cognitive Abilities

Early studies in several countries (Cohen et al., 1973, 1980, 1981; Bronzaft and McCarthy, 1975; Green et al., 1982; Evans et al., 1998; Haines et al., 2002; Lercher et al., 2003) showed lower reading scores for children living or attending school in noisy areas than for children away from those areas. In some studies, noise exposed children were less likely to solve difficult puzzles or more likely to give up.

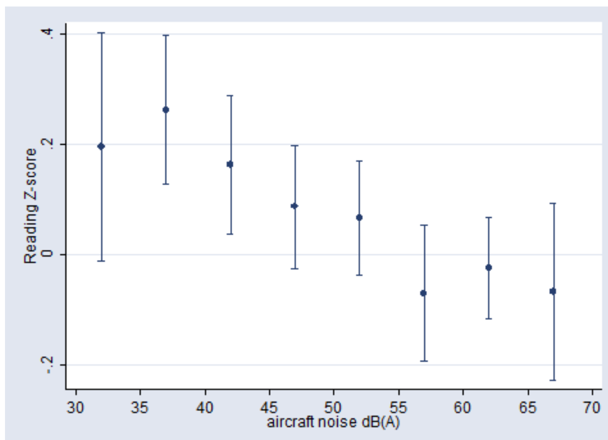
A longitudinal study reported by Evans et al. (1998), conducted prior to relocation of the old Munich airport in 1992, reported that high noise exposure was associated with deficits in long-term memory and reading comprehension in children with a mean age of 10.8 years. Two years after the closure of the airport, these deficits disappeared, indicating that noise effects on cognition may be reversible if exposure to the noise ceases. Most convincing was the finding that deficits in memory and reading comprehension developed over the 2-year follow-up for children who became newly noise exposed near the new airport; deficits were also observed in speech perception for the newly noise-exposed children.

More recently, the Road Traffic and Aircraft Noise Exposure and Children's Cognition and Health (RANCH) study (Stansfeld et al., 2005; Clark et al., 2005) compared the effect of aircraft and road traffic noise on over 2,000 children in three countries. This was the first study to derive exposure-effect associations for a range of cognitive and health effects and was the first to compare effects across countries.

The study found a linear relation between chronic aircraft noise exposure and impaired reading comprehension and recognition memory. No associations were found between chronic road traffic noise exposure and cognition. Conceptual recall and information recall surprisingly showed better performance in high road traffic noise areas. Neither aircraft noise nor road traffic noise affected attention or working memory (Stansfeld et al., 2005; Clark et al., 2005).

Figure C-12 shows RANCH's result relating noise to reading comprehension. It shows that reading falls below average (a z-score of 0) at L_{eq} greater than 55 dB. Because the relationship is linear, reducing exposure at any level should lead to improvements in reading comprehension.

An observation of the RANCH study was that children may be exposed to aircraft noise for many of their childhood years, and the consequences of long-term noise exposure were unknown. A follow-up study of the children in the RANCH project is being analyzed to examine the long-term effects on children's reading comprehension (Clark et al., 2009). Preliminary analysis indicated a trend for reading comprehension to be poorer at 15 to 16 years of age for children who attended noise-exposed primary schools. An additional study utilizing the same data set (Clark et al., 2012) investigated the effects of traffic-related air pollution and found little evidence that air pollution moderated the association of noise exposure on children's cognition.



Sources: Stansfeld et al. 2005; Clark et al. 2006

Figure C-12. Road Traffic and Aircraft Noise Exposure and Children's Cognition and Health (RANCH) Study Reading Scores Varying with Equivalent Sound Level

There was also a trend for reading comprehension to be poorer in aircraft noise exposed secondary schools. Significant differences in reading scores were found between primary school children in the two different classrooms at the same school (Bronzaft and McCarthy, 1975). One classroom was exposed to high levels of railway noise while the other classroom was quiet. The mean reading age of the noise-exposed children was 3 to 4 months behind that of the control children. Studies suggest that the evidence of the effects of noise on children's cognition has grown stronger over recent years (Stansfeld and Clark, 2015), but further analysis adjusting for confounding factors is ongoing and is needed to confirm these initial conclusions.

Studies identified a range of linguistic and cognitive factors to be responsible for children´s unique difficulties with speech perception in noise. Children have lower stored phonological knowledge to reconstruct degraded speech reducing the probability of successfully matching incomplete speech input when compared with adults. Additionally, young children are less able than older children and adults to make use of contextual cues to reconstruct noise-masked words presented in sentential context (Klatte et al., 2013).

FICAN funded a pilot study to assess the relationship between aircraft noise reduction and standardized test scores (Eagan et al., 2004; FICAN, 2007). The study evaluated whether abrupt aircraft noise reduction within classrooms, from either airport closure or sound insulation, was associated with improvements in test scores. Data were collected in 35 public schools near three airports in Illinois and Texas. The study used several noise metrics. These were, however, all computed indoor levels, which makes it hard to compare with the outdoor levels used in most other studies.
The FICAN study found a significant association between noise reduction and a decrease in failure rates for high school students but not middle or elementary school students. There were some weaker

associations between noise reduction and an increase in failure rates for middle and elementary schools. Overall, the study found that the associations observed were similar for children with or without learning difficulties and between verbal and math/science tests. As a pilot study, it was not expected to obtain final answers but provided useful indications (FICAN, 2007).

A recent study of the effect of aircraft noise on student learning (Sharp et al., 2014) examined student test scores at a total of 6,198 US elementary schools, 917 of which were exposed to aircraft noise at 46 airports with noise exposures exceeding the 55-dB DNL. The study found small but statistically significant associations between airport noise and student mathematics and reading test scores, after taking demographic and school factors into account. Associations were also observed for ambient noise and total noise on student mathematics and reading test scores, suggesting that noise levels per se, as well as from aircraft, might play a role in student achievement.

As part of the Noise-Related Annoyance, Cognition and Health study conducted at Frankfurt airport, reading tests were conducted on 1,209 school children at 29 primary schools. It was found that there was a small decrease in reading performance that corresponded to a 1-month reading delay; however, a recent study observing children at 11 schools surrounding Los Angeles International Airport found that the majority of distractions to elementary age students were other students followed by themselves, which includes playing with various items and daydreaming. Less than 1 percent of distractions were caused by traffic noise.

While there are many factors that can contribute to learning deficits in school-aged children, there is increasing awareness that chronic exposure to high aircraft noise levels may impair learning. This awareness has led WHO and a North Atlantic Treaty Organization (NATO) working group to conclude that daycare centers and schools should not be located near major sources of noise, such as highways, airports, and industrial sites (NATO, 2000; WHO, 1999). The awareness has also led to the classroom noise standard discussed earlier (ANSI, 2002).

C.2.4.5 Noise Effects on Animals and Wildlife

Hearing is critical to an animal's ability to react, compete, reproduce, hunt, forage, and survive in its environment. While the existing literature does include studies on possible effects of jet aircraft noise and sonic booms on wildlife, there appears to have been little concerted effort in developing quantitative comparisons of aircraft noise effects on normal auditory characteristics. Behavioral effects have been relatively well described, but the larger ecological context issues, and the potential for drawing conclusions regarding effects on populations, have not been well developed.

The relationships between potential auditory/physiological effects and species interactions with their environments are not well understood. Manci et al. (1988) assert that the consequences that physiological effects may have on behavioral patterns are vital to understanding the long-term effects of noise on wildlife. Questions regarding the effects (if any) on predator-prey interactions, reproductive success, and intraspecific behavior patterns remain.

The following discussion provides an overview of the existing literature on noise effects (particularly jet aircraft noise) on animal species. The literature reviewed here involves those studies that have focused on the observations of the behavioral effects that jet aircraft and sonic booms have on animals.

A great deal of research was conducted in the 1960s and 1970s on the effects of aircraft noise on the public and the potential for adverse ecological impacts. These studies were largely completed in response to the increase in air travel and as a result of the introduction of supersonic jet aircraft. According to Manci et al. (1988), the foundation of information created from that focus does not necessarily correlate or provide information specific to the impacts to wildlife in areas overflown by aircraft at supersonic speed or at low altitudes. The abilities to hear sounds and noise and to communicate assist wildlife in maintaining group cohesiveness and survivorship. Social species communicate by transmitting calls of warning, introduction, and other types that are subsequently related to an individual's or group's responsiveness.

Animal species differ greatly in their responses to noise. Noise effects on domestic animals and wildlife are classified as primary, secondary, and tertiary. Primary effects are direct, physiological changes to the auditory system and most likely include the masking of auditory signals. Masking is defined as the inability of an individual to hear important environmental signals that may arise from mates, predators, or prey. There is some potential that noise could disrupt a species' ability to communicate or could interfere with behavioral patterns (Manci et al., 1988). Although the effects are likely temporal, aircraft noise may cause masking of auditory signals within exposed faunal communities. Animals rely on hearing to avoid predators, obtain food, and communicate with, and attract, other members of their species. Aircraft noise may mask or interfere with these functions. Other primary effects, such as ear drum rupture or temporary and permanent hearing threshold shifts, are not as likely given the subsonic noise levels produced by aircraft overflights.

Secondary effects may include nonauditory effects such as stress and hypertension; behavioral modifications; interference with mating or reproduction; and impaired ability to obtain adequate food, cover, or water. Tertiary effects are the direct result of primary and secondary effects and include population decline and habitat loss. Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles, 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) also influence secondary and tertiary effects and confound the ability to identify the ultimate factor in limiting productivity of a certain nest, area, or region (Smith et al., 1988). Overall, the literature suggests that species differ in their response to various types, durations, and sources of noise (Manci et al., 1988).

Many scientific studies have investigated the effects of aircraft noise on wildlife, and some have focused on wildlife "flight" due to noise. Animal responses to aircraft are influenced by many variables, including size, speed, proximity (both height above the ground and lateral distance), engine noise, color, flight profile, and radiated noise. The type of aircraft (e.g., fixed wing versus rotor-wing [helicopter]) and type of flight mission may also produce different levels of disturbance, with varying animal responses (Smith et al., 1988). Consequently, it is difficult to generalize animal responses to noise disturbances across species.

One result of the Manci et al. (1988) literature review was the conclusion that, while behavioral observation studies were relatively limited, a general behavioral reaction in animals from exposure to aircraft noise is the startle response. The intensity and duration of the startle response appears to be dependent on which species is exposed, whether there is a group or an individual, and whether there have been some previous exposures. Responses range from flight, trampling, stampeding, jumping, or running, to movement of the head in the apparent direction of the noise source. Manci et al. (1988) reported that the literature indicated that avian species may be more sensitive to aircraft noise than mammals.

<u>Domestic Animals</u>

Although some studies report that the effects of aircraft noise on domestic animals is inconclusive, a majority of the literature reviewed indicates that domestic animals exhibit some behavioral responses to military overflights but generally seem to habituate to the disturbances over a period of time. Mammals in particular appear to react to noise at sound levels higher than 90 dB, with responses including the startle response, freezing (i.e., becoming temporarily stationary), and fleeing from the sound source. Many studies on domestic animals suggest that some species appear to acclimate to some forms of sound disturbance (Manci et al., 1988). Some studies have reported such primary and secondary effects as reduced milk production and rate of milk release, increased glucose concentrations, decreased levels of hemoglobin, increased heart rate, and a reduction in thyroid activity. These latter effects appear to represent a small percentage of the findings occurring in the existing literature. Some reviewers have indicated that earlier studies, and claims by farmers linking adverse effects of aircraft noise on livestock, did not necessarily provide clear-cut evidence of cause and effect (Cottereau, 1978). In contrast, many studies conclude that there is no evidence that aircraft overflights affect feed intake, growth, or production rates in domestic animals.

Wildlife

Studies on the effects of overflights and sonic booms on wildlife have been focused mostly on avian species and ungulates such as caribou and bighorn sheep. Few studies have been conducted on marine mammals, small terrestrial mammals, reptiles, amphibians, and carnivorous mammals. Generally, species that live entirely below the surface of the water have also been ignored due to the fact they do not experience the same level of sound as terrestrial species (National Park Service, 1994). Wild ungulates appear to be much more sensitive to noise disturbance than domestic livestock. This may be due to previous exposure to disturbances. One common factor appears to be that low-altitude flyovers seem to be more disruptive in terrain where there is little cover (Manci et al., 1988).

Some physiological/behavioral responses such as increased hormonal production, increased heart rate, and reduction in milk production have been described in a small percentage of studies. A majority of the studies focusing on these types of effects have reported short-term or no effects. The relationships between physiological effects and how species interact with their environments have not been thoroughly studied; therefore, the larger ecological context issues regarding physiological effects of jet aircraft noise (if any) and resulting behavioral pattern changes are not well understood.

Animal species exhibit a wide variety of responses to noise. It is therefore difficult to generalize animal responses to noise disturbances or to draw inferences across species, as reactions to jet aircraft noise appear to be species-specific. Consequently, some animal species may be more sensitive than other species and/or may exhibit different forms or intensities of behavioral responses. For instance, wood ducks appear to be more sensitive and more resistant to acclimation to jet aircraft noise than Canada geese in one study. Similarly, wild ungulates seem to be more easily disturbed than domestic animals.

The literature does suggest that common responses include the “startle” or “fright” response and, ultimately, habituation. It has been reported that the intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects. The majority of the literature suggests that domestic animal species (cows, horses, chickens) and wildlife species exhibit adaptation, acclimation, and habituation after repeated exposure to jet aircraft noise and sonic booms.

Animal responses to aircraft noise appear to be somewhat dependent on, or influenced by, the size, shape, speed, proximity (vertical and horizontal), engine noise, color, and flight profile of planes. Helicopters also appear to induce greater intensities and durations of disturbance behavior as compared to fixed-wing aircraft. Some studies showed that animals that had been previously exposed to jet aircraft noise exhibited greater degrees of alarm and disturbance to other objects creating noise, such as boats, people, and objects blowing across the landscape. Other factors influencing response to jet aircraft noise may include wind direction, speed, and local air turbulence; landscape structures (i.e., amount and type of vegetative cover); and, in the case of bird species, whether the animals are in the incubation/nesting phase.

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C.3 SAFETY

C.3.1 Definition of the Resource

Safety concerns associated with ground, explosive, and flight activities are considered in this section. Ground safety considers issues associated with ground operations and maintenance activities that support civil and military operations including jet blast/maintenance testing and safety danger. Aircraft maintenance testing occurs in designated safety zones. Ground safety also considers the safety of personnel and facilities on the ground that may be placed at risk from flight operations in the vicinity of the airfield and in the airspace. Safety zones, which include Clear Zones (CZs), Accident Potential Zones (APZs), and Quantity-Distance (QD) arcs around military airfields and Runway Protection Zones (RPZs) around civil airports restrict the public's exposure to areas where there is a higher accident potential. Although ground and flight safety are addressed separately, in the immediate vicinity of the runway, risks associated with safety-of-flight issues are interrelated with ground safety concerns.

Explosives safety relates to the management and safe use of ordnance and munitions. Flight safety considers aircraft flight risks such as midair collision, bird/wildlife-aircraft strike hazard (BASH), and in-flight emergency. F-16 FTU operators will follow Air Force safety procedures and aircraft specific emergency procedures based on the aircraft design which are produced by the original equipment manufacturer of the aircraft. Basic airmanship procedures also exist for handling any deviations to ATC procedures due to an in-flight emergency; these procedures are defined in Air Force Instruction (AFI) 11-202 (Volume 3), *General Flight Rules*, and established aircraft flight manuals. F-16 FTU operators would also maintain a Flight Crew Information File, a safety resource for aircrew day-to-day operations which is composed of air and ground operation rules and procedures.

The Regions of Influences (ROIs) for Holloman AFB and ROW include the airfield and areas immediately adjacent to the airport property where ground and explosive safety concerns are described, as well as the airfield and airspaces where flight safety is discussed.

C.3.2 Aircraft Accident and Incident Notification

Per 49 CFR § 830.5, *Notification of Aircraft Accidents, Incidents, and Overdue Aircraft*, the operator of any civil aircraft, or any public aircraft not operated by the Armed Forces or an intelligence agency of the United States, or any foreign aircraft shall immediately, and by the most expeditious means available, notify the nearest National Transportation Safety Board (NTSB) office when an aircraft accident or serious incidents occur or an aircraft is overdue and is believed to have been involved in an accident.

An aircraft *accident*, per 49 CFR § 830.2, is an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage. Key terms used above are defined as follows:

- *Civil aircraft* means any aircraft other than a public aircraft.
- *Operator* means any person who causes or authorizes the operation of an aircraft, such as the owner, lessee, or bailee of an aircraft.
- *Serious injury* means any injury which (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date of the injury was received; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) causes severe hemorrhages, nerve, muscle, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface. *Fatal injury* means any injury which results in death within 30 days of the accident.
- *Substantial damage* means damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Engine failure or damage limited to an engine if only one engine fails or is damaged, bent fairings or cowling, dented skin, small punctured holes in the skin or fabric, ground damage to rotor or propeller blades, and damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wingtips are not considered "substantial damage."

An aircraft *incident*, per 49 CFR § 830.5, is an occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations. Serious incidents that require NTSB notification include:

- flight control system malfunction or failure;
- inability of any required flight crewmember to perform normal flight duties as a result of injury or illness;
- failure of any internal turbine engine component that results in the escape of debris other than out the exhaust path;
- in-flight fire;
- aircraft collision in flight;
- damage to property, other than the aircraft, estimated to exceed $25,000 for repair (including materials and labor) or fair market value in the event of total loss, whichever is less;
- for large multiengine aircraft (more than 12,500 pounds maximum certificated takeoff weight),
  - in-flight failure of electrical systems which requires the sustained use of an emergency bus powered by a back-up source such as a battery, auxiliary power unit, or air-driven generator to retain flight control or essential instruments;
  - in-flight failure of hydraulic systems that results in sustained reliance on the sole remaining hydraulic or mechanical system for movement of flight control surfaces;
  - sustained loss of the power or thrust produced by two or more engines; and
  - an evacuation of an aircraft in which an emergency egress system is utilized.
- release of all or a portion of a propeller blade from an aircraft, excluding release caused solely by ground contact;
- a complete loss of information, excluding flickering, from more than 50 percent of an aircraft's cockpit displays known as
  - Electronic Flight Instrument System displays;
  - Engine Indication and Crew Alerting System displays;
  - Electronic Centralized Aircraft Monitor displays; or
  - other displays of this type, which generally include a primary flight display, primary navigation display, and other integrated displays.
- Airborne Collision and Avoidance System resolution advisories issued when an aircraft is being operated on an instrument flight rules flight plan and compliance with the advisory is necessary to avert a substantial risk of collision between two or more aircraft.
- damage to helicopter tail or main rotor blades, including ground damage, that requires major repair or replacement of the blade(s); or
- any event in which an operator, when operating an airplane as an air carrier at a public-use airport on land,
  - lands or departs on a taxiway, incorrect runway, or other area not designed as a runway or
  - experiences a runway incursion that requires the operator or the crew of another aircraft or vehicle to take immediate corrective action to avoid a collision.

C.3.3 References

49 CFR §830, Notification of Aircraft Accidents, Incidents, and Overdue Aircraft, and Preservation of Aircraft Wreckage, Mail, Cargo, and Records.

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C.4 AIR QUALITY

Appendix C.4 presents an overview of the Clean Air Act (CAA) and the relevant state of New Mexico air quality regulations/standards. It also presents calculations, including the assumptions used for the air quality analyses presented in the Air Quality sections of this EA. Air quality modeling and calculations, including the assumptions used for the air quality analyses presented in **Section 3.6** are included in **Appendix D.2**.

C.4.1 Definition of the Resource

The United States Environmental Protection Agency (USEPA) has divided the country into geographical regions known as Air Quality Control Regions (AQCRs) to evaluate compliance with the National Ambient Air Quality Standards (NAAQS). Holloman AFB is located in Otero County, New Mexico, and lies within the El Paso-Las Cruces-Alamogordo Interstate AQCR (40 CFR § 81.82).

For the purposes of this EA, there are multiple ROIs for air quality. One includes the AQCRs within which the airfields proposed for use of the F-16C aircraft (including areas within their vicinities) are located. In addition, multiple AQCRs were considered which coincide with the SUAs proposed for use for the F-16C aircraft. For consideration of potential air quality impacts, it is the volume of air extending up to the mixing height (3,000 feet [ft] above ground level [AGL]) and coinciding with the spatial distribution of the regions of influence that is considered in this section. The mixing height is the altitude at which the lower atmosphere will undergo mechanical or turbulent mixing, producing a nearly uniform air mass. The height of the mixing level determines the volume of air within which pollutants can disperse. Pollutants that are released above the mixing height typically will not disperse downward and thus will have little or no effect on ground level concentrations of pollutants. Mixing heights at any one location or region can vary by the season and time of day, but for air quality applications an average mixing height of 3,000 ft AGL is an acceptable default value (40 CFR § 93.153[c][2]).

C.4.1.1 Criteria Pollutants

In accordance with CAA requirements, the air quality in each region or area is measured by the concentration of various pollutants in the atmosphere. Measurements of these "criteria pollutants" in ambient air are expressed in units of parts per million or in units of micrograms per cubic meter. Regional air quality is a result of the types and quantities of atmospheric pollutants and pollutant sources in an area as well as surface topography, the size of the "air basin," and prevailing meteorological conditions.

The CAA directed the USEPA to develop, implement, and enforce strong environmental regulations that would ensure clean and healthy ambient air quality. To protect public health and welfare, the USEPA developed numerical concentration-based standards, NAAQS, for pollutants that have been determined to impact human health and the environment and established both primary and secondary NAAQS under the provisions of the CAA. NAAQS are currently established for six criteria air pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter (including particulates equal to or less than 10 microns in diameter (PM_{10}) and particulates equal to or less than 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). The primary NAAQS represent maximum levels of background air pollution that are considered safe, with an adequate margin of safety to protect public health. Secondary NAAQS represent the maximum pollutant concentration necessary to protect vegetation, crops, and other public resources in addition to maintaining visibility standards. The primary and secondary NAAQS are presented in **Table C-5**.

Table C-5
National Ambient Air Quality Standards

Pollutant	Standard Value[6]		Standard Type
Carbon Monoxide (CO)			
8-hour average	9 ppm	(10 mg/m^3)	Primary
1-hour average	35 ppm	(40 mg/m^3)	Primary
Nitrogen Dioxide (NO_2)			

Table C-5
National Ambient Air Quality Standards

Pollutant	Standard Value[6]		Standard Type
Annual arithmetic mean	0.053 ppm	(100 μg/m^3)	Primary and Secondary
1-hour average[1]	0.100 ppm	(188 μg/m^3)	Primary
Ozone (O_3)			
8-hour average[2]	0.070 ppm	(137 μg/m^3)	Primary and Secondary
Lead (Pb)			
3-month average[3]		0.15 μg/m^3	Primary and Secondary
Particulate <10 Micrometers (PM_{10})			
24-hour average[4]		150 μg/m^3	Primary and Secondary
Particulate <2.5 Micrometers ($PM_{2.5}$)			
Annual arithmetic mean[4]		12 μg/m^3	Primary
Annual arithmetic mean[4]		15 μg/m^3	Secondary
24-hour average[4]		35 μg/m^3	Primary and Secondary
Sulfur Dioxide (SO_2)			
1-hour average[5]	0.075 ppm	(196 μg/m^3)	Primary
3-hour average[5]	0.5 ppm	(1,300 μg/m^3)	Secondary

Source: USEPA, 2016, 2020

Notes:

- In February 2010, the USEPA established a new 1-hour standard for NO2 at a level of 0.100 ppm, based on the 3-year average of the 98th percentile of the yearly distribution concentration, to supplement the then-existing annual standard.
- In October 2015, the USEPA revised the level of the 8-hour standard to 0.070 ppm, based on the annual 4th highest daily maximum concentration, averaged over 3 years; the regulation became effective on 28 December 2015. The previous (2008) standard of 0.075 ppm remains in effect for some areas. A 1-hour standard no longer exists.
- In November 2008, USEPA revised the primary Pb standard to 0.15 μg/m3. USEPA revised the averaging time to a rolling 3-month average.
- In October 2006, USEPA revised the level of the 24-hour PM2.5 standard to 35 μg/m3 and retained the level of the annual PM2.5 standard at 15 μg/m3. In 2012, USEPA split standards for primary & secondary annual PM2.5. All are averaged over 3 years, with the 24-hour average determined at the 98th percentile for the 24-hour standard. USEPA retained the 24-hour primary standard and revoked the annual primary standard for PM10.
- In 2012, the USEPA retained a secondary 3-hour standard, which is not to be exceeded more than once per year. In June 2010, USEPA established a new 1-hour SO2 standard at a level of 75 parts per billion, based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations.
- Parenthetical value is an approximately equivalent concentration for NO2, O3, and SO2.

μg/m^3 = micrograms per cubic meter; mg/m^3 = milligrams per cubic meter; ppm = parts per million; USEPA = United States Environmental Protection Agency

The criteria pollutant O_3 is not usually emitted directly into the air but is formed in the atmosphere by photochemical reactions involving sunlight and previously emitted pollutants, or “O_3 precursors.” These O_3 precursors consist primarily of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) that are directly emitted from a wide range of emissions sources. For this reason, regulatory agencies limit atmospheric O_3 concentrations by controlling VOC pollutants (also identified as reactive organic gases) and NO_x.

The USEPA has recognized that particulate matter emissions can have different health affects depending on particle size and, therefore, developed separate NAAQS for coarse particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$). The pollutant $PM_{2.5}$ can be emitted from emission sources directly as very fine dust and/or liquid mist or formed secondarily in the atmosphere as condensable particulate matter, typically forming nitrate and sulfate compounds. Secondary (indirect) emissions vary by region depending upon the predominant emission sources located there and thus which precursors are considered significant for $PM_{2.5}$ formation and identified for ultimate control.

The CAA and USEPA delegated responsibility for ensuring compliance with NAAQS to the states and local agencies. As such, each state must develop air pollutant control programs and promulgate regulations and rules that focus on meeting NAAQS and maintaining healthy ambient air quality levels. When a region or area fails to meet a NAAQS for a pollutant, that region is classified as “non-attainment” for that pollutant. In such cases the affected State must develop a State Implementation Plan (SIP) that is subject to USEPA review and approval. A SIP is a compilation of regulations, strategies, schedules, and enforcement actions designed to move the state into compliance with all NAAQS. Any changes to the compliance schedule or plan (e.g., new regulations, emissions budgets, controls) must be incorporated into the SIP and approved by USEPA.

The CAA required the USEPA draft general conformity regulations that are applicable in nonattainment areas, or in designated maintenance areas (i.e., attainment areas that were reclassified from a previous nonattainment status, which are required to prepare a maintenance plan for air quality). These regulations are designed to ensure that federal actions do not impede local efforts to achieve or maintain attainment with the NAAQS. The General Conformity Rule and the promulgated regulations found in 40 CFR Part 93 exempt certain federal actions from conformity determinations (e.g., contaminated site cleanup and natural disaster response activities). Other federal actions are assumed to conform if total indirect and direct project emissions are below de minimis levels presented in 40 CFR § 93.153. The threshold levels (in tons of pollutant per year) depend upon the nonattainment status that USEPA has assigned to a region. Once the net change in nonattainment pollutants is calculated, the federal agency must compare them to the de minimis thresholds.

Title I of the CAA Amendments of 1990 requires the federal government to reduce emissions from cars, trucks, and buses; from consumer products such as hair spray and window-washing compounds; and from ships and barges during the loading and unloading of petroleum products to address urban air pollution problems of O_3, CO, and PM_{10}. Under Title I, the federal government develops the technical guidance that states need to control stationary sources of pollutants. Title I also allows the USEPA to define boundaries of nonattainment areas. Title V of the CAA Amendments of 1990 requires state and local agencies to implement permitting programs for major stationary sources. A major stationary source is a facility (plant, base, activity, etc.) that has the potential to emit more than 100 tons annually of any one criteria air pollutant in an attainment area.

Federal Prevention of Significant Deterioration (PSD) regulations also define air pollutant emissions from proposed major stationary sources or modifications to be “significant” if a proposed project’s net emission increase meets or exceeds the rate of emissions listed in 40 CFR § 52.21(b)(23)(i); or a proposed project is within 10 miles (mi) of any Class I area (wilderness area greater than 5,000 acres or national park greater than 6,000 acres).

Titles I and V of the CAA Amendments of 1990 apply to Holloman AFB, and compliance requirements under the relevant regulations would apply. This is because emissions increase from the Proposed Action would occur from stationary and mobile sources which are governed by Titles I and V; therefore, the requirements originating from Titles I and V are considered.

C.4.1.2 Greenhouse Gases

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. These emissions are generated by both natural processes and human activities. The accumulation of GHGs in the atmosphere helps regulate the earth’s temperature and are believed to contribute to global climate change. GHGs include water vapor, carbon dioxide (CO_2), methane, nitrous oxide, O_3, and several hydrocarbons and chlorofluorocarbons. Each GHG has an estimated global warming potential (GWP), which is a function of its atmospheric lifetime and its ability to absorb and radiate infrared energy emitted from the earth’s surface. The GWP of a particular gas provides a relative basis for calculating its carbon dioxide equivalent (CO_2e) or the amount of CO_2e to the emissions of that gas. CO_2 has a GWP of 1 and is, therefore, the standard by which all other GHGs are measured. Potential impacts associated with GHG emissions are discussed in **Section C.4.1.4.**

In New Mexico, the USEPA regulates GHG primarily through a permitting program known as the GHG Tailoring Rule. This rule applies to GHG emissions from stationary sources. In addition to the GHG Tailoring Rule in 2009, the USEPA promulgated a rule requiring sources to report their GHG emissions if they emit more than 25,000 metric tons or more of CO_2e per year (40 CFR § 98.2[a][2]). Again, this only applies to stationary sources of emissions.

C.4.1.3 Climate Change Considerations

A vast amount of scientific research supports the theory that climate change is affecting weather patterns, average sea levels, ocean acidification, and precipitation rates. Likelihood of occurrence of these patterns are predicted to intensify in the future. Like many locations in the United States, climate trends within the western United States could be adversely affected by global climate change, including mass migration and loss or extinction of plant and animal species. There are scientific studies to indicate that the potential effects of climate change could lead to adverse human health. These include an increase in extreme heat events, increased levels of pollutants in the atmosphere and an increase in intensity and number of natural disasters, such as flooding, hurricanes, and drought.

GHG emissions in New Mexico are showing a slightly decreasing trend between 2005 and 2018, not considering the oil and natural gas sector. GHG emissions in New Mexico peaked in 2005, and ever since moderate reductions in New Mexico's GHG emissions have occurred due to various factors, including changes in the energy sector. Transportation now exceeds electricity generation and has become the State's largest sector of GHGs. For 2018, New Mexico's net GHG emissions totaled 53.2 million metric tons of CO_2e (not including the oil and gas sector), with transportation accounting for 29.7 percent of gross emissions.

To serve as a reference point, projected GHG emissions were compared against New Mexico's net GHG emissions from various sectors, and to the Title V and PSD major source thresholds for CO_2e applicable to stationary sources (**Table C-6**). Based on the relative magnitude of the project's GHG emissions, a general inference can be drawn regarding whether the Proposed Action is meaningful with respect to the discussion regarding climate change.

C.4.1.4 Greenhouse Gas Emissions Modeling Results

As **Table C-6** demonstrates, GHG emissions for the F-16C FTU Alternative 2 would be well below regulatory thresholds for stationary source permitting and would account for about 0.042 percent of the New Mexico's 2018 GHG emissions. The state's GHG emissions are the result of mainly transportation and electricity generation. Based on this analysis, the incremental GHG emissions from the Proposed Action are not considered significant.

Table C-6
Metrics for Greenhouse Gas Emission Impacts

Emission Scenario	Title V Permit CO_2e Regulatory Threshold (tpy)	PSD New Source CO_2e Regulatory Threshold (tpy)	PSD Modified Source CO_2e Regulatory Threshold (tpy)	New Mexico's 2018 Net GHG Emissions (tpy)[3,4]	F-16 FTU % of New Mexico's Emissions[5]
Highest[1]	100,000	100,000	75,000	58,642,360	0.042

Notes:
[1] Sum of highest Air Conformity Applicability Model estimated GHG emissions from airfield operations and SUA sorties from Alternative 2.
- Represents MMT CO_2e from transportation, electricity generation, industry, residential and commercial. Also, includes projected emissions from waste, agriculture, coal mining, and natural and working lands. Does not include oil and gas (fugitive and combustion) sector.
- Source: E3, 2020; Converted 53.2 MMT CO_2e to tpy by multiplying MMT CO_2e by a factor of 1.1023x106.
- Percentage based on worst case (high) emission scenario.

CO_2e = carbon dioxide equivalent; FTU = Formal Training Unit; GHG = greenhouse gas; MMT = million metric tons; PSD = Prevention of Significant Deterioration; SUA = special use airspace; tpy = tons per year

C.4.2 Air Conformity Applicability Analysis

C.4.2.1 Air Quality Program Overview

To protect public health and welfare, the USEPA has developed numerical concentration-based standards, or NAAQS, for six "criteria" pollutants (based on health-related criteria) under the provisions of the CAA Amendments of 1970. There are two kinds of NAAQS: Primary and Secondary standards. Primary standards prescribe the maximum permissible concentration in the ambient air to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards prescribe the maximum concentration or level of air quality required to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings (40 CFR Part 50).

The CAA gives states the authority to establish air quality rules and regulations. These rules and regulations must be equivalent to, or more stringent than, the federal program. The New Mexico Environment Department (NMED) oversees the state's air pollution control program under the authority of the federal CAA and amendments, federal regulations, and state laws. They have jurisdiction over all New Mexico counties except Bernalillo County and facilities on tribal lands. New Mexico has adopted the federal NAAQS (20 New Mexico Administrative Code Chapter 2, Part 3).

The NMED operates and maintains an ambient air monitoring network that uses the methods and procedures approved by the USEPA. Based on measured ambient air pollutant concentrations, the USEPA designates areas of the United States as having air quality better than (attainment) the NAAQS, worse than (nonattainment) the NAAQS, and unclassifiable. The areas that cannot be classified (based on available information) as meeting or not meeting the NAAQS for a particular pollutant are "unclassifiable" and are treated as attainment until proven otherwise. Attainment areas can be further classified as "maintenance" areas, which are areas previously classified as nonattainment but where air pollutant concentrations have been successfully reduced to below the standard. Maintenance areas are under special maintenance plans and must operate under some of the nonattainment area plans to ensure compliance with the NAAQS.

Section 176(c) (1) of the CAA contains legislation that ensures federal activities conform to relevant SIPs and thus do not hamper local efforts to control air pollution. Conformity to a SIP is defined as conformity to a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards. As such, a general conformity analysis is required for areas of nonattainment or maintenance where a federal action is proposed.

The action can be shown to conform by demonstrating that the total direct and indirect emissions are below the *de minimis* levels (**Table C-7**), and/or showing that the Proposed Action emissions are within the State- or Tribe-approved budget of the facility as part of the SIP or Tribal Implementation Plan (USEPA, 2010).

Direct emissions are those that occur as a direct result of the action. For example, emissions from new equipment that are a permanent component of the completed action (e.g., boilers, heaters, generators, paint booths) are considered direct emissions. Indirect emissions are those that occur at a later time or at a distance from the Proposed Action. For example, increased vehicular/commuter traffic because of the action is considered an indirect emission. Construction emissions must also be considered. For example, the emissions from vehicles and equipment used to clear and grade building sites, build new buildings, and construct new roads must be evaluated. These types of emissions are considered direct emissions.

Table C-7
General Conformity Rule De Minimis Emission Thresholds

Pollutant	Attainment Classification	Tons per year
Ozone (VOC and NO_x)	Serious nonattainment	50
	Severe nonattainment	25
	Extreme nonattainment	10
	Other areas outside an ozone transport region	100
Ozone (NO_x)	Marginal and moderate nonattainment inside an ozone transport region	100
	Maintenance	100
Ozone (VOC)	Marginal and moderate nonattainment inside an ozone transport region	50
	Maintenance within an ozone transport region	50
	Maintenance outside an ozone transport region	100
Carbon Monoxide, SO_2 and NO_2	All nonattainment and maintenance	100
PM_{10}	Serious nonattainment	70
	Moderate nonattainment and maintenance	100
$PM_{2.5}$ Direct emissions, SO_2, NO_x (unless determined not to be a significant precursor), VOC and ammonia (if determined to be significant precursors)	All nonattainment and maintenance	100
Lead	All nonattainment and maintenance	25

Source: USEPA, 2017

NO_2 = nitrogen dioxide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulates equal to or less than 2.5 microns in diameter; PM_{10} = particulates equal to or less than 10 microns in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound

Each state is required to develop a SIP that sets forth how CAA provisions will be imposed within the state. The SIP is the primary means for the implementation, maintenance, and enforcement of the measures needed to attain and maintain the NAAQS within each state and includes control measures, emissions limitations, and other provisions required to attain and maintain the ambient air quality standards. The purpose of the SIP is twofold. First, it must provide a control strategy that will result in the attainment and maintenance of the NAAQS. Second, it must demonstrate that progress is being made in attaining the standards in each nonattainment area.

In attainment areas, major new or modified stationary sources of air emissions on and in the area are subject to PSD review to ensure that these sources are constructed without causing significant adverse deterioration of the clean air in the area. A major new source is defined as one that has the potential to emit any pollutant regulated under the CAA in amounts equal to or exceeding specific major source thresholds; that is, 100 or 250 tons/year based on the source’s industrial category. These thresholds are applicable to stationary sources.

The goals of the PSD program are to (1) ensure economic growth while preserving existing air quality; (2) protect public health and welfare from adverse effects that might occur even at pollutant levels better than the NAAQS; and (3) preserve, protect, and enhance the air quality in areas of special natural recreational, scenic, or historic value, such as national parks and wilderness areas. Sources subject to PSD review are required by the CAA to obtain a permit before commencing construction. The permit process requires an extensive review of all other major sources within a 50-mi radius and all Class I areas within a 62-mi radius of the facility. Emissions from any new or modified source must be controlled using Best Available Control Technology. The air quality, in combination with other PSD sources in the area, must not exceed the maximum allowable incremental increases, as specified.

National parks and wilderness areas are designated as Class I areas, where any appreciable deterioration in air quality is considered significant. Class II areas are those where moderate, well-controlled industrial growth could be permitted. Class III areas allow for greater industrial development. There are no Class I areas near Holloman AFB; however, some areas within the SUAs proposed for use by the F-16 aircraft are close to Class 1 areas in New Mexico. These areas include the White Mountain Wilderness Area, Bosque del Apache Wilderness Area, Organ Mountains Wilderness Area, and Pecos Wilderness Area. Typically, determination of air quality impacts within Class 1 areas are conducted for stationary emission sources covered by PSD permit regulations. Mobile sources, including those from aircraft emissions are not part of the PSD permit review process. However, emissions from proposed action have the potential to impact visibility within Class 1 areas and is considered here, qualitatively. These areas are given special air quality and visibility protection under the CAA.

The Air Quality Monitoring Program monitors ambient air throughout the state. The purpose is to monitor, assess and provide information on statewide ambient air quality conditions and trends as specified by the state and federal CAA. The Air Quality Monitoring Program works in conjunction with local air pollution agencies and some industries, measuring air quality throughout the states.

The air quality monitoring network is used to identify areas where the ambient air quality standards are being violated and plans are needed to reduce pollutant concentration levels to be in attainment with the standards. Also included are areas where the ambient standards are being met, but plans are necessary to ensure maintenance of acceptable levels of air quality in the face of anticipated population or industrial growth.

The USEPA has specific requirements for a minimum number of monitoring sites, known as National Air Monitoring Sites. New Mexico has augmented these with additional sites, called Air Surveillance and Analysis, to provide additional air quality data for NMED Health needs. Locations of these monitoring sites are determined by factors such as emissions sources, population density, permitting needs, modeling results, and site accessibility.

The result of this attainment/maintenance analysis is the development of local and statewide strategies for controlling emissions of criteria air pollutants from stationary and mobile sources. The first step in this process is the annual compilation of the ambient air monitoring results, and the second step is the analysis of the monitoring data for general air quality, exceedances of air quality standards, and pollutant trends.

C.4.2.2 Assumptions

The following assumptions were used in the air quality analysis for the Proposed Action:

1. The permanent assignment of the additional F-16C aircraft would require construction of new facilities and repair of existing facilities that would be located around the existing airfield and runway at Holloman AFB. This includes grading, trenching, construction, architectural coatings, and paving. Emissions were considered only from construction equipment and/or vehicles and from worker commute for projects that include minor interior building fabrication, interior painting, or upgrades to building heating and cooling systems.
2. Start date for construction at Holloman AFB was assumed to be January 2023. All construction would be completed within a year. Duration for coating and paving activities for the proposed projects is assumed to be 15 days. For construction and/or repair projects, duration is assumed to be 6-10 months, based on the nature of the project.

3. Assumed new facilities to be equipped with natural gas boilers, as necessary. Operational (steady state) emissions are for 2024 and beyond.
4. Some of the data related to construction (e.g., building construction area, estimated area for paving, grading and trenching square-foot area) were inferred based on the general description of project, if specific information was not available. Also, if unavailable, building heights used for Air Conformity Applicability Model (ACAM) inputs were assumed, based on engineering judgements or heights used in other similar projects.
5. For proposed grading activity, assumed entire building construction area would be graded and 10 percent of total graded area for material hauled in and material hauled out.
6. For proposed projects that would require the construction of concrete pads, a building height of 15 inches is assumed for ACAM modeling.
7. No installation of new generators for any new facility construction.
8. Additional Jet-A fuel to be used for the additional F-16C aircraft at Holloman AFB would be calculated based on additional number of sorties, and average engine fuel consumption rate for F-16C aircraft. Fuel storage emissions were estimated using ACAM defaults.
9. Existing corrosion control facilities and paint booths would be used for the additional F-16C aircraft. Amounts of solvents and coatings that would be used for the additional aircraft were estimated based on a 3-year average use data that are tracked for the air quality permit. The material type and use information were obtained from aircraft maintenance personnel at Holloman AFB. ACAM emissions were estimated using chemical data for a representative worst-case material (solvent and paint) and a total annual usage provided for each of the paint shop. Individual emission estimates were not performed.
10. For the purposes of ACAM modeling, all construction and F-16 additional aircraft flight operations are assumed to start in January 2023. Construction and repair projects would be completed in a year and flight operations would become permanent. This represents a maximum emissions scenario for analysis purposes; construction is expected to take place per the timing listed in Table 2-4.
11. Additional F-16 aircraft landing and takeoff (LTO) cycles - use/assume ACAM default "times in mode" to be conservative.
12. Assume once an aircraft is out of the LTO cycle the time (5 to 10 minutes) spent traveling to/from the SUAs is at an altitude above 3,000 ft.
13. Assume mixing height is 3,000 ft (this matches USEPA and US Air Force [Air Force] Guidance).
14. Any change (increase) in emissions for air operations (AOPs) would be strictly due to the addition of the F-16 aircraft and associated ground and maintenance activities.
15. For Aerospace Ground Equipment (AGE) and Auxiliary Power Units (APUs) – ACAM defaults are used.
16. For trim tests, ACAM default is assumed based on aircraft and engine type.
17. Assume all new personnel (pilots and maintenance staff) would live off-base and commute to the base 5 days per week. Will use ACAM defaults for commute distances.
18. Estimated amount of time each F-16 aircraft would spend within the SUAs at or below 3,000 ft AGL is proportioned based on percent time spent between 500 ft (surface) to 3,000 ft. Assuming an average mission time of 40 minutes, the time spent at or below 3,000 ft AGL would be 13.33 minutes (see Table C-8). Activity in SUA extending beyond the mixing height (3,000 ft AGL) is not considered for the AQ analysis.
19. ACAM does not have separate inputs for time spent within a SUA. To represent the time spent at or below 3,000 ft, time per sortie spent at or below 3,000 ft altitude is estimated to be 13.33 minutes and an 88/12 split between military and afterburner mode was applied. Thus, 11.7 minutes was assigned to military mode and 1.6 minutes was assigned to the afterburner mode within the ACAM LTO input fields. No time was assigned to any other power modes, but default ACAM output also lists Trim Tests and touch-and-gos; however, all inputs for these fields were set to zero.
20. Assume the time spent below 3,000 ft would be the same for all sorties.

21. No changes to current aircraft baseline AOPs (sorties) due to the addition of the proposed F-16 additional aircraft.
22. No/little changes to transit and civilian AOPs due to the additional F-16 additional aircraft.
23. For consideration of potential air quality impacts, it is the volume of air extending up to the mixing height (3,000 ft AGL) and coinciding with the spatial distribution of the region of influence that is considered. Pollutants that are released above the mixing height typically would not disperse downward and thus would have little or no effect on ground level concentrations of pollutants. The mixing height is the altitude at which the lower atmosphere undergoes mechanical or turbulent mixing, producing a nearly uniform air mass. The height of the mixing level determines the volume of air within which pollutants can disperse. Mixing heights at any one location or region can vary by the season and time of day, but for air quality applications an average mixing height of 3,000 ft AGL is an acceptable default value (40 CFR § 93.153[c][2]).
24. **Tables C-8** shows the basis for air emission calculations in ACAM for flight operations.

Table C-8
Air Conformity Applicability Model Data Inputs and Assumptions for F-16 Operations

Location	Type of Operation	Number of Sorties per Year (Alternative 2)	Ground Operation Emission Sources
Holloman Airfield	LTO Cycles	5,000[a]	Auxiliary power unit equipment, AGE, personal vehicle use, aircraft maintenance (solvent use), fuel handling and storage, engine test cells, painting operations, aircraft trim tests (12 per aircraft)
	TGO Cycles	7,500	
ROW Airfield	LTO Cycles	107 [a]	Aircraft trim tests (12 per aircraft)
	TGO Cycles	187	
WSMR Restricted Airspace (R-5107 & R-5111)	Sorties at ≤3,000 ft AGL	2,811[a,b,c]	Not Applicable
McGregor Range Restricted Areas (R-5103 A-C)	Sorties at ≤3,000 ft AGL	346[a,b,c]	Not Applicable
Pecos North High/Low; South MOAs	Sorties at ≤3,000 ft AGL	15[a,b,c]	Not Applicable

Notes:
• Air quality impacts are assessed for the airport airfield and SUA based on the total annual sorties from the selected airfield.
• All sorties are low-altitude operations (≤3,000 ft AGL) and would spend the estimated time per sortie in the mixing layer.
• Estimated time per sortie spent at or below 3,000 ft altitude is 13.33 minutes. 88/12 split between military and afterburner mode.
AGE = aerospace ground equipment; AGL= above ground level; ft = foot (feet); LTO = Landing and Takeoff; SUA = special use airspace; TGO = Touch and Go

C.4.2.3 Significance Indicators and Evaluation Criteria

The CAA Section 176(c), *General Conformity*, requires federal agencies to demonstrate that their proposed activities would conform to the applicable SIP for attainment of the NAAQS. General conformity applies only to nonattainment and maintenance areas. If the emissions from a federal action proposed in a nonattainment area exceed annual *de minimis* thresholds identified in the rule, a formal conformity determination is required of that action. The thresholds are more restrictive as the severity of the nonattainment status of the region increases. The Council on Environmental Quality defines significance in terms of context and intensity in 40 CFR § 1508.27. This requires that the significance of the action be analyzed with respect to the setting of the Proposed Action and based relative to the severity of the impact. The Council on Environmental Quality National Environmental Policy Act regulations (40 CFR § 1508.27[b]) provide 10 key factors to consider in determining an impact's intensity.

Based on guidance in Chapter 4 of the *Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide*, *Volume II – Advanced Assessments*, for air quality impact analysis, project criteria pollutant emissions were compared against the insignificance indicator of 250 tons per year (tpy) for Prevention of Significant Deterioration (PSD) major source permitting threshold for actions occurring in areas that are in attainment for all criteria pollutants (25 tpy for lead). These "Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the NAAQS. These insignificance indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for each criteria pollutant is considered so insignificant that the action would not cause or contribute to an exceedance on one or more NAAQSs. Although PSD and Title V are not applicable to mobile sources, the PSD major source thresholds provide a benchmark to compare air emissions against and to determine project impacts.

For proposed action alternatives that would occur in nonattainment/maintenance areas, the net-change emissions estimated for the relevant criteria pollutant(s) are compared against General Conformity *de minimis* values to perform a General Conformity evaluation. If the estimated annual net emissions for each relevant pollutant from the Proposed Action alternative are below the corresponding *de minimis* threshold values, General Conformity Rule requirements would not be applicable.

Emissions from the Proposed Action in the vicinity of the Holloman AFB and at ROW are assessed in **Chapter 3.6** of the EA and compared to applicable insignificance indicators. An overview of ACAM inputs and the methodologies used to estimate emissions are summarized in **Section D.2.1** of this appendix.

C.4.3 References

E3. 2020. Energy and Environmental Economics, Inc. (E3). *New Mexico GHG Inventory and Forecast.* 27 October .

USEPA. 2010. *40 CFR Parts 51 and 93, Revisions to the General Conformity Regulations*. 75 Federal Register 14283, EPA-HQ-OAR-2006-0669; FRL-9131-7. 24 March.

USEPA. 2017. *NAAQS Table*. <https://www.epa.gov/criteria-air-pollutants/naaqs-table>. 20 December.

C.5 BIOLOGICAL RESOURCES

C.5.1 Definition of the Resource

Biological resources include native, nonnative, and invasive plants and animals; sensitive and protected floral and faunal species; and the habitats, such as wetlands, forests, and grasslands, in which they exist. Habitat can be defined as the resources and conditions in an area that support a defined suite of organisms. The following is a description of the primary federal statutes that form the regulatory framework for the evaluation of biological resources.

Special status species include plant and animal species (1) listed as endangered, threatened, or proposed for listing by the USFWS under the ESA and their designated critical habitats; (2) protected by the federal Migratory Bird Treaty Act (MBTA) of 1981; (3) protected under the Bald and Golden Eagle Protection Act (BGEPA) of 1940; or (4) listed under state ESAs or similar conservation laws. Descriptions of the primary federal statutes that form the regulatory framework for the evaluation of biological resources is provided below.

C.5.1.1 Endangered Species Act

The ESA of 1973 (16 United States [US] Code [U.S.C.] § 1531 et seq.) established protection over and conservation of threatened and endangered species and the ecosystems upon which they depend. Sensitive and protected biological resources include plant and animal species listed as threatened, endangered, or special status by the USFWS and National Marine Fisheries Service (NMFS). Under the ESA (16 U.S.C. § 1536), an “endangered species” is defined as any species in danger of extinction throughout all, or a large portion, of its range. A “threatened species” is defined as any species likely to become an endangered species in the foreseeable future. The USFWS maintains a list of species considered to be candidates for possible listing under the ESA. The ESA also allows the designation of geographic areas as critical habitat for threatened or endangered species. Although candidate species receive no statutory protection under the ESA, the USFWS has attempted to advise government agencies, industry, and the public that these species are at risk and may warrant protection under the ESA.

Section 9 of the ESA prohibits the take of federally listed species. “Take” as defined under the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” Section 7 of the ESA prohibits any federal agency from engaging in any action that is likely to "jeopardize" the continued existence of listed endangered or threatened species or that destroys or adversely affects the critical habitat of such species. Any federal agency proposing an action which may adversely impact an endangered or threatened species must "consult" with USFWS (on an informal or formal basis, as appropriate) before carrying out that action would place a listed species and/or its critical habitat in jeopardy. Species proposed for listing under ESA (candidate species) are not protected under law; however, these species could become federally listed in the near term; and, therefore, they are considered in this analysis to avoid future conflicts if they were to be listed during the preparation of this EA. Under Section 10(j) of the ESA, the USFWS can designate reintroduced populations established outside of the species’ current range, but within its historical range, as “experimental”. The experimental population can be designated as “essential” or “non-essential” to the continued existence of the species. The regulatory restrictions are considerably reduced for a species with a Nonessential Experimental Population designation. Critical habitat is designated by USFWS through a formal process to provide protection for those habitat areas believed to be essential to the species’ conservation.

C.5.1.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918 makes it unlawful for anyone to take migratory birds or their parts, nests, or eggs unless permitted to do so by regulations. Per the MBTA, “take” is defined as to “pursue, hunt, shoot, wound, kill, trap, capture, or collect” (50 Code of Federal Regulations § 10.12). Migratory birds include nearly all species in the United States, with the exception of some upland game birds and nonnative species.

Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, requires all federal agencies undertaking activities that may negatively impact migratory birds to follow a prescribed set of actions to further implement the MBTA.

The National Defense Authorization Act for Fiscal Year 2003 (Public Law 107-314, 116 Stat. 2458) provided the Secretary of the Interior the authority to prescribe regulations to exempt the armed forces from the incidental take of migratory birds during authorized military readiness activities. Congress defined military readiness activities as all training and operations of the US armed forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use.

In December 2017, the US Department of the Interior issued M-Opinion 37050 (US Department of Interior, 2017) which concluded that the take of migratory birds from an activity is not prohibited by the MBTA when the underlying purpose of that activity is not the take of a migratory bird. The USFWS interprets the M-Opinion to mean that the MBTA's prohibition on take does not apply when the take of birds, eggs, or nests occurs as a result of an activity, the purpose of which is not to take birds, eggs, or nests.

On 7 January 2021, the USFWS issued Final Rule (86 Federal Register 1134), effective 8 February 2021 determining that the MBTA's prohibitions on pursuing, hunting, taking, capturing, killing, or attempting to do the same, applies only to actions directed at migratory birds, their nests, or their eggs; however, the USFWS delayed the implementation of the final MBTA rule until 8 March 2021 in conformity with the Congressional Rule Act (86 Federal Register 8715).

C.5.1.3 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. § 668 to 668c) prohibits the "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*), alive or dead, or any part, nest, or egg thereof." "Take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb," and "disturb" is defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, injury to an eagle, a decrease in productivity by substantially interfering with the eagle's normal breeding, feeding or sheltering behavior, or nest abandonment by substantially interfering with the eagle's normal breeding, feeding or sheltering behavior." The Bald and Golden Eagle Protection Act also prohibits activities around an active or inactive nest site that could result in an adverse impact on the eagle.

C.5.1.4 Invasive Species

As defined in Executive Order 13112, *Invasive Species*, are "an alien species whose introduction does or is likely to cause economic or environmental harm to human health." Invasive species are highly adaptable and oftentimes displace native species. The characteristics that enable them to do so include high reproduction rates, resistance to disturbances, lack of natural predators, efficient dispersal mechanisms, and the ability to outcompete native species.

C.5.2 Biological Effects of Countermeasure Chaff and Flare

In approved areas, chaff and flares (types similar to RR-188 chaff and M206 flares) are proposed for annual use during the training sortie operations. Potential direct impacts on resources from training activities include the deposition of residual materials, such as plastic, from chaff and flare use, its accumulation in sensitive and protected areas, and the ultimate breakdown of these materials into substrate mediums. Indirect impacts include fire risk, transportation of these materials to other areas by environmental elements, and the potential for ingestion by sensitive species within the ROI and beyond. Depending on the altitude of release and wind speed and direction, the chaff from a single bundle can be spread over distances ranging from less than a 0.25 mi to over 100 mi (Air Force, 1997). The most confined distribution would be from a low-altitude release in calm conditions (Air Force, 1997).

Chaff chemical composition, composition, rate of decomposition, and tendency to leach toxic chemicals under various situations paired with baseline substrate chemistry and conditions are factors that could potentially alter substrate chemistry. A change in chemistry could potentially affect fauna, flora, vegetative cover, substrate stability, the type and quality of habitat, and leaching and runoff potential. Silica (silicon dioxide), aluminum, and stearic acid are major components of chaff with minor quantities of copper, manganese, titanium, vanadium, and zinc in the aluminum chaff coating. All are generally prevalent in the environment, and all but titanium are either found in plants and animals and/or necessary essentials for their growth. Silica does not present a concern to chemistry as it is found in silicate minerals, the most common mineral group on Earth. Silica is more stable in acidic environments than alkaline. Aluminum is also very abundant in the earth's crust, forming common minerals like feldspars, micas, and clays. While acidic and extremely alkaline substrates increase the solubility of aluminum, what is left eventually oxidizes to aluminum oxide which is insoluble. Stearic acid is used in conjunction with palmitic acid to produce an anticlumping compound for chaff fibers and both degrade when exposed to light and air (Air Force, 1997).

The primary material in flares is magnesium, which is not highly toxic, and it is highly unlikely organisms would ingest flare materials; however, plastic caps are released with the deployment of both chaff and flares and, although highly unlikely, could be ingested. Some flares utilize impulse cartridges and initiates which contain chromium and sometimes lead. Even though these are hazardous air pollutants under the CAA and have been known to cause health risk in certain avian species, significant effects on biological resources are not expected because previous studies have indicated that there are no health risks from most flare components (Air Force, 1997), the amount of lead is expected to be very small and dispersed over great distances, and the use of BMPs would avoid the selection of flares containing lead. More significantly, flares have a potential to start fires that can spread, adversely and indirectly affecting many resources. Flare-induced fires depend on the probabilities of flare materials reaching the ground, igniting vegetation, and causing significant damage if fire spreads (Air Force, 1997); however, all use of flares in authorized areas of the SUA and ATCAAs is subject to altitude and seasonal restrictions based on specific location and the fire danger level. These restrictions greatly reduce the risk of wildland fires due to flare use.

The following BMPs would be implemented as appropriate:

- Comply with Air Force and local procedures.
- Establish a capability to analyze fire risks on a site-specific basis. The methodologies presented in this report provide a mechanism for accomplishing this.
- Replace impulse cartridges and initiators in future procurements of flares with models that do not contain toxic air pollutants such as chromium and lead.
- Consider a public information program in areas where flares are used over non-DOD land to educate the public about the hazards of dud flares and proper procedures to follow if a dud flare is found.

C.5.3 Threatened and Endangered Species and Designated Critical Habitat

The Region of Influence includes Holloman AFB, the SUA that consists of MOAs and Restricted Airspace, ATCAA, and MTRs. Lists of species that could potentially occur in the ROI were obtained from the USFWS Environmental Conservation Online System, Information for Planning and Consultation (IPaC) website (USFWS, 2023a), the New Mexico Department of Game and Fish (NMDGF) Biota Information System of New Mexico (BISON-M) database (NMDGF, 2022), Arizona Game and Fish Department (AGFD, 2022), and Texas Parks and Wildlife (TPW, 2022a) and are provided in **Tables C-8 and C-9**. A total of 52 species were identified with the potential to be within the Holloman AFB, ROW, SUA, ATCAA, and MTR ROI and include federally listed as threatened and endangered, as well as candidate, or proposed for listing, and experimental populations under the ESA (**Tables C-9 and C-10**). Of these federally listed species, seven birds, three mammals, and one insect have the potential to be impacted from aircraft operations or the use of chaff and flare within special use airspace. A description of these species can be found in section C.5.3.1. Because there would be no ground disturbing activities and aircraft movement, aircraft noise, and the use of defensive countermeasures would have no effect on federally listed amphibians, fish, mollusks, plants or reptiles, there would be no impacts on these species. A total of 122 state listed species were identified with the potential to be within the Holloman AFB, ROW, SUA, ATCAA, and MTR ROI (**Table C-10**), several of these species are also federal listed.

Table C-9
Federal Listed Species with the Potential to be on Installations or within the Airspace and Training Ranges Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base – By Airspace

Species	Federal Status[1]	Holloman AFB	Roswell IAC	Special Use Airspace						
				Beak ATCAA and MOAs	Wiley ATCAA	Talon ATCAA and MOAs	Pecos MOAs	Smitty and Cato MOAs	WSMR Restricted Areas and Training Ranges	McGregor Range Restricted Areas and Training Range
Birds										
Lesser prairie-chicken (*Tympanuchus pallidicinctus*)	F	X	X	X		X	X			
Mexican spotted owl (*Strix occidentalis lucida*)	T	X		X/CH	X/CH	X	X	X/CH	X	X/CH
Northern aplomado falcon (*Falco femoralis*)	E									X
Northern aplomado falcon (*Falco femoralis*)	EXPN	X	X	X	X	X	X	X	X	X
Piping plover (*Charadrius melodus*)	T		X	X	X	X	X	X	X	X
Red Knot (*Calidris canutus rufa*)	T									X
Southwestern willow flycatcher (*Empidonax traillii extimus*)	E			X	X	X	X	X	X	X
Yellow-billed cuckoo (*Coccyzus americanus*)	T	X		X	X	X		X	X	X
Mammals										
New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)	E	X		X	X/CH	X	X	X	X	X
Mexican gray wolf (*Canis lupus baileyi*)	E									
Mexican gray wolf (*Canis lupus baileyi*)	EXPN			X	X			X	X	
Peñasco least chipmunk (*Neotamias minimus atristriatus*)	PE	X		X	X	X	X		X	X
Amphibians										
Chiricahua leopard frog (*Lithobates chiricahuensis*)	T			X	X			X/CH	X	
Reptiles										
Narrow-headed Gartersnake (*Thamnophis rufipunctatus*)	T							X/CH	X	

Table C-9
Federal Listed Species with the Potential to be on Installations or within the Airspace and Training Ranges Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base – By Airspace

Species	Federal Status[1]	Holloman AFB	Roswell IAC	Special Use Airspace						
				Beak ATCAA and MOAs	Wiley ATCAA	Talon ATCAA and MOAs	Pecos MOAs	Smitty and Cato MOAs	WSMR Restricted Areas and Training Ranges	McGregor Range Restricted Areas and Training Range
Northern Mexican Gartersnake (*Thamnophis eques megalops*)	T							X		
Fish										
Gila trout (*Oncorhynchus gilae*)	T							X	X	
Loach minnow (*Tiaroga cobitis*)	E							X/CH		
Pecos bluntnose shiner (*Notropis simus pecosensis*)	T		X	X	X	X/CH	X/CH			
Pecos gambusia (*Gambusia nobilis*)	E		X	X	X	X	X			
Rio Grande cutthroat trout (*Oncorhynchus clarkii virginalis*)	C	X		X	X	X	X		X	X
Rio Grande silvery minnow *Hybognathus amarus*)	E			X	X			X	X	
Spikedace (*Meda fulgida*)	E							X		
Mollusks										
Alamosa springsnail (*Pseudotryonia alamosae*)	E			X				X	X	
Chupadera springsnail (*Pyrgulopsis chupaderae*)	E			X				X	X	
Socorro springsnail (*Pyrgulopsis neomexicana*)	E			X				X	X	
Texas hornshell (*Popenaias popeii*)	E					X/CH				
Crustaceans										
Socorro isopod (*Thermosphaeroma thermophilum*)	E			X				X	X	
Insects										
Monarch Butterfly (*Danaus plexippus*)	C	X	X	X	X	X	X	X	X	X
Plants										
Gypsum Wild-buckwheat (*Eriogonum gypsophilum*)	T					X				

Table C-9
Federal Listed Species with the Potential to be on Installations or within the Airspace and Training Ranges Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base – By Airspace

Species	Federal Status[1]	Holloman AFB	Roswell IAC	Special Use Airspace						
				Beak ATCAA and MOAs	Wiley ATCAA	Talon ATCAA and MOAs	Pecos MOAs	Smitty and Cato MOAs	WSMR Restricted Areas and Training Ranges	McGregor Range Restricted Areas and Training Range
Kuenzler hedgehog cactus (*Echinocereus fendleri* var. *kuenzleri*)	T	X	X	X	X	X	X		X	X
Lee Pincushion Cactus (*Coryphantha sneedii var. leei*)	T					X				
Pecos (=puzzle, =paradox) Sunflower (*Helianthus paradoxus*)	T		X	X	X	X	X	X	X	
Sacramento Mountains thistle (*Cirsium vinaceum*)	T	X		X	X	X			X	X
Sacramento prickly poppy (*Argemone pleiacantha* ssp. *pinnatisecta*)	E	X		X	X	X			X	X
Sneed Pincushion (*Coryphantha sneedii var. sneedii*)	E					X			X	
Todsen's pennyroyal (*Hedeoma todsenii*)	E	X		X	X	X			X/CH	X
Wright's marsh thistle (*Cirsium wrightii*)	PT	X	X	X	X	X	X	X	X	X
Zuni Fleabane (*Erigeron rhizomatus*)	T							X		

Notes:
[1] Source: US Fish and Wildlife Service Information for Planning and Consultation listing (Project Codes 2023--0027029 and 2023-0027024).
- CH indicates that designated critical habitat is located beneath the airspace.

AFB = Air Force Base; ATCAA = Air Traffic Control Assigned Airspace; C = Candidate; CH = Designated Critical Habitat; E = Endangered; EXPN = Nonessential Experimental Population; IAC = International Air Center; MOA = Military Operations Area; PE = Proposed Endangered; PT = Proposed Threatened; T = Threatened; WSMR = White Sands Missile Range

Table C-10
Federally Listed Species within the Military Training Routes (MTR) Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base – By MTR

Species	Federal Status	Special Use Airspace			
		IR-192/194	IR-134/195	VR-176	IR-133/142
Birds					
Lesser prairie-chicken (*Tympanuchus pallidicinctus*)	E	X	X		X
Mexican spotted owl (*Strix occidentalis lucida*)	T	X/CH	X	X/CH	X
Northern aplomado falcon (*Falco femoralis*)	E	X			
Northern aplomado falcon (*Falco femoralis*)	EXPN	X	X	X	X
Piping plover (*Charadrius melodus*)	T	X	X	X	X
Red Knot (*Calidris canutus rufa*)	T	X			
Southwestern willow flycatcher (*Empidonax traillii extimus*)	E	X	X	X/CH	X
Yellow-billed cuckoo (*Coccyzus americanus*)	T	X	X	X/CH	X
Mammals					
Mexican gray wolf (*Canis lupus baileyi*)	EXPN			X	X
New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)	E	X		X/CH	X
Peñasco least chipmunk (*Neotamias minimus atristriatus*)	PE	X	X	X	X
Amphibians					
Chiricahua leopard frog (*Lithobates chiricahuensis*)	T			X/CH	X
Reptiles					
Mexican gartersnake (*Thamnophis eques*)	T			X	
Narrow-headed Gartersnake (*Thamnophis rufipunctatus)*	T			X/CH	
Fish					
Apache trout (*Oncorhynchus apache*)	T			X	
Beautiful Shiner (*Cyprinella formosa*)	T			X	
Chihuahua chub (*Gila nigrescens*)	T			X	
Gila chub (*Gila intermedia*)	E			X/CH	
Gila topminnow (*Poeciliopsis occidentalis occidentalis*)	E			X	
Gila trout (*Oncorhynchus gilae*)	T			X	
Little Colorado spinedace (*Lepidomeda vittate*)	T			X/CH	
Loach minnow (*Tiaroga cobitis*)	E			X/CH	
Pecos bluntnose shiner (*Notropis simus pecosensis*)	T	X	X		
Fish *(continued)*					
Pecos gambusia (*Gambusia nobilis*)	E	X	X		

Table C-10
Federally Listed Species within the Military Training Routes (MTR) Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base – By MTR

Species	Federal Status	Special Use Airspace			
		IR-192/194	IR-134/195	VR-176	IR-133/142
Razorback sucker (*Xyrauchen texanus*)	E			X	
Rio Grande cutthroat trout (*Oncorhynchus clarkii virginalis*)	C	X	X	X	X
Rio Grande silvery minnow (*Hybognathus amarus*)	E			X/CH	
Rio Grande silvery minnow (*Hybognathus amarus*)	EXPN	X			
Spikedace (*Meda fulgida*)	E			X/CH	
Zuni bluehead sucker (*Catostomus discobolus yarrow*)	E			X	
Mollusks					
Alamosa springsnail (*Pseudotryonia alamosae*)	E			X	X
Chupadera springsnail (*Pyrgulopsis chupaderae*)	E			X/CH	X
Socorro springsnail (*Pyrgulopsis neomexicana*)	E			X	X
Three Forks sringsnail (*Pyrgulopsis trivialis*)	E			X/CH	
Texas hornshell (*Popenaias popeii*)	E	X/CH	X		
Crustaceans					
Socorro isopod (*Thermosphaeroma thermophilum*)	E			X	X
Insects					
Monarch butterfly (*Danaus plexippus*)	C	X	X	X	X
Flowering Plants					
Guadalupe fescue (*Festuca ligulata*)	E	X			
Gypsum wild-buckwheat (*Eriogonum gypsophilum*)	T	X/CH			
Kuenzler hedgehog cactus (*Echinocereus fendleri* var. *kuenzleri*)	T	X	X	X	X
Lee Pincushion Cactus (*Coryphantha sneedii* var. *leei*)	T	X			
Pecos (=puzzle, =paradox) Sunflower (*Helianthus paradoxus*)	T	X	X	X	
Sacramento Mountains thistle (*Cirsium vinaceum*)	T	X	X	X	X
Sacramento prickly poppy (*Argemone pleiacantha* ssp. *pinnatisecta*)	E	X	X	X	X
Sneed pincushion (*Coryphantha sneedii* var. *sneedii*)	E	X	X	X	
Todsen's pennyroyal (*Hedeoma todsenii*)	E	X	X	X	X
Wright's marsh thistle (*Cirsium wrightii*)	PT	X	X	X	X
Zuni fleabane (*Erigeron rhizomatus*)	T			X	
Ferns and Allies					

Table C-10
Federally Listed Species within the Military Training Routes (MTR) Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base – By MTR

Species	Federal Status	Special Use Airspace			
		IR-192/194	IR-134/195	VR-176	IR-133/142
American Hart's-tongue Fern (*Asplenium scolopendrium* var. *Americanum*)	T			X	

Source: US Fish and Wildlife Service Information for Planning and Consultation listing (Project Codes 2023-0027029 and 2023-0027024).
Notes:
- CH indicates that designated critical habitat is located beneath the airspace.

C = Candidate; CH = Designated Critical Habitat; E = Endangered; EXPN = Nonessential Experimental Population; PE = Proposed Endangered; PT = Proposed Threatened; T = Threatened

Table C-11
State Listed Species with the Potential to be on Installations or within the Airspace, Training Ranges, and Military Training Routes Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base

Common Name	Scientific Name	New Mexico Status	Arizona Status[1, 2]	Texas Status[3]
Birds				
American Peregrine Falcon	*Falco peregrinus anatum*	T	1A	T
Aplomado Falcon	*Falco femoralis*	E		
Baird's Sparrow	*Ammodramus bairdii*	T		
Bald Eagle	*Haliaeetus leucocephalus*	T	1A	
Bald Eagle - Winter Population	*Haliaeetus leucocephalus*		1A	
Bell's Vireo	*Vireo bellii*	T		
Broad-Billed Hummingbird	*Cynanthus latirostris*	T		
Brown Pelican	*Pelecanus occidentalis*	E		
Common Black-Hawk	*Buteogallus anthracinus*	T		
Common Ground-Dove	*Columbina passerina*	E		
Costa's Hummingbird	*Calypte costae*	T		
Elegant Trogon	*Trogon elegans*	E		
Gray Vireo	*Vireo vicinior*	T		
Interior Least Tern	*Sternula antillarum athalassos*	E		
Least Tern	*Sternula antillarum*	E		
Mexican Spotted Owl	*Strix occidentalis lucida*		1A	T
Neotropic Cormorant	*Phalacrocorax brasilianus*	T		
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	E		
Peregrine Falcon	*Falco peregrinus*	T		
Piping Plover	*Charadrius melodus*	T		
Southwestern Willow Flycatcher	*Empidonax traillii extimus*		1A	E
Varied Bunting	*Passerina versicolor*	T		
White-faced ibis	*Plegadis chihi*			T
Yellow-billed Cuckoo	*Coccyzus americanus*		1A	
Mammals				
Arizona Montane Vole	*Microtus montanus arizonensis*	E		
Black bear	*Ursus americanus*			T
Least Shrew	*Cryptotis parva*	T		
Mexican Wolf	*Canis lupus baileyi*		1A	
New Mexico Meadow Jumping Mouse	*Zapus hudsonius luteus*		1A	
Organ Mountains Colorado Chipmunk	*Neotamias quadrivittatus australis*	T		
Oscura Mountains Colorado Chipmunk	*Neotamias quadrivittatus oscuraensis*	T		
Peñasco Least Chipmunk	*Tamias minimus atristriatus*	E		
Spotted Bat	*Euderma maculatum*	T		

Table C-11
State Listed Species with the Potential to be on Installations or within the Airspace, Training Ranges, and Military Training Routes Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base

Common Name	Scientific Name	New Mexico Status	Arizona Status[1, 2]	Texas Status[3]
Reptiles				
Dunes Sagebrush Lizard	*Sceloporus arenicolus*	E		
Gray-Banded Kingsnake	*Lampropeltis alterna*	E		
Mottled Rock Rattlesnake	*Crotalus lepidus lepidus*	T		
Mountain short-horned lizard	*Phrynosoma hernandesi*			T
Plainbelly Water Snake	*Nerodia erythrogaster*	E		
Texas horned lizard	*Phrynosoma cornutum*			T
Western Ribbon Snake	*Thamnophis proximus*	T		
Western River Cooter	*Pseudemys gorzugi*	T		
Amphibians				
Chiricahua Leopard Frog	*Rana chiricahuensis*		1A	
Lowland Leopard Frog	*Lithobates yavapaiensis*	E	1A	
Sacramento Mountain Salamander	*Aneides hardii*	T		
Fishes				
Apache Trout	*Oncorhynchus apache*		1A	
Arkansas River Shiner	*Notropis girardi*	E		
Bigscale Logperch	*Percina macrolepida*	T		
Blue Sucker	*Cycleptus elongatus*	E		
Bluehead Sucker	*Catostomus discobolus discobolus*		1A	
Chihuahua Chub	*Gila nigrescens*	E		
Gila Trout	*Oncorhynchus gilae*	T	1A	
Gray Redhorse	*Moxostoma congestum*	E		
Greenthroat Darter	*Etheostoma lepidum*	T		
Headwater catfish	*Ictalurus lupus*			T
Headwater Chub	*Gila nigra*	E		
Little Colorado Spinedace	*Lepidomeda vittata*		1A	
Little Colorado Sucker	*Catostomus* sp. 3		1A	
Loach Minnow	*Tiaroga cobitis*		1A	
Mexican Tetra	*Astyanax mexicanus*	T		
Pecos Gambusia	*Gambusia nobilis*	E		
Pecos pupfish	*Cyprinodon pecosensis*	T		T
Razorback Sucker	*Xyrauchen texanus*		1A	
Rio Grande Silvery Minnow	*Hybognathus amarus*	E		
Roundtail Chub	*Gila robusta*	E	1A	
Spikedace	*Meda fulgida*		1A	
Suckermouth Minnow	*Phenacobius mirabilis*	T		

Table C-11
State Listed Species with the Potential to be on Installations or within the Airspace, Training Ranges, and Military Training Routes Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base

Common Name	Scientific Name	New Mexico Status	Arizona Status[1, 2]	Texas Status[3]
White Sands Pupfish	*Cyprinodon tularosa*	T		
Zuni Bluehead Sucker	*Catostomus discobolus yarrowi*	E		
Clams				
Texas Hornshell	*Popenaias popeii*	E		
Mussels				
California Floater	*Anodonta californiensis*		1A	
Snails				
Alamosa Springsnail	*Tryonia alamosae*	E		
Gila Springsnail	*Pyrgulopsis gilae*	T		
Mineral Creek Mountainsnail	*Oreohelix pilsbryi*	T		
New Mexico Hot Springsnail	*Pyrgulopsis thermalis*	T		
Ovate Vertigo	*Vertigo ovata*	T		
Pecos Springsnail	*Pyrgulopsis pecosensis*	T		
Socorro Springsnail	*Pyrgulopsis neomexicana*	E		
Three Forks Springsnail	*Pyrgulopsis trivialis*		1A	
Crustaceans				
Socorro Isopod	*Thermosphaeroma thermophilus*	E		
Plants				
Allred's Flax	*Linum allredii*	E		
Arizona Crested Coralroot	*Hexalectris arizonica*	E		
Clover's cactus	*Sclerocactus cloverae*	E		
Crested Coralroot	*Hexalectris spicata*	E		
Duncan's Corycactus	*Escobaria duncanii*	E		
Goodding's Onion	*Allium gooddingii*	E		
Guadalupe Fescue	*Festuca ligulata*			E
gypsum scalebroom	*Lepidospartum burgessii*	E		T
Gypsum Wild-buckwheat	*Eriogonum gypsophilum*	E		
Hess's Fleabane	*Erigeron hessii*	E		
Kuenzler Hedgehog Cactus	*Echinocereus fendleri* var. *kuenzleri*	E		
Lee Pincushion Cactus	*Coryphantha sneedii* var. *leei*	E		
Mescalero Milkwort	*Polygala rimulicola* var. *mescalerorum*	E		
Metcalfe's Penstemon	*Penstemon metcalfei*	E		
Mimbres Figwort	*Scrophularia macrantha*	E		
Mountain Lily	*Lilium philadelphicum* var. *andinum*	E		

Table C-11
State Listed Species with the Potential to be on Installations or within the Airspace, Training Ranges, and Military Training Routes Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base

Common Name	Scientific Name	New Mexico Status	Arizona Status[1, 2]	Texas Status[3]
Night-Blooming Cereus	*Peniocereus greggii* var. *greggii*	E		
Organ Mountain Pincushion Cactus	*Escobaria organensis*	E		
Parish's Alkali Grass	*Puccinellia parishii*	E		
Puzzle Sunflower	*Helianthus paradoxus*	E		
Rhizome Fleabane	*Erigeron rhizomatus*	E		
Sacramento Mountains Thistle	*Cirsium vinaceum*	E		
Sacramento Prickly Poppy	*Argemone pleiacantha* ssp. *pinnatisecta*	E		
Sand Prickly-Pear	*Opuntia arenaria*	E		
Scheer's Pincushion Cactus	*Coryphantha robustispina* ssp. *scheeri*	E		
Shining Coralroot	*Hexalectris nitida*	E		
Sneed Pincushion Cactus	*Coryphantha sneedii* var. *sneedii*	E		
Tharp's Blue Star	*Amsonia tharpii*	E		
Todsen's Pennyroyal	*Hedeoma todsenii*	E		
Villard's Pincushion Cactus	*Escobaria villardii*	E		
Wright's Marsh Thistle	*Cirsium wrightii*	E		
Yellow Lady's-Slipper	*Cypripedium parviflorum* var. *pubescens*	E		

Notes:
[1] A indicates vulnerability in at least one of the eight categories and matches at least one of the following: Federally listed as endangered or threatened under the Endangered Species Act (ESA); Candidate species under ESA; Is specifically covered under a signed conservation agreement or a signed conservation agreement with assurances; Recently removed from ESA and currently requires post-delisting monitoring; Closed season species (i.e., no take permitted) as identified in Arizona Game and Fish Commission Orders.
[2] Only those species identified within the portion of Military Training Route (MTR) VR-176 within the Arizona border.
[3] Only those species identified within the portion of MTR IR-192/194 within the Texas border.

C.5.3.1 Birds

Lesser Prairie-Chicken. The lesser prairie-chicken is a federally endangered species of prairie grouse (USFWS, 2023a, 2023c). This species has been broken into two distinct population segments (DPS) by the USFWS, a northern DPS, and a southern DPS (USFWS, 2022). The southern DPS encompasses New Mexico and Texas; therefore encompassing the ROI. In the southern DPS, suitable habitat includes shortgrass prairies where shinnery oak, sand sagebrush, and bluestem grasses are the predominant vegetation; characterized as the Shinnery-Oak Ecoregion. Prairie-chickens are relatively short-lived species, with a two- to three-year expected lifespan. Breeding occurs in the spring and broods are raised throughout the summer (USFWS, 2022). There is the potential for this species to occur in the eastern most portion of the ROI, on both Holloman AFB and Roswell International Air Center, as well as underneath the Beak, Talon, and Pecos airspaces.

Northern Aplomado Falcon. In New Mexico and Arizona there are Nonessential Experimental Populations of northern aplomado falcon (*Falco femoralis*) due to releases from captive breeding programs (USFWS, 2023b). Permanent residents in the coastal counties from Cameron to Calhoun Counties and the Trans-Pecos region, the northern aplomado falcon is also listed as federally endangered in Texas (TPW, 2022b). The northern aplomado falcon is a slender, moderate-sized, long-tailed falcon that is distinct in pattern and coloration. The northern aplomado falcon breeds and forages in open desert grasslands and savannahs. The northern aplomado falcon nests in yuccas within intact grassland habitats and appropriates the nests of other birds, laying eggs in old stick nests. There is the potential for this species to occur in grasslands under the airspace proposed for use.

Mexican Spotted Owl. The Mexican spotted owl (*Strix occidentalis lucida*) is federally threatened and is a medium-sized brown owl with a loud voice that carries long distances, are typically very curious, and can be relatively easily approached (USFWS, 2023b). The Mexican spotted owl occurs in the southern Rocky Mountains and the highlands of north and central mainland Mexico. This species is most often found in old-growth mixed-conifer forests, usually more than 200 years old. Habitat characteristics include forests with high canopy closure, high stand density, a multilayered canopy, uneven-aged stands, numerous snags, and downed woody material. Mexican spotted owls are permanent residents of higher elevation forests located beneath the airspace proposed for use. There is designated critical habitat in the action area (see **Table C-9** and **Table C-10**) and owls are known to be present year-round.

Piping Plover. Piping plover (*Charadrius melodus*) is federally threatened. The piping plover is similar in appearance to many other small shorebirds and sandpipers but are more compactly built and thicker-necked and can be distinguished by the blackish band on the forecrown and across the breast and the characteristic thick neck of plover species. This species occurs on sandflats and bare shoreline of water bodies in the U.S. Midwest and Northeast. This species breeds from Alberta and Manitoba, Canada, south to Nebraska, in the Great Lakes region, and along the Atlantic Coast from New Brunswick, Canada, south to North Carolina. In New Mexico, the piping plover is a rare migrant and has been occasionally observed on the shorelines of reservoirs (NMDGF, 2022). In New Mexico, it is known as a spring (April) migrant. It is highly unlikely to occur in the special use airspace, and if it would occur, its presence would only be as a stray migrant. Their diet consists of invertebrates, including worms, crustaceans, and insects (NMDGF, 2022; USFWS, 2023b).

Red Knot. The red knot (*Calidris canutus rufa*) is federally threatened. Within the ROI, the red knot only needs consideration for wind projects (USFWS, 2023b) This species nests in the Arctic and typically immigrates to southern South America during the winter, making one of the longest known migrations in the animal kingdom (USFWS, 2023b). The red knot is a specialized molluscivore, eating hard-shelled mollusks, sometimes supplemented with easily accessed softer invertebrate prey, such as shrimp- and crab-like organisms, marine worms, and horseshoe crab eggs. As a long-distant migrant shorebird, they are highly dependent on the continued existence of quality habitat at a few key staging areas. These areas serve as steppingstones between wintering and breeding areas. Habitats used by red knots in migration and wintering areas are generally coastal marine and estuarine habitats with large areas of exposed intertidal sediments. Red knots have been documented on Fort Bliss from the middle of August to the middle of September and as an accidental transient on Holloman AFB in October (NMDGF, 2022). It also is believed to occur in Culberson County, Texas (USFWS, 2023b). While designated critical habitat is proposed for the red knot in Texas, none is proposed in Culberson County.

Southwestern Willow Flycatcher. The southwestern willow flycatcher (*Empidonax traillii extimus*), federally endangered, breeds in riparian habitats from southern California to Arizona and New Mexico and in southern Utah and Nevada; it may also be found in southwest Colorado and western Texas. It is a small, light-colored bird with double wingbars; however, their vocalizations are the best means for identification. In comparison to other flycatchers, it tends to have a higher body mass and fat stores (NMDGF, 2022; USFWS, 2023b). The southwestern willow flycatcher occurs in the United States only during the breeding season from May until September and migrates to Central and South America in the winter. This species occurs in non-riparian habitats during migration from the months of May to September, but are confined to riparian woodlands in the breeding season. It nests in riparian habitats primarily with mature native trees, and have also been observed nesting in riparian areas dominated by saltcedar (*Tamarix* spp.). In New Mexico, the historic breeding range is considered primarily from the Rio Grande Valley westward. In Arizona, its historic range includes portions of all major watersheds, while in Texas its historic breeding range is the Texas-Pecos region of western Texas. Designated critical habitat for the southwestern willow flycatcher is located beneath the VR-176 MTR in New Mexico and Arizona.

Yellow-billed Cuckoo. The yellow-billed cuckoo (*Coccyzus americanus*) is federally listed as threatened. It is a slim, brown-backed bird with a large yellow bill that is slightly downturned. Unlike European cuckoo, the yellow-billed cuckoo rarely lays its eggs in the nests of other birds. With the shortest incubation and nestling period known of any known bird, this species begins migration at 3-4 weeks of age. It occurs in New Mexico, Nevada, Texas, Arizona, and several other southwestern states (NMDGF, 2019; USFWS, 2023b). The yellow-billed cuckoo is found in deciduous woodlands, low scrubby vegetation, abandoned farmland, and dense riparian thickets. The greatest threat to the species has been reported to be loss of riparian habitat. It has been estimated that 90 percent of the cuckoo's stream-side habitat has been lost. Habitat loss in the western United States is attributed to agriculture, dams, and river flow management, overgrazing and competition from exotic plants such as tamarisk. Designated critical habitat is located beneath the VR-176 MTR in New Mexico and Arizona.

C.5.3.2 Mammals

New Mexico Meadow Jumping Mouse. The New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) is listed as federally endangered. It is a small nocturnal rodent identified by grayish-brown fur and a long, bicolored tail. There are only 29 documented residual populations in Colorado, New Mexico, and Arizona (NMDGF, 2022). Except for their long hindlegs and jumping gait, the New Mexico Meadow Jumping Mouse behaves like mice of other taxonomic families. It is primarily associated with riparian habitats in New Mexico and found in areas with high soil moisture. It typically hibernates for all but the summer months and is relatively short-lived. There is designated Critical Habitat for the New Mexico meadow jumping mouse in the action area and suitable habitat occurs in the Sacramento Mountains, New Mexico under the Beak MOAs and ATCAA, as well as in the Apache National Forest, Arizona under the VR-176 MTR.

Mexican Gray Wolf and Gray Wolf. The Mexican gray wolf (*Canis lupus baileyi*) is a subspecies of the gray wolf (*C. lupus*). The Mexican gray wolf is listed as a Nonessential Experimental Population under the ESA from the reintroduction of Mexican wolves into the Mexican Wolf Experimental Population Area and listed as endangered by the State of New Mexico (USFWS, 2023b). In addition, the southwestern Distinct Population Segment is proposed for listing as endangered in portions of Arizona and New Mexico north of the centerline of Interstate Highway 40. The Mexican gray wolf is the largest wild member of the dog family in New Mexico and is dark overall in coloration, varying from grayish brown to blackish. Mexican gray wolves are found in a variety of southwestern habitats but prefer mountain woodlands. Historically, the wolves ranged throughout the mountainous regions from central Mexico, through southeastern Arizona, southern New Mexico, and southwestern Texas; however, by the mid-1900s, the wolves were effectively eliminated from the United States from intensive efforts to eradicate them. After lengthy recovery efforts, captive-reared Mexican gray wolves were released into the wild in the Blue Range Wolf Recovery Area in eastern Arizona and western New Mexico. As of January 2020, at least 163 wolves occupied the Mexican Wolf Recovery Area. This species has been documented occurring in Catron, Grant, Hidalgo, Sierra, and Socorro Counties in New Mexico and Apache, Coconino, Gila, Graham, Green lee, and Navajo Counties in Arizona. This species also historically occurred in the Gila, Lincoln, Cibola, and Coronado National Forests.

Peñasco least chipmunk. The Peñasco least chipmunk (*Neotamias minimus atristriatus*) is proposed for listing as federally endangered (USFWS, 2023b). The Peñasco least chipmunk is found primarily in southern New Mexico. It is the only rodent species in New Mexico to have stripes on its dorsum, an identifying characteristic. Bunchgrasses serve as important habitat for the species, serving as cover from predators and a source of food for foraging individuals. Their diet consists primarily of seeds from sunflowers, fruits, leaves, and cultivated grains. The Peñasco least chipmunk are highly active, primarily diurnal mammals, retreating into burrows at night and during cold weather (NMDGF, 2022). Populations of the Peñasco least chipmunk are located east of Cloudcroft in the Sacramento Mountains of Otero County, occurring between 6,800 and 8,000 ft in elevation in ponderosa pine forest. It is believed to be endemic to the White Mountains in Otero and Lincoln Counties and the Sacramento Mountains of Otero County (NMDFG, 2022).

C.5.3.3 Insects

Monarch Butterfly. Monarchs (*Danaus plexippus*) are large butterflies with bright orange wings with a black border and black veins. The black border contains a double row of white spots on the upperside of the wings (USFWS, 2023b). Monarchs are distributed throughout most of the contiguous US. Monarchs deposit eggs on obligate milkweed host plants, typically *Asclepias* species, and monarch larvae emerge from two to five days later. Development from larvae to adult butterflies typically takes anywhere from 14 to 32 days. Adult monarchs will live about two to five weeks, although adults that enter reproductive diapause (a suspended reproduction phase) may live six to nine months. Monarchs in temperate climates such as western North America will undergo long-distance migration in the fall while in reproductive diapause, some as far as 3,000 kilometers, to overwintering locations. In the early spring, the monarchs will break diapause and mate before dispersing back through breeding grounds.

C.5.3.4 Designated Critical Habitat

Within the SUA, ATCAAs and the MTRs proposed for use, there is designated critical habitat for 17 species. **Table C-12** provides the species with designated critical habitat within the ROI.

Table C-12
Designated Critical Habitat located within the Airspace, Training Ranges, and Military Training Routes Proposed for Use by the Permanent Beddown of Additional F-16 Formal Training Units at Holloman Air Force Base

Species Designated Critical Habitat	NM	TX	AZ
Chiricahua Leopard Frog	X		X
Chupadera Springsnail	X		
Gila Chub			X
Gypsum Wild-buckwheat	X		
Little Colorado Spinedace			X
Loach Minnow	X		X
Mexican Spotted Owl	X		X
Narrow-headed Gartersnake	X		X
New Mexico Meadow Jumping Mouse	X		X
Pecos Bluntnose Shiner	X		
Rio Grande Silvery Minnow	X		
Southwestern Willow Flycatcher	X		X
Spikedace	X		X
Texas Hornshell	X		
Three Forks Springsnail			X
Todsen's Pennyroyal	X		
Yellow-billed Cuckoo	X		X

C.5.4 References

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C.6 HAZARDOUS MATERIALS AND WASTES, ENVIRONMENTAL RESTORATION PROGRAM, AND TOXIC SUBSTANCES

C.5.1 Definition of the Resource

The Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act and the Toxic Substances Control Act (TSCA), defines hazardous materials (HAZMAT). HAZMAT is defined as any substance with physical properties of ignitability, corrosivity, reactivity, or toxicity that might cause an increase in mortality, serious irreversible illness, and incapacitating reversible illness, or that might pose a substantial threat to human health or the environment. The Occupational Safety and Health Administration (OSHA) is responsible for enforcement and implementation of federal laws and regulations pertaining to worker health and safety under 29 CFR Part 1910. OSHA also includes the regulation of HAZMAT in the workplace and ensures appropriate training in their handling.

The Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act (RCRA), which was further amended by the Hazardous and Solid Waste Amendments, defines hazardous wastes. Hazardous waste is defined as any solid, liquid, contained gaseous, or semi-solid waste, or any combination of wastes, that pose a substantial present or potential hazard to human health or the environment. In general, both HAZMAT and hazardous wastes include substances that, because of their quantity, concentration, physical, chemical, or infectious characteristics, might present substantial danger to public health and welfare or the environment when released or otherwise improperly managed.

Air Force Policy Directive (AFPD) 32-70 establishes the policy that the Air Force is committed to

- cleaning up environmental damage resulting from its past activities;
- meeting all environmental standards applicable to its present operations;
- planning its future activities to minimize environmental impacts;
- responsibly managing the irreplaceable natural and cultural resources it holds in public trust; and
- eliminating pollution from its activities wherever possible.

AFI 32-7044, *Storage Tank Compliance*, implements AFPD 32-70 and identifies compliance requirements for underground storage tanks (USTs), aboveground storage tanks (ASTs), and associated piping that store petroleum products and hazardous substances. Evaluation of HAZMAT and hazardous wastes focuses on USTs and ASTs as well as the storage, transport, and use of pesticides, fuels, oils, and lubricants. Evaluation might also extend to generation, storage, transportation, and disposal of hazardous wastes when such activity occurs at or near the project site of a Proposed Action. In addition to being a threat to humans, the improper release of HAZMAT and hazardous wastes can threaten the health and well-being of wildlife species, botanical habitats, soil systems, and water resources. In the event of release of HAZMAT or hazardous wastes, the extent of contamination varies based on type of soil, topography, weather conditions, and water resources.

AFI 32-7086, *Hazardous Materials Management*, establishes procedures and standards that govern management of HAZMAT throughout the Air Force. It applies to all Air Force personnel who authorize, procure, issue, use, or dispose of HAZMAT and to those who manage, monitor, or track any of those activities.

Through the Environmental Restoration Program (ERP) initiated in 1980, a subcomponent of the Defense ERP that became law under Superfund Amendments and Reauthorization Act (formerly the Installation Restoration Program), each DOD installation is required to identify, investigate, and clean up hazardous waste disposal or release sites. Remedial activities for ERP sites follow the Hazardous and Solid Waste Amendment of 1984 under the RCRA Corrective Action Program. The ERP provides a uniform, thorough methodology to evaluate past disposal sites, control the migration of contaminants, minimize potential hazards to human health and the environment, and clean up contamination through a series of stages until it is decided that no further remedial action is warranted.

Description of ERP activities provides a useful gauge of the condition of soils, water resources, and other resources that might be affected by contaminants. It also aids in identification of properties and their usefulness for given purposes (e.g., activities dependent on groundwater usage might be foreclosed where a groundwater contaminant plume remains to complete remediation).

Toxic substances might pose a risk to human health but are not regulated as contaminants under the hazardous waste statutes. Included in this category are asbestos-containing materials (ACM), lead-based paint (LBP), radon, and polychlorinated biphenyls (PCBs). The presence of special hazards or controls over them might affect, or be affected by, a Proposed Action. Information on special hazards describing their locations, quantities, and condition assists in determining the significance of a Proposed Action.

Asbestos. AFI 32-1052, *Facility Asbestos Management*, provides the direction for asbestos management at Air Force installations. This instruction incorporates by reference applicable requirements of 29 CFR Part 669 et seq., 29 CFR § 1910.1025, 29 CFR § 1926.58, 40 CFR § 61.3.80, Section 112 of the CAA, and other applicable AFIs and DOD Directives. AFI 32-1052 requires bases to develop an Asbestos Management Plan to maintain a permanent record of the status and condition of ACM in installation facilities, as well as documenting asbestos management efforts. In addition, the instruction requires installations to develop an asbestos operating plan detailing how the installation accomplishes asbestos-related projects. Asbestos is regulated by the USEPA with the authority promulgated under OSHA, 29 U.S.C. § 669 et seq. Section 112 of the CAA regulates emissions of asbestos fibers to ambient air. USEPA policy is to leave asbestos in place if disturbance or removal could pose a health threat.

Lead-based Paint. Human exposure to lead has been determined an adverse health risk by agencies such as OSHA and the USEPA. Sources of exposure to lead are dust, soils, and paint. In 1973, the Consumer Product Safety Commission established a maximum lead content in paint of 0.5 percent by weight in a dry film of newly applied paint. In 1978, under the Consumer Product Safety Act (Public Law 101-608, as implemented by 16 CFR Part 1303), the Consumer Product Safety Commission lowered the allowable lead level in paint to 0.06 percent (600 ppm). The Act also restricted the use of LBP in nonindustrial facilities. DOD implemented a ban of LBP use in 1978; therefore, it is possible that facilities constructed prior to or during 1978 may contain LBP.

Radon. The United States Surgeon General (USSG) defines radon as an invisible, odorless, and tasteless gas, with no immediate health symptoms, that comes from the breakdown of naturally occurring uranium inside the earth (USSG, 2005). Radon that is present in soil can enter a building through small spaces and openings, accumulating in enclosed areas such as basements. No federal or state standards are in place to regulate residential radon exposure at the present time, but guidelines were developed. Although 4.0 picocuries per liter (pCi/L) is considered an “action” limit, any reading over 2 pCi/L qualifies as a “consider action” limit. The USEPA and the USSG have evaluated the radon potential around the country to organize and assist building code officials in deciding whether radon-resistant features are applicable in new construction. Radon zones can range from 1 (high) to 3 (low).

Polychlorinated Biphenyls. PCBs are a group of chemical mixtures used as insulators in electrical equipment, such as transformers and fluorescent light ballasts. Chemicals classified as PCBs were widely manufactured and used in the United States until they were banned in 1979. The disposal of PCBs is regulated under the federal TSCA (15 U.S.C. § 2601, et seq., as implemented by 40 CFR Part 761), which banned the manufacture and distribution of PCBs, with the exception of PCBs used in enclosed systems. Per Air Force policy, all installations should have been PCB-free as of 21 December 1998. In accordance with 40 CFR Part 761 and Air Force policy, both of which regulate all PCB articles, which are regulated as follows:

- Less than 50 ppm—non-PCB (or PCB-free)
- 50 ppm to 499 ppm—PCB-contaminated
- 500 ppm and greater—PCB equipment (USEPA, 2008)

The TSCA regulates and the USEPA enforces the removal and disposal of all sources of PCBs containing 50 ppm or more; the regulations are more stringent for PCB equipment than for PCB-contaminated equipment.

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APPENDIX D
METHODOLOGIES AND MODELING

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D.1 NOISE MODELING

The following sections describe input data used in the noise modeling process. This data was developed in coordination with Holloman AFB personnel.

D.1.1 Noise Models

This section summarizes the analysis tools used to calculate the noise levels for the EA.

NOISEMAP

Analyses of aircraft noise exposure and compatible land uses around DOD airfield-like facilities are normally accomplished using a group of computer-based programs, collectively called NOISEMAP (Czech and Plotkin, 1998; Wasmer and Maunsell, 2006a, 2006b). The core computational program of the NOISEMAP suite is NMAP. In this report NMAP Version 7.3 was used to analyze aircraft operations and to generate noise contours.

MR_NMAP

When the aircraft flight tracks are not well defined and are distributed over a wide area, such as in military training routes with wide corridors or MOAs, the Air Force uses the DOD-approved MR_NMAP program (Lucas and Calamia, 1996). In this report, MR_NMAP Version 3.0 was used to model subsonic aircraft noise in special use airspace. For airspace environments where noise levels are calculated to be less than 45 dB, the noise levels are stated as "<45 dB."

PCBoom

Environmental analysis of supersonic aircraft operations requires calculation of sonic boom amplitudes. For the purposes of this study, the Air Force and DOD-approved PCBoom program was used to assess sonic boom exposure due to military aircraft operations in supersonic airspace. In this report, PCBoom Version 4 was used to calculate sonic boom overpressure footprints and ground signatures from supersonic vehicles performing steady, level flight operations (Plotkin, 2002).

BooMap

For cumulative sonic boom exposure under supersonic air combat training arenas, the Air Force and DOD-approved BooMap program was used. In this report, BooMap96 was used to calculate cumulative C-weighted DNL (CDNL) exposure based on long-term measurements in a number of airspaces (Plotkin, 1993).

D.1.2 Airfield Operations

Table D-1 summarizes the existing and Alternative 1 proposed operations at Holloman AFB, broken out by aircraft type. Note that the only difference between the existing conditions and Alternative 1 is that the 8 FS is considered temporarily assigned to Holloman AFB under the existing conditions and permanently assigned to Holloman AFB under Alternative 2. **Table D-2** shows the Alternative 2 proposed operations at Holloman AFB.

Table D-3 summarizes the existing operations at Roswell International Air Center. **Table D-4** shows the Alternative 1 proposed operations at Roswell International Air Center, and **Table D-5** shows the Alternative 2 proposed operations at Roswell International Air Center.

Table D-1
Baseline and Alternative 1 Proposed Operations at Holloman Air Force Base

Category	Squadron / Unit / Group	Aircraft	Modeled Type (if different) or engine designation	AB Departure			Standard/MIL Departure			Overhead Arrivals			Straight In Arrivals			Closed Pattern[1]			Total		
				Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total
Based	311, 314 FS	F-16C	F100-PW-220	5700	300	6000	3800	200	4000	7905	595	8500	1395	105	1500	29400	600	30000	48200	1800	50000
Based	8 FS	F-16C	F110-GE-100	2850	150	3000	1900	100	2000	3953	298	4250	698	53	750	14700	300	15000	24100	900	25000
Based	49 WG	MQ-9	Cessna 441	-	-	-	1320	1680	3000	-	-	-	3000	-	3000	380	20	400	4700	1700	6400
Based	82 ATRS	QF-16C	F-16C	400	-	400	-	-	-	260	-	260	140	-	140	2280	-	2280	3080	-	3080
Based	ACC/AFGSC	T-38A		91	4	95	-	-	-	5	-	5	90	-	90	513	-	513	699	4	703
Based	ADAIR	A-4N	A-4C	3040	160	3200	-	-	-	2720	-	2720	256	224	480	864	-	864	6880	384	7264
Based	586 FLTS	T-38C		365	15	380	-	-	-	317	-	317	63	-	63	2052	-	2052	2797	15	2812
Based	586 FLTS	C-12		-	-	-	361	19	380	-	-	-	361	19	380	1083	57	1140	1805	95	1900
Based	Army	C-12		-	-	-	190	10	200	-	-	-	190	10	200	38	2	40	418	22	440
Based	Army	UH-60 Lima	UH-60A	-	-	-	510	90	600	-	-	-	588	12	600	-	-	-	1098	102	1200
Based	Aeroclub	DA-40	T-3 (Firefly)	-	-	-	288	-	288	-	-	-	288	-	288	-	-	-	576	-	576
Based	Aeroclub	Cessna 172	T-41	-	-	-	288	-	288	-	-	-	288	-	288	-	-	-	576	-	576
Transient		F-18A/C	F-18A/C	-	-	-	669	-	669	-	-	-	669	-	669	-	-	-	1338	-	1338
Transient		Fighter Jets	F-35	-	-	-	8	-	8	-	-	-	8	-	8	-	-	-	16	-	16
Transient		Small Props	T-6	-	-	-	350	-	350	-	-	-	350	-	350	-	-	-	700	-	700
Transient		Small Jets	C-20	-	-	-	210	-	210	-	-	-	210	-	210	-	-	-	420	-	420
Transient		Big Jets	C-17	-	-	-	117	-	117	-	-	-	117	-	117	-	-	-	234	-	234
Transient		Big Props	C-130E	-	-	-	15	-	15	-	-	-	15	-	15	-	-	-	30	-	30
Transient		Helos	UH-1N	-	-	-	1	-	1	-	-	-	1	-	1	-	-	-	2	-	2
Based Totals				12446	629	13075	8657	2099	10756	15240	893	16132	7277	423	7699	51310	979	52289	94929	5022	9951
Transient Totals				0	0	0	1370	0	1370	0	0	0	1370	0	1370	0	0	0	2740	0	2740
Grand Totals				**12446**	**629**	**13075**	**10027**	**2099**	**12126**	**15240**	**893**	**16132**	**8647**	**423**	**9069**	**51310**	**979**	**52289**	**97669**	**5022**	**102691**

Notes:

[1] Each circuit counted as two operations

- All operations shown to nearest integer

Table D-2
Alternative 2 Proposed Operations at Holloman Air Force Base

Category	Squadron / Unit / Group	Aircraft	Modeled Type (if different) or engine designation	AB Departure			Standard/MIL Departure			Overhead Arrivals			Straight In Arrivals			Closed Pattern[1]			Total		
				Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total
Based	311, 314 FS	F-16C	F100-PW-220	5700	300	6000	3800	200	4000	7905	595	8500	1395	105	1500	29400	600	30000	48200	1800	50000
	8 FS	F-16C	F110-GE-100	2850	150	3000	1900	100	2000	3953	298	4250	698	53	750	14700	300	15000	24100	900	25000
	Proposed	F-16C	F110-GE-100	2850	150	3000	1900	100	2000	3953	298	4250	698	53	750	14700	300	15000	24100	900	25000
	49 WG	MQ-9	Cessna 441	-	-	-	1320	1680	3000	-	-	-	3000	-	3000	380	20	400	4700	1700	6400
	82 ATRS	QF-16C	F-16C	400	-	400	-	-	-	260	-	260	140	-	140	2280	-	2280	3080	-	3080
	ACC/AFGSC	T-38A		91	4	95	-	-	-	5	-	5	90	-	90	513	-	513	699	4	703
	ADAIR	A-4N	A-4C	3040	160	3200	-	-	-	2720	-	2720	256	224	480	864	-	864	6880	384	7264
	586 FLTS	T-38C		365	15	380	-	-	-	317	-	317	63	-	63	2052	-	2052	2797	15	2812
		C-12		-	-	-	361	19	380	-	-	-	361	19	380	1083	57	1140	1805	95	1900
	Army	C-12		-	-	-	190	10	200	-	-	-	190	10	200	38	2	40	418	22	440
		UH-60 Lima	UH-60A	-	-	-	510	90	600	-	-	-	588	12	600	-	-	-	1098	102	1200
	Aeroclub	DA-40	T-3 (Firefly)	-	-	-	288	-	288	-	-	-	288	-	288	-	-	-	576	-	576
		Cessna 172	T-41	-	-	-	288	-	288	-	-	-	288	-	288	-	-	-	576	-	576
Transient		F-18A/C	F-18A/C	-	-	-	669	-	669	-	-	-	669	-	669	-	-	-	1338	-	1338
		Fighter Jets	F-35	-	-	-	8	-	8	-	-	-	8	-	8	-	-	-	16	-	16
		Small Props	T-6	-	-	-	350	-	350	-	-	-	350	-	350	-	-	-	700	-	700
		Small Jets	C-20	-	-	-	210	-	210	-	-	-	210	-	210	-	-	-	420	-	420
		Big Jets	C-17	-	-	-	117	-	117	-	-	-	117	-	117	-	-	-	234	-	234
		Big Props	C-130E	-	-	-	15	-	15	-	-	-	15	-	15	-	-	-	30	-	30
		Helos	UH-1N	-	-	-	1	-	1	-	-	-	1	-	1	-	-	-	2	-	2
Based Totals				15296	779	16075	10557	2199	12756	19192	1990	20682	7974	475	8449	66010	1279	67289	119029	5922	124951
Transient Totals				0	0	0	1370	0	1370	0	0	0	1370	0	1370	0	0	0	2740	0	2740
Grand Totals				**15296**	**779**	**16075**	**11927**	**2199**	**14126**	**19192**	**1990**	**20382**	**9344**	**475**	**9819**	**66010**	**1279**	**67289**	**121769**	**5922**	**127691**

Notes:
[1] Each circuit counted as two operations
- All operations shown to nearest integer

Table D-3
Existing Operations at Roswell International Air Center

Category	Aircraft Type	Departure			Arrival			Closed Pattern[1]			Total		
		Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total
Military	Helos	11	-	11	11	-	11	-	-	-	22	-	22
	Big Props (C-130E)	153	-	153	153	-	153	-	-	-	306	-	306
	Small Jets (C-20)	2,302	-	2,302	2,302	-	2,302	-	-	-	4,604	-	4,604
	Big Jets (C-17)	1,283	-	1,283	1,283	-	1,283	-	-	-	2,566	-	2,566
	Small Props (T-6)	3,815	-	3,815	3,815	-	3,815	-	-	-	7,630	-	7,630
	F-35A	88	-	88	88	-	88	-	-	-	176	-	176
	F-18A/C	7,324	-	7,324	7,324	-	7,324	-	-	-	14,649	-	14,649
	F-16C (Holloman)	230	0	230	230	0	230	920	0	920	1,380	0	1,380
Civilian	Air Carrier	1,001	253	1,254	1,002	253	1,255	0	0	0	2,003	506	2,509
	Air Taxi and GA Jet	1,405	43	1,448	1,406	43	1,449	0	0	0	2,811	86	2,897
	GA 2- engine turboprop or piston	857	109	966	857	109	966	-	-	-	1,714	218	1,932
	GA 2- engine turboprop or piston	3,457	782	4,239	3,457	782	4,239	-	-	-	6,914	1,564	8,478
Military Totals		15,206	0	15,206	15,206	0	15,206	920	0	920	31,333	0	31,333
Civilian Totals		6,720	1,187	7,907	6,722	1,187	7,909	0	0	0	13,442	2,374	15,816
Grand Totals		**21,926**	**1,187**	**23,113**	**21,928**	**1,187**	**23,115**	**920**	**0**	**920**	**44,775**	**2,374**	**47,149**

Notes:

[1] Each circuit counted as two operations
- All operations shown to nearest integer

Table D-4
Alternative 1 Proposed Operations at Roswell International Air Center

Category	Aircraft Type	Departure			Arrival			Closed Pattern[1]			Total		
		Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total
Military	Helos	11	-	11	11	-	11	-	-	-	22	-	22
	Big Props (C-130E)	153	-	153	153	-	153	-	-	-	306	-	306
	Small Jets (C-20)	2,302	-	2,302	2,302	-	2,302	-	-	-	4,604	-	4,604
	Big Jets (C-17)	1,283	-	1,283	1,283	-	1,283	-	-	-	2,566	-	2,566
	Small Props (T-6)	3,815	-	3,815	3,815	-	3,815	-	-	-	7,630	-	7,630
	F-35A	88	-	88	88	-	88	-	-	-	176	-	176
	F-18A/C	7,324	-	7,324	7,324	-	7,324	-	-	-	14,649	-	14,649
	F-16C (Holloman)	322	0	322	322	0	322	1,127	0	1,127	1,771	0	1,771
Civilian	Air Carrier	1,001	253	1,254	1,002	253	1,255	0	0	0	2,003	506	2,509
	Air Taxi and GA Jet	1,405	43	1,448	1,406	43	1,449	0	0	0	2,811	86	2,897
	GA 2- engine turboprop or piston	857	109	966	857	109	966	-	-	-	1,714	218	1,932
	GA 2- engine turboprop or piston	3,457	782	4,239	3,457	782	4,239	-	-	-	6,914	1,564	8,478
Military Totals		15,298	0	15,298	15,298	0	15,298	1,127	0	1,127	31,724	0	31,724
Civilian Totals		6,720	1,187	7,907	6,722	1,187	7,909	0	0	0	13,442	2,374	15,816
Grand Totals		**22,018**	**1,187**	**23,205**	**22,020**	**1,187**	**23,207**	**1,127**	**0**	**1,127**	**45,166**	**2,374**	**47,540**

Notes:

[1] Each circuit counted as two operations
• All operations shown to nearest integer

Table D-5
Alternative 2 Proposed Operations at Roswell International Air Center

Category	Aircraft Type	Departure			Arrival			Closed Pattern[1]			Total		
		Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total
Military	Helos	11	-	11	11	-	11	-	-	-	22	-	22
	Big Props (C-130E)	153	-	153	153	-	153	-	-	-	306	-	306
	Small Jets (C-20)	2,302	-	2,302	2,302	-	2,302	-	-	-	4,604	-	4,604
	Big Jets (C-17)	1,283	-	1,283	1,283	-	1,283	-	-	-	2,566	-	2,566
	Small Props (T-6)	3,815	-	3,815	3,815	-	3,815	-	-	-	7,630	-	7,630
	F-35A	88	-	88	88	-	88	-	-	-	176	-	176
	F-18A/C	7,324	-	7,324	7,324	-	7,324	-	-	-	14,649	-	14,649
	F-16C (Holloman)	429	0	429	429	0	429	1,501	0	1,501	2,359	0	2,359
Civilian	Air Carrier	1,001	253	1,254	1,002	253	1,255	0	0	0	2,003	506	2,509
	Air Taxi and GA Jet	1,405	43	1,448	1,406	43	1,449	0	0	0	2,811	86	2,897
	GA 2- engine turboprop or piston	857	109	966	857	109	966	-	-	-	1,714	218	1,932
	GA 2- engine turboprop or piston	3,457	782	4,239	3,457	782	4,239	-	-	-	6,914	1,564	8,478
Military Totals		15,405	0	15,405	15,405	0	15,405	1,501	0	1,501	32,312	0	32,312
Civilian Totals		6,720	1,187	7,907	6,722	1,187	7,909	0	0	0	13,442	2,374	15,816
Grand Totals		**22,125**	**1,187**	**23,312**	**22,127**	**1,187**	**23,314**	**1,501**	**0**	**1,501**	**45,754**	**2,374**	**48,128**

Notes:

[1] Each circuit counted as two operations
- All operations shown to nearest integer

D.1.3 Runway and Flight Track Use

This section describes the flight tracks used by the aircraft operating out of Holloman AFB as well as the runway utilization. Utilization percentages are provided for each runway in **Table D-6**. Flight track maps for all aircraft are presented on **Figure D-1** (departures), **Figure D-2** (arrivals), and **Figure D-3** (closed patterns). Closed pattern flight track represent aircraft patterns that depart and arrive on the same runway. Example flight profiles that use closed pattern flight tracks are simulated flame out and visual flight rules pattern profiles.

Note: The information in the figures below was prepared using Federal Aviation Administration Aeronautical Charts. These data do not reflect the update from White Sands National Monument to White Sands National Park that occurred in 2019.

Table D-6
Runway Usage for Aircraft at Holloman Air Force Base

Op Type	Runway ID	Based						Transient
		54 FG - F-16C	49 WG - MQ-9	82 ATRS-QF-16C	ACC/AGCS T-38A 586 FLTS-T-38C	586 FLTS & Army C-12	Aeroclub	
Departure	Day/Night[1]:	95%/5%	44%/56%	100%/0%	96%/4%	95%/5%	100%/0%	100%/0%
	04	0%	0%	0%	0%	0%	0%	0%
	22	5%	0%	33%	0%	0%	50%	0%
	07	0%	0%	0%	0%	0%	0%	0%
	25	15%	45%	57%	95%	95%	50%	100%
	16	70%	8%	7%	4%	4%	0%	0%
	34	10%	47%	3%	1%	1%	0%	0%
Arrivals	Day/Night[1]:	93%/7%	100%/0%	100%/0%	100%/0%	95%/5%	100%/0%	100%/0%
	04	0%	0%	33%	0%	0%	0%	0%
	22	5%	6%	3%	0%	0%	50%	0%
	07	0%	0%	0%	0%	0%	0%	0%
	25	1%	40%	7%	2%	2%	50%	0%
	16	84%	40%	52%	95%	95%	0%	100%
	34	10%	14%	5%	3%	3%	0%	0%
Closed Patterns	Day/Night[1]:	98%/2%	95%/5%	100%/0%	100%/0%	95%/5%	100%/0%	100%/0%
	04	0%	0%	33%	0%	0%	0%	0%
	22	5%	6%	3%	0%	0%	0%	0%
	07	0%	0%	0%	0%	0%	0%	0%
	25	5%	40%	7%	8%	8%	0%	0%
	16	80%	40%	52%	90%	90%	0%	0%
	34	10%	14%	5%	2%	2%	0%	0%

Notes:
[1] Day (0700-2200), Night (2200-0700)
- Army UH-60 helicopters utilize the landing pad NHP with 15% Departure and 2% Arrival night operations.

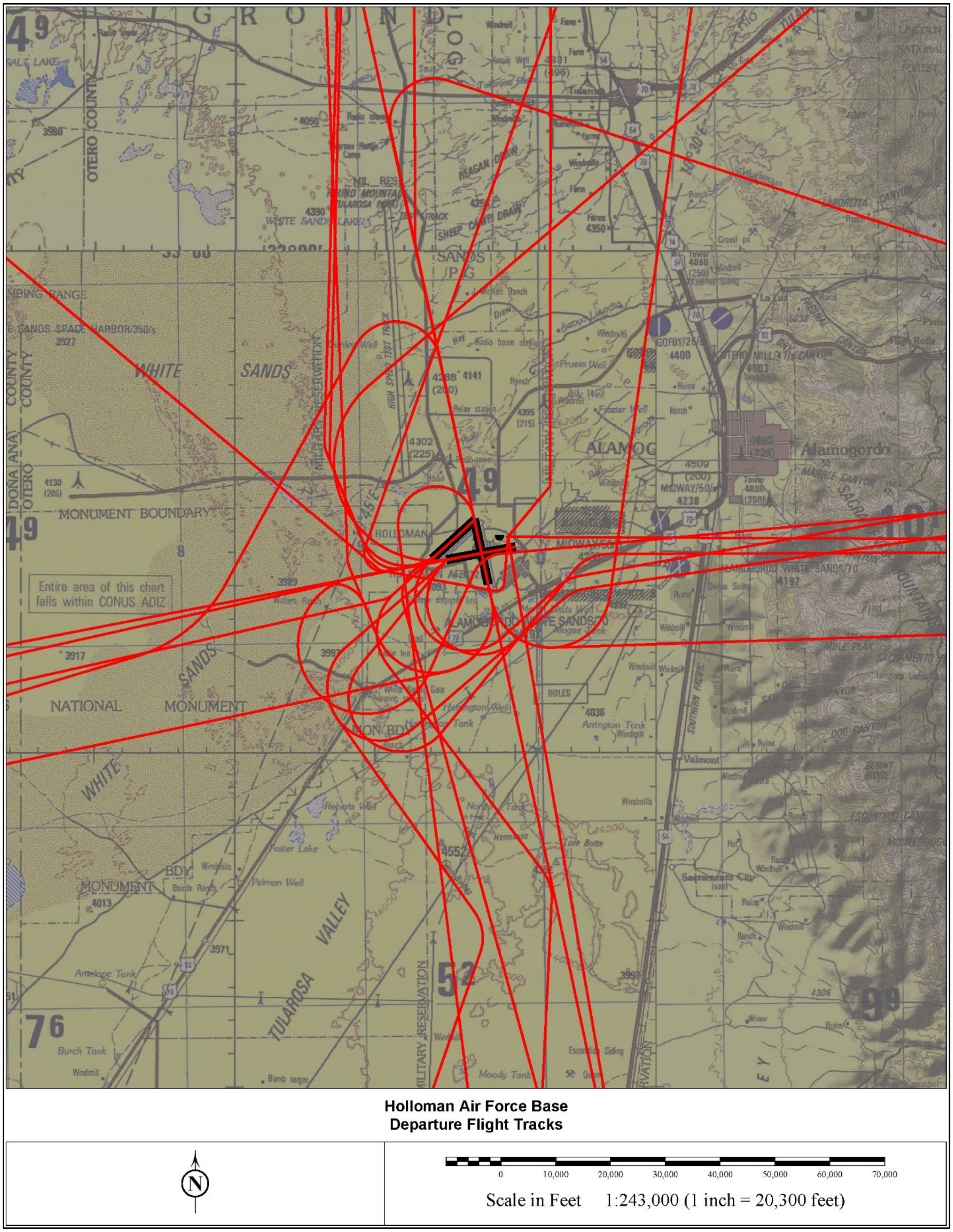


Figure D-1. Departure Flight Tracks at Holloman Air Force Base.

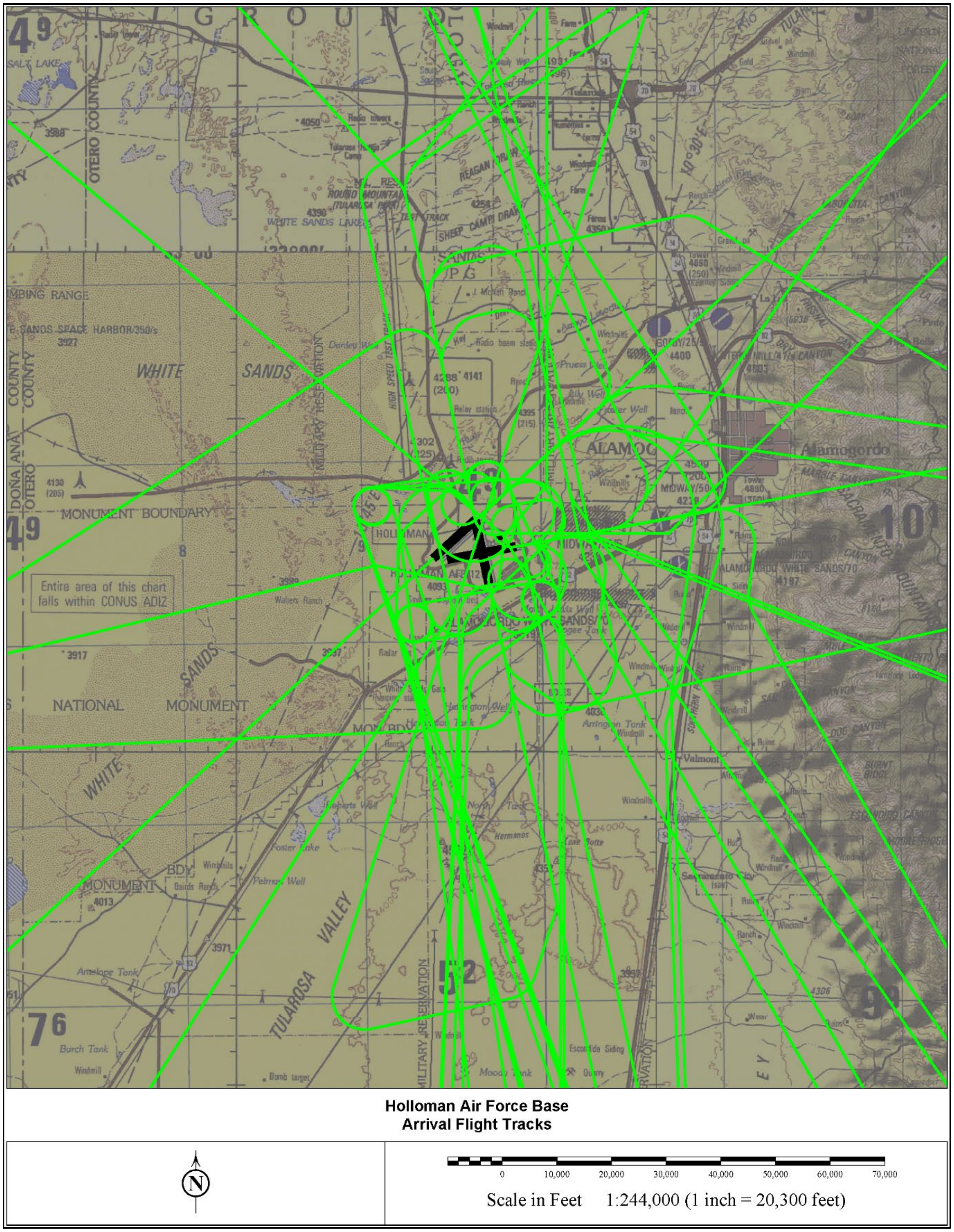


Figure D-2. Arrival Flight Tracks at Holloman Air Force Base.

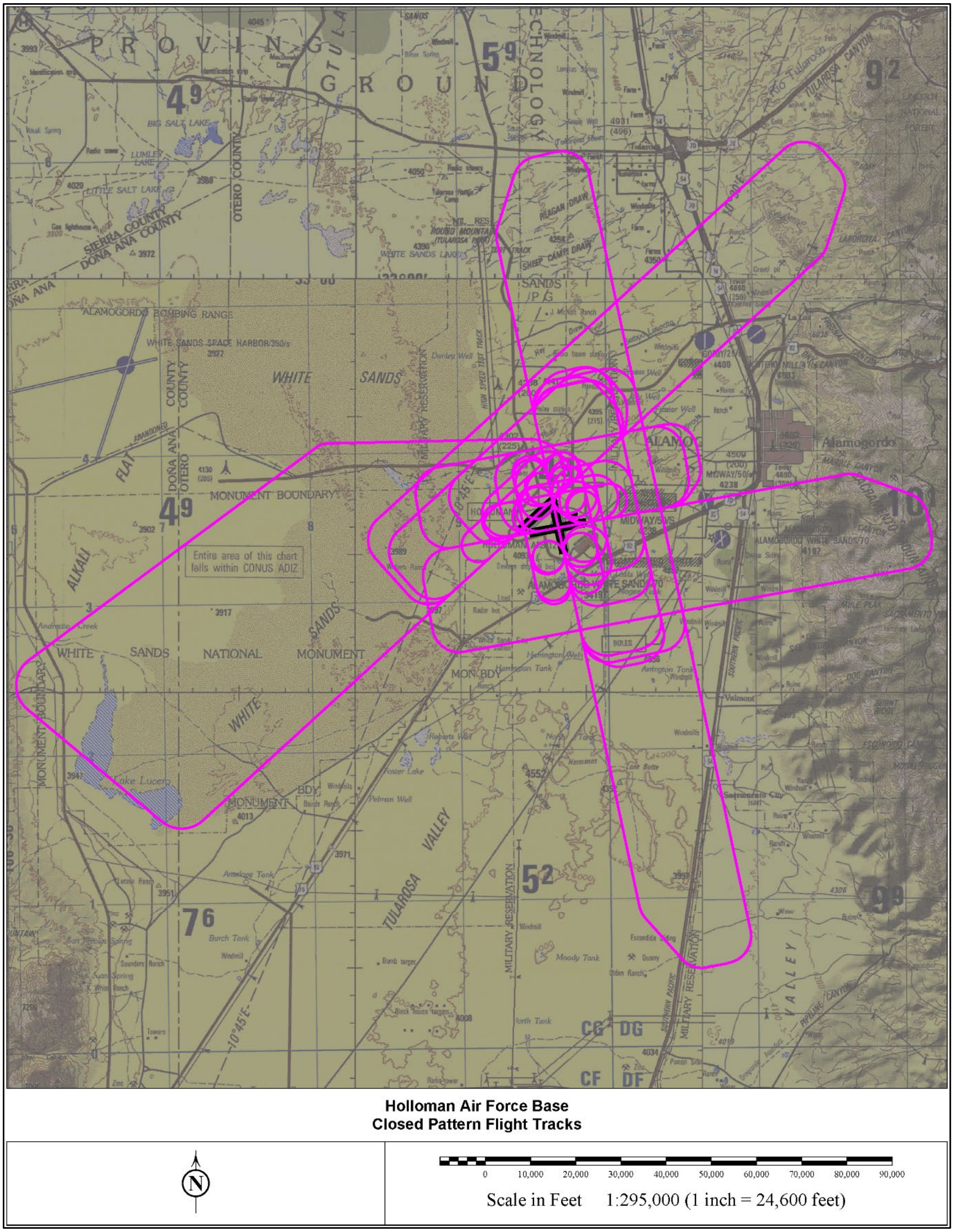


Figure D-3. Closed Pattern Flight Tracks at Holloman Air Force Base.

D.1.4 Flight Profiles and Aircraft

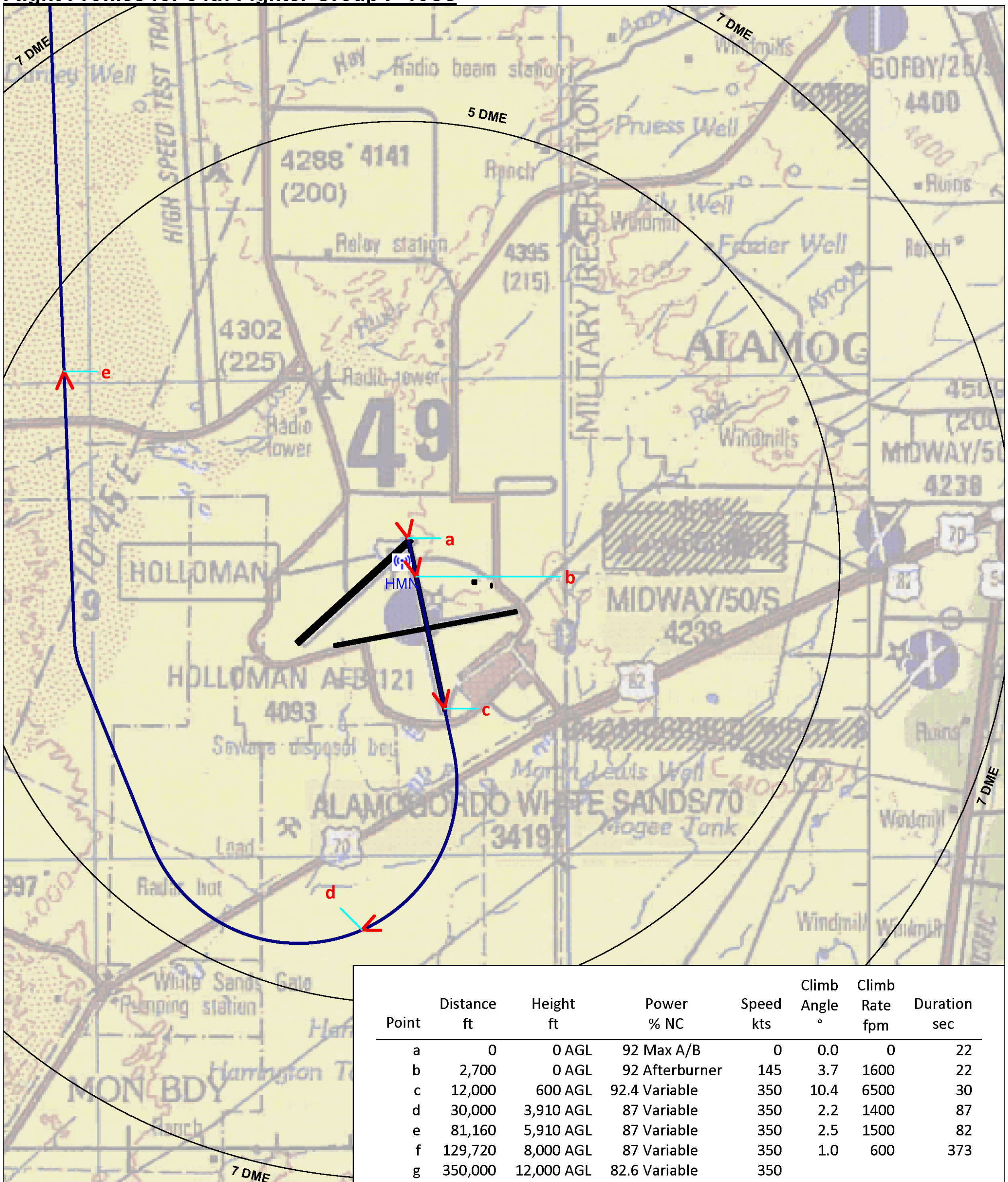
Representative profiles provide the speed and power setting of each type of aircraft as a function of distance along the flight track for the representative maneuvers. For modeling purposes, the appropriate profile is used for all flight tracks that conform to that maneuver type. For example, all overhead break arrival tracks utilize the representative profile for modeling that maneuver.

D.1.4.1 Based Aircraft Representative Flight Profiles – Holloman AFB

This section details the representative profiles for each aircraft that is based at Holloman AFB. This includes the F-16C aircraft of the 54 FG, the MQ-9s of the 49 WG, the QF-16Cs of the 82 ATRS, the T-38As that are sent to Holloman AFB for maintenance, the T-38Cs of the 586 FLTS, the C-12s used by the Army and 586 FLTS, UH-60L helicopters, the DA-40 and Cessna 172 planes flown by the Aeroclub, and the contract adversary air (ADAIR) aircraft (Category B).

Note: The information in the figures below was prepared using Federal Aviation Administration Aeronautical Charts. These data do not reflect the update from White Sands National Monument to White Sands National Park that occurred in 2019.

Flight Profiles for 54th Fighter Group F-16Cs



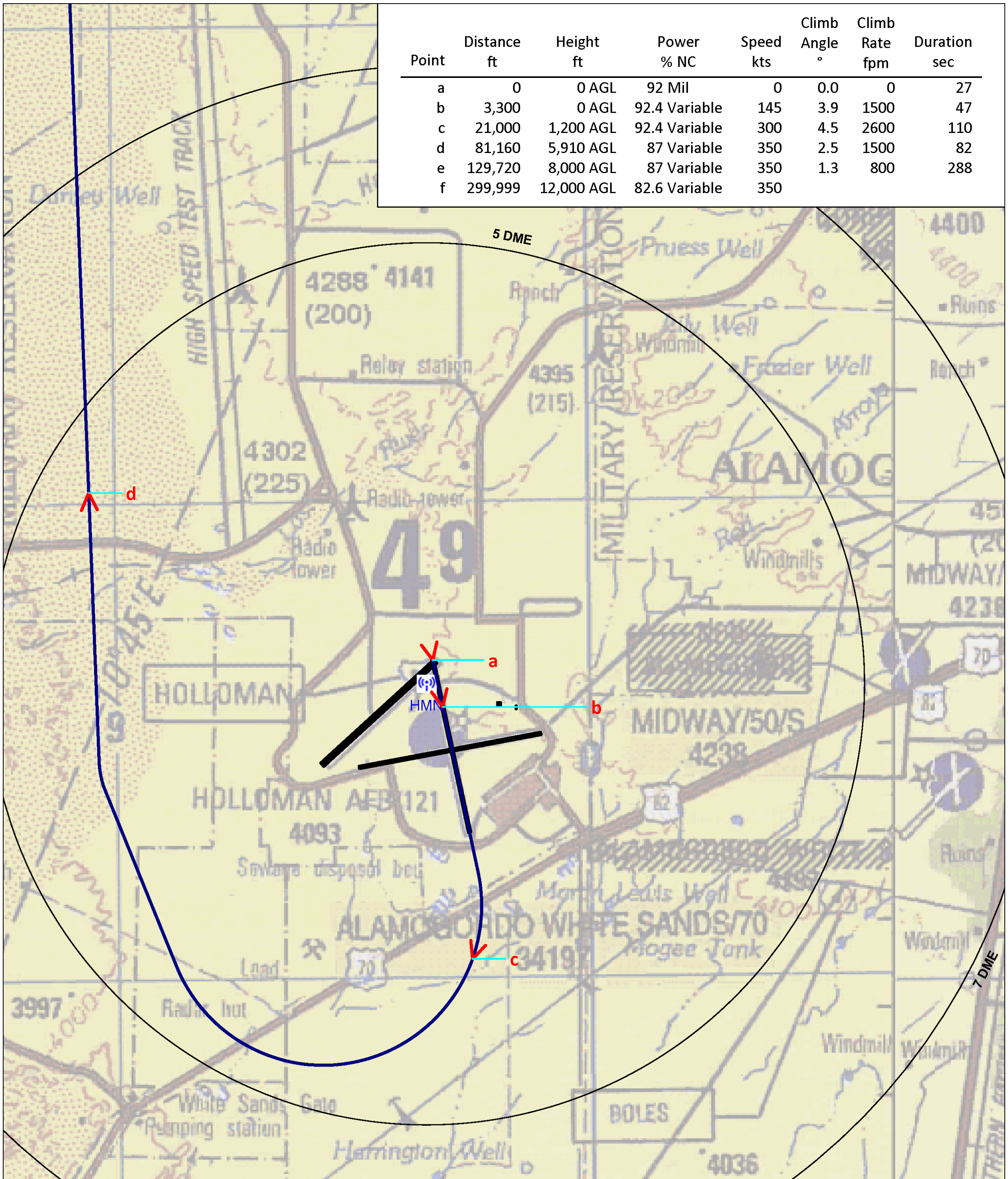
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	0 AGL	92 Max A/B	0	0.0	0	22
b	2,700	0 AGL	92 Afterburner	145	3.7	1600	22
c	12,000	600 AGL	92.4 Variable	350	10.4	6500	30
d	30,000	3,910 AGL	87 Variable	350	2.2	1400	87
e	81,160	5,910 AGL	87 Variable	350	2.5	1500	82
f	129,720	8,000 AGL	87 Variable	350	1.0	600	373
g	350,000	12,000 AGL	82.6 Variable	350			

Flight Profile 16DD
AB TAKEOFF TO 'ROMEO' LINE-REPRESENTATIVE

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000

Scale in Feet 1:98,000 (1 inch = 8,170 feet)

N



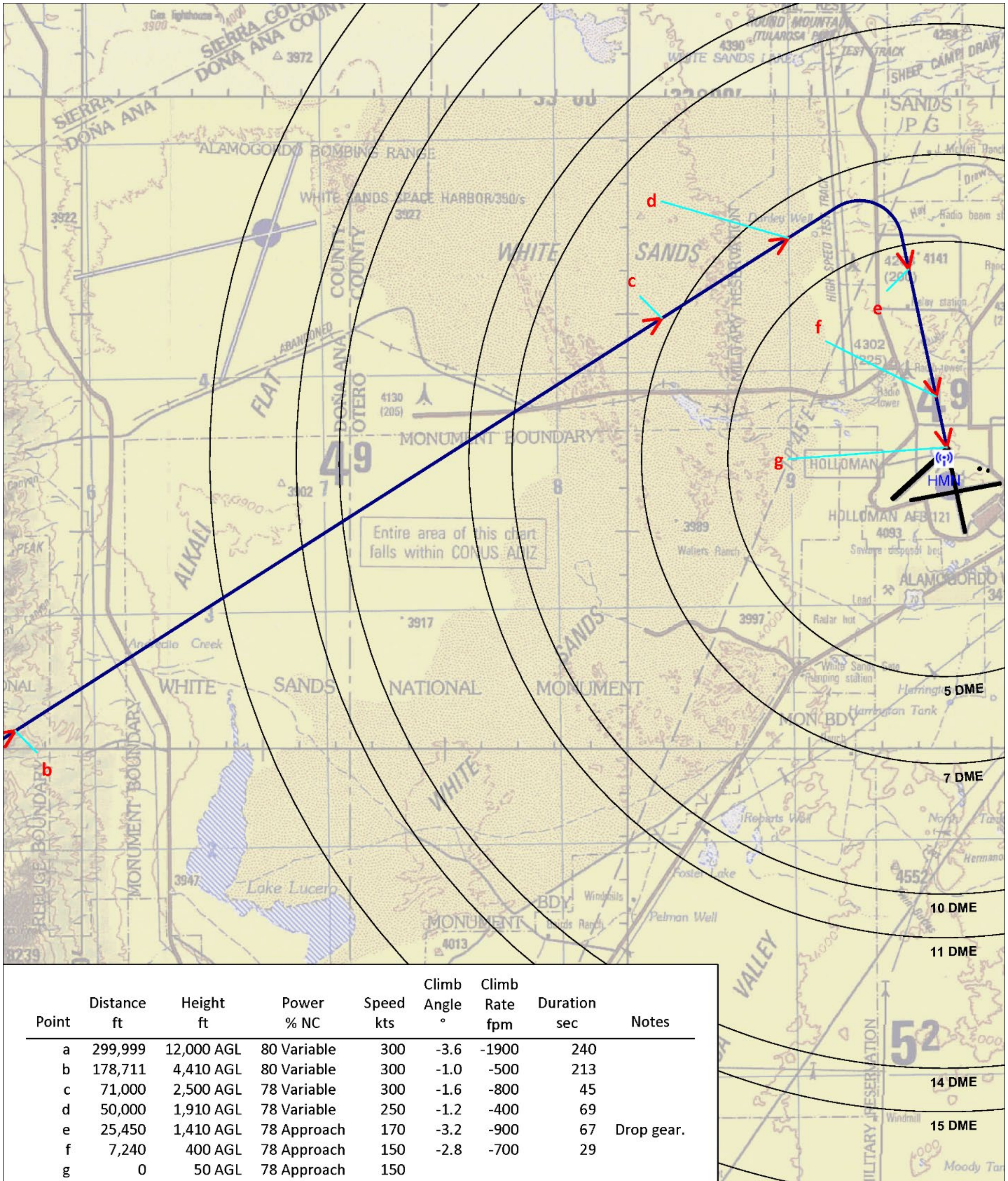
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	0 AGL	92 Mil	0	0.0	0	27
b	3,300	0 AGL	92.4 Variable	145	3.9	1500	47
c	21,000	1,200 AGL	92.4 Variable	300	4.5	2600	110
d	81,160	5,910 AGL	87 Variable	350	2.5	1500	82
e	129,720	8,000 AGL	87 Variable	350	1.3	800	288
f	299,999	12,000 AGL	82.6 Variable	350			

Flight Profile 16DC
MIL TAKEOFF TO 'ROMEO' LINE-REPRESENTATIVE

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000

Scale in Feet 1:98,000 (1 inch = 8,170 feet)

N

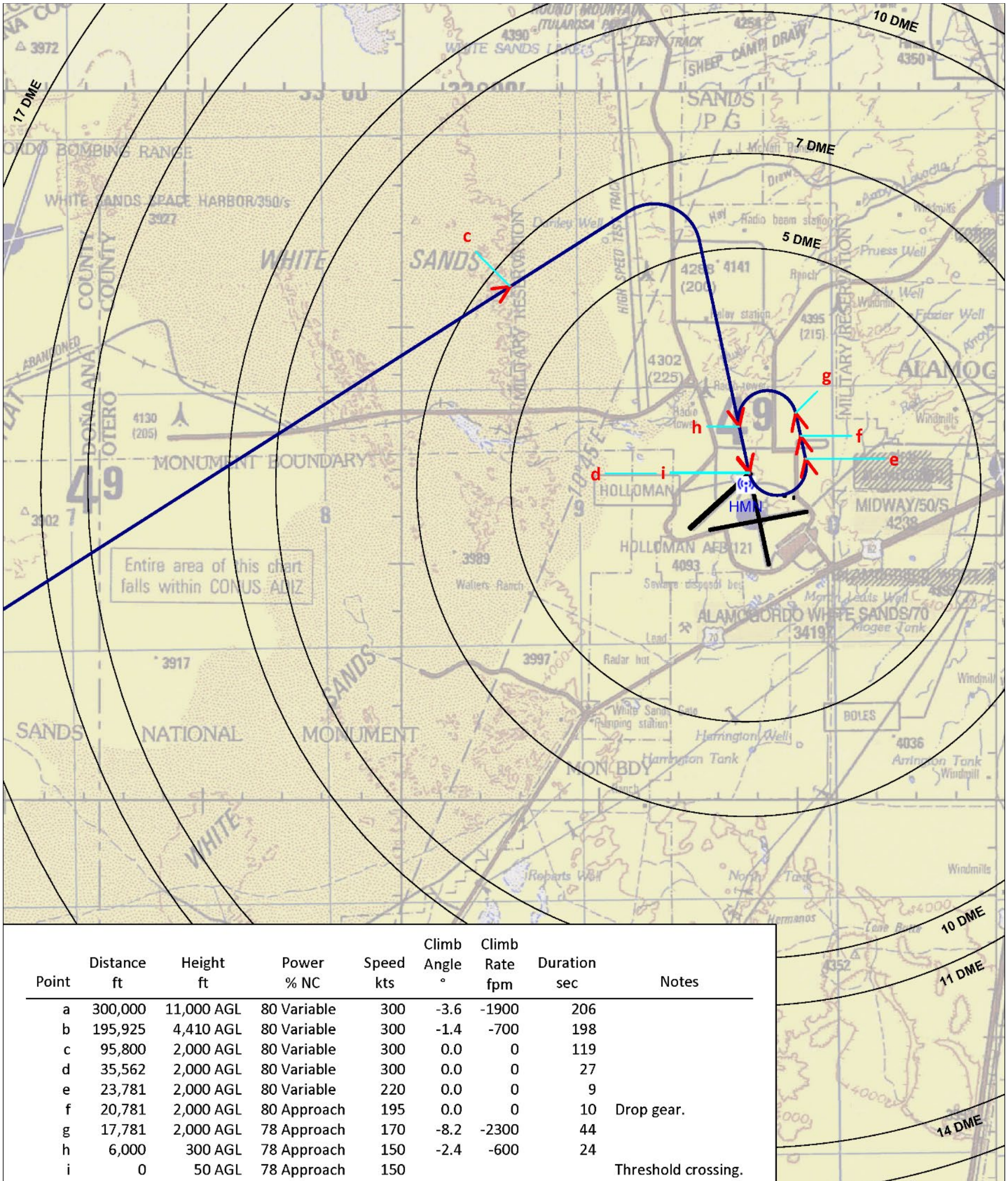


Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	299,999	12,000 AGL	80 Variable	300	-3.6	-1900	240	
b	178,711	4,410 AGL	80 Variable	300	-1.0	-500	213	
c	71,000	2,500 AGL	78 Variable	300	-1.6	-800	45	
d	50,000	1,910 AGL	78 Variable	250	-1.2	-400	69	
e	25,450	1,410 AGL	78 Approach	170	-3.2	-900	67	Drop gear.
f	7,240	400 AGL	78 Approach	150	-2.8	-700	29	
g	0	50 AGL	78 Approach	150				

Flight Profile 16AB
VFR WSMRS STRAIGHT-IN-REPRESENTATIVE

0 10,000 20,000 30,000 40,000 50,000 60,000
Scale in Feet 1:199,000 (1 inch = 16,600 feet)

N



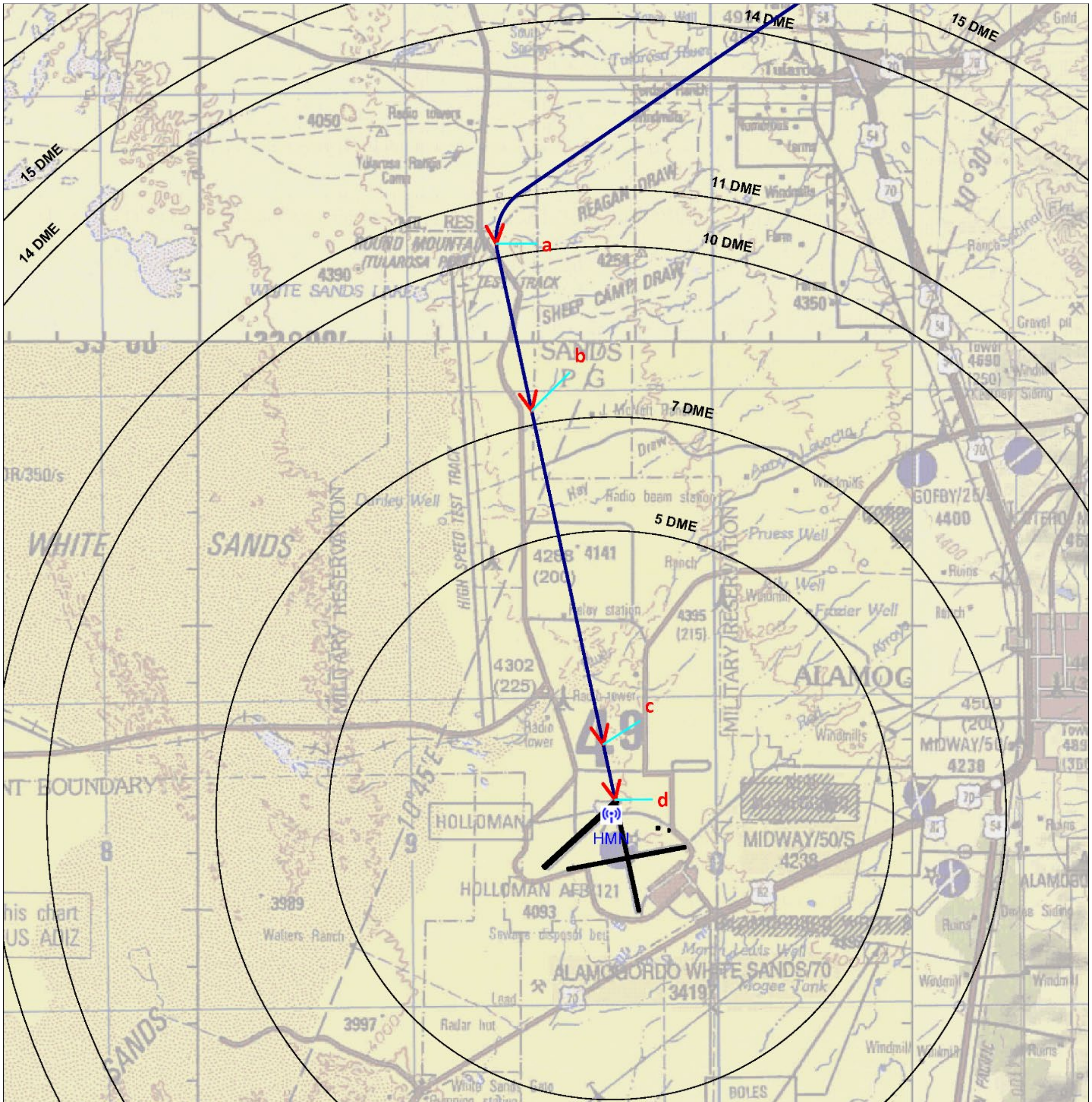
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	300,000	11,000 AGL	80 Variable	300	-3.6	-1900	206	
b	195,925	4,410 AGL	80 Variable	300	-1.4	-700	198	
c	95,800	2,000 AGL	80 Variable	300	0.0	0	119	
d	35,562	2,000 AGL	80 Variable	300	0.0	0	27	
e	23,781	2,000 AGL	80 Variable	220	0.0	0	9	
f	20,781	2,000 AGL	80 Approach	195	0.0	0	10	Drop gear.
g	17,781	2,000 AGL	78 Approach	170	-8.2	-2300	44	
h	6,000	300 AGL	78 Approach	150	-2.4	-600	24	
i	0	50 AGL	78 Approach	150				Threshold crossing.

Flight Profile 16ABO
ARRIVAL WSMRS - PITCH - REPRESENTATIVE

0 10,000 20,000 30,000 40,000 50,000 60,000

Scale in Feet 1:183,000 (1 inch = 15,200 feet)

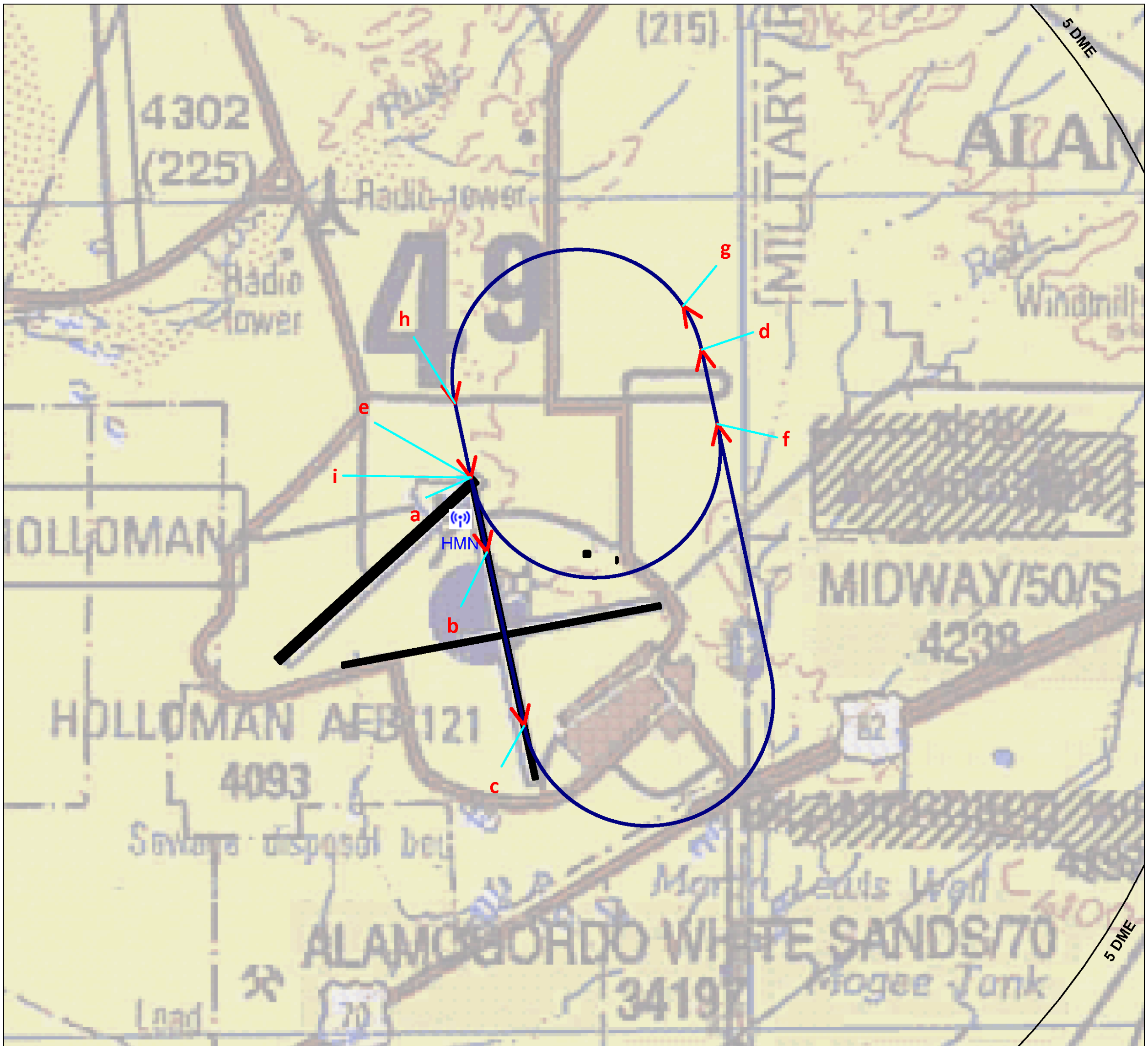
N



Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	60,761	10,000 AGL	55 Variable	200	-9.3	-3300	54	
b	42,532	7,000 AGL	55 Approach	200	-9.3	-3300	108	Gear down
c	6,076	1,000 AGL	55 Approach	200	-8.9	-3000	19	
d	0	50 AGL	55 Approach	180				Threshold crossing

Flight Profile 16AJ
RANDOM ENTRY SFO-REPRESENTATIVE

0 10,000 20,000 30,000 40,000 50,000
Scale in Feet 1:165,000 (1 inch = 13,700 feet)



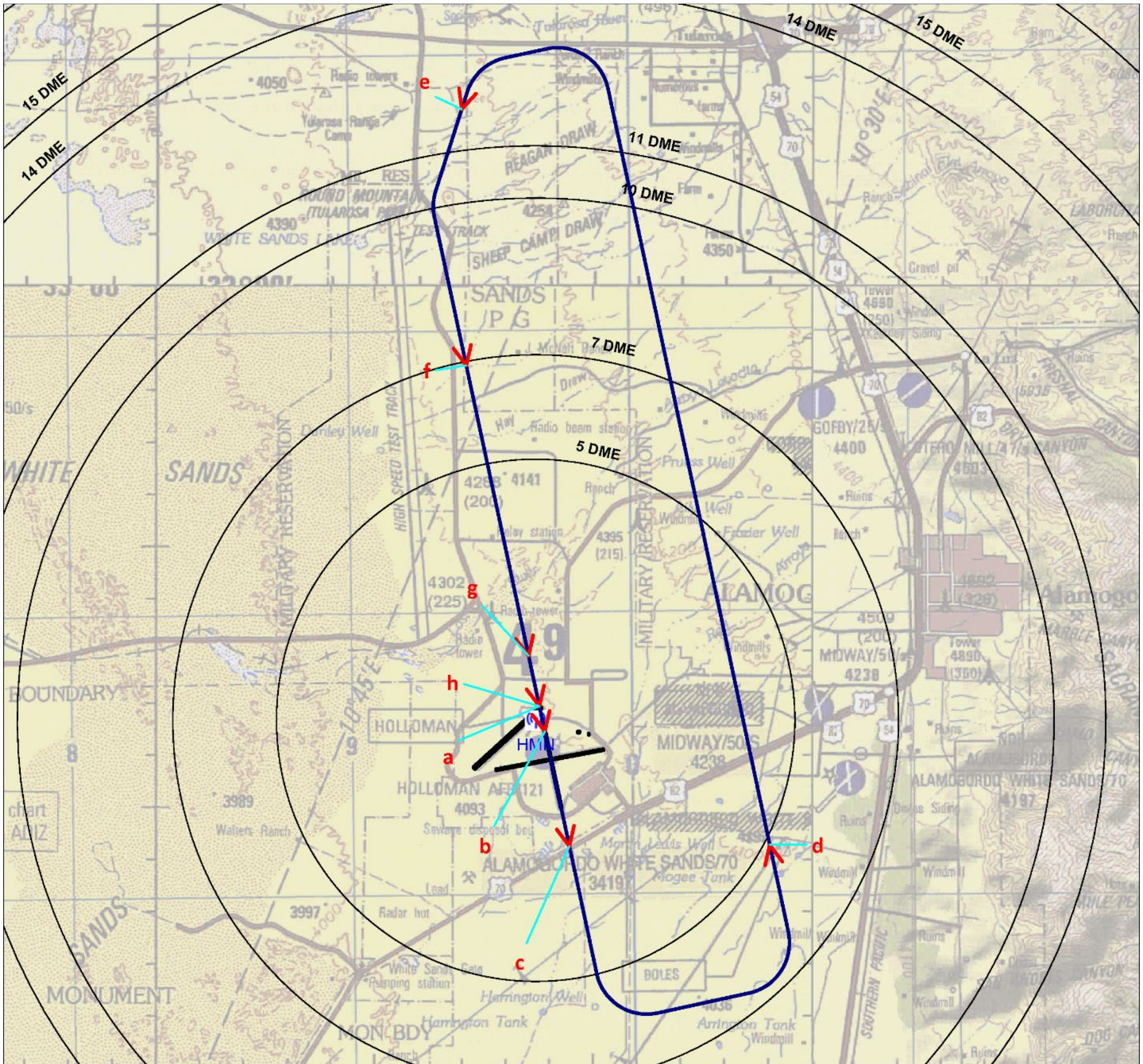
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	92.6 Variable	150	0.0	0	11	
b	3,000	50 AGL	92.6 Variable	170	1.2	500	20	
c	10,000	200 AGL	92.6 Variable	250	15.0	6400	72	
d	38,708	7,910 AGL	80 Variable	220	0.0	0	50	
e	57,416	7,910 AGL	55 Approach	220	-14.3	-5700	42	Drop gear
f	73,124	3,910 AGL	55 Approach	220	-21.4	-8700	13	
g	78,000	2,000 AGL	55 Approach	220	-7.0	-2500	41	
h	91,832	300 AGL	55 Approach	180	-4.8	-1400	11	
i	94,831	50 AGL	92.6 Variable	150				Threshold crossing

Flight Profile 16CA
SFO-REPRESENTATIVE

0 4,000 8,000 12,000 16,000 20,000

Scale in Feet 1:63,800 (1 inch = 5,320 feet)

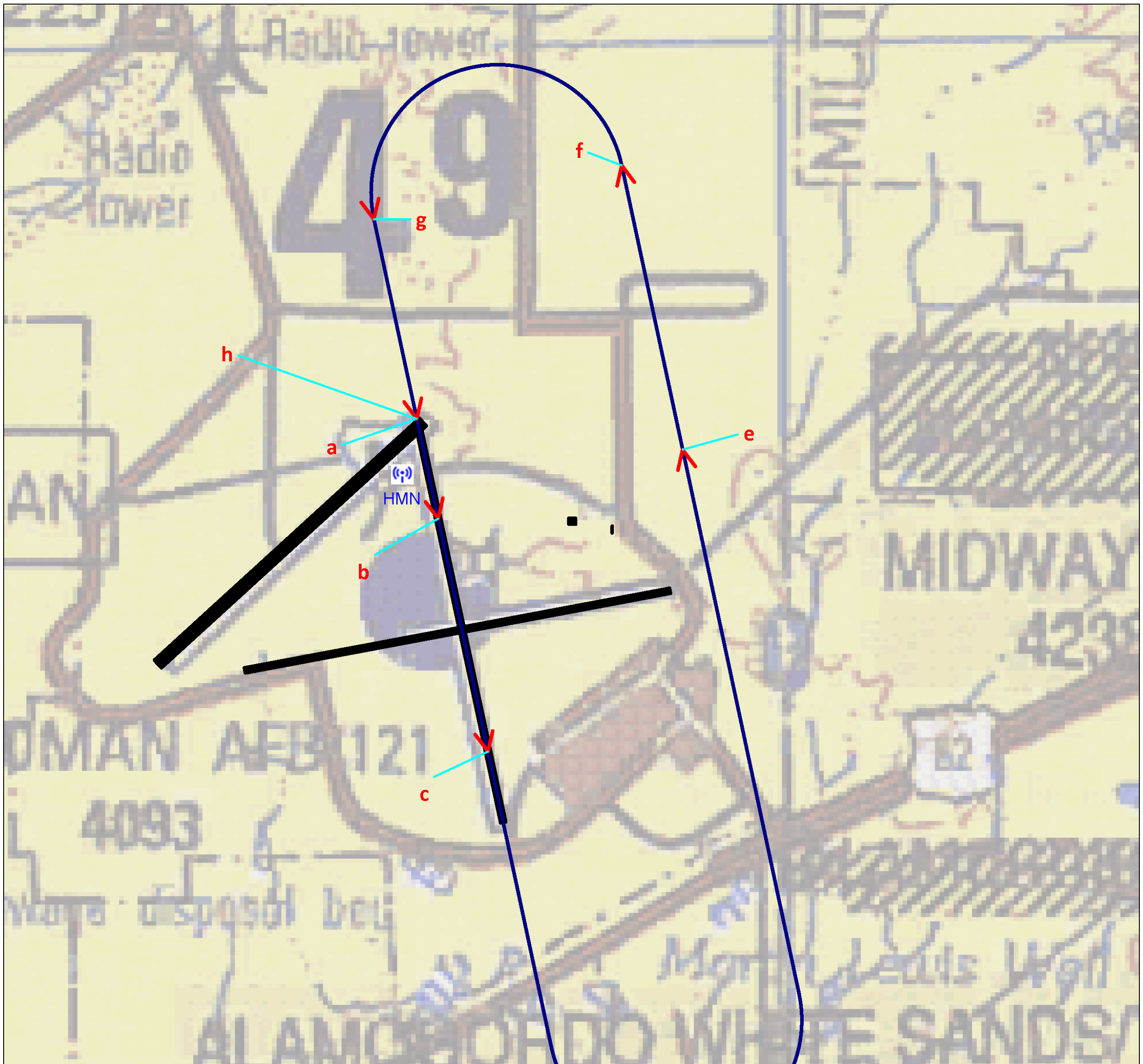
N



Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	92.6 Variable	150	0.0	0	11	
b	3,000	50 AGL	92.6 Variable	170	8.1	3000	39	
c	16,655	2,000 AGL	92.6 Variable	250	0.0	0	131	
d	72,000	2,000 AGL	80 Variable	250	0.0	0	267	
e	184,796	2,000 AGL	78 Variable	250	0.0	0	73	
f	215,520	2,000 AGL	78 Approach	250	-2.8	-1000	102	Drop gear
g	250,091	300 AGL	78 Approach	150	-2.4	-600	24	
h	256,091	50 AGL	92.6 Variable	150				Threshold crossing

Flight Profile 16CB
RADAR PATTERN-REPRESENTATIVE

0 10,000 20,000 30,000 40,000 50,000 60,000
Scale in Feet 1:188,000 (1 inch = 15,600 feet)



Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	92.6 Variable	150	0.0	0	9	
b	3,000	50 AGL	92.6 Variable	225	2.0	900	17	
c	10,000	300 AGL	92.6 Variable	270	7.0	3000	34	
d	23,912	2,000 AGL	80 Variable	210	0.0	0	65	
e	47,000	2,000 AGL	80 Approach	210	0.0	0	27	Drop gear
f	55,541	2,000 AGL	78 Approach	170	-8.2	-2300	44	
g	67,322	300 AGL	78 Approach	150	-2.4	-600	24	Final approach
h	73,322	50 AGL	92.6 Variable	150				Threshold crossing

5 DME

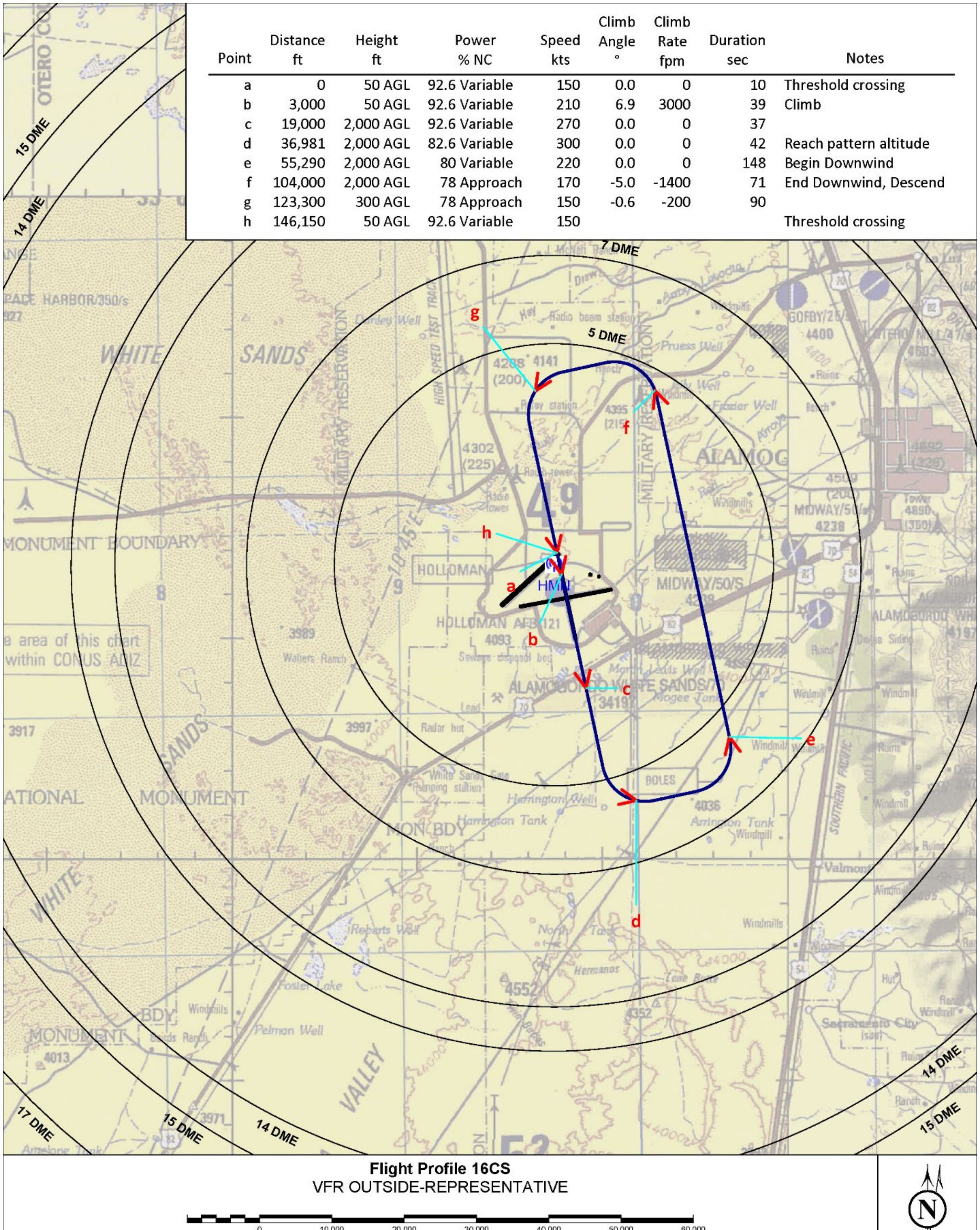
Flight Profile 16CC
VFR INSIDE-REPRESENTATIVE

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000

Scale in Feet 1:47,400 (1 inch = 3,950 feet)

N

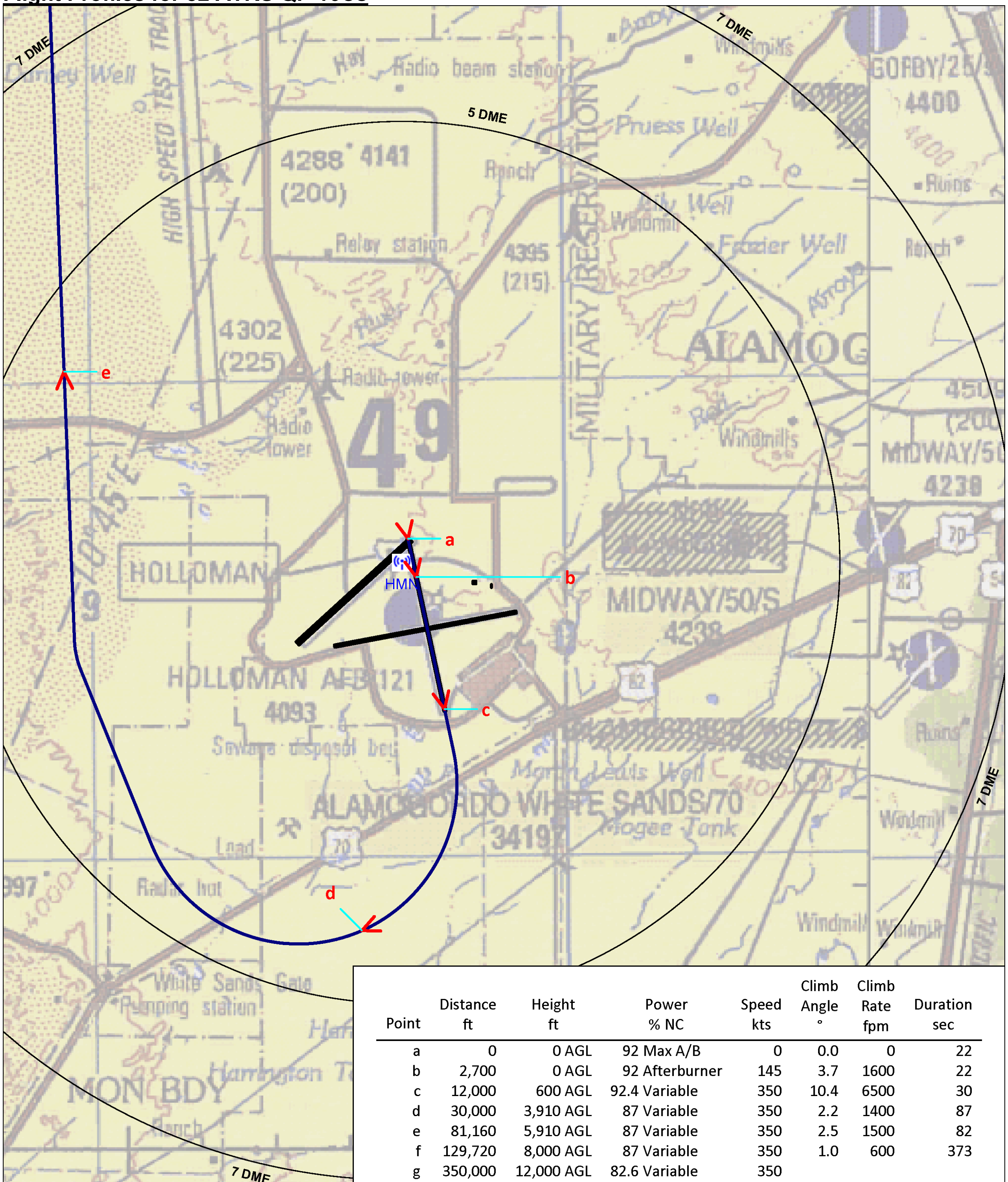
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	92.6 Variable	150	0.0	0	10	Threshold crossing
b	3,000	50 AGL	92.6 Variable	210	6.9	3000	39	Climb
c	19,000	2,000 AGL	92.6 Variable	270	0.0	0	37	
d	36,981	2,000 AGL	82.6 Variable	300	0.0	0	42	Reach pattern altitude
e	55,290	2,000 AGL	80 Variable	220	0.0	0	148	Begin Downwind
f	104,000	2,000 AGL	78 Approach	170	-5.0	-1400	71	End Downwind, Descend
g	123,300	300 AGL	78 Approach	150	-0.6	-200	90	
h	146,150	50 AGL	92.6 Variable	150				Threshold crossing



Flight Profile 16CS
VFR OUTSIDE-REPRESENTATIVE

Scale in Feet 1:190,000 (1 inch = 15,800 feet)

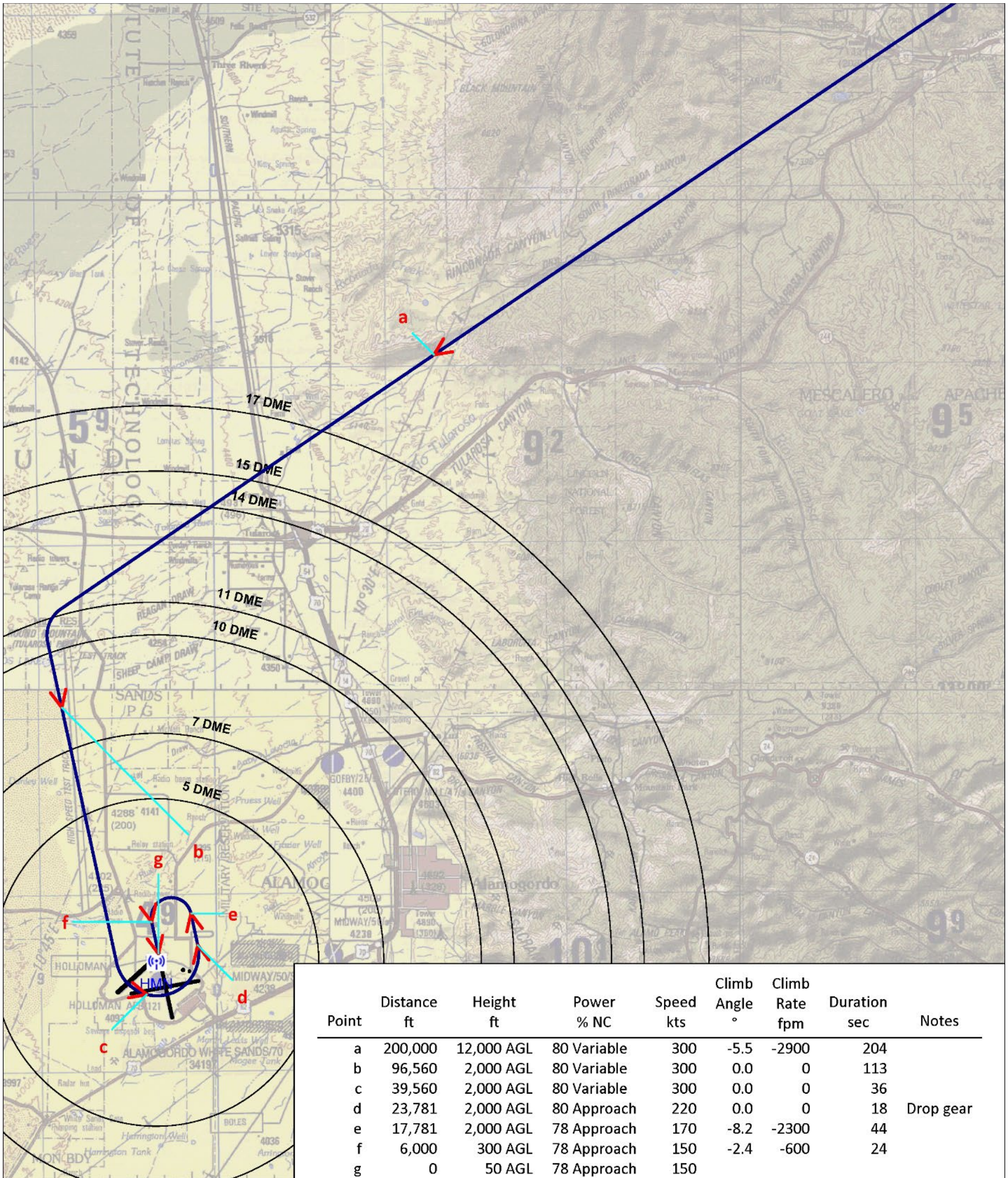
Flight Profiles for 82 ATRS QF-16Cs



Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	0 AGL	92 Max A/B	0	0.0	0	22
b	2,700	0 AGL	92 Afterburner	145	3.7	1600	22
c	12,000	600 AGL	92.4 Variable	350	10.4	6500	30
d	30,000	3,910 AGL	87 Variable	350	2.2	1400	87
e	81,160	5,910 AGL	87 Variable	350	2.5	1500	82
f	129,720	8,000 AGL	87 Variable	350	1.0	600	373
g	350,000	12,000 AGL	82.6 Variable	350			

Flight Profile QF-16DD
AB TAKEOFF TO 'ROMEO' LINE-REPRESENTATIVE

Scale in Feet 1:98,000 (1 inch = 8,170 feet)

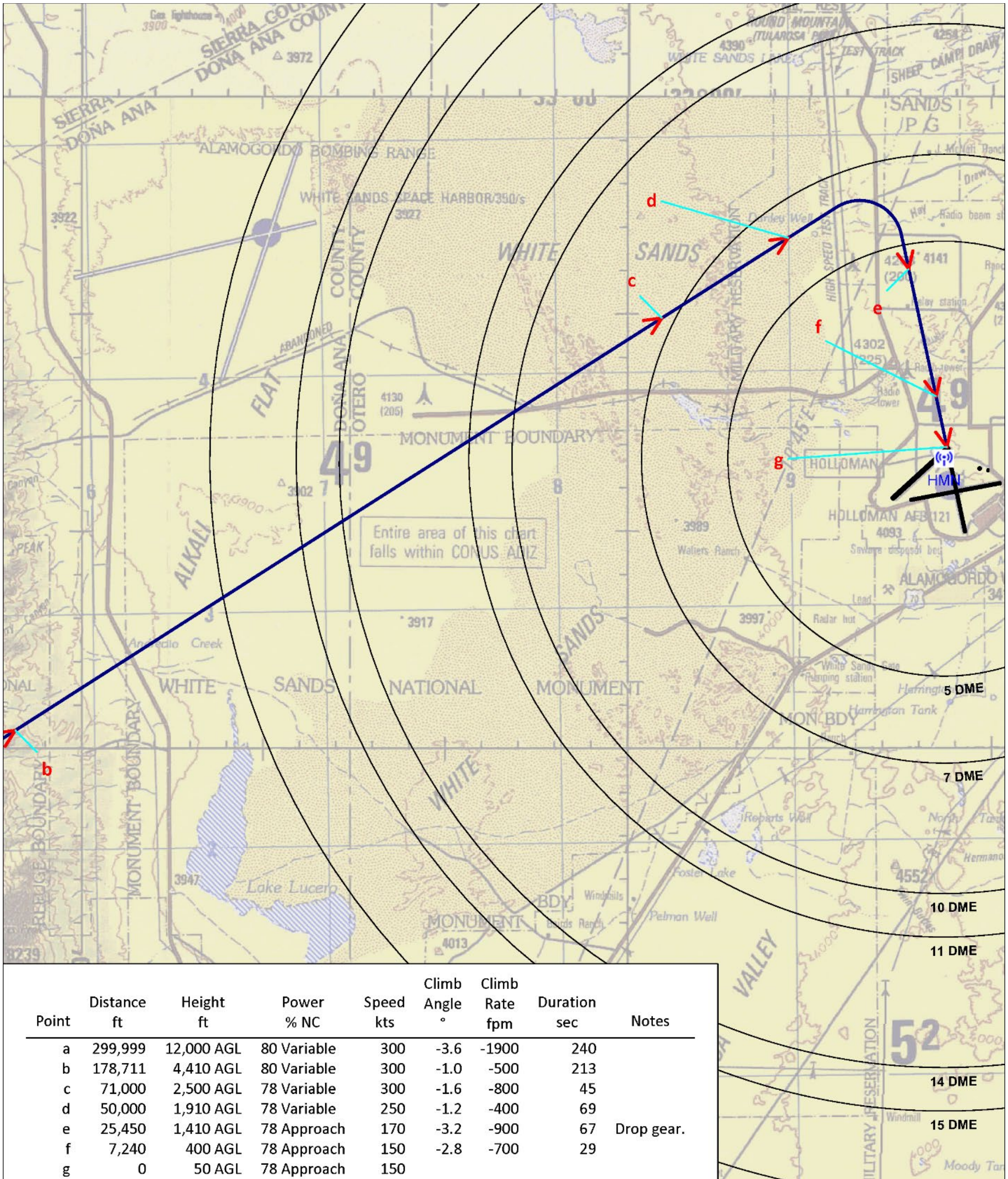


Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	200,000	12,000 AGL	80 Variable	300	-5.5	-2900	204	
b	96,560	2,000 AGL	80 Variable	300	0.0	0	113	
c	39,560	2,000 AGL	80 Variable	300	0.0	0	36	
d	23,781	2,000 AGL	80 Approach	220	0.0	0	18	Drop gear
e	17,781	2,000 AGL	78 Approach	170	-8.2	-2300	44	
f	6,000	300 AGL	78 Approach	150	-2.4	-600	24	
g	0	50 AGL	78 Approach	150				

Flight Profile QF-16A15
Tactical Approach

0 10,000 20,000 30,000 40,000 50,000 60,000 70,000 80,000 90,000

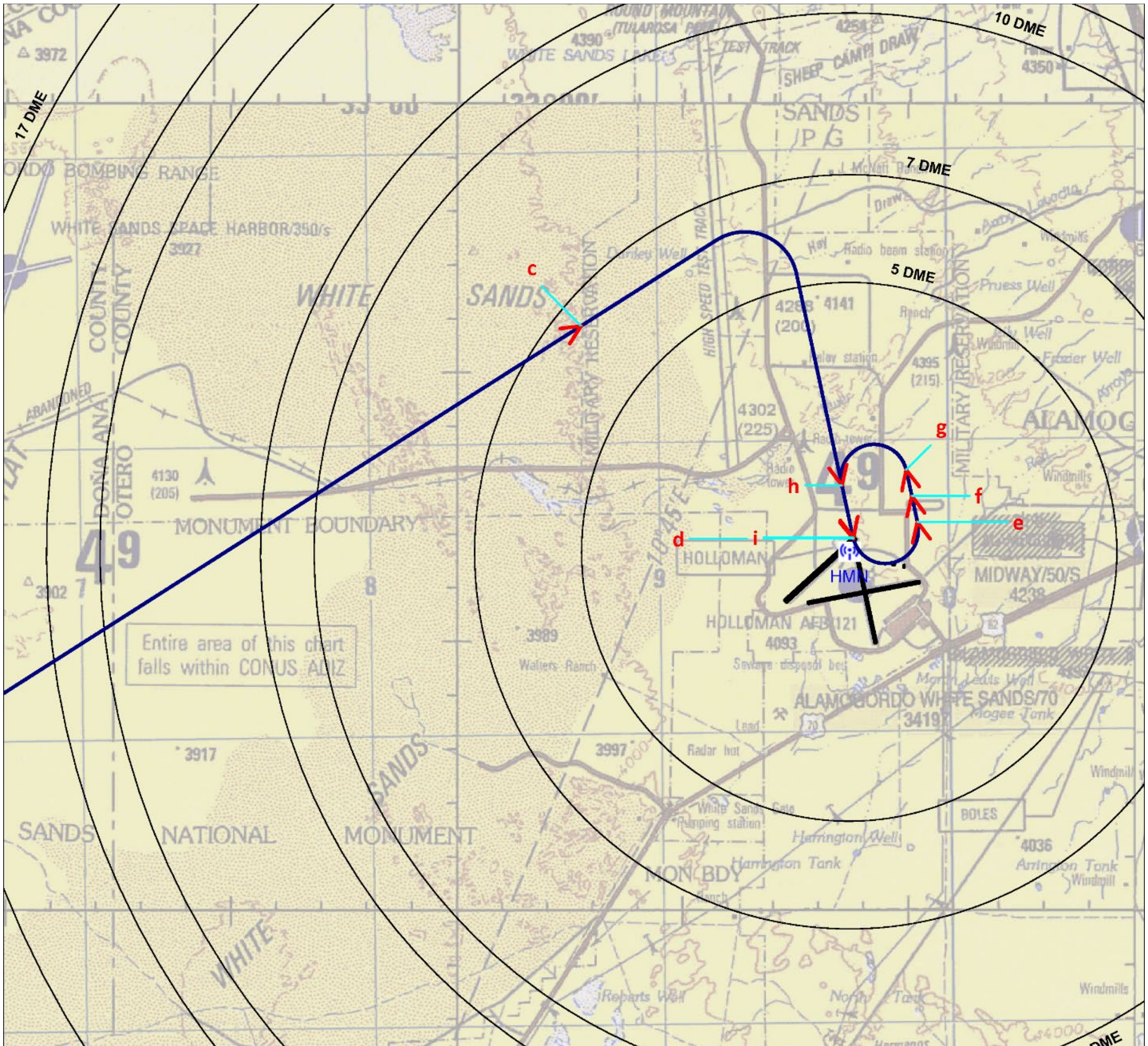
Scale in Feet 1:264,000 (1 inch = 22,000 feet)



Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	299,999	12,000 AGL	80 Variable	300	-3.6	-1900	240	
b	178,711	4,410 AGL	80 Variable	300	-1.0	-500	213	
c	71,000	2,500 AGL	78 Variable	300	-1.6	-800	45	
d	50,000	1,910 AGL	78 Variable	250	-1.2	-400	69	
e	25,450	1,410 AGL	78 Approach	170	-3.2	-900	67	Drop gear.
f	7,240	400 AGL	78 Approach	150	-2.8	-700	29	
g	0	50 AGL	78 Approach	150				

Flight Profile QF-16AB
VFR WSMRS STRAIGHT-IN-REPRESENTATIVE

Scale in Feet 1:199,000 (1 inch = 16,600 feet)

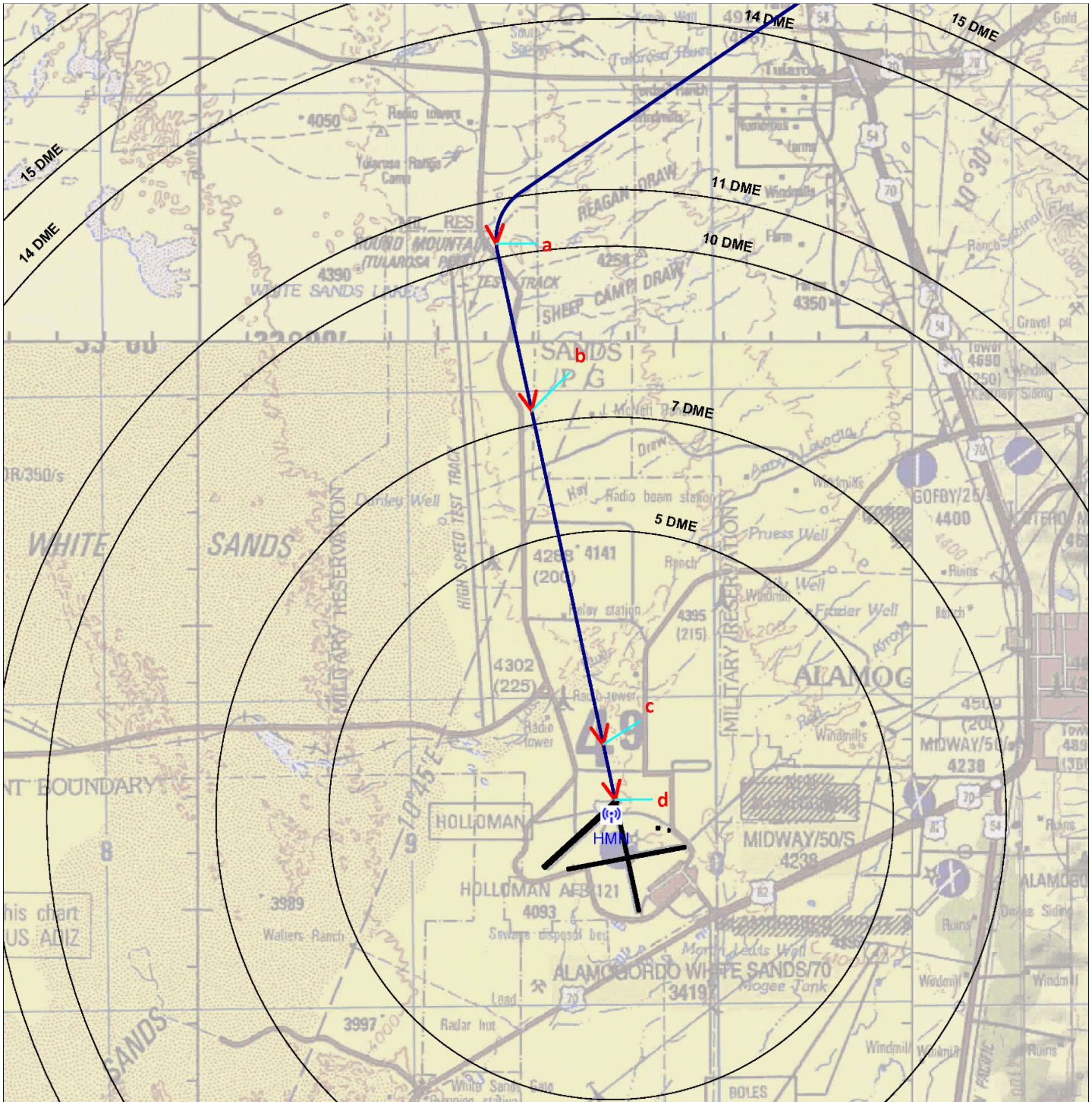


Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	300,000	11,000 AGL	80 Variable	300	-3.6	-1900	206	
b	195,925	4,410 AGL	80 Variable	300	-1.4	-700	198	
c	95,800	2,000 AGL	80 Variable	300	0.0	0	119	
d	35,562	2,000 AGL	80 Variable	300	0.0	0	27	
e	23,781	2,000 AGL	80 Variable	220	0.0	0	9	
f	20,781	2,000 AGL	80 Approach	195	0.0	0	10	Drop gear.
g	17,781	2,000 AGL	78 Approach	170	-8.2	-2300	44	
h	6,000	300 AGL	78 Approach	150	-2.4	-600	24	
i	0	50 AGL	78 Approach	150				Threshold crossing.

Flight Profile QF-16ABO
ARRIVAL WSMRS - PITCH - REPRESENTATIVE

0 10,000 20,000 30,000 40,000 50,000 60,000

Scale in Feet 1:183,000 (1 inch = 15,200 feet)



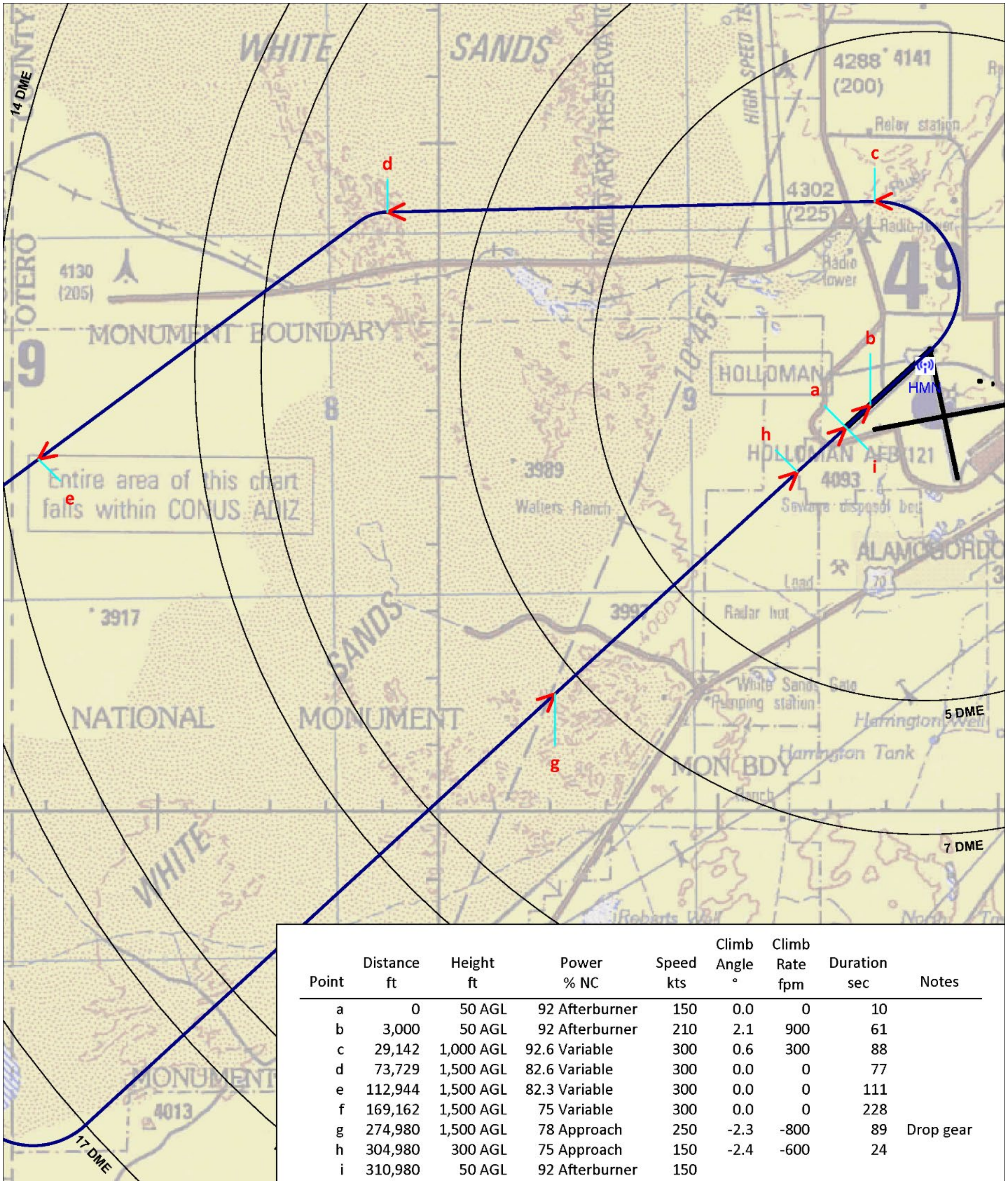
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	60,761	10,000 AGL	55 Variable	200	-9.3	-3300	54	
b	42,532	7,000 AGL	55 Approach	200	-9.3	-3300	108	Gear down
c	6,076	1,000 AGL	55 Approach	200	-8.9	-3000	19	
d	0	50 AGL	55 Approach	180				Threshold crossing

Flight Profile QF-16AJ
RANDOM ENTRY SFO-REPRESENTATIVE

0 10,000 20,000 30,000 40,000 50,000

Scale in Feet 1:165,000 (1 inch = 13,700 feet)

N

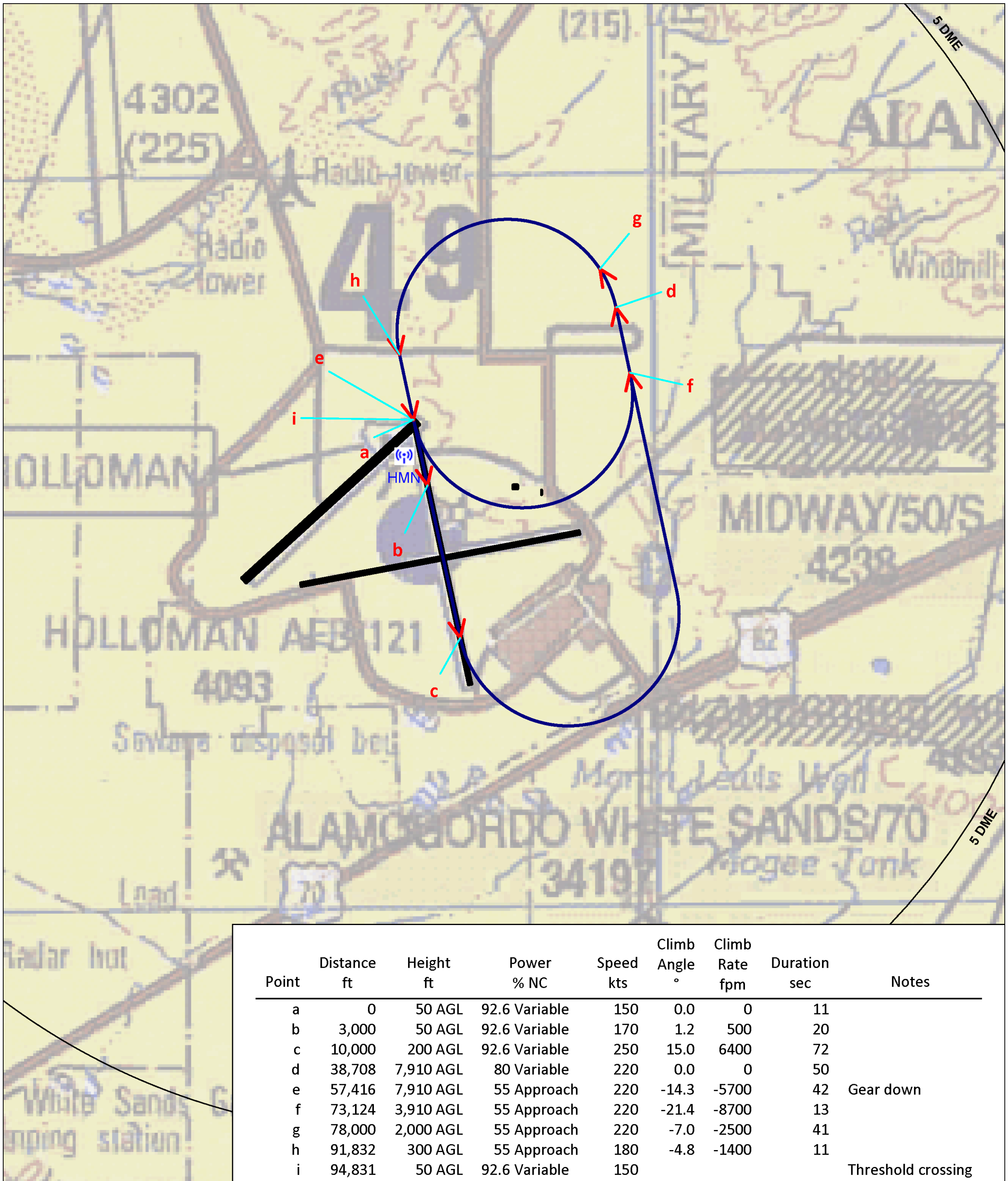


Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	92 Afterburner	150	0.0	0	10	
b	3,000	50 AGL	92 Afterburner	210	2.1	900	61	
c	29,142	1,000 AGL	92.6 Variable	300	0.6	300	88	
d	73,729	1,500 AGL	82.6 Variable	300	0.0	0	77	
e	112,944	1,500 AGL	82.3 Variable	300	0.0	0	111	
f	169,162	1,500 AGL	75 Variable	300	0.0	0	228	
g	274,980	1,500 AGL	78 Approach	250	-2.3	-800	89	Drop gear
h	304,980	300 AGL	75 Approach	150	-2.4	-600	24	
i	310,980	50 AGL	92 Afterburner	150				

Flight Profile QF-16C1
WSMR Closed

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000

Scale in Feet 1:129,000 (1 inch = 10,800 feet)

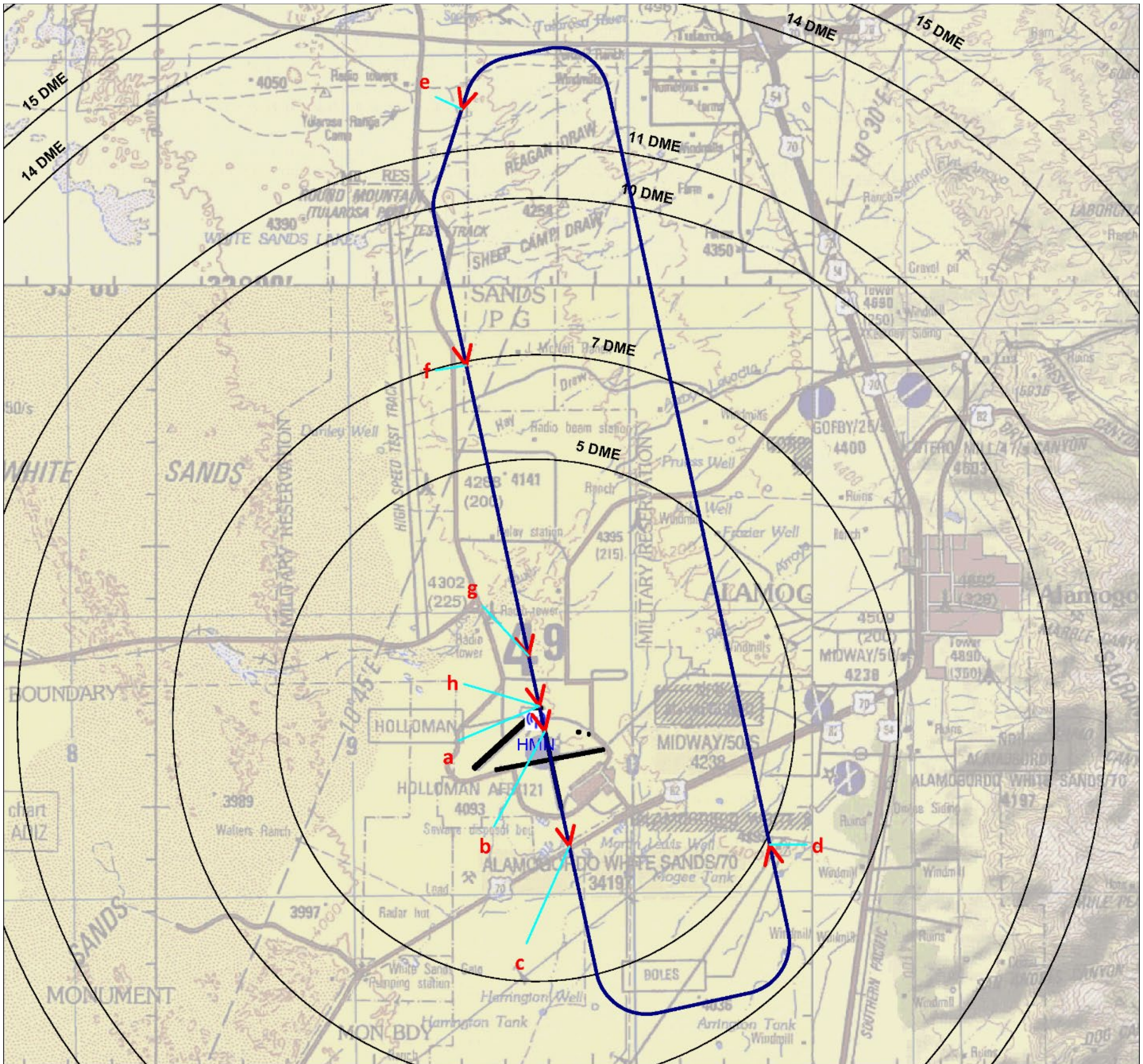


Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	92.6 Variable	150	0.0	0	11	
b	3,000	50 AGL	92.6 Variable	170	1.2	500	20	
c	10,000	200 AGL	92.6 Variable	250	15.0	6400	72	
d	38,708	7,910 AGL	80 Variable	220	0.0	0	50	
e	57,416	7,910 AGL	55 Approach	220	-14.3	-5700	42	Gear down
f	73,124	3,910 AGL	55 Approach	220	-21.4	-8700	13	
g	78,000	2,000 AGL	55 Approach	220	-7.0	-2500	41	
h	91,832	300 AGL	55 Approach	180	-4.8	-1400	11	
i	94,831	50 AGL	92.6 Variable	150				Threshold crossing

Flight Profile QF-16CA
SFO-REPRESENTATIVE

0 4,000 8,000 12,000 16,000 20,000

Scale in Feet 1:63,800 (1 inch = 5,320 feet)



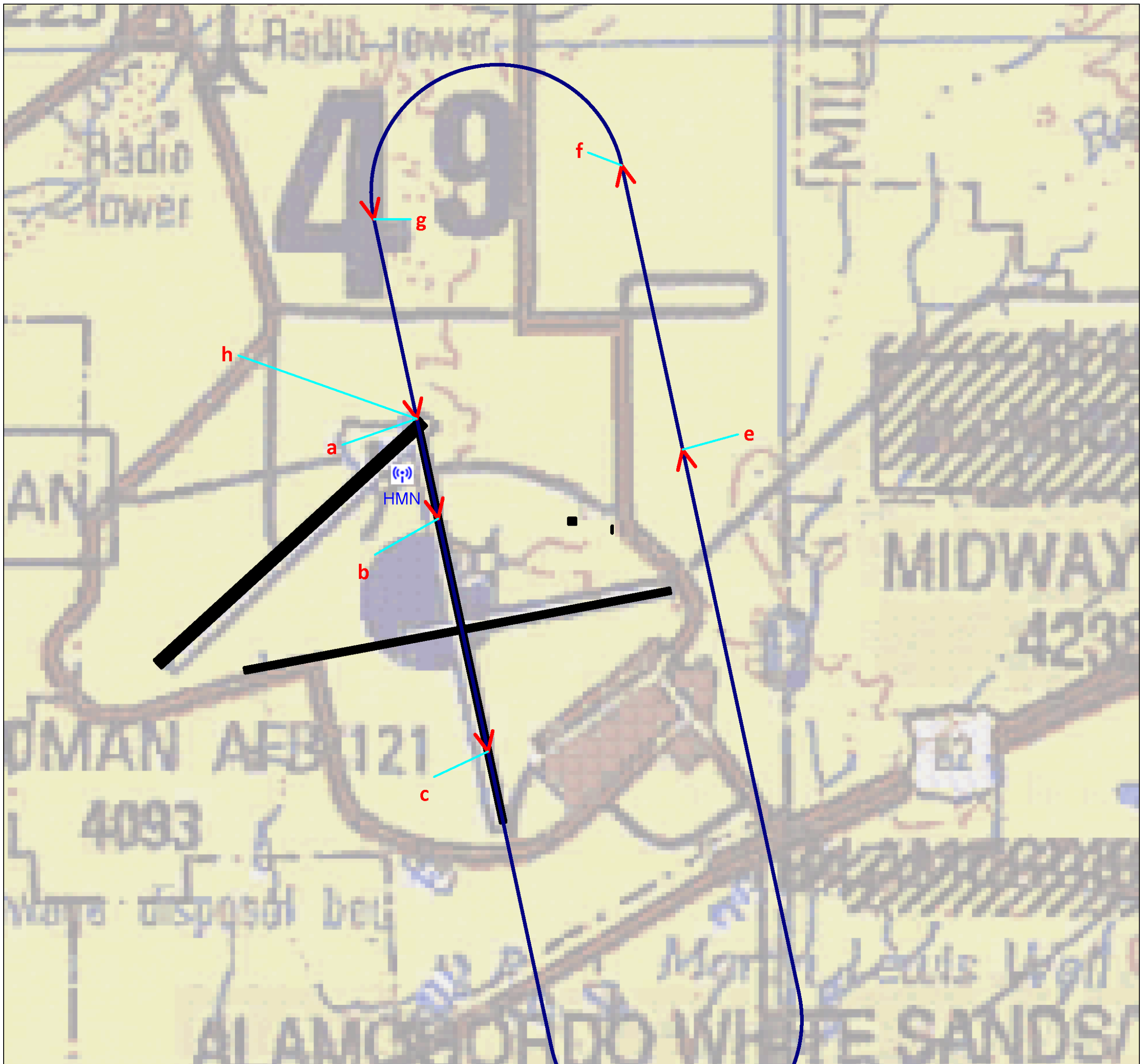
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	92.6 Variable	150	0.0	0	11	
b	3,000	50 AGL	92.6 Variable	170	8.1	3000	39	
c	16,655	2,000 AGL	92.6 Variable	250	0.0	0	131	
d	72,000	2,000 AGL	80 Variable	250	0.0	0	267	
e	184,796	2,000 AGL	78 Variable	250	0.0	0	73	
f	215,520	2,000 AGL	78 Approach	250	-2.8	-1000	102	Drop gear
g	250,091	300 AGL	78 Approach	150	-2.4	-600	24	
h	256,091	50 AGL	92.6 Variable	150				Threshold crossing

Flight Profile QF-16CB
RADAR PATTERN-REPRESENTATIVE

0 10,000 20,000 30,000 40,000 50,000 60,000

Scale in Feet 1:188,000 (1 inch = 15,600 feet)

N



Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	92.6 Variable	150	0.0	0	9	
b	3,000	50 AGL	92.6 Variable	225	2.0	900	17	
c	10,000	300 AGL	92.6 Variable	270	7.0	3000	34	
d	23,912	2,000 AGL	80 Variable	210	0.0	0	65	
e	47,000	2,000 AGL	80 Approach	210	0.0	0	27	Drop gear
f	55,541	2,000 AGL	78 Approach	170	-8.2	-2300	44	
g	67,322	300 AGL	78 Approach	150	-2.4	-600	24	Final approach
h	73,322	50 AGL	92.6 Variable	150				Threshold crossing

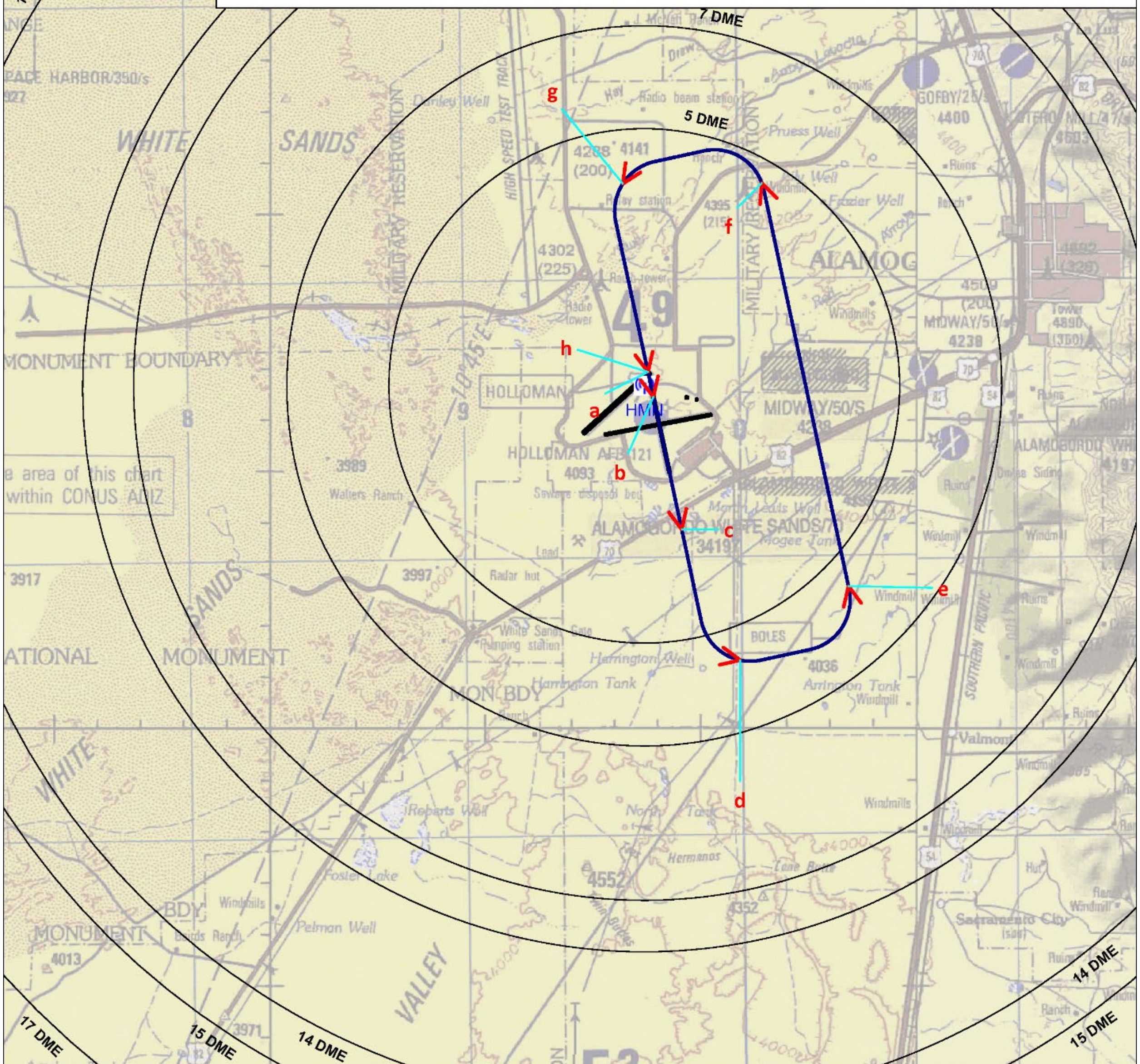
Flight Profile QF-16CC
VFR INSIDE-REPRESENTATIVE

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000

Scale in Feet 1:47,400 (1 inch = 3,950 feet)

N

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	92.6 Variable	150	0.0	0	10	Threshold crossing
b	3,000	50 AGL	92.6 Variable	210	6.9	3000	39	Climb
c	19,000	2,000 AGL	92.6 Variable	270	0.0	0	37	
d	36,981	2,000 AGL	82.6 Variable	300	0.0	0	42	Reach pattern altitude
e	55,290	2,000 AGL	80 Variable	220	0.0	0	148	Begin Downwind
f	104,000	2,000 AGL	78 Approach	170	-5.0	-1400	71	End Downwind, Descend
g	123,300	300 AGL	78 Approach	150	-0.6	-200	90	
h	146,150	50 AGL	92.6 Variable	150				Threshold crossing

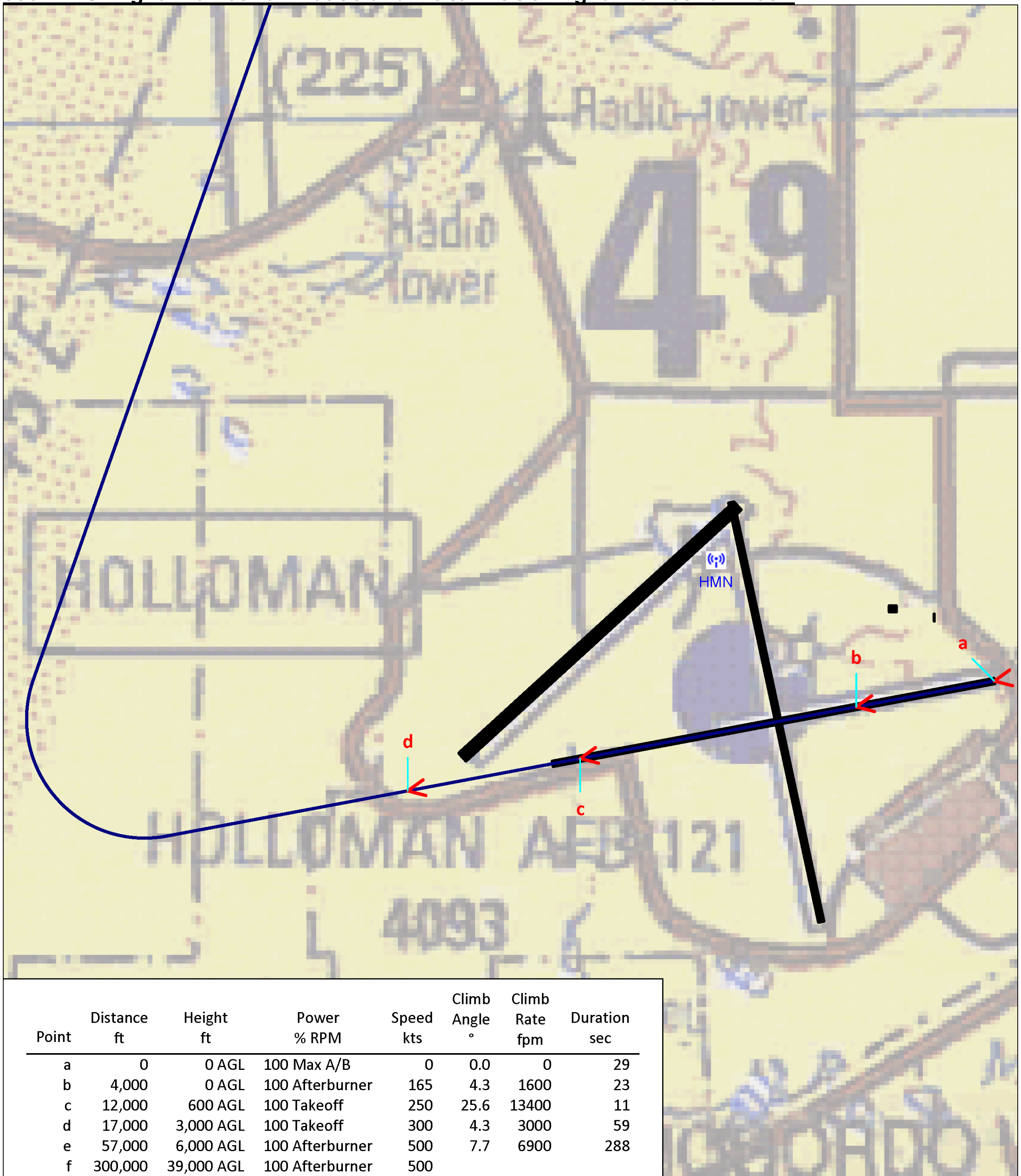


Flight Profile QF-16CS
VFR OUTSIDE-REPRESENTATIVE

0 10,000 20,000 30,000 40,000 50,000 60,000

Scale in Feet 1:190,000 (1 inch = 15,800 feet)

586 FLTS Flight Profiles for T-38Cs and ACC/AFGSC Flight Profiles for T-38A



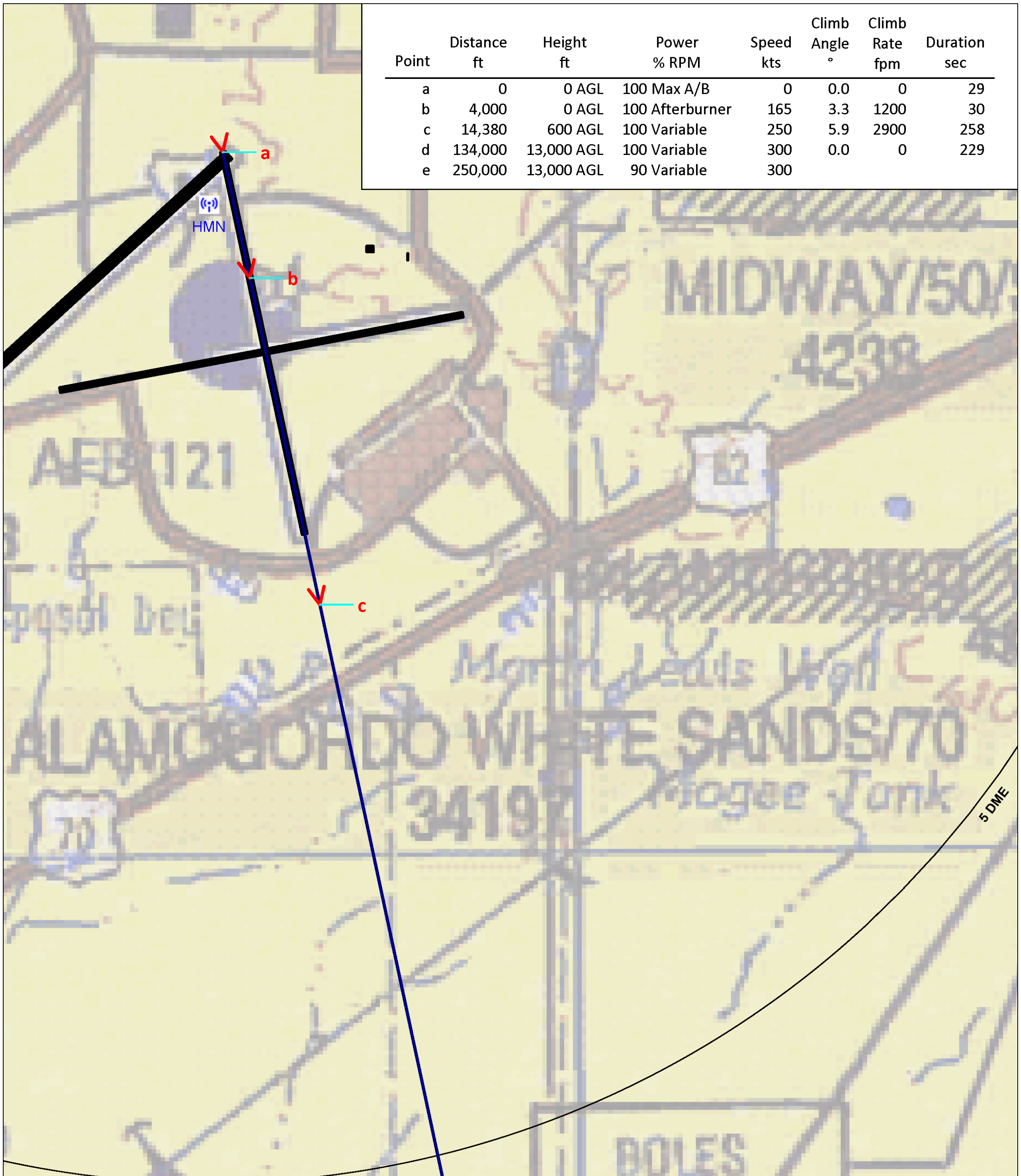
Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	0 AGL	100 Max A/B	0	0.0	0	29
b	4,000	0 AGL	100 Afterburner	165	4.3	1600	23
c	12,000	600 AGL	100 Takeoff	250	25.6	13400	11
d	17,000	3,000 AGL	100 Takeoff	300	4.3	3000	59
e	57,000	6,000 AGL	100 Afterburner	500	7.7	6900	288
f	300,000	39,000 AGL	100 Afterburner	500			

Flight Profile 38FCF
ACC/AFGSC T-38A
Flight Track: 25D14 - Functional Control Flight Track for T-38As

0 2,000 4,000 6,000 8,000 10,000 12,000
Scale in Feet 1:40,800 (1 inch = 3,400 feet)

N

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	0 AGL	100 Max A/B	0	0.0	0	29
b	4,000	0 AGL	100 Afterburner	165	3.3	1200	30
c	14,380	600 AGL	100 Variable	250	5.9	2900	258
d	134,000	13,000 AGL	100 Variable	300	0.0	0	229
e	250,000	13,000 AGL	90 Variable	300			



Flight Profile 38GB
586 FLTS T-38C
Flight Track: 16D4 - VFR TO SOUTH

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000
Scale in Feet 1:44,700 (1 inch = 3,730 feet)

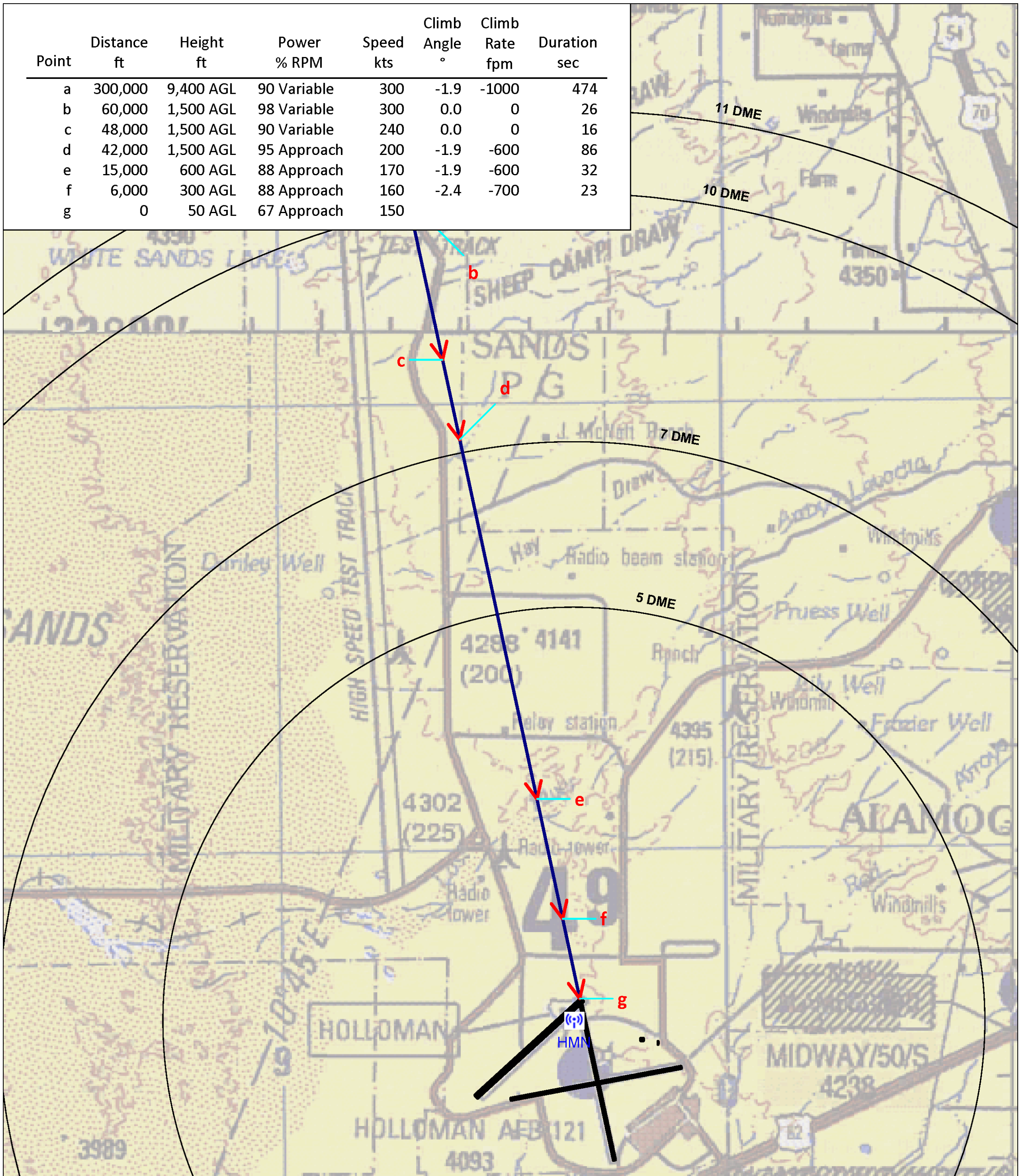
Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	200,000	8,900 AGL	90 Variable	300	-1.3	-600	263	
b	78,000	6,100 AGL	88 Variable	250	0.0	0	43	
c	60,000	6,100 AGL	88 Variable	250	-8.7	-3500	47	
d	42,000	3,340 AGL	95 Approach	202	-8.7	-2900	38	
e	30,000	1,500 AGL	88 Approach	170	-2.8	-800	111	
f	0	50 AGL	67 Approach	150				idle over threshold

Flight Profile 38BA
586 FLTS T-38C
Flight Track: 16A1 - IFR

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000

Scale in Feet 1:131,000 (1 inch = 10,900 feet)

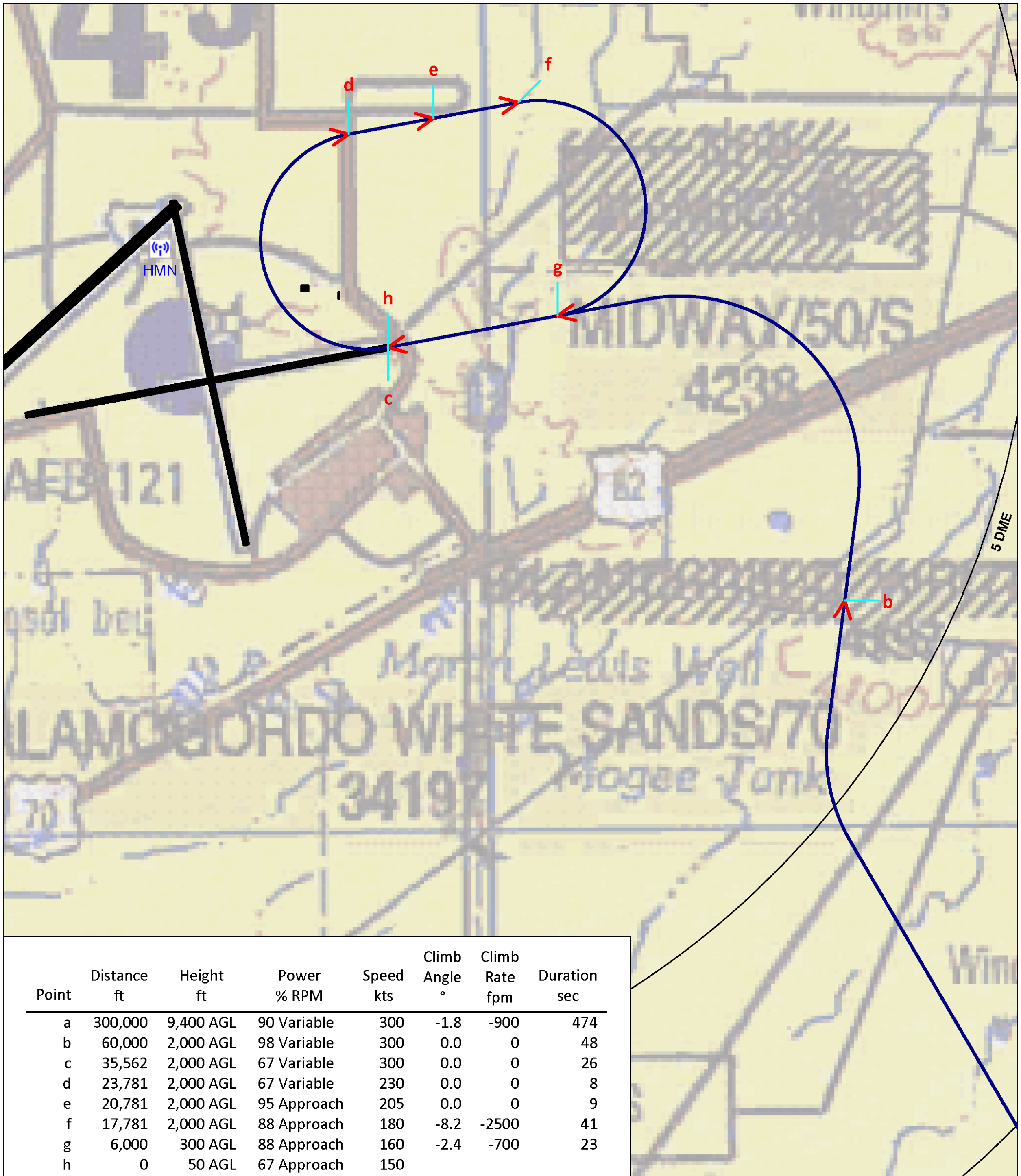
Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	300,000	9,400 AGL	90 Variable	300	-1.9	-1000	474
b	60,000	1,500 AGL	98 Variable	300	0.0	0	26
c	48,000	1,500 AGL	90 Variable	240	0.0	0	16
d	42,000	1,500 AGL	95 Approach	200	-1.9	-600	86
e	15,000	600 AGL	88 Approach	170	-1.9	-600	32
f	6,000	300 AGL	88 Approach	160	-2.4	-700	23
g	0	50 AGL	67 Approach	150			



Flight Profile 38BB
586 FLTS T-38C
Flight Track: 16A2 - TULIE RECOVERY

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000

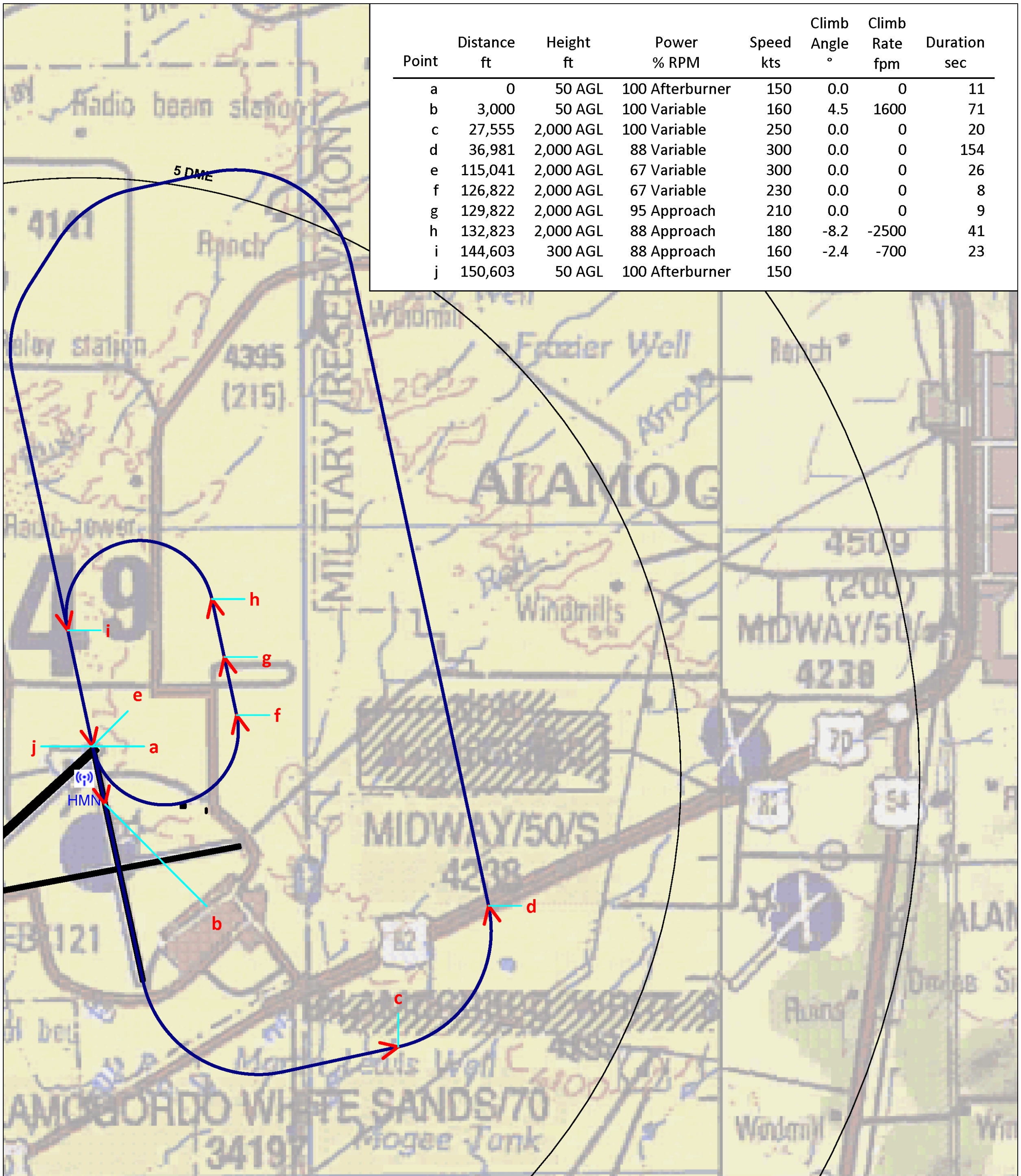
Scale in Feet 1:106,000 (1 inch = 8,820 feet)



Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	300,000	9,400 AGL	90 Variable	300	-1.8	-900	474
b	60,000	2,000 AGL	98 Variable	300	0.0	0	48
c	35,562	2,000 AGL	67 Variable	300	0.0	0	26
d	23,781	2,000 AGL	67 Variable	230	0.0	0	8
e	20,781	2,000 AGL	95 Approach	205	0.0	0	9
f	17,781	2,000 AGL	88 Approach	180	-8.2	-2500	41
g	6,000	300 AGL	88 Approach	160	-2.4	-700	23
h	0	50 AGL	67 Approach	150			

Flight Profile 38DH
586 FLTS T-38C
Flight Track: 25A9OH - VFR FROM MCGREGOR-PITCH

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000
Scale in Feet 1:49,800 (1 inch = 4,150 feet)

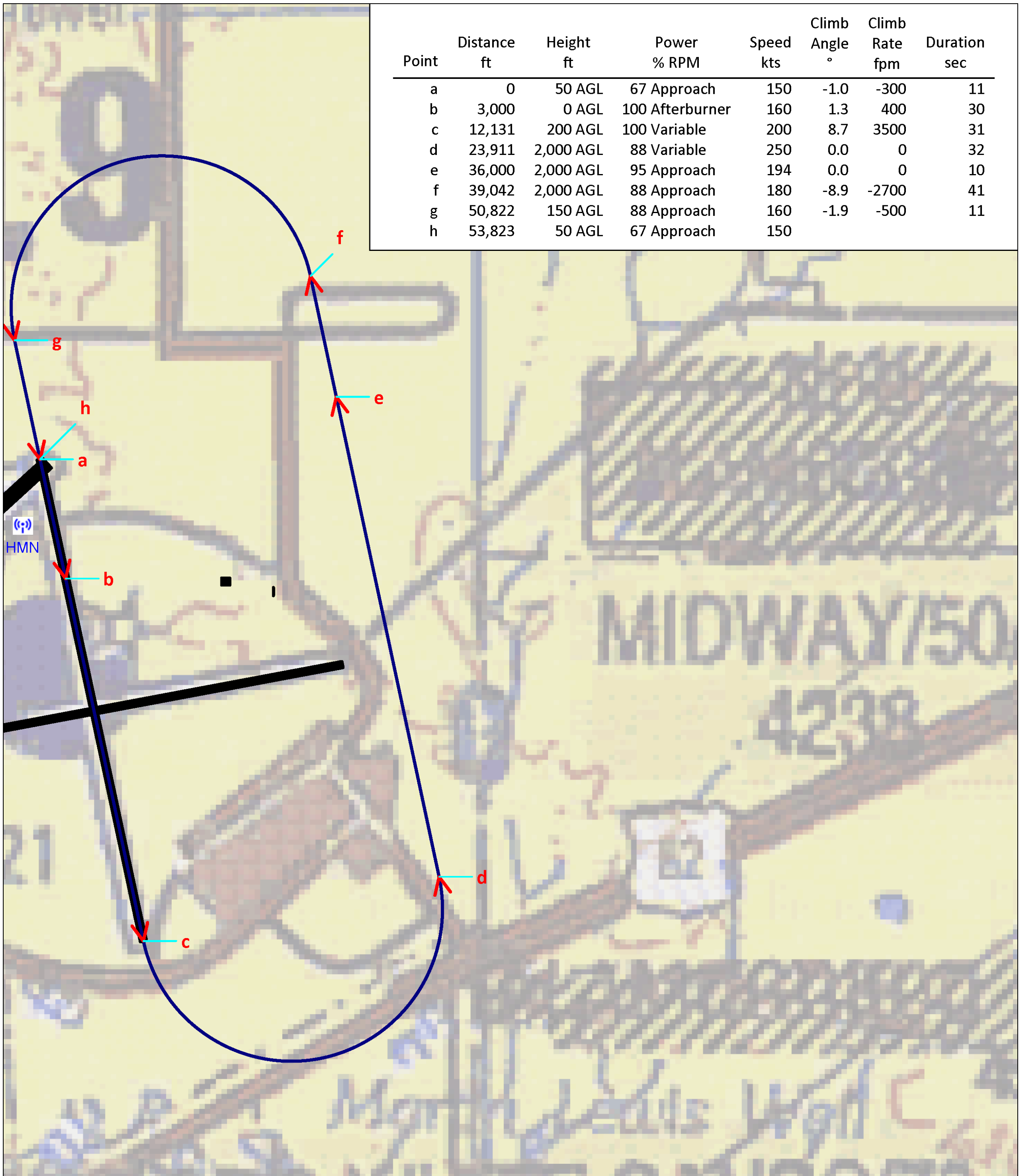


Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	50 AGL	100 Afterburner	150	0.0	0	11
b	3,000	50 AGL	100 Variable	160	4.5	1600	71
c	27,555	2,000 AGL	100 Variable	250	0.0	0	20
d	36,981	2,000 AGL	88 Variable	300	0.0	0	154
e	115,041	2,000 AGL	67 Variable	300	0.0	0	26
f	126,822	2,000 AGL	67 Variable	230	0.0	0	8
g	129,822	2,000 AGL	95 Approach	210	0.0	0	9
h	132,823	2,000 AGL	88 Approach	180	-8.2	-2500	41
i	144,603	300 AGL	88 Approach	160	-2.4	-700	23
j	150,603	50 AGL	100 Afterburner	150			

Flight Profile 38LB
586 FLTS T-38C
Flight Track: 16C2 - VFR OUTSIDE DOWNWIND - PITCH

0 4,000 8,000 12,000 16,000 20,000

Scale in Feet 1:72,800 (1 inch = 6,070 feet)



Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	50 AGL	67 Approach	150	-1.0	-300	11
b	3,000	0 AGL	100 Afterburner	160	1.3	400	30
c	12,131	200 AGL	100 Variable	200	8.7	3500	31
d	23,911	2,000 AGL	88 Variable	250	0.0	0	32
e	36,000	2,000 AGL	95 Approach	194	0.0	0	10
f	39,042	2,000 AGL	88 Approach	180	-8.9	-2700	41
g	50,822	150 AGL	88 Approach	160	-1.9	-500	11
h	53,823	50 AGL	67 Approach	150			

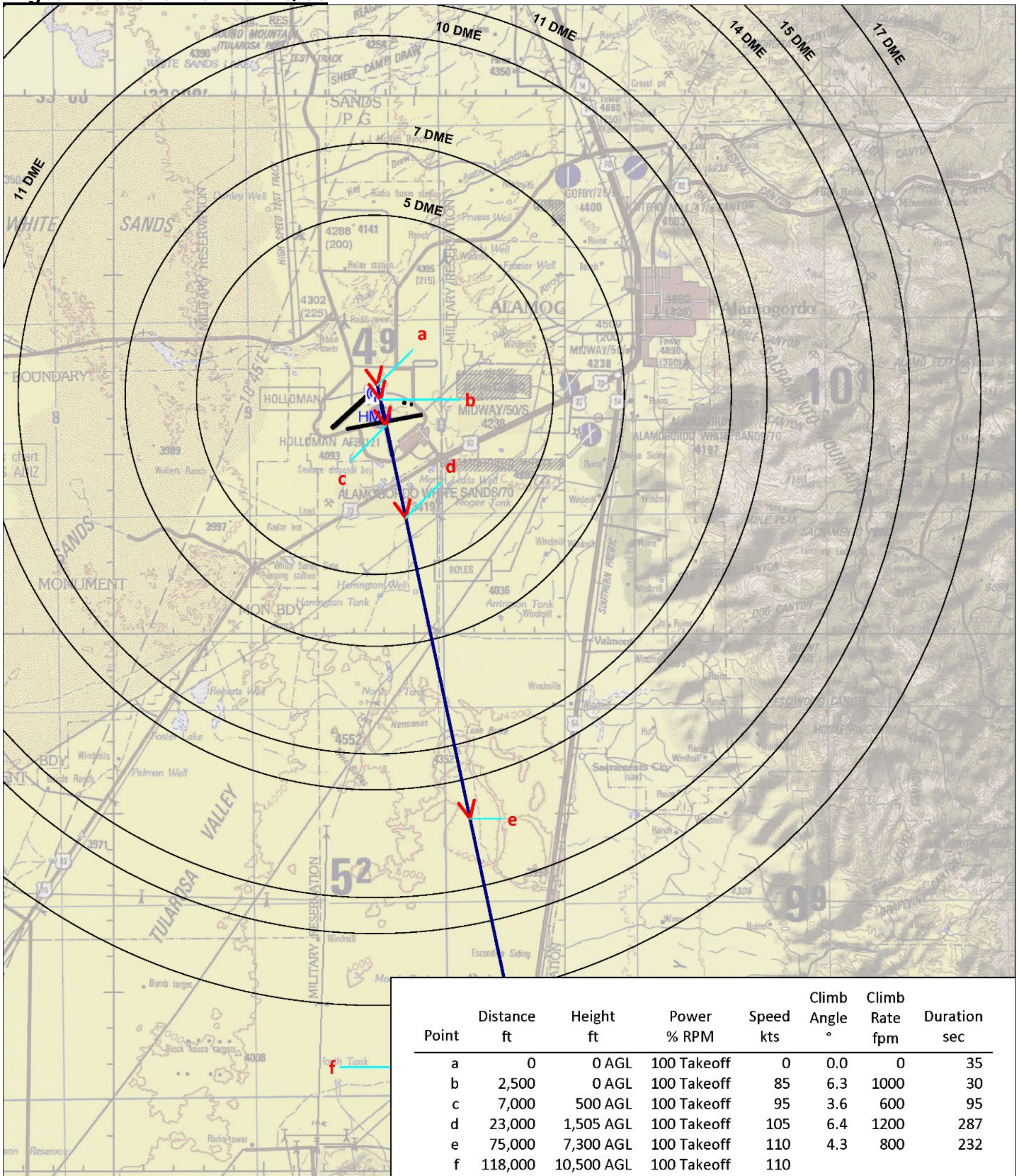
Flight Profile 38LC
586 FLTS T-38C
Flight Track: 16C3o

0 2,000 4,000 6,000 8,000 10,000

Scale in Feet 1:35,500 (1 inch = 2,960 feet)

N

Flight Profiles for 49 WG MQ-9s



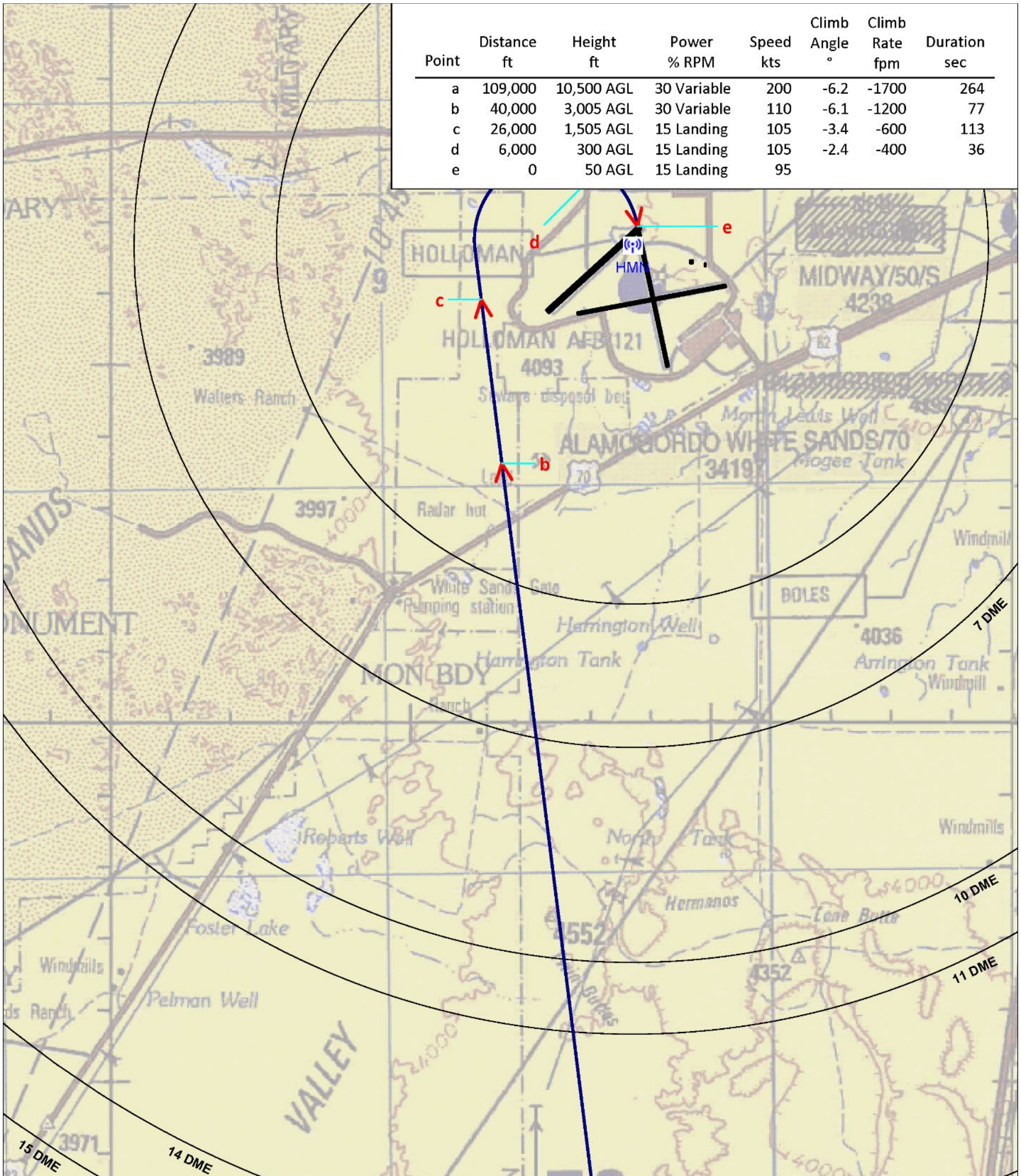
Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	0 AGL	100 Takeoff	0	0.0	0	35
b	2,500	0 AGL	100 Takeoff	85	6.3	1000	30
c	7,000	500 AGL	100 Takeoff	95	3.6	600	95
d	23,000	1,505 AGL	100 Takeoff	105	6.4	1200	287
e	75,000	7,300 AGL	100 Takeoff	110	4.3	800	232
f	118,000	10,500 AGL	100 Takeoff	110			

Flight Profile MQ9D2
49 WG MQ-9
Flight Track: 16D4 - VFR TO SOUTH

0 10,000 20,000 30,000 40,000 50,000 60,000 70,000 80,000

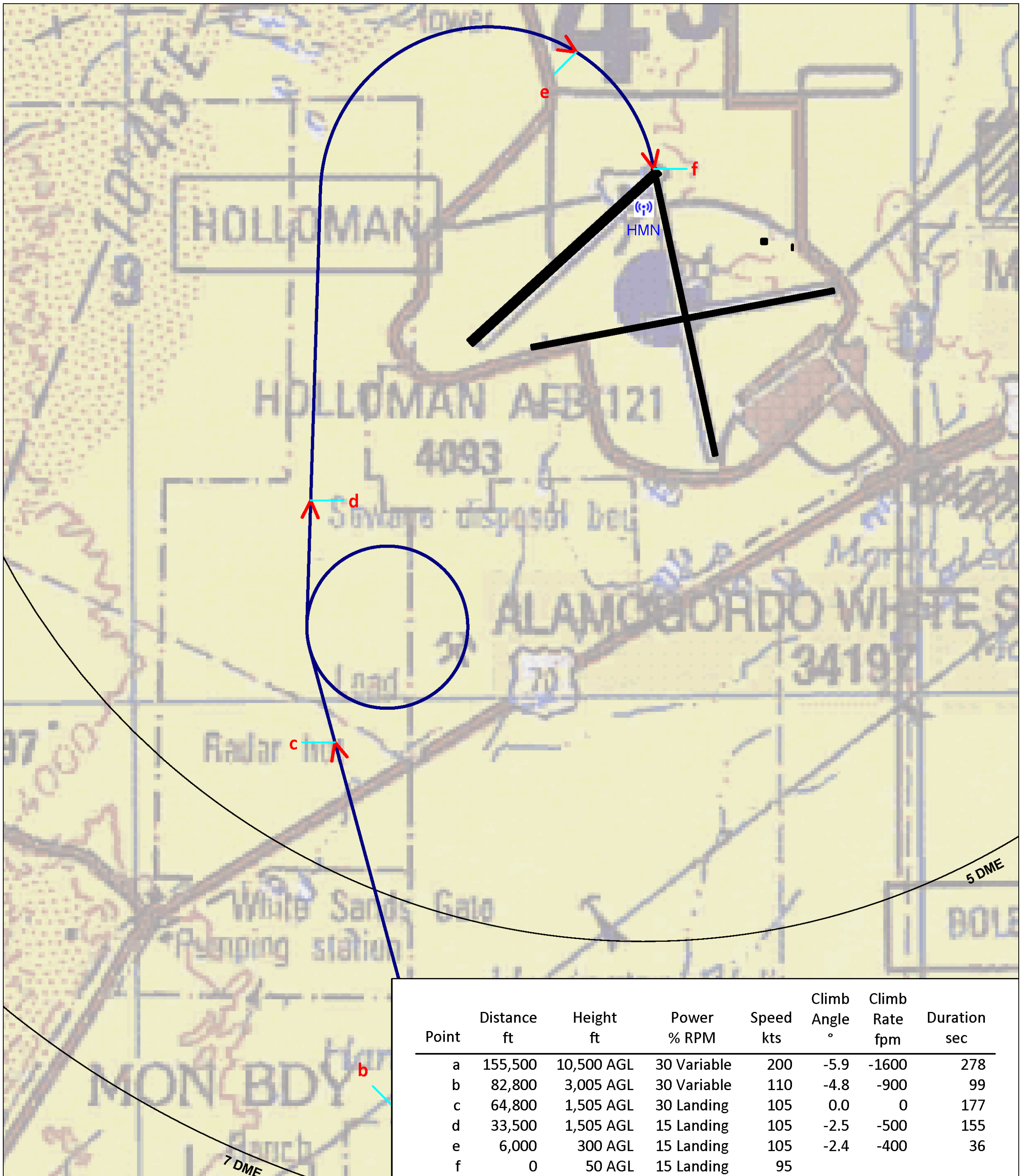
Scale in Feet 1:243,000 (1 inch = 20,300 feet)

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	109,000	10,500 AGL	30 Variable	200	-6.2	-1700	264
b	40,000	3,005 AGL	30 Variable	110	-6.1	-1200	77
c	26,000	1,505 AGL	15 Landing	105	-3.4	-600	113
d	6,000	300 AGL	15 Landing	105	-2.4	-400	36
e	0	50 AGL	15 Landing	95			



Flight Profile MQ9A5
49 WG MQ-9
Flight Track: 16A20 - RPA FROM SOUTH

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000
Scale in Feet 1:122,000 (1 inch = 10,200 feet)

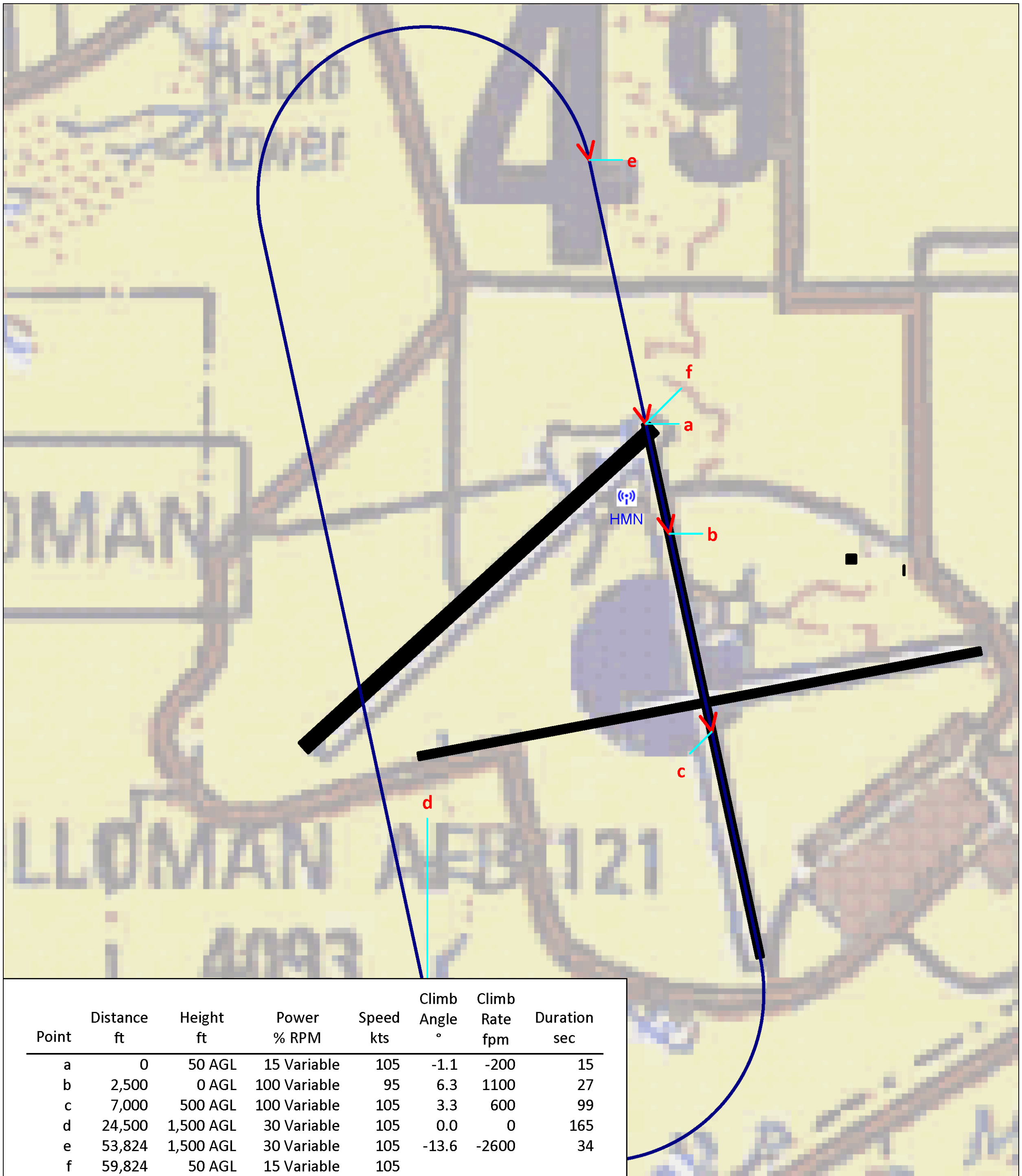


Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	155,500	10,500 AGL	30 Variable	200	-5.9	-1600	278
b	82,800	3,005 AGL	30 Variable	110	-4.8	-900	99
c	64,800	1,505 AGL	30 Landing	105	0.0	0	177
d	33,500	1,505 AGL	15 Landing	105	-2.5	-500	155
e	6,000	300 AGL	15 Landing	105	-2.4	-400	36
f	0	50 AGL	15 Landing	95			

Flight Profile MQ9A6
49 WG MQ-9
Flight Track: 16A21 - RPA FROM PHOENIX HOLDING PATTERN

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000
Scale in Feet 1:59,800 (1 inch = 4,980 feet)

N

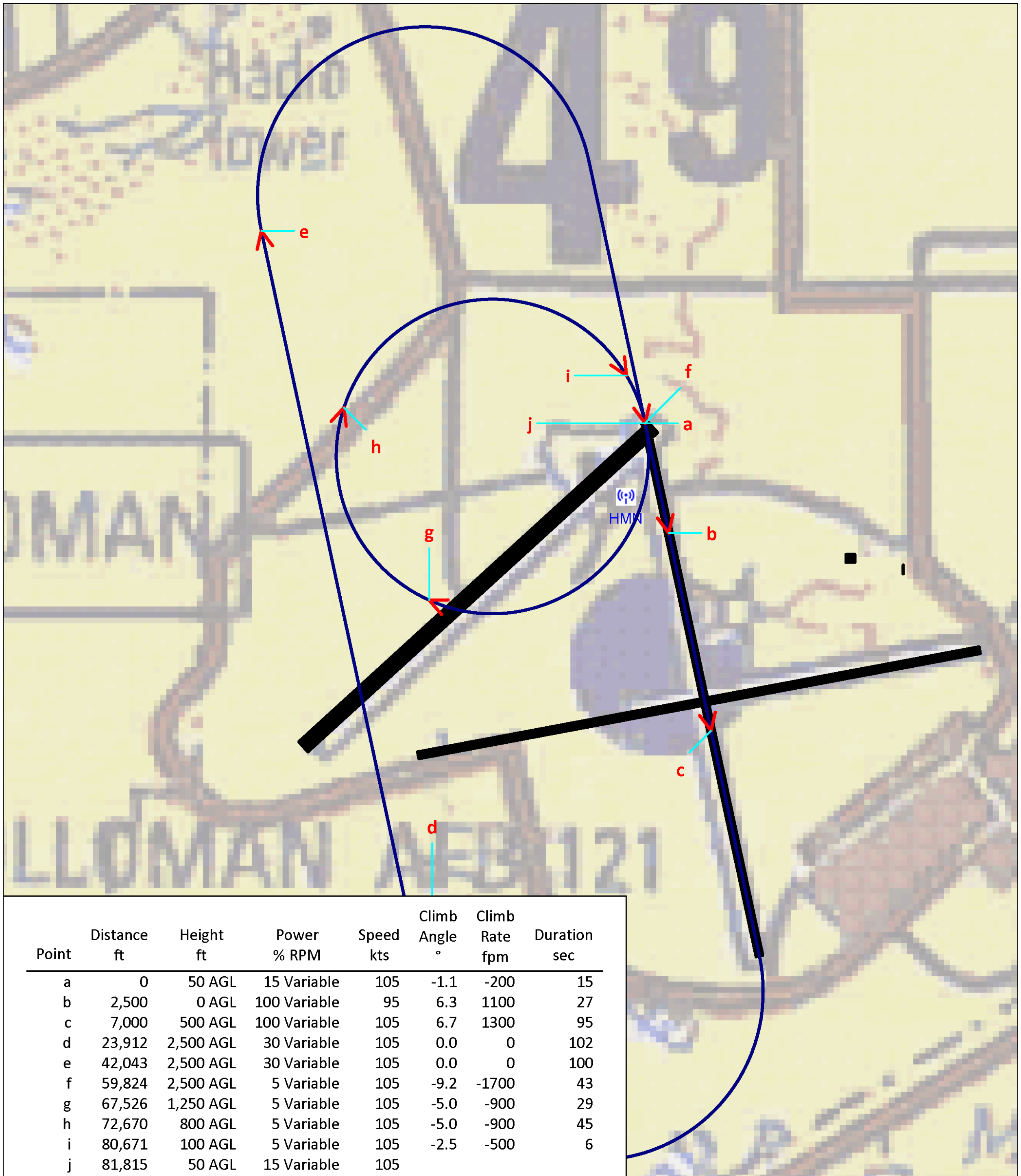


Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	50 AGL	15 Variable	105	-1.1	-200	15
b	2,500	0 AGL	100 Variable	95	6.3	1100	27
c	7,000	500 AGL	100 Variable	105	3.3	600	99
d	24,500	1,500 AGL	30 Variable	105	0.0	0	165
e	53,824	1,500 AGL	30 Variable	105	-13.6	-2600	34
f	59,824	50 AGL	15 Variable	105			

Flight Profile MQ9C2
49 WG MQ-9
Flight Track: 16C3M - VFR INSIDE DOWNWIND

0 2,000 4,000 6,000 8,000 10,000
Scale in Feet 1:32,100 (1 inch = 2,670 feet)

N



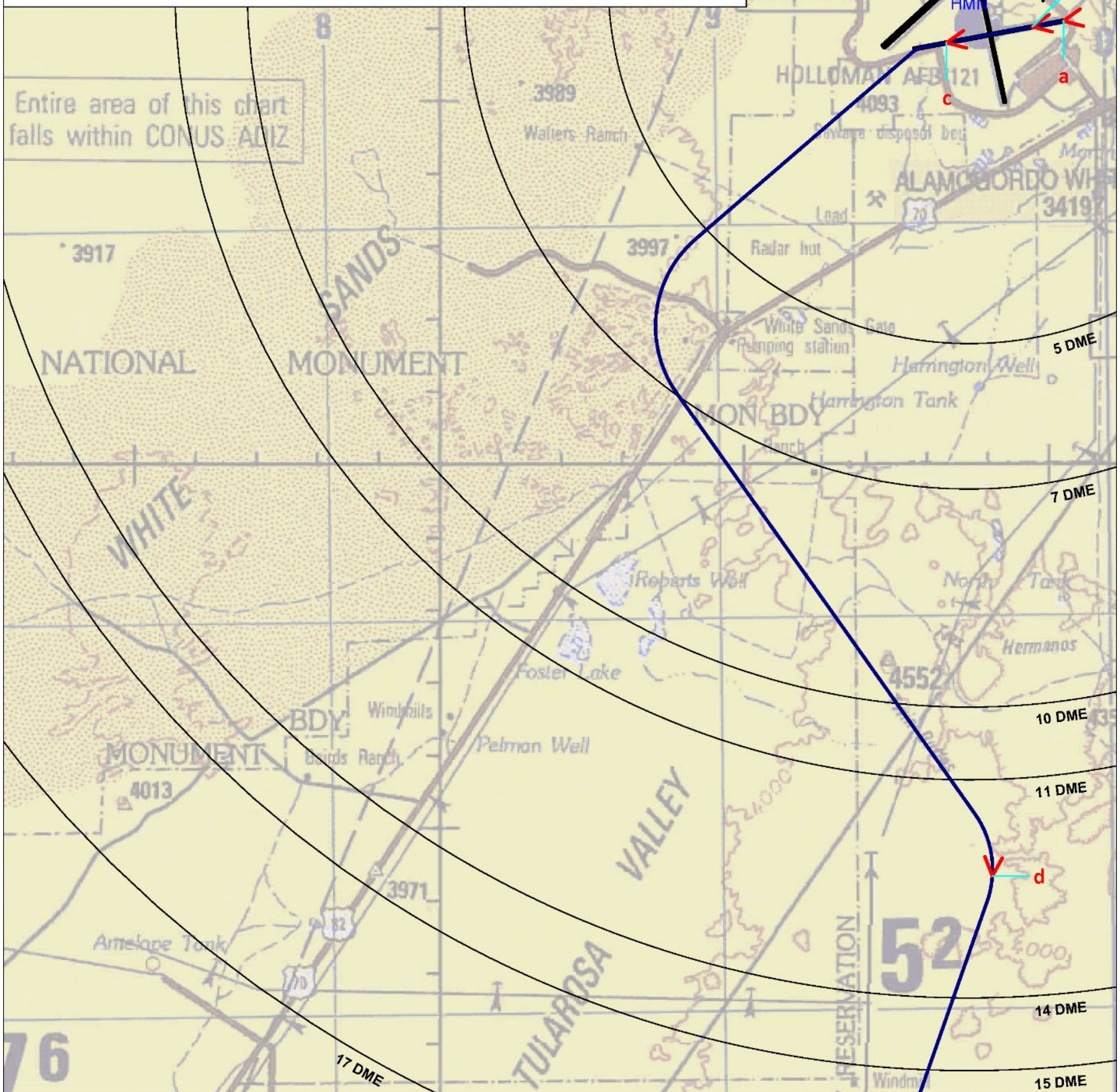
Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	50 AGL	15 Variable	105	-1.1	-200	15
b	2,500	0 AGL	100 Variable	95	6.3	1100	27
c	7,000	500 AGL	100 Variable	105	6.7	1300	95
d	23,912	2,500 AGL	30 Variable	105	0.0	0	102
e	42,043	2,500 AGL	30 Variable	105	0.0	0	100
f	59,824	2,500 AGL	5 Variable	105	-9.2	-1700	43
g	67,526	1,250 AGL	5 Variable	105	-5.0	-900	29
h	72,670	800 AGL	5 Variable	105	-5.0	-900	45
i	80,671	100 AGL	5 Variable	105	-2.5	-500	6
j	81,815	50 AGL	15 Variable	105			

Flight Profile MQ9CS2
49 WG MQ-9
Flight Track: 16CS - VFR INSIDE DOWNWIND w SFO

Scale in Feet 1:32,100 (1 inch = 2,670 feet)

Flight Profiles for 586 FLTS and Army C-12s

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	0 AGL	100 100% Torque	0	0.0	0	27
b	2,662	0 AGL	100 Takeoff	115	5.0	1600	24
c	10,000	644 AGL	100 Takeoff	250	5.0	2200	213
d	100,000	8,547 AGL	90 Takeoff	250	42.4	23100	237
e	200,100	100,000 AGL	90 Takeoff	250			



Flight Profile C1IB
586 FLTS C-12
Flight Track: 25D2o - VFR TO SOUTH/ LONE BUTTE

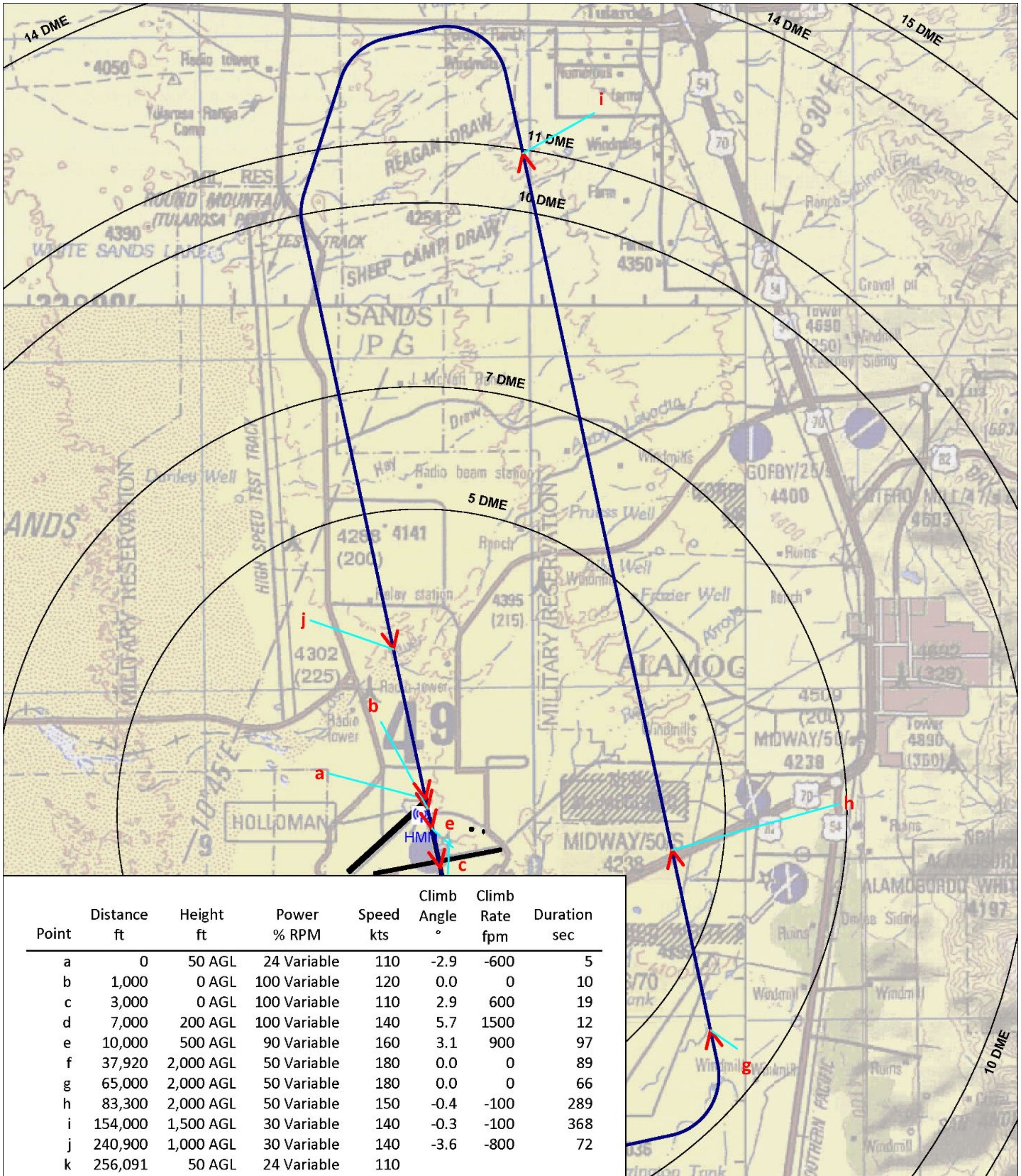
0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000
Scale in Feet 1:132,000 (1 inch = 11,000 feet)

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	300,000	10,000 AGL	85 Landing	160	-1.9	-500	933
b	48,000	1,500 AGL	85 Landing	160	0.0	0	74
c	30,000	1,500 AGL	70 Landing	130	-2.8	-600	148
d	0	50 AGL	24 Landing	110			

Flight Profile C12_586A16a
586 FLTS C-12
Flight Track: 16A1 - IFR

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000
Scale in Feet 1:105,000 (1 inch = 8,710 feet)

N

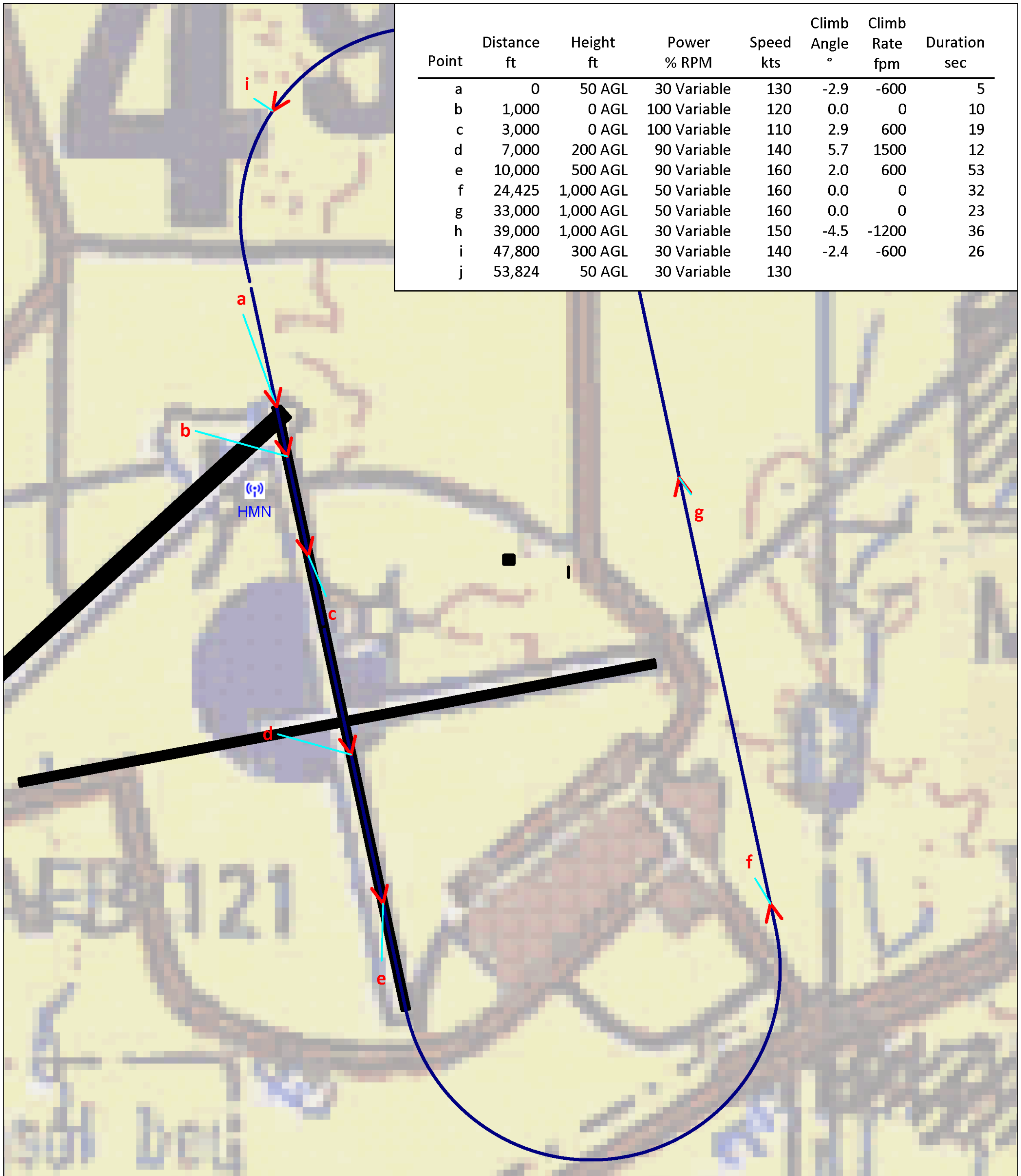


Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	50 AGL	24 Variable	110	-2.9	-600	5
b	1,000	0 AGL	100 Variable	120	0.0	0	10
c	3,000	0 AGL	100 Variable	110	2.9	600	19
d	7,000	200 AGL	100 Variable	140	5.7	1500	12
e	10,000	500 AGL	90 Variable	160	3.1	900	97
f	37,920	2,000 AGL	50 Variable	180	0.0	0	89
g	65,000	2,000 AGL	50 Variable	180	0.0	0	66
h	83,300	2,000 AGL	50 Variable	150	-0.4	-100	289
i	154,000	1,500 AGL	30 Variable	140	-0.3	-100	368
j	240,900	1,000 AGL	30 Variable	140	-3.6	-800	72
k	256,091	50 AGL	24 Variable	110			

Flight Profile C12_586C16a
586 FLTS C-12
Flight Track: 16C1 - IFR CLOSED

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000 48,000

Scale in Feet 1:143,000 (1 inch = 11,900 feet)

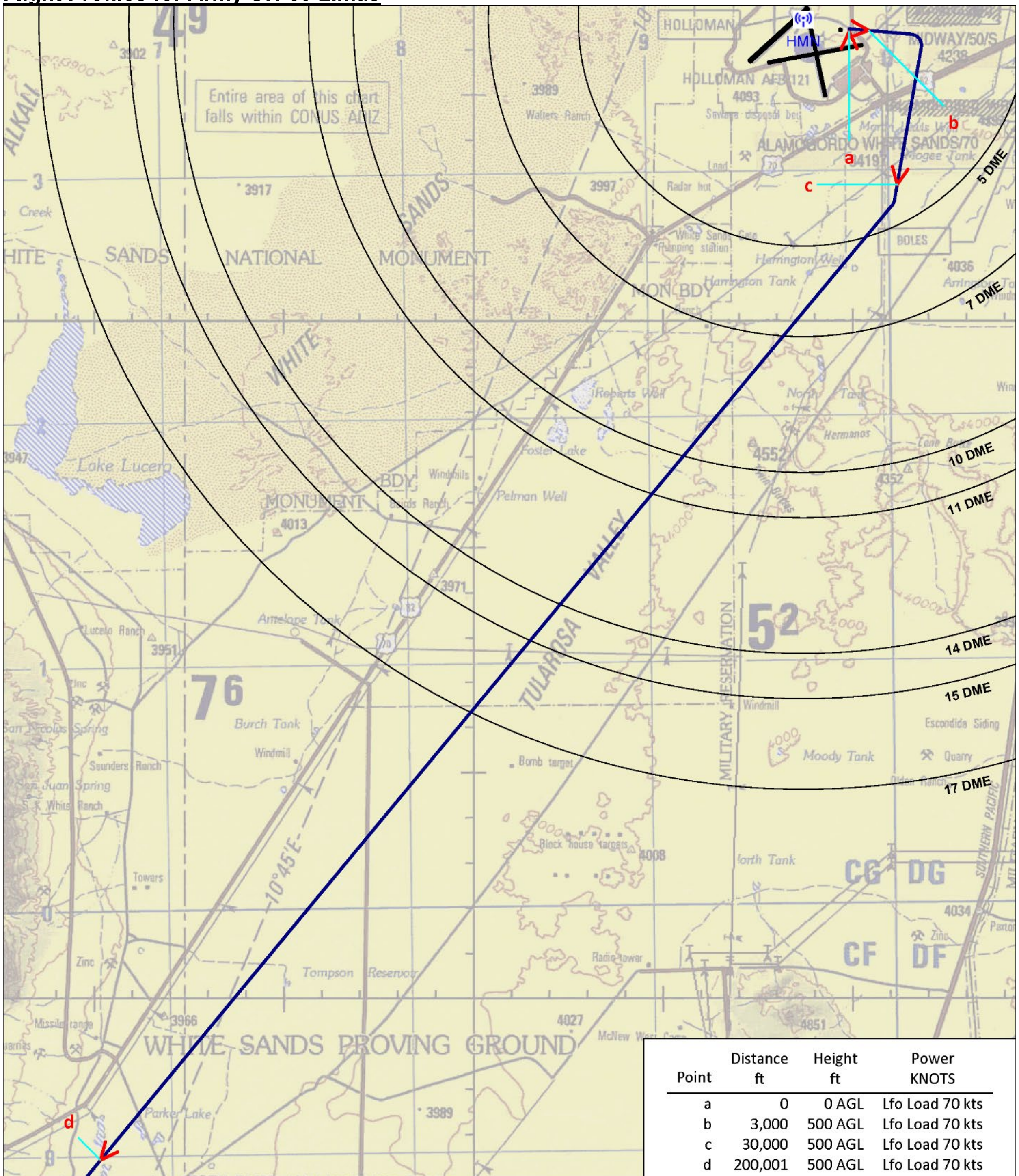


Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	50 AGL	30 Variable	130	-2.9	-600	5
b	1,000	0 AGL	100 Variable	120	0.0	0	10
c	3,000	0 AGL	100 Variable	110	2.9	600	19
d	7,000	200 AGL	90 Variable	140	5.7	1500	12
e	10,000	500 AGL	90 Variable	160	2.0	600	53
f	24,425	1,000 AGL	50 Variable	160	0.0	0	32
g	33,000	1,000 AGL	50 Variable	160	0.0	0	23
h	39,000	1,000 AGL	30 Variable	150	-4.5	-1200	36
i	47,800	300 AGL	30 Variable	140	-2.4	-600	26
j	53,824	50 AGL	30 Variable	130			

Flight Profile C12_586C16b
586 FLTS C-12
Flight Track: 16C3o

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000
Scale in Feet 1:28,300 (1 inch = 2,360 feet)

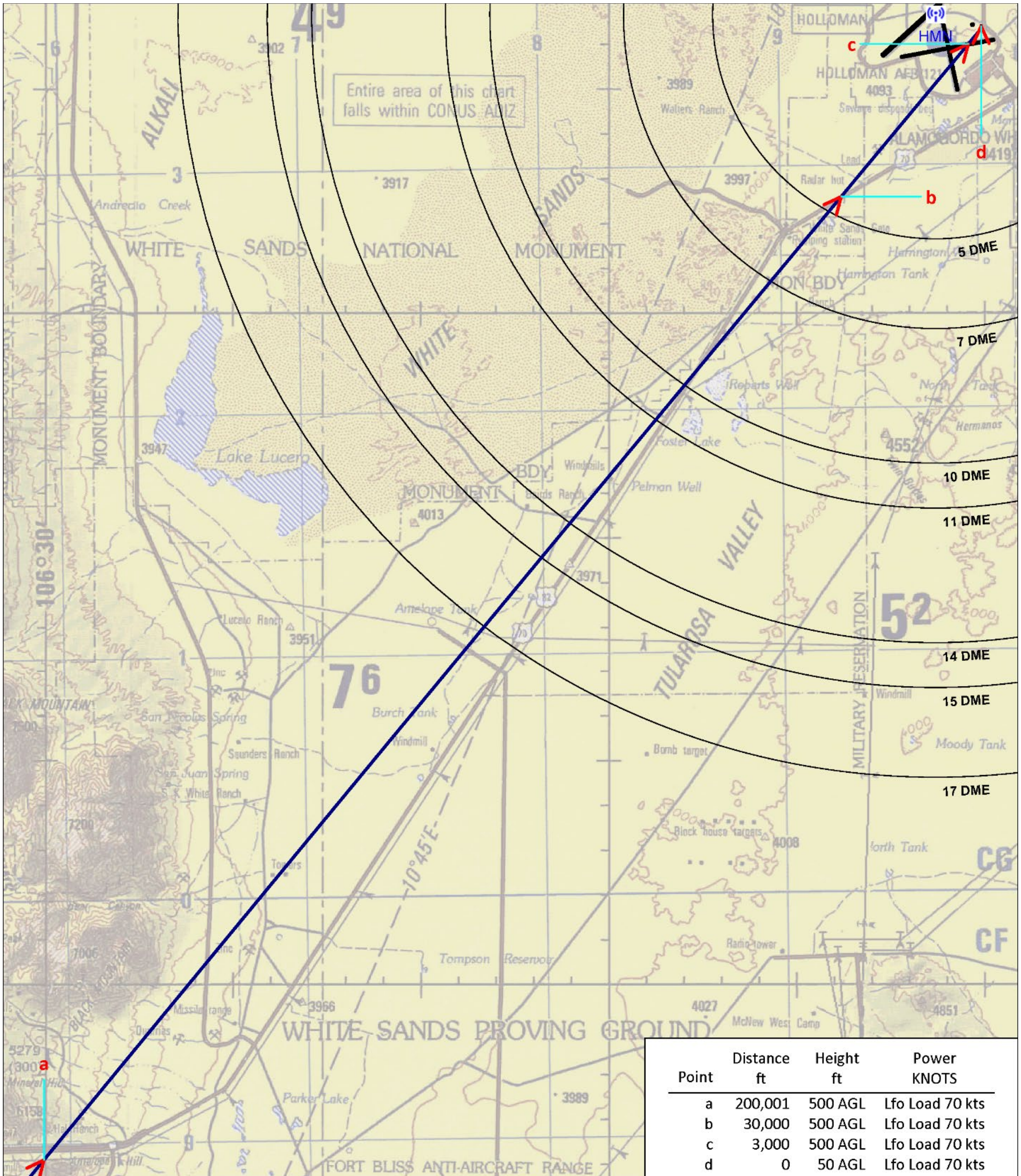
Flight Profiles for Army UH-60 Limas



Point	Distance ft	Height ft	Power KNOTS
a	0	0 AGL	Lfo Load 70 kts
b	3,000	500 AGL	Lfo Load 70 kts
c	30,000	500 AGL	Lfo Load 70 kts
d	200,001	500 AGL	Lfo Load 70 kts

Flight Profile OHD4
Army UH60A
Flight Track: BOAD - cut East, then south

0 10,000 20,000 30,000 40,000 50,000 60,000
Scale in Feet 1:193,000 (1 inch = 16,100 feet)



Point	Distance ft	Height ft	Power KNOTS
a	200,001	500 AGL	Lfo Load 70 kts
b	30,000	500 AGL	Lfo Load 70 kts
c	3,000	500 AGL	Lfo Load 70 kts
d	0	50 AGL	Lfo Load 70 kts

Flight Profile OHA1
Army UH60A
Flight Track: HSW - in from Southwest

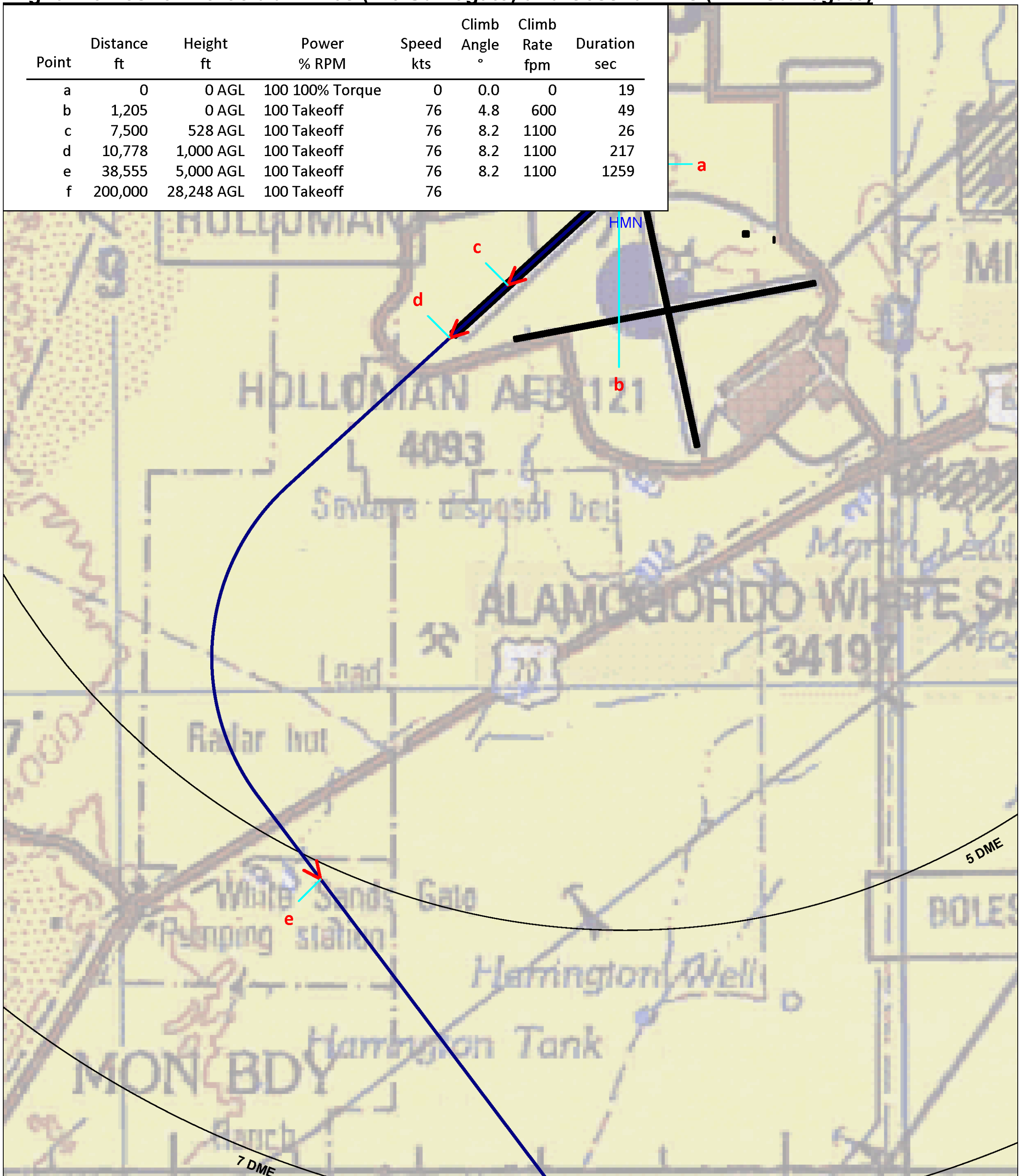
0 10,000 20,000 30,000 40,000 50,000 60,000

Scale in Feet 1:195,000 (1 inch = 16,300 feet)

N

Flight Profiles for Aeroclub DA40s (T-3 Surrogate) and Cessna 172s (T-41 Surrogate)

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	0 AGL	100 100% Torque	0	0.0	0	19
b	1,205	0 AGL	100 Takeoff	76	4.8	600	49
c	7,500	528 AGL	100 Takeoff	76	8.2	1100	26
d	10,778	1,000 AGL	100 Takeoff	76	8.2	1100	217
e	38,555	5,000 AGL	100 Takeoff	76	8.2	1100	1259
f	200,000	28,248 AGL	100 Takeoff	76			

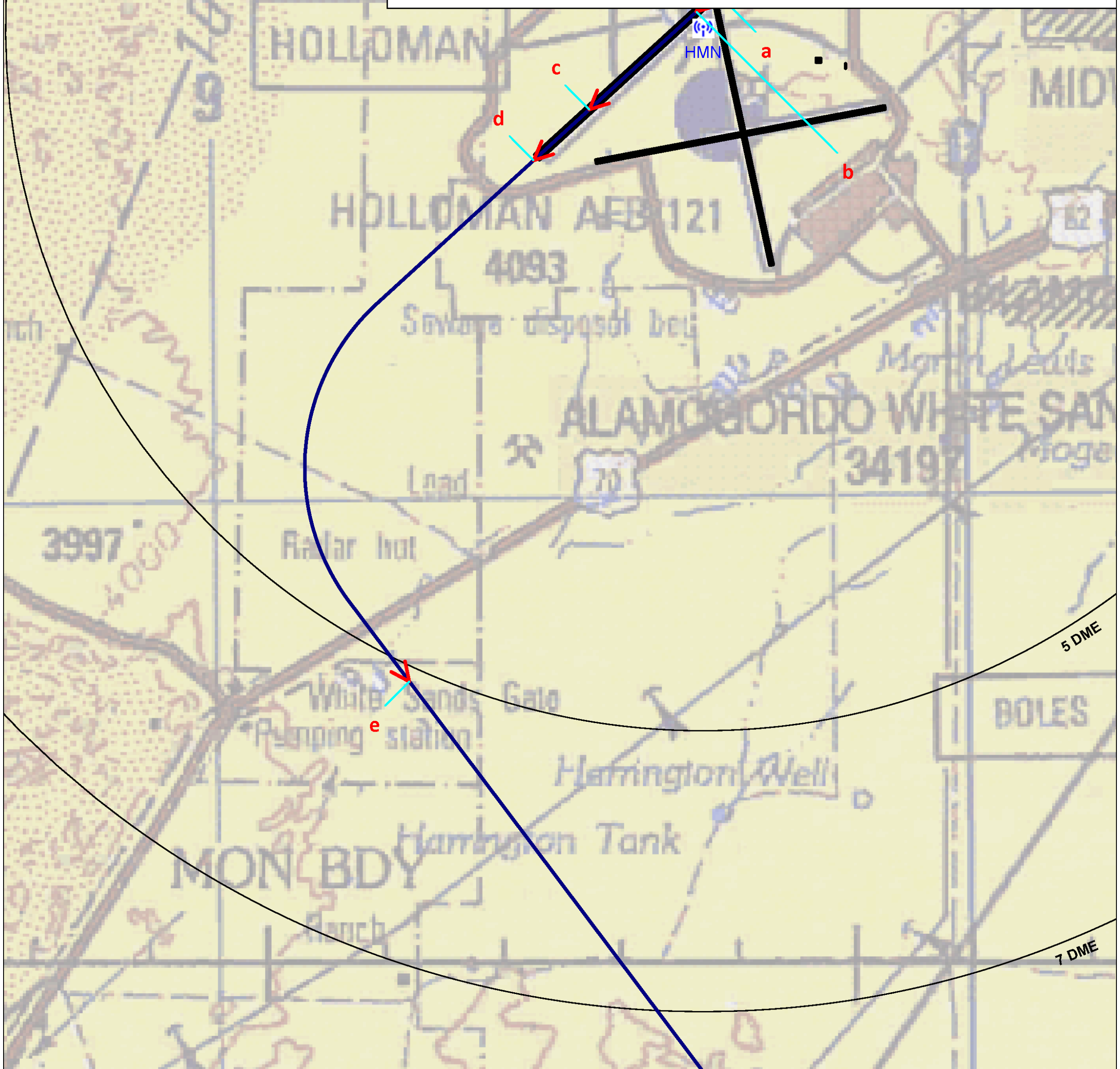


Flight Profile 1PGB
Civilian Aeroclub T-41
Flight Track: 22D2o - vfr to south/ lone butte

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000
Scale in Feet 1:60,000 (1 inch = 5,000 feet)

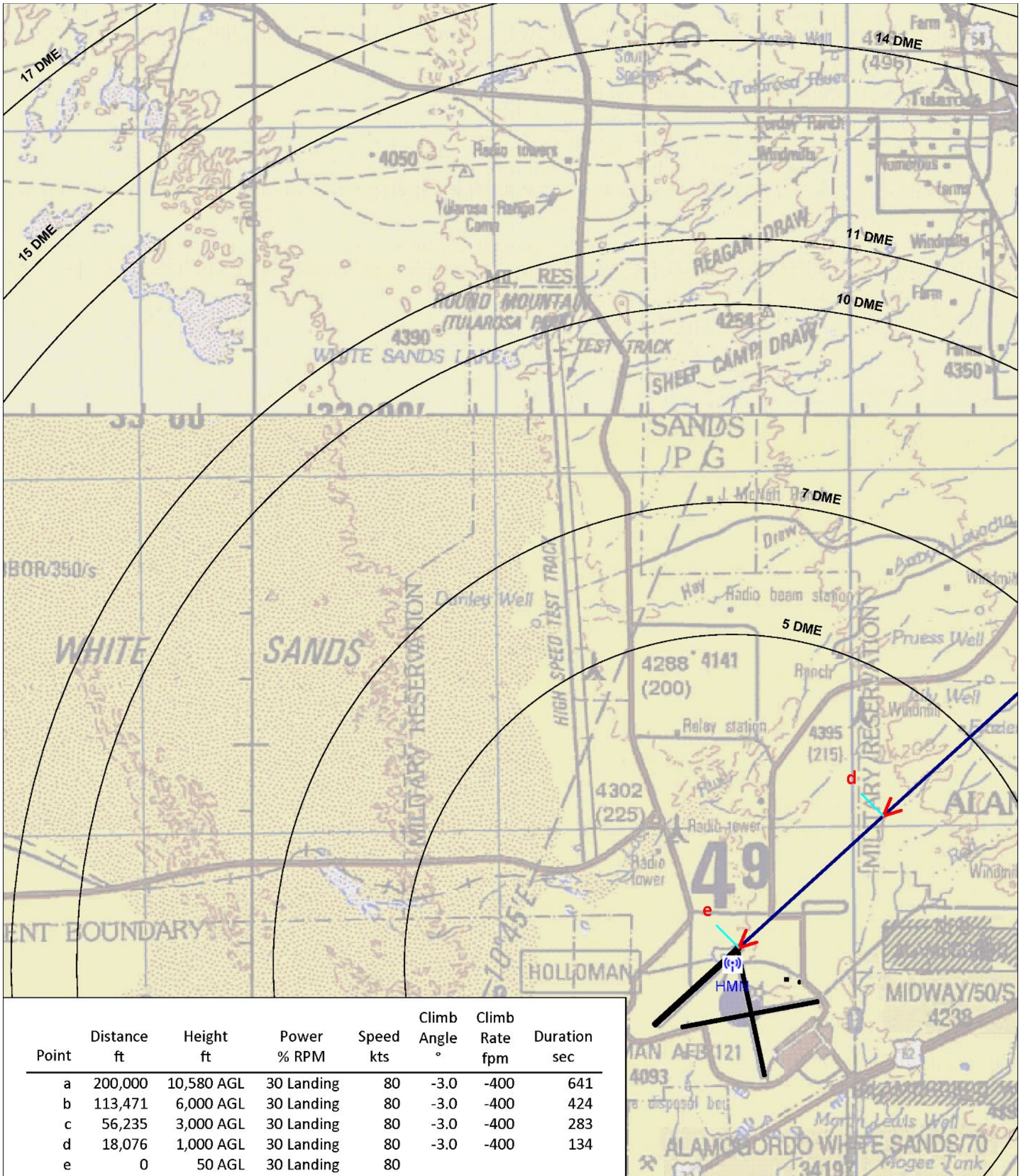
N

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	0 AGL	100 100% Torque	0	0.0	0	19
b	1,205	0 AGL	100 Takeoff	76	4.8	600	49
c	7,500	528 AGL	100 Takeoff	76	8.2	1100	26
d	10,778	1,000 AGL	100 Takeoff	76	8.2	1100	217
e	38,555	5,000 AGL	100 Takeoff	76	8.2	1100	1259
f	200,000	28,248 AGL	100 Takeoff	76			



Flight Profile 2PGB
Civilian Aeroclub T-3 (FIREFLY)
Flight Track: 22D2o - vfr to south/ lone butte

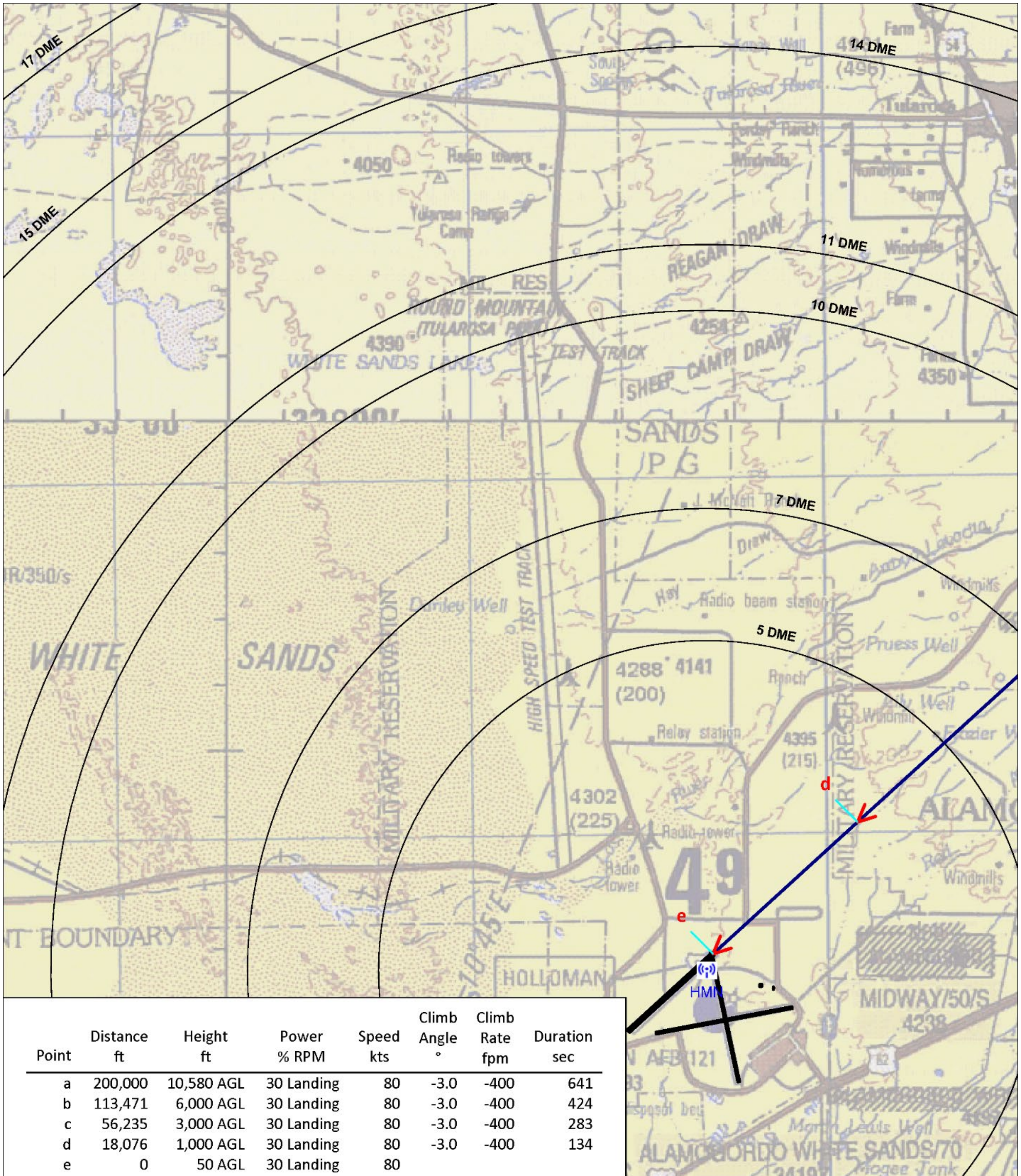
0 4,000 8,000 12,000 16,000 20,000
Scale in Feet 1:68,400 (1 inch = 5,700 feet)



Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	200,000	10,580 AGL	30 Landing	80	-3.0	-400	641
b	113,471	6,000 AGL	30 Landing	80	-3.0	-400	424
c	56,235	3,000 AGL	30 Landing	80	-3.0	-400	283
d	18,076	1,000 AGL	30 Landing	80	-3.0	-400	134
e	0	50 AGL	30 Landing	80			

Flight Profile 2PBB
Civilian Aeroclub T-3 (FIREFLY)
Flight Track: 22A1 - IFR TO 22

Scale in Feet 1:133,000 (1 inch = 11,100 feet)



Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	200,000	10,580 AGL	30 Landing	80	-3.0	-400	641
b	113,471	6,000 AGL	30 Landing	80	-3.0	-400	424
c	56,235	3,000 AGL	30 Landing	80	-3.0	-400	283
d	18,076	1,000 AGL	30 Landing	80	-3.0	-400	134
e	0	50 AGL	30 Landing	80			

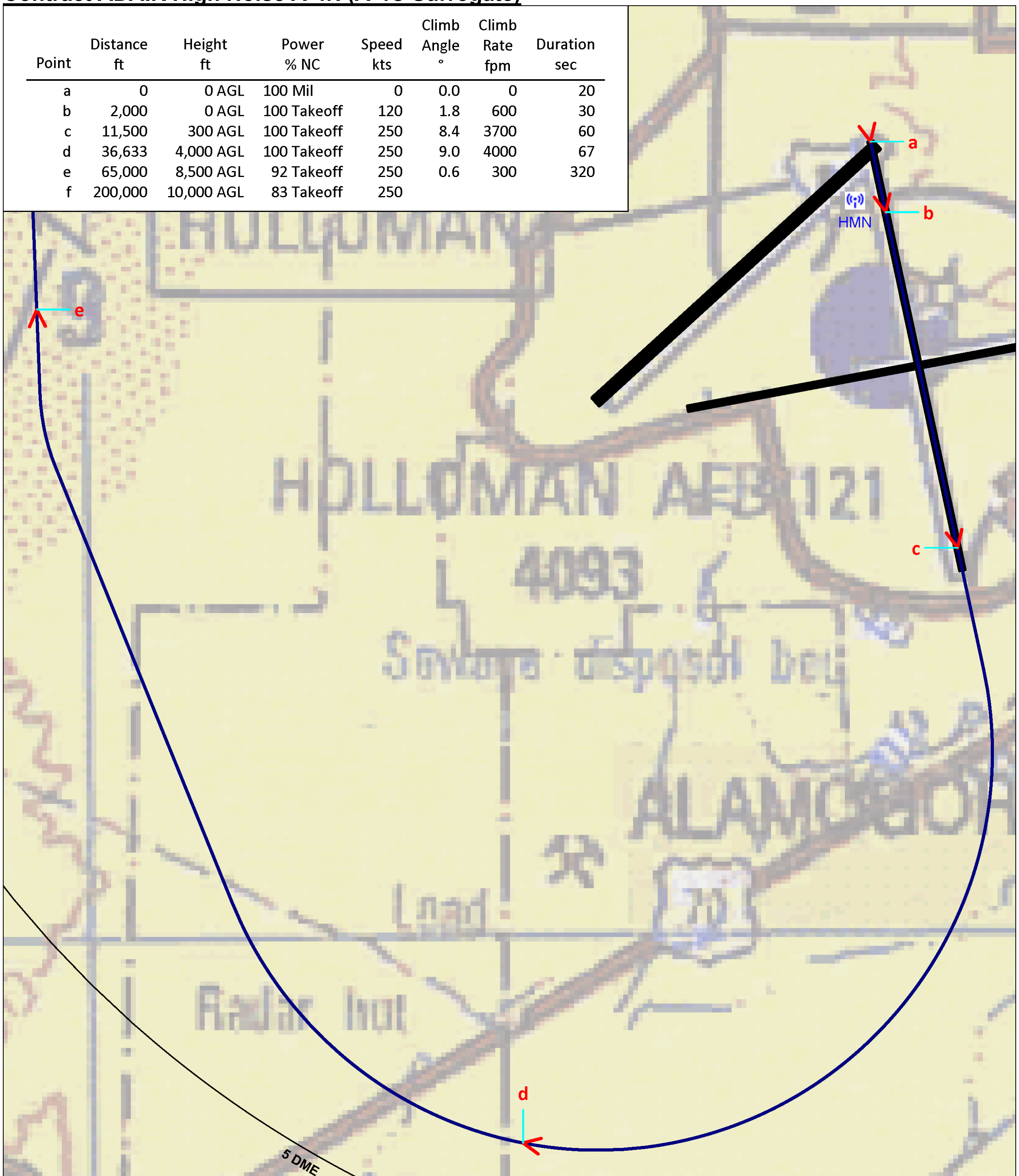
Flight Profile 1PBB
Civilian Aeroclub T-41
Flight Track: 22A1 - IFR TO 22

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000

Scale in Feet 1:133,000 (1 inch = 11,100 feet)

Contract ADAIR High Noise A-4N (A-4C Surrogate)

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0	0 AGL	100 Mil	0	0.0	0	20
b	2,000	0 AGL	100 Takeoff	120	1.8	600	30
c	11,500	300 AGL	100 Takeoff	250	8.4	3700	60
d	36,633	4,000 AGL	100 Takeoff	250	9.0	4000	67
e	65,000	8,500 AGL	92 Takeoff	250	0.6	300	320
f	200,000	10,000 AGL	83 Takeoff	250			



Flight Profile ADHD01
ADAIR Cat B High
Flight Track: 16D5 - VFR TO 'ROMEO' LINE

0 2,000 4,000 6,000 8,000 10,000 12,000
Scale in Feet 1:39,800 (1 inch = 3,320 feet)

N

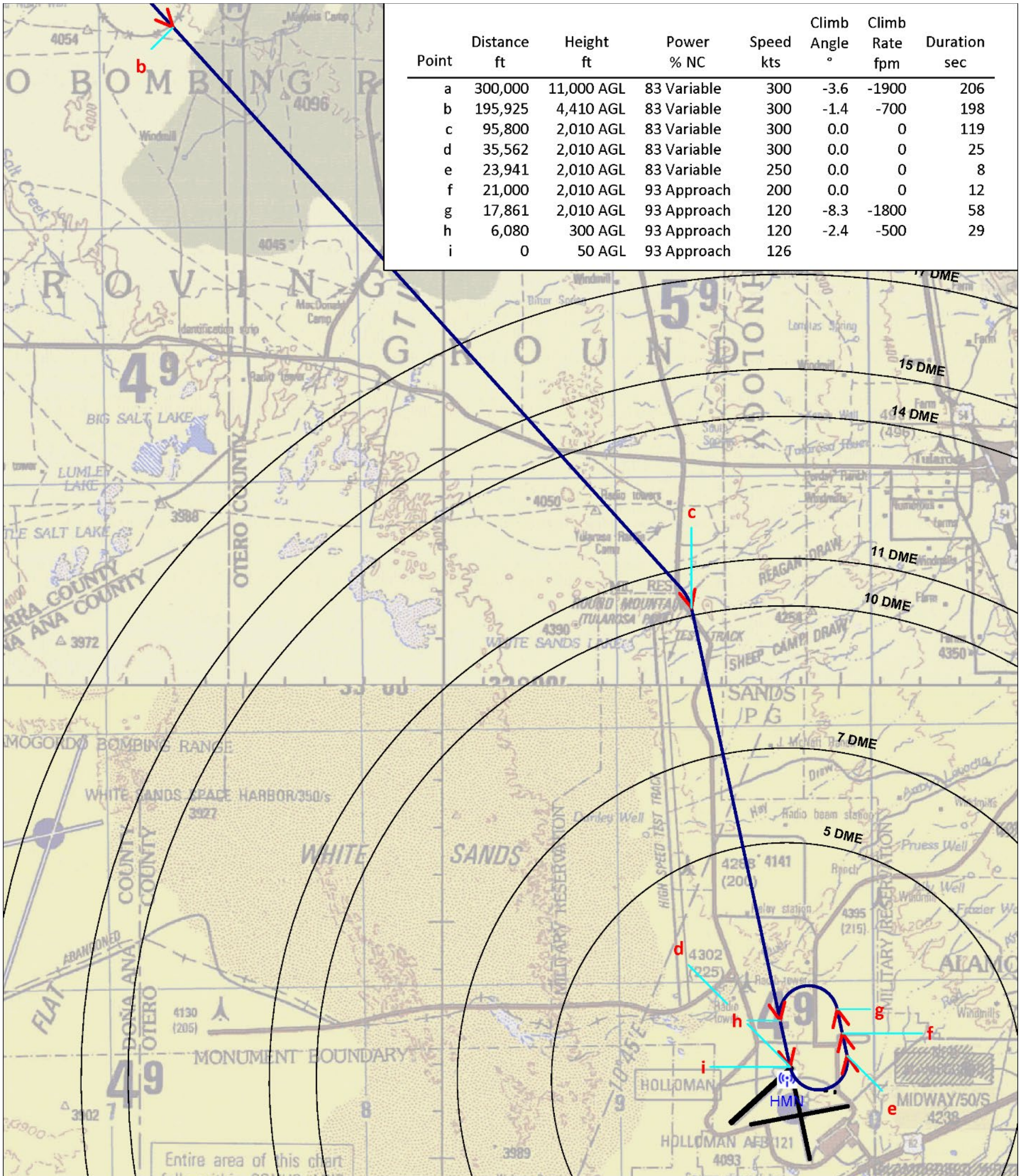
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	200,000	15,000 AGL	83 Cruise	300	-4.8	-1900	329
b	75,000	4,500 AGL	83 Cruise	150	-2.4	-600	186
c	28,000	2,500 AGL	93 Approach	150	-5.7	-1300	98
d	6,076	300 AGL	93 Approach	115	-2.4	-500	31
e	0	50 AGL	93 Approach	115			

Flight Profile ADHA02
ADAIR Cat B High
Flight Track: 16A13N - ARRIVE FROM WSMR NORTH

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000

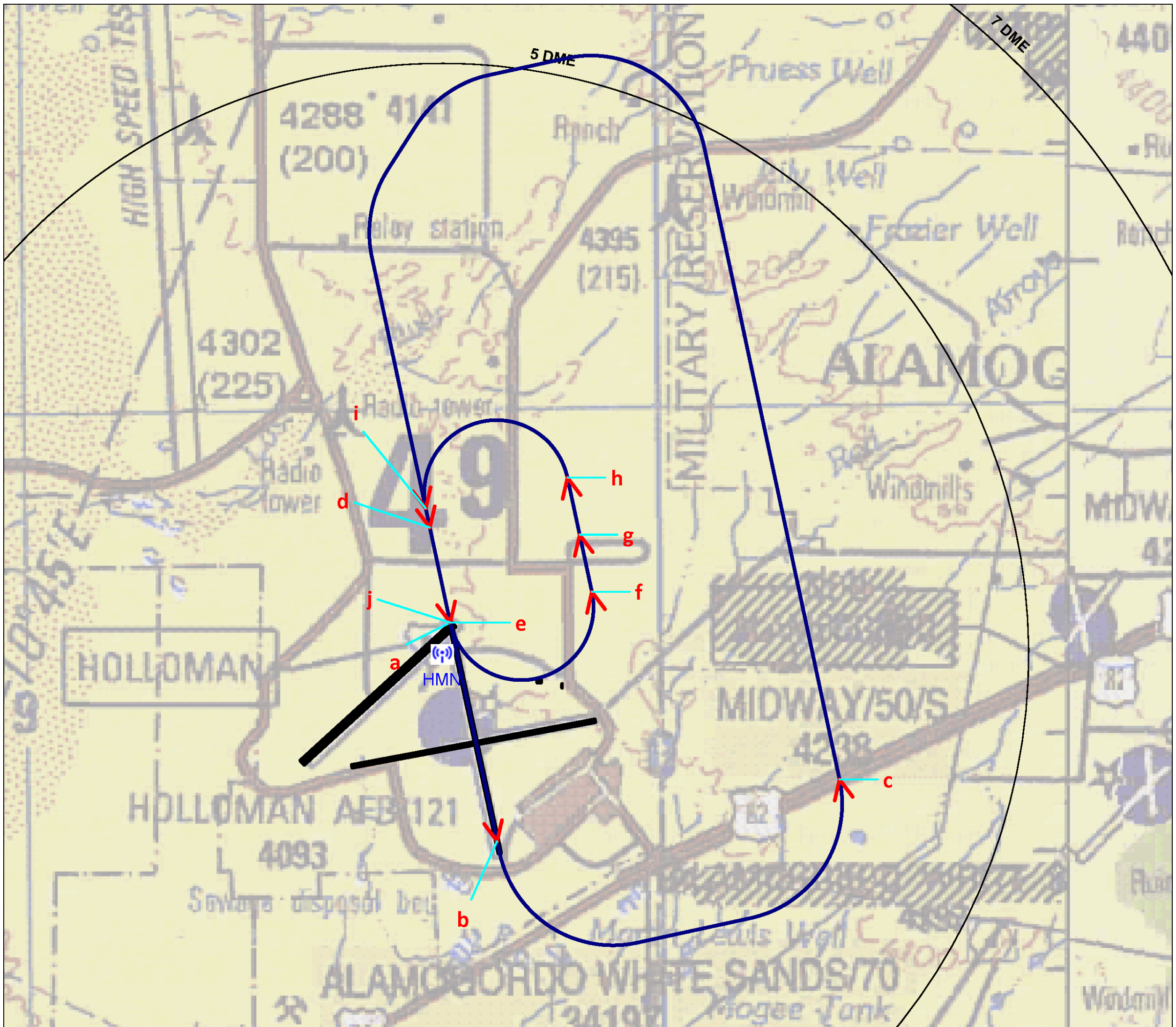
Scale in Feet 1:104,000 (1 inch = 8,690 feet)

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	300,000	11,000 AGL	83 Variable	300	-3.6	-1900	206
b	195,925	4,410 AGL	83 Variable	300	-1.4	-700	198
c	95,800	2,010 AGL	83 Variable	300	0.0	0	119
d	35,562	2,010 AGL	83 Variable	300	0.0	0	25
e	23,941	2,010 AGL	83 Variable	250	0.0	0	8
f	21,000	2,010 AGL	93 Approach	200	0.0	0	12
g	17,861	2,010 AGL	93 Approach	120	-8.3	-1800	58
h	6,080	300 AGL	93 Approach	120	-2.4	-500	29
i	0	50 AGL	93 Approach	126			



Flight Profile ADHA01
ADAIR Cat B High
Flight Track: 16A13NOH - ARRIVE FROM WSMR NORTH - PITCH

Scale in Feet 1:185,000 (1 inch = 15,400 feet)



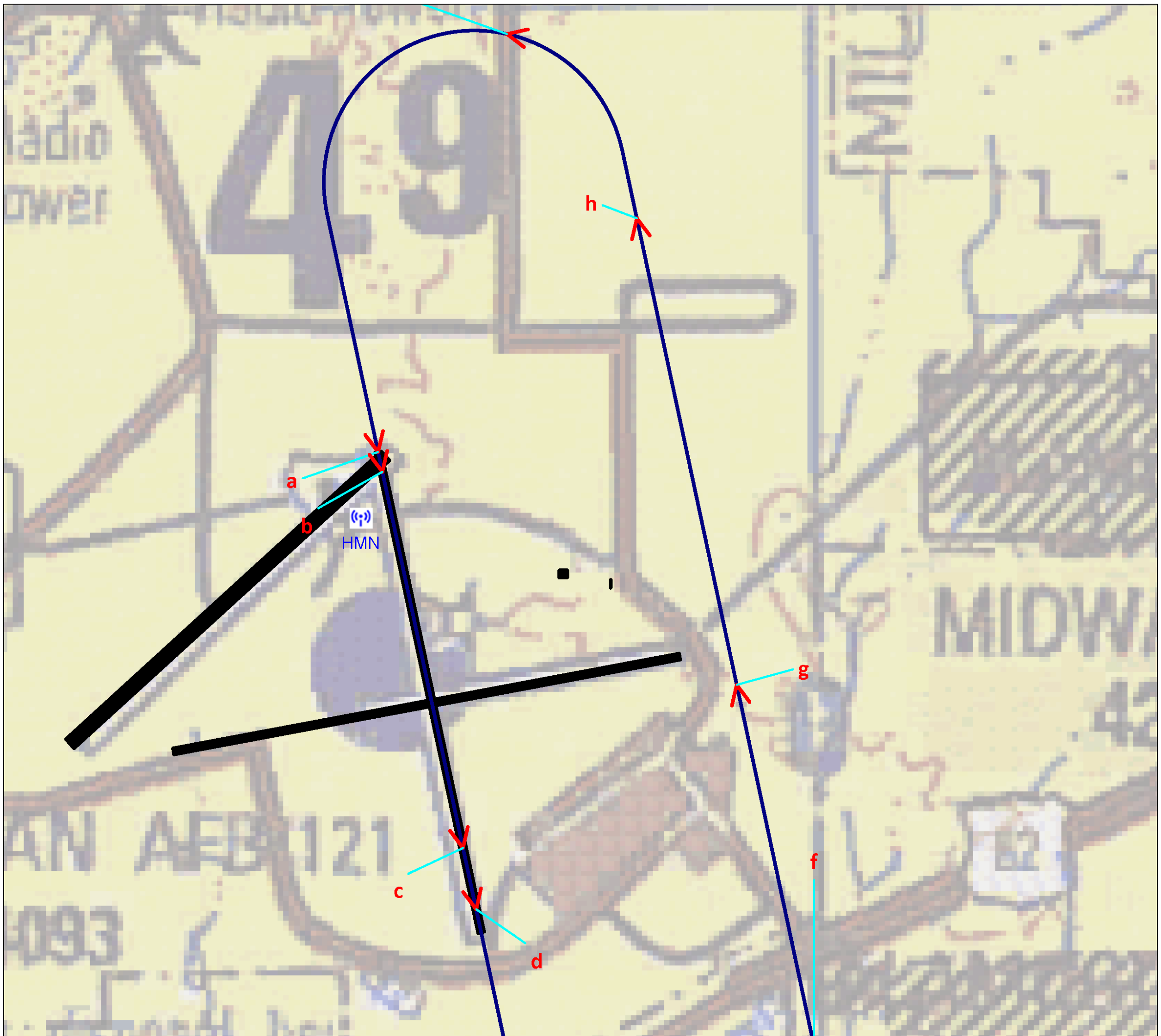
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	100 Takeoff	115	1.2	400	37	
b	11,500	300 AGL	100 Takeoff	250	3.8	1900	55	
c	36,981	2,000 AGL	92 Variable	300	0.0	0	144	
d	110,039	2,000 AGL	83 Variable	300	0.0	0	10	
e	115,041	2,000 AGL	79 Variable	300	0.0	0	25	
f	126,822	2,000 AGL	83 Variable	250	0.0	0	8	
g	129,822	2,000 AGL	93 Approach	220	0.0	0	11	gear down
h	132,822	2,000 AGL	90 Approach	115	-8.2	-1700	61	
i	144,603	300 AGL	90 Approach	115	-2.4	-500	31	
j	150,603	50 AGL	100 Takeoff	115				Threshold crossing

Flight Profile ADHC02
ADAIR Cat B High
Flight Track: 16C2 - VFR OUTSIDE DOWNWIND - PITCH

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000

Scale in Feet 1:85,300 (1 inch = 7,110 feet)

N



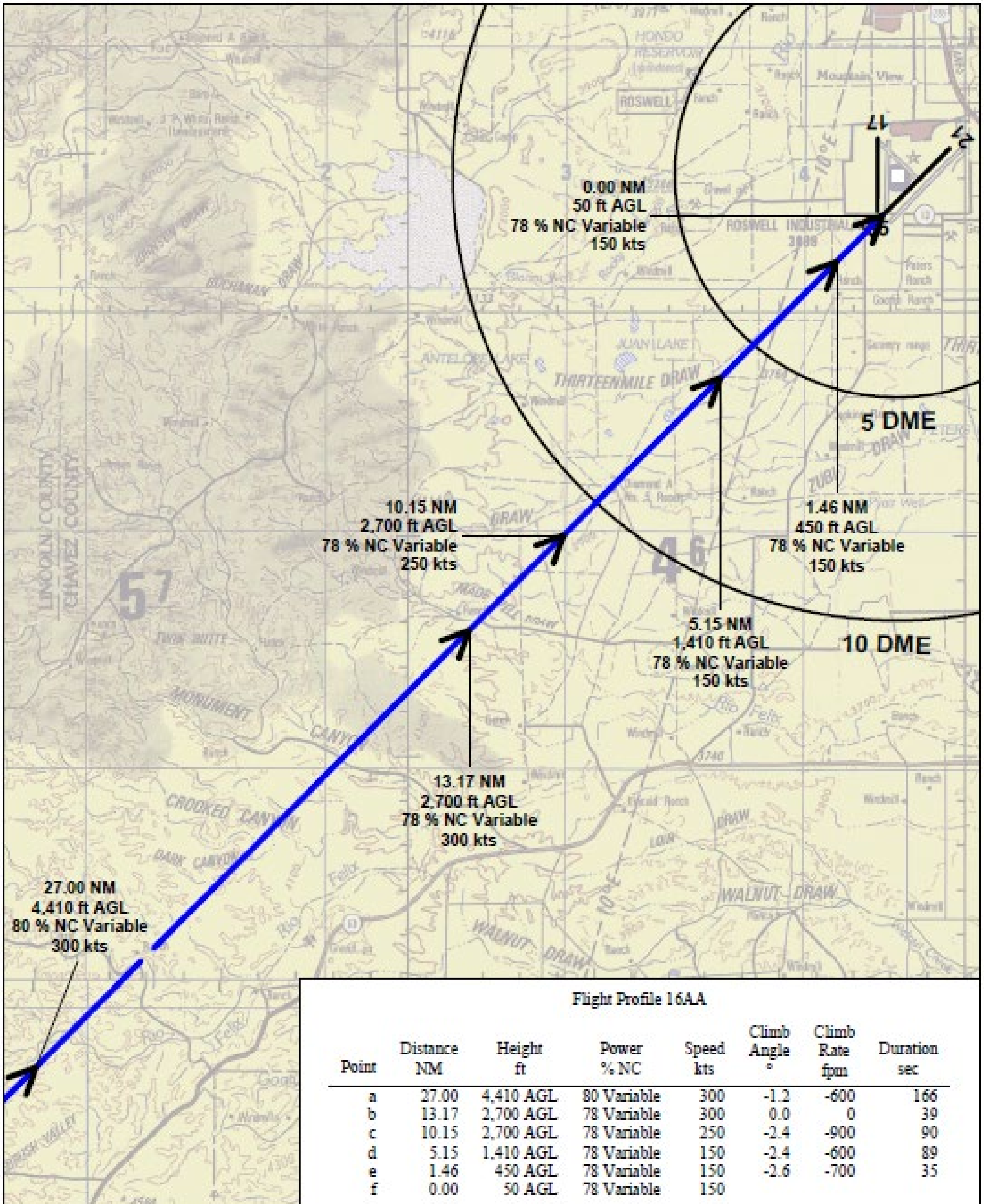
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	50 AGL	90 Approach	115	-5.7	-1200	2	
b	500	0 AGL	100 Takeoff	126	1.8	500	35	
c	10,000	300 AGL	100 Takeoff	200	47.6	25000	4	
d	11,550	2,000 AGL	100 Variable	250	0.0	0	29	
e	23,912	2,000 AGL	83 Variable	250	0.0	0	23	
f	32,912	2,000 AGL	93 Approach	220	0.0	0	32	
g	42,043	2,000 AGL	90 Approach	115	-8.2	-1700	61	
h	53,824	300 AGL	90 Approach	115	-2.4	-500	31	
i	59,824	50 AGL	90 Approach	115				Threshold crossing

Flight Profile ADHC01
ADAIR Cat B High
Flight Track: 16C3L - VFR INSIDE DOWNWIND

0 2,000 4,000 6,000 8,000 10,000 12,000
Scale in Feet 1:40,500 (1 inch = 3,370 feet)

D.1.4.2 Based Aircraft Representative Flight Profiles – Roswell International Air Center (ROW)

This section details the representative profiles for each aircraft that is based at ROW. This includes the F-16C aircraft of the 54 FG, military aircraft of various types from various installations, and civilian aircraft that regularly operate at ROW.

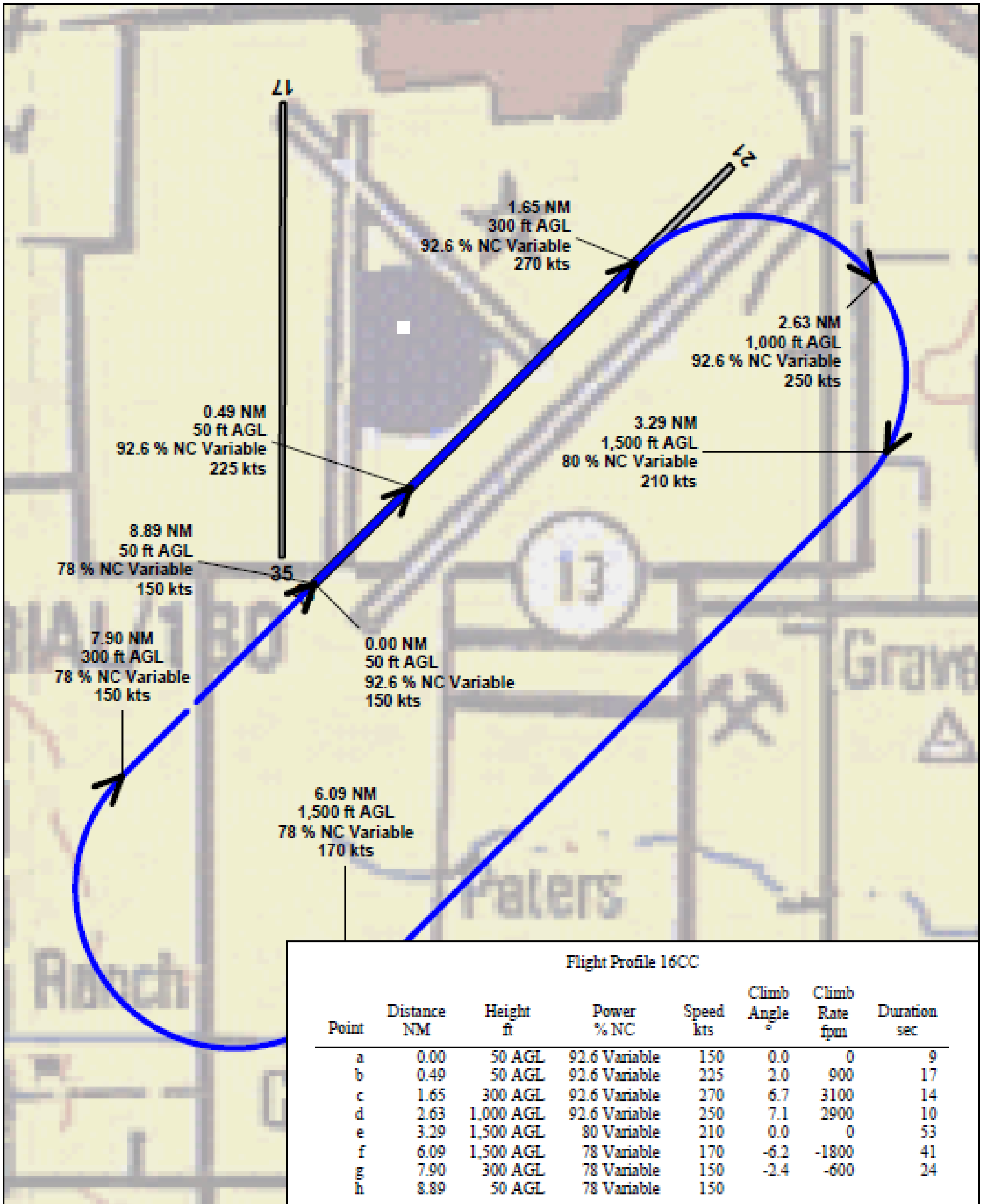


Flight Profile 16AA

Point	Distance NM	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	27.00	4,410 AGL	80 Variable	300	-1.2	-600	166
b	13.17	2,700 AGL	78 Variable	300	0.0	0	39
c	10.15	2,700 AGL	78 Variable	250	-2.4	-900	90
d	5.15	1,410 AGL	78 Variable	150	-2.4	-600	89
e	1.46	450 AGL	78 Variable	150	-2.6	-700	35
f	0.00	50 AGL	78 Variable	150			

Flight Profile 16AA
F-16 Arrival

0 10,000 20,000 30,000 40,000 50,000 60,000 70,000 80,000
Scale in Feet 1:246,000 (1 inch = 20,500 feet)



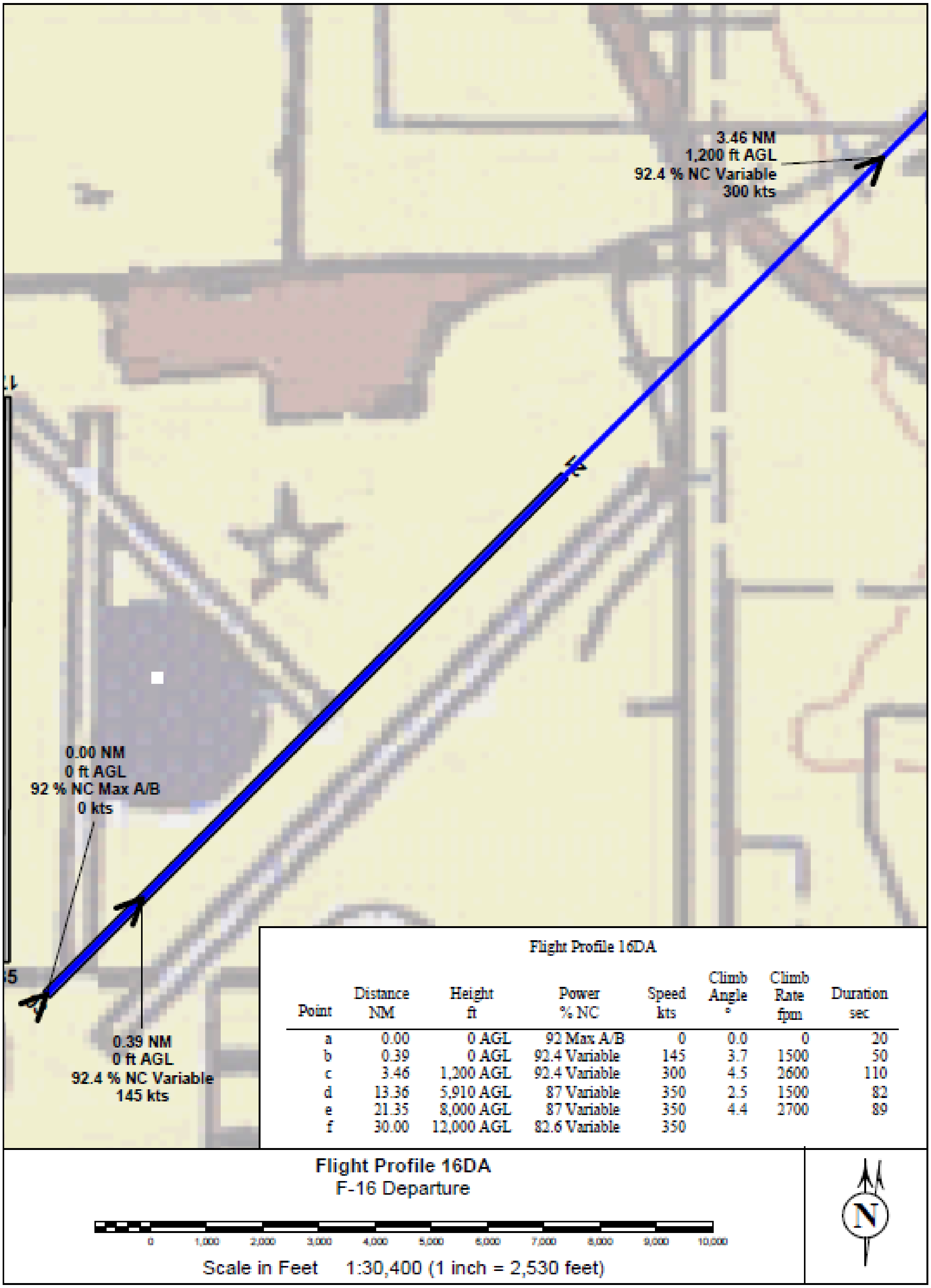
Flight Profile 16CC

Point	Distance NM	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0.00	50 AGL	92.6 Variable	150	0.0	0	9
b	0.49	50 AGL	92.6 Variable	225	2.0	900	17
c	1.65	300 AGL	92.6 Variable	270	6.7	3100	14
d	2.63	1,000 AGL	92.6 Variable	250	7.1	2900	10
e	3.29	1,500 AGL	80 Variable	210	0.0	0	53
f	6.09	1,500 AGL	78 Variable	170	-6.2	-1800	41
g	7.90	300 AGL	78 Variable	150	-2.4	-600	24
h	8.89	50 AGL	78 Variable	150			

Flight Profile 16CC
F-16 Closed Pattern

0 2,000 4,000 6,000 8,000 10,000 12,000
Scale in Feet 1:39,700 (1 inch = 3,310 feet)

N

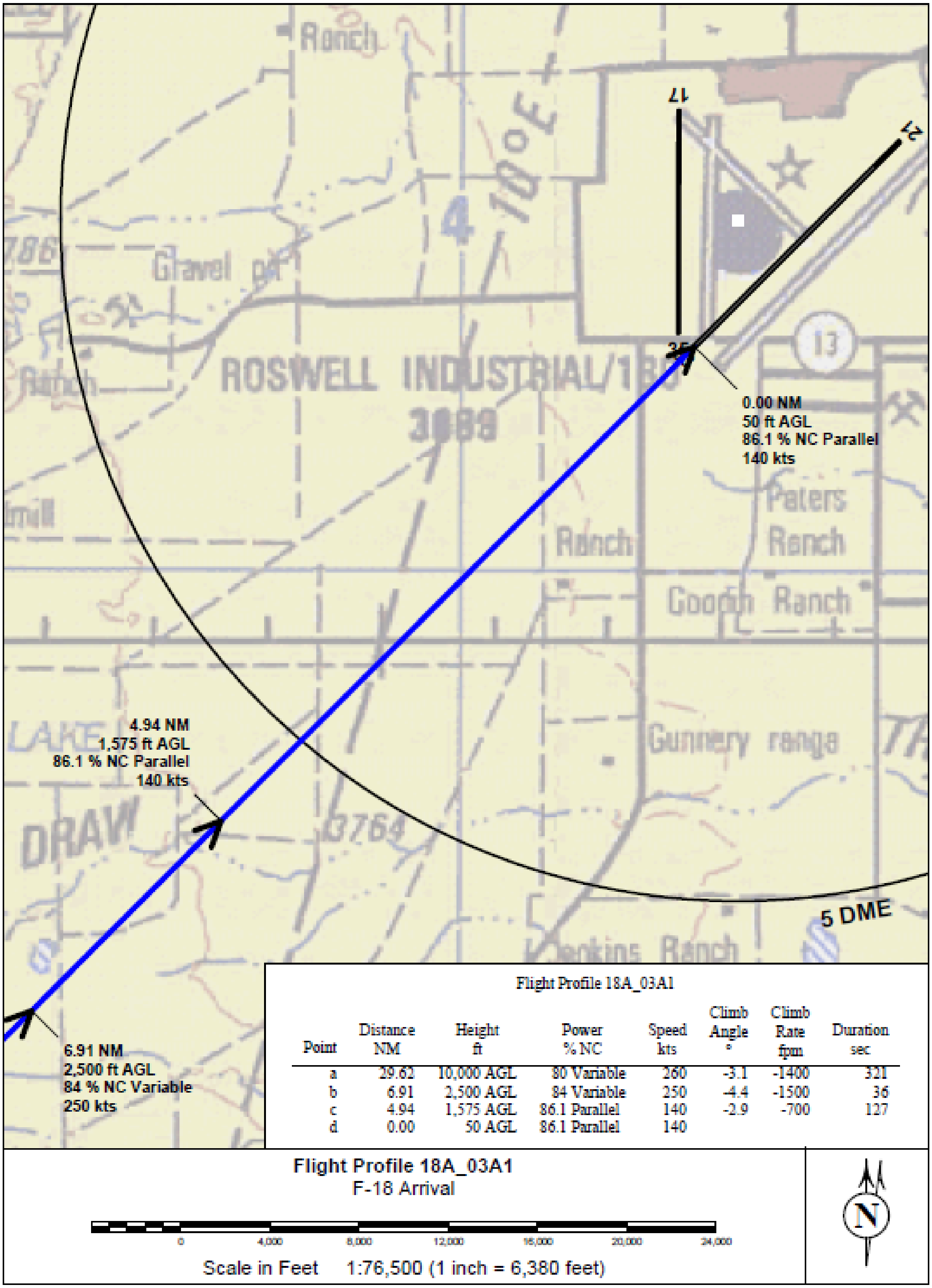


Flight Profile 16DA

Point	Distance NM	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0.00	0 AGL	92 Max A/B	0	0.0	0	20
b	0.39	0 AGL	92.4 Variable	145	3.7	1500	50
c	3.46	1,200 AGL	92.4 Variable	300	4.5	2600	110
d	13.36	5,910 AGL	87 Variable	350	2.5	1500	82
e	21.35	8,000 AGL	87 Variable	350	4.4	2700	89
f	30.00	12,000 AGL	82.6 Variable	350			

Flight Profile 16DA
F-16 Departure

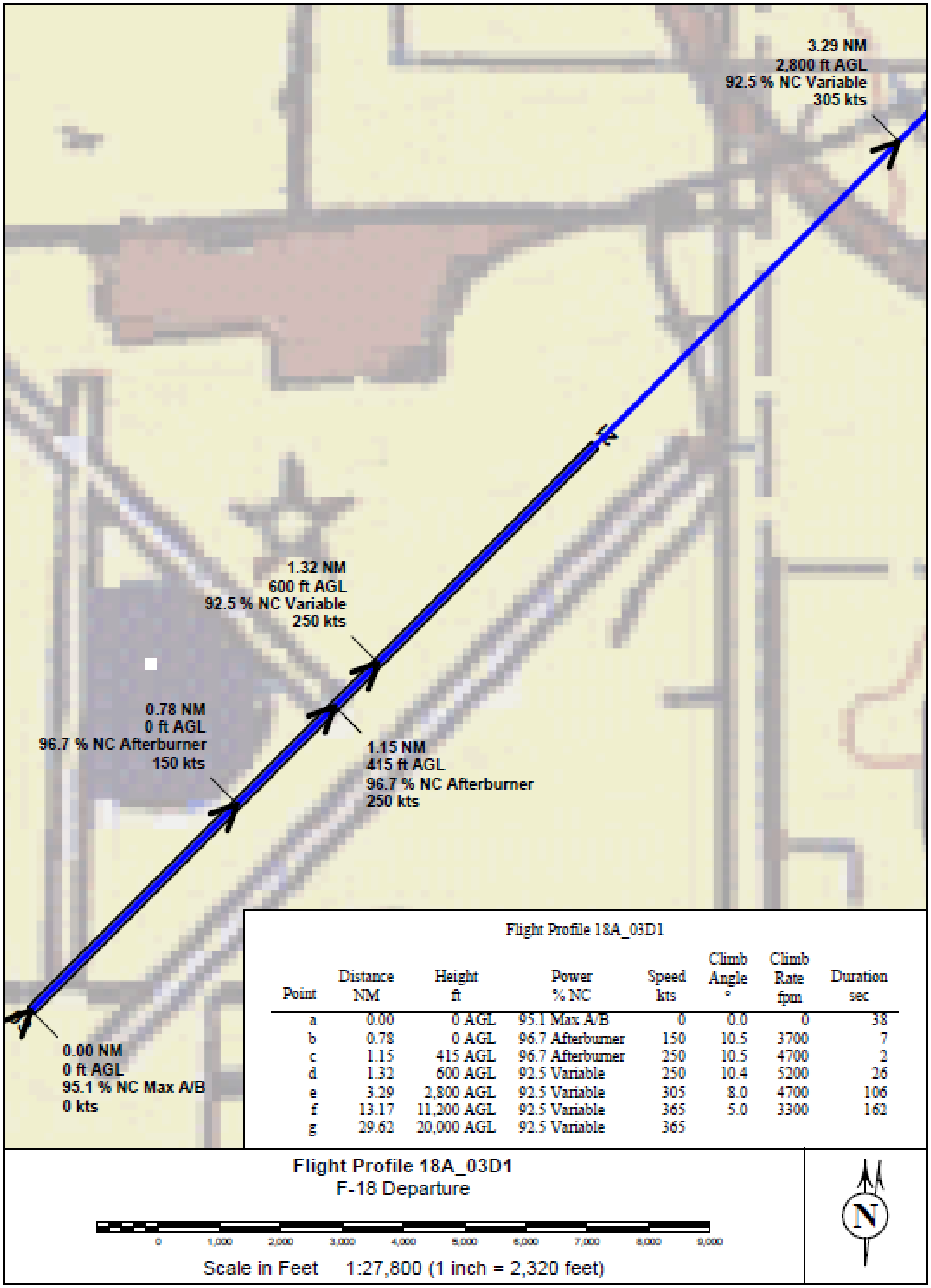
Scale in Feet 1:30,400 (1 inch = 2,530 feet)



Flight Profile 18A_03A1

Point	Distance NM	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	29.62	10,000 AGL	80 Variable	260	-3.1	-1400	321
b	6.91	2,500 AGL	84 Variable	250	-4.4	-1500	36
c	4.94	1,575 AGL	86.1 Parallel	140	-2.9	-700	127
d	0.00	50 AGL	86.1 Parallel	140			

Flight Profile 18A_03A1
F-18 Arrival

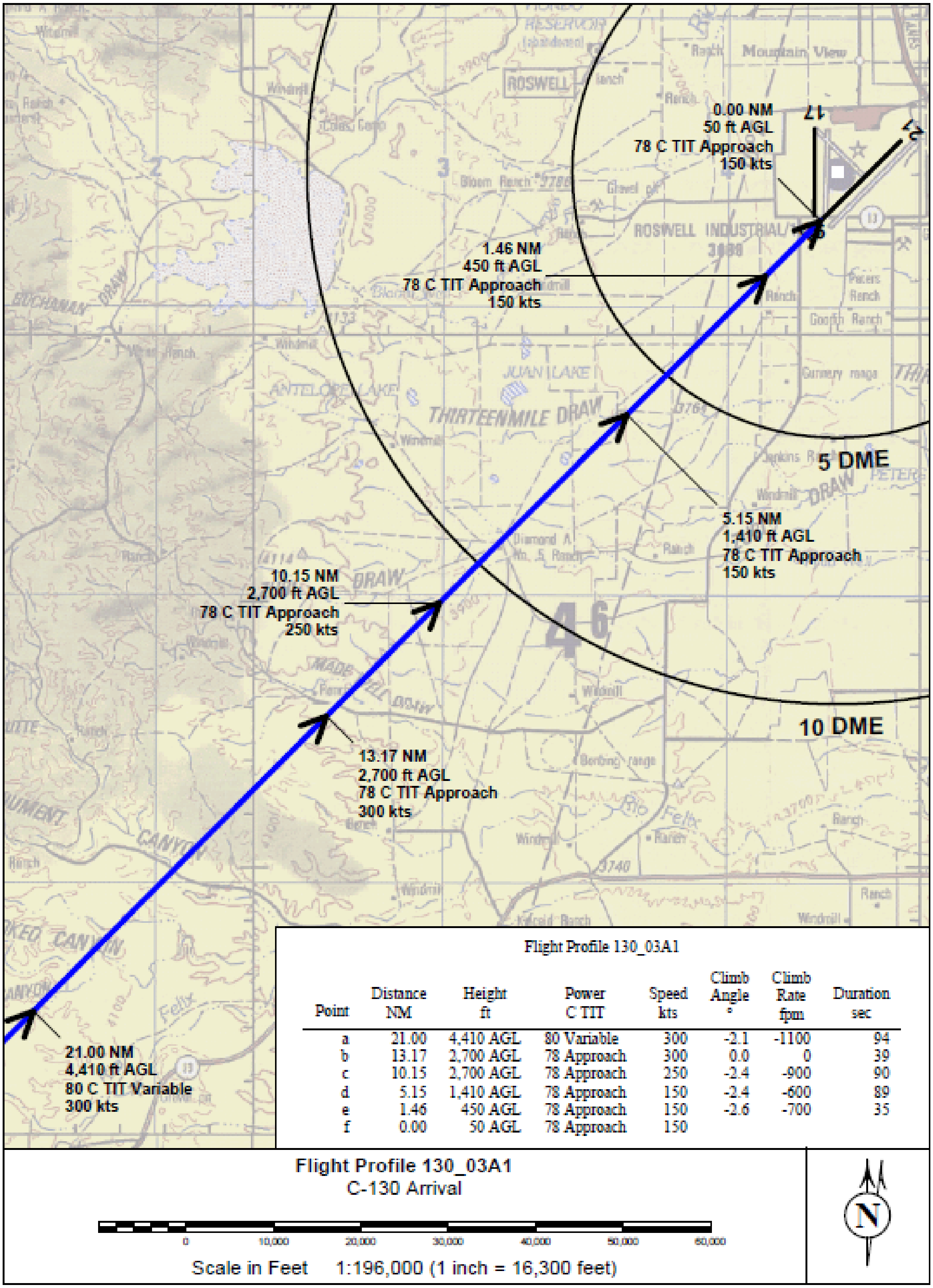


Flight Profile 18A_03D1

Point	Distance NM	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0.00	0 AGL	95.1 Max A/B	0	0.0	0	38
b	0.78	0 AGL	96.7 Afterburner	150	10.5	3700	7
c	1.15	415 AGL	96.7 Afterburner	250	10.5	4700	2
d	1.32	600 AGL	92.5 Variable	250	10.4	5200	26
e	3.29	2,800 AGL	92.5 Variable	305	8.0	4700	106
f	13.17	11,200 AGL	92.5 Variable	365	5.0	3300	162
g	29.62	20,000 AGL	92.5 Variable	365			

Flight Profile 18A_03D1
F-18 Departure

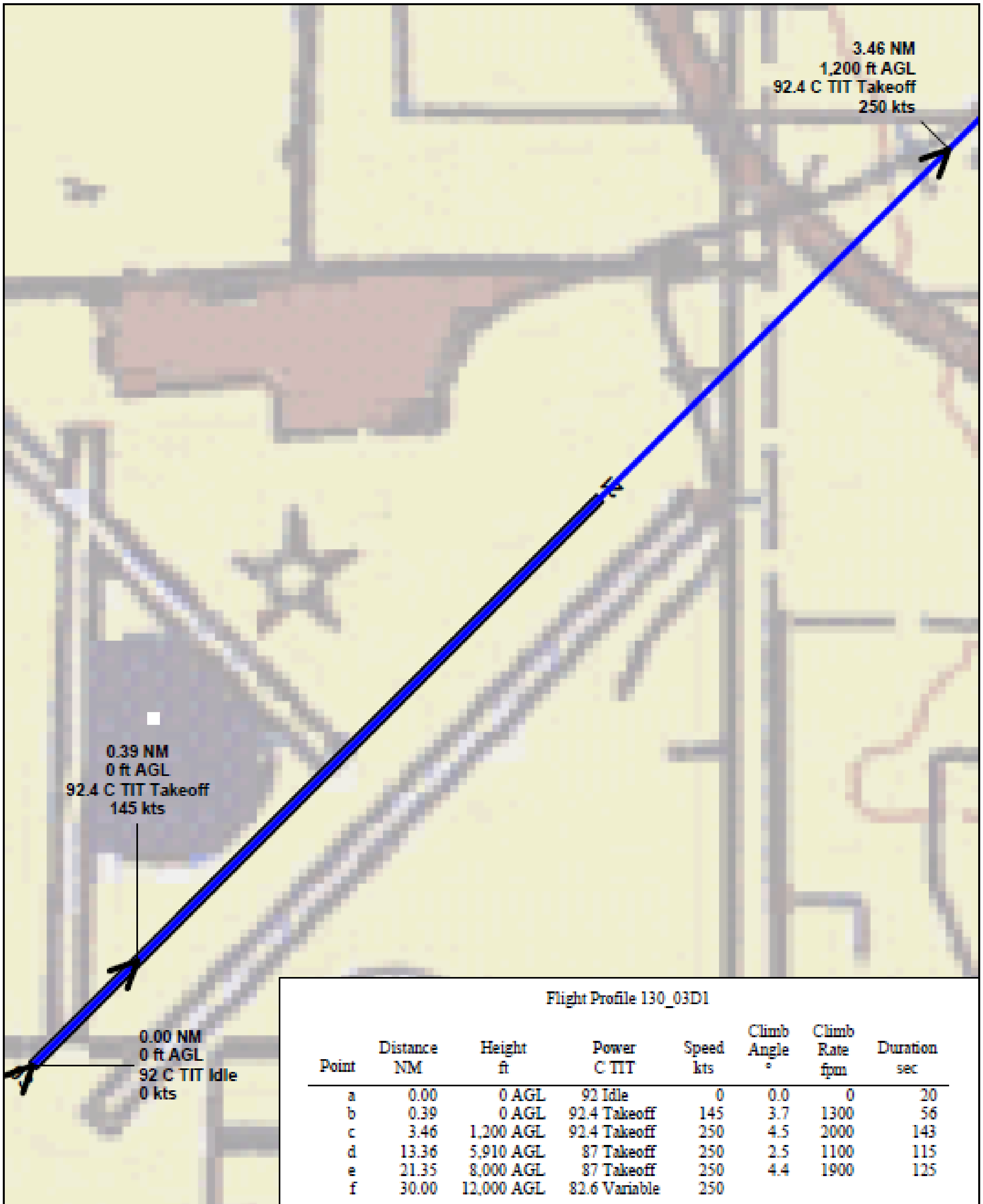
Scale in Feet 1:27,800 (1 inch = 2,320 feet)



Flight Profile 130_03A1

Point	Distance NM	Height ft	Power C TIT	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	21.00	4,410 AGL	80 Variable	300	-2.1	-1100	94
b	13.17	2,700 AGL	78 Approach	300	0.0	0	39
c	10.15	2,700 AGL	78 Approach	250	-2.4	-900	90
d	5.15	1,410 AGL	78 Approach	150	-2.4	-600	89
e	1.46	450 AGL	78 Approach	150	-2.6	-700	35
f	0.00	50 AGL	78 Approach	150			

Flight Profile 130_03A1
C-130 Arrival



Flight Profile 130_03D1

Point	Distance NM	Height ft	Power C TIT	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0.00	0 AGL	92 Idle	0	0.0	0	20
b	0.39	0 AGL	92.4 Takeoff	145	3.7	1300	56
c	3.46	1,200 AGL	92.4 Takeoff	250	4.5	2000	143
d	13.36	5,910 AGL	87 Takeoff	250	2.5	1100	115
e	21.35	8,000 AGL	87 Takeoff	250	4.4	1900	125
f	30.00	12,000 AGL	82.6 Variable	250			

Flight Profile 130_03D1
C-130 Departure

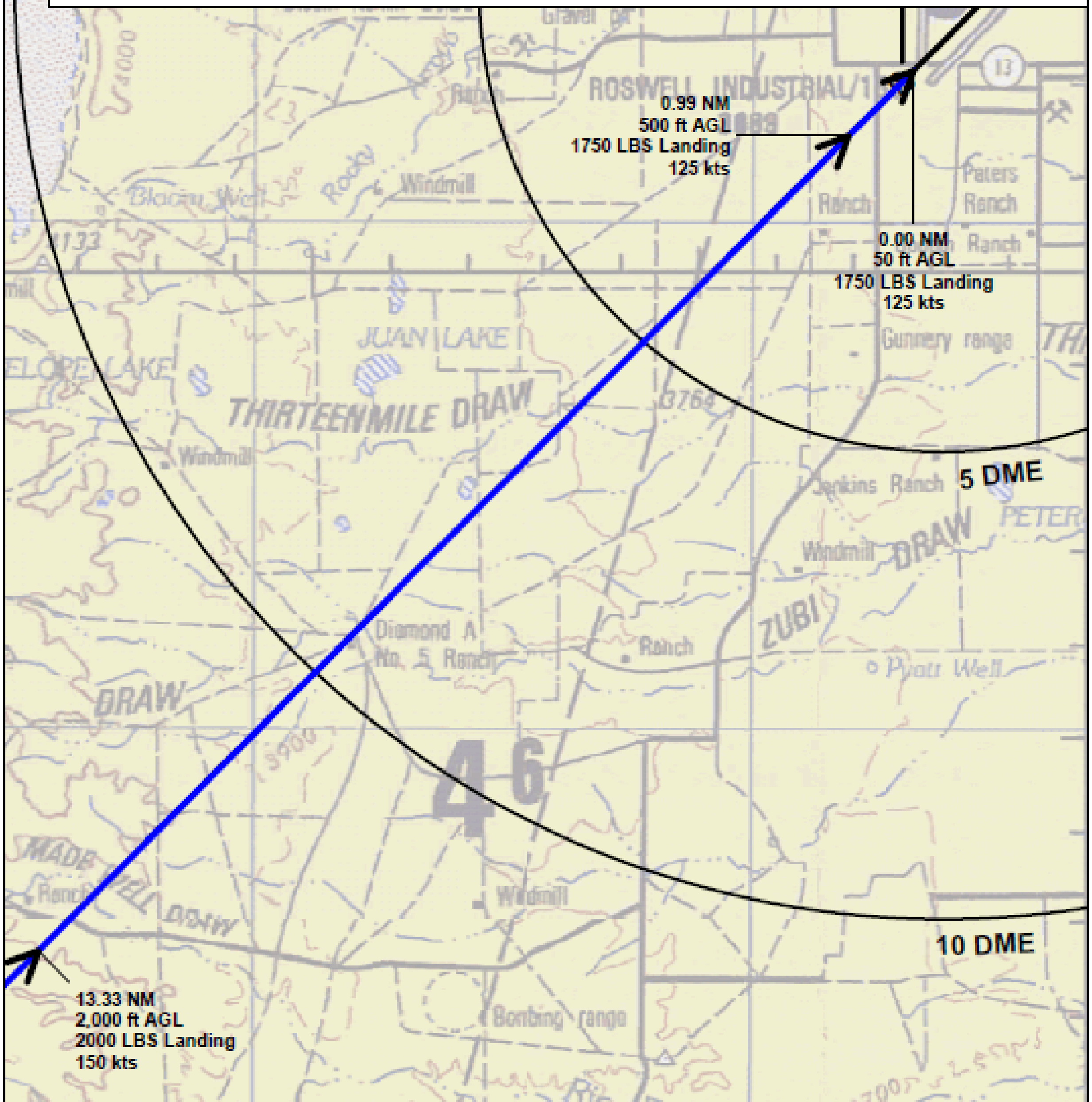
0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

Scale in Feet 1:29,200 (1 inch = 2,440 feet)

N

Flight Profile BA1

Point	Distance NM	Height ft	Power LBS	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	30.00	20,000 AGL	11000 Cruise	250	-9.1	-4100	148	-4.4 deg, -1940 fpm, 308 sec
b	19.75	10,000 AGL	10000 Cruise	250	-11.6	-4200	116	-11.6 deg, -4070 fpm, 116 sec
c	13.33	2,000 AGL	2000 Landing	150	-1.1	-300	323	-1.1 deg, -280 fpm, 323 sec
d	0.99	500 AGL	1750 Landing	125	-4.3	-900	28	-4.3 deg, -950 fpm, 28 sec
e	0.00	50 AGL	1750 Landing	125				



Flight Profile BA1
B-737 Arrival

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000

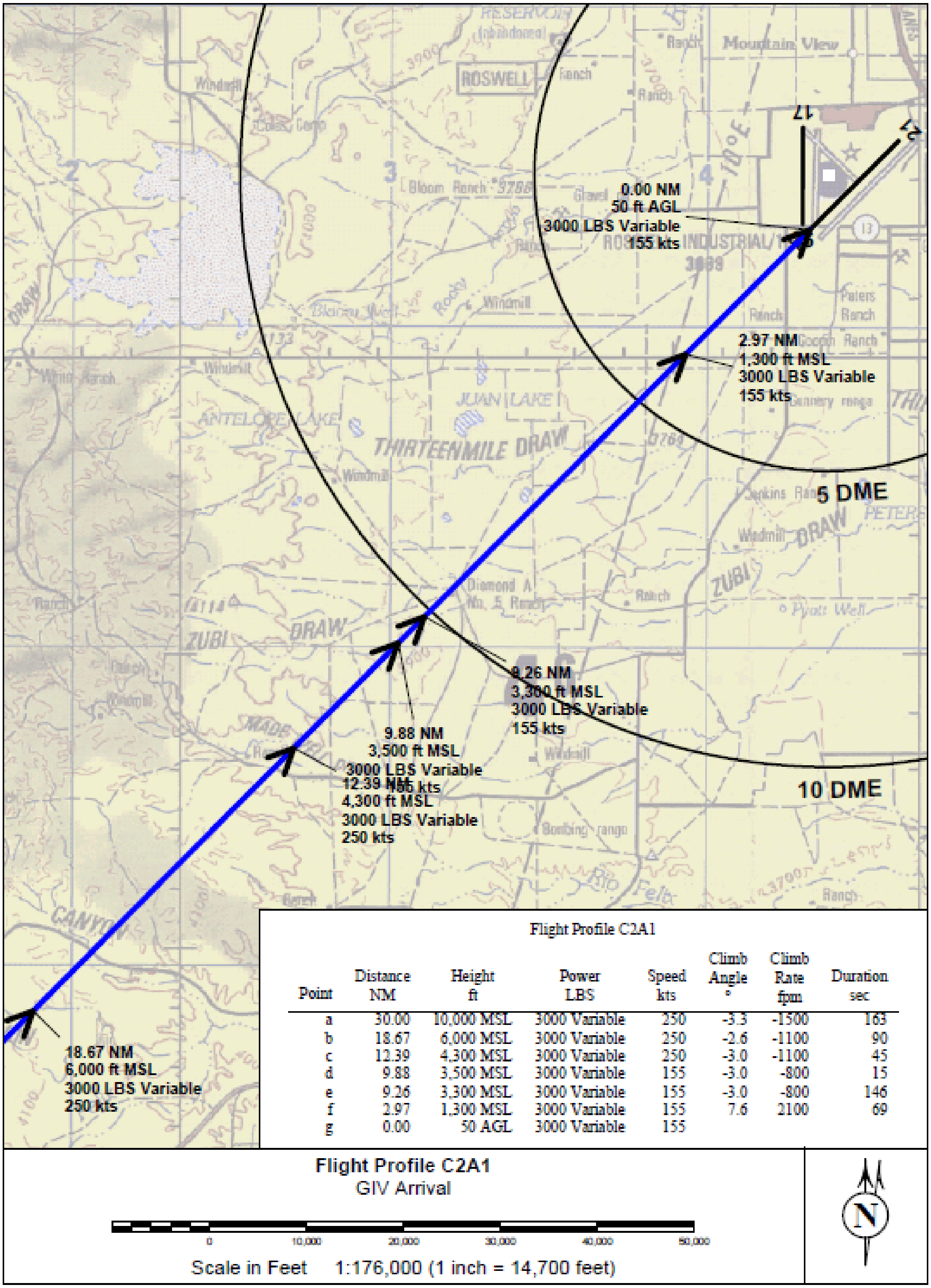
Scale in Feet 1:131,000 (1 inch = 10,900 feet)

Flight Profile BD1

Point	Distance NM	Height ft	Power LBS	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0.00	0 AGL	15200 Takeoff	0	0.0	0	38	0.0 deg, 0 fpm, 38 sec
b	0.66	0 AGL	15200 Takeoff	125	5.4	1300	34	5.4 deg, 1300 fpm, 34 sec
c	1.97	750 AGL	15200 Takeoff	150	5.0	1600	61	5.0 deg, 1540 fpm, 61 sec
d	4.94	2,325 AGL	15200 Takeoff	200	4.7	1900	118	4.7 deg, 1860 fpm, 118 sec
e	12.34	6,000 AGL	14500 Takeoff	250	4.6	2000	118	4.6 deg, 2020 fpm, 118 sec
f	20.57	10,000 AGL	11000 Cruise	250	9.9	4400	136	4.6 deg, 2020 fpm, 296 sec
g	30.00	20,000 AGL	10000 Cruise	250				

Flight Profile BD1
B-737 Departure

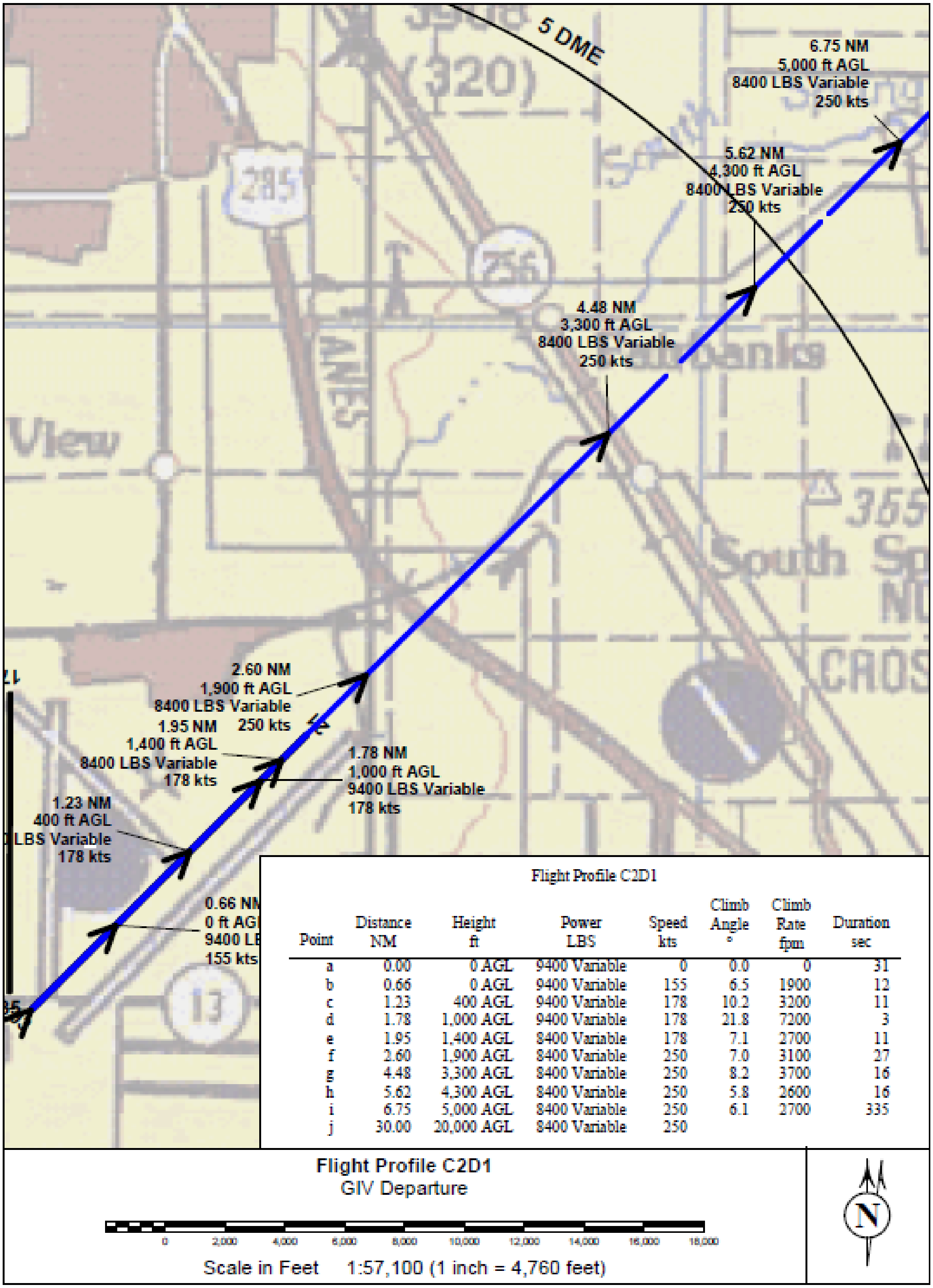
Scale in Feet 1:41,800 (1 inch = 3,480 feet)



Flight Profile C2A1

Point	Distance NM	Height ft	Power LBS	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	30.00	10,000 MSL	3000 Variable	250	-3.3	-1500	163
b	18.67	6,000 MSL	3000 Variable	250	-2.6	-1100	90
c	12.39	4,300 MSL	3000 Variable	250	-3.0	-1100	45
d	9.88	3,500 MSL	3000 Variable	155	-3.0	-800	15
e	9.26	3,300 MSL	3000 Variable	155	-3.0	-800	146
f	2.97	1,300 MSL	3000 Variable	155	7.6	2100	69
g	0.00	50 AGL	3000 Variable	155			

Flight Profile C2A1
GIV Arrival



Flight Profile C2D1

Point	Distance NM	Height ft	Power LBS	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0.00	0 AGL	9400 Variable	0	0.0	0	31
b	0.66	0 AGL	9400 Variable	155	6.5	1900	12
c	1.23	400 AGL	9400 Variable	178	10.2	3200	11
d	1.78	1,000 AGL	9400 Variable	178	21.8	7200	3
e	1.95	1,400 AGL	8400 Variable	178	7.1	2700	11
f	2.60	1,900 AGL	8400 Variable	250	7.0	3100	27
g	4.48	3,300 AGL	8400 Variable	250	8.2	3700	16
h	5.62	4,300 AGL	8400 Variable	250	5.8	2600	16
i	6.75	5,000 AGL	8400 Variable	250	6.1	2700	335
j	30.00	20,000 AGL	8400 Variable	250			

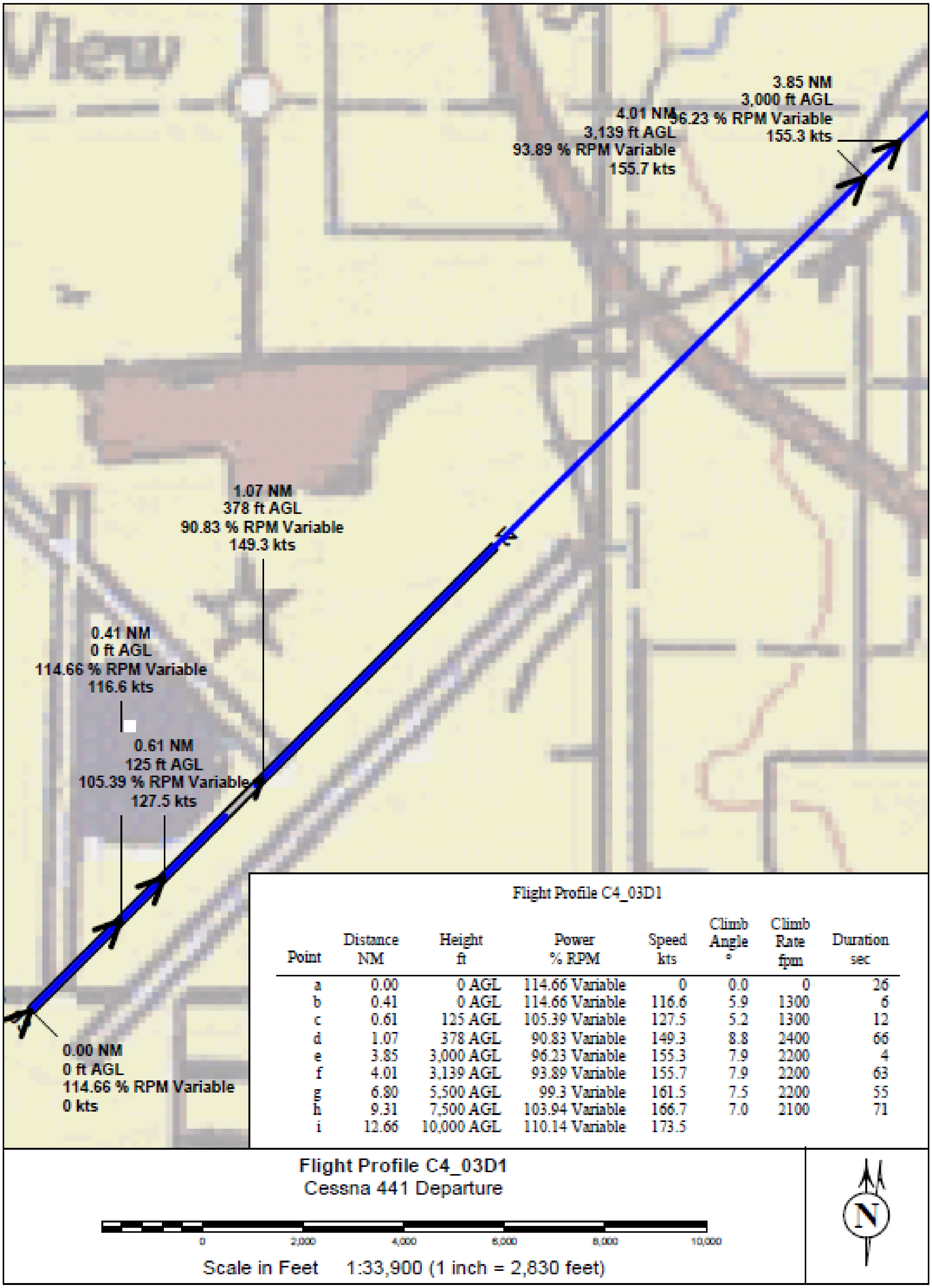
Flight Profile C4_03A1

Point	Distance NM	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	18.84	6,000 AGL	17.31 Variable	186	-3.0	-800	217
b	9.42	3,000 AGL	23.45 Variable	126.4	-3.0	-600	142
c	4.71	1,500 AGL	28.99 Variable	112.7	-3.0	-600	53
d	3.14	1,000 AGL	35.15 Variable	101.1	-3.0	-500	113
e	0.00	0 AGL	33.88 Variable	99.6			

Flight Profile C4_03A1
Cessna 441 Arrival

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000

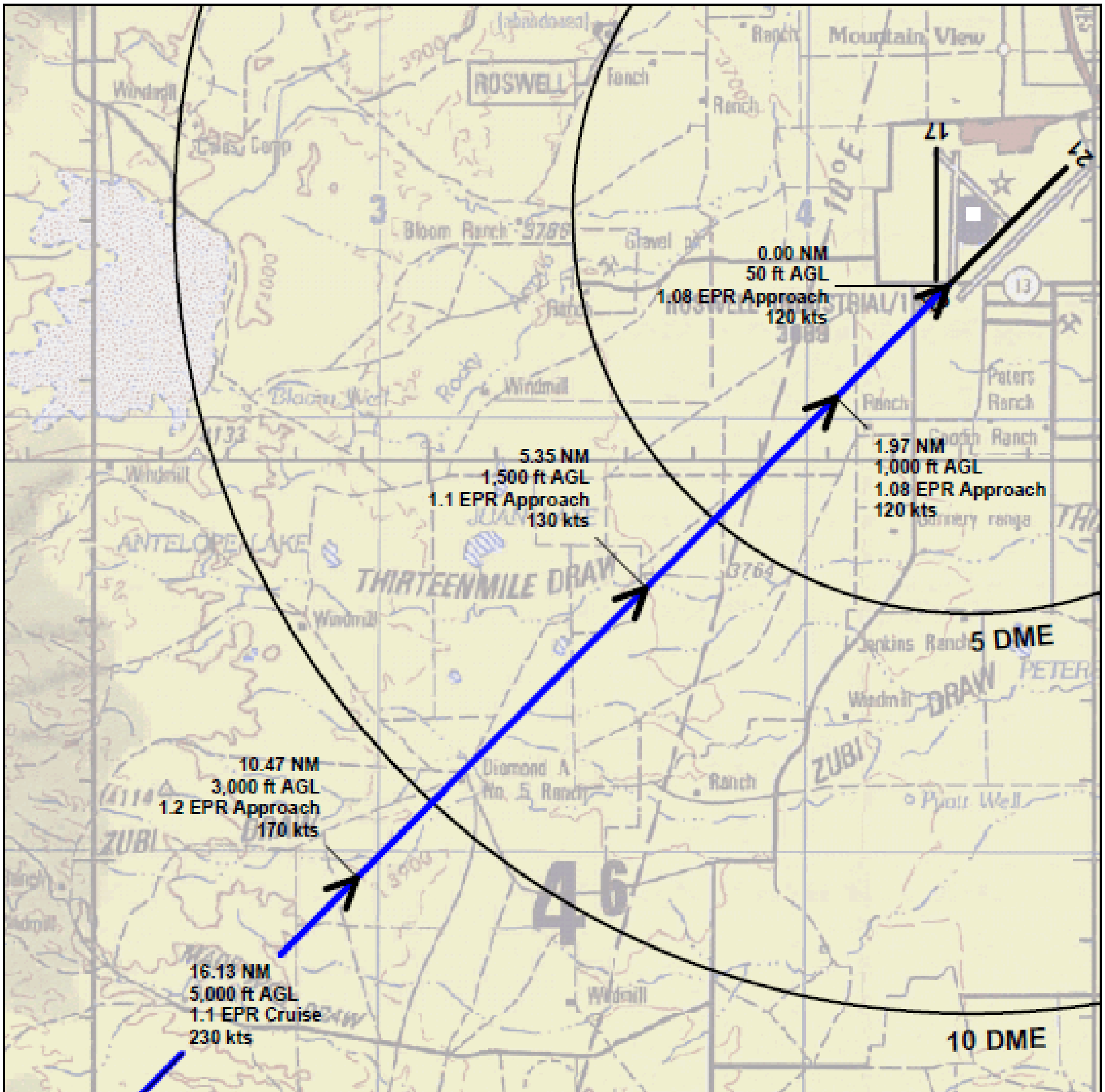
Scale in Feet 1:97,700 (1 inch = 8,150 feet)



Flight Profile C4_03D1

Point	Distance NM	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0.00	0 AGL	114.66 Variable	0	0.0	0	26
b	0.41	0 AGL	114.66 Variable	116.6	5.9	1300	6
c	0.61	125 AGL	105.39 Variable	127.5	5.2	1300	12
d	1.07	378 AGL	90.83 Variable	149.3	8.8	2400	66
e	3.85	3,000 AGL	96.23 Variable	155.3	7.9	2200	4
f	4.01	3,139 AGL	93.89 Variable	155.7	7.9	2200	63
g	6.80	5,500 AGL	99.3 Variable	161.5	7.5	2200	55
h	9.31	7,500 AGL	103.94 Variable	166.7	7.0	2100	71
i	12.66	10,000 AGL	110.14 Variable	173.5			

Flight Profile C4_03D1
Cessna 441 Departure



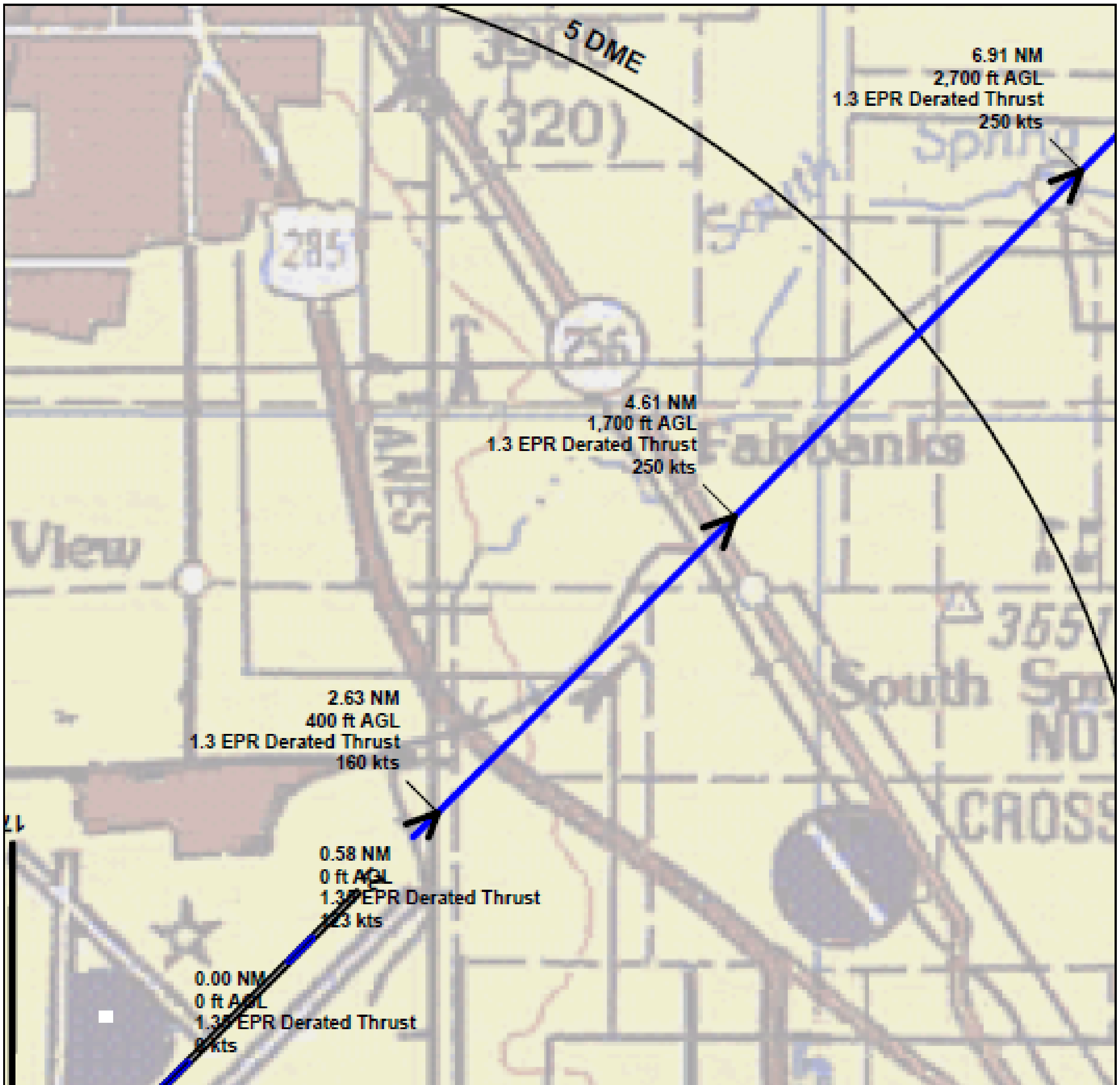
Flight Profile C7A1

Point	Distance NM	Height ft	Power EPR	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	30.00	10,532 AGL	1.1 Cruise	250	-3.8	-1600	208	-3.1 deg, -1320 fpm, 252 sec
b	16.13	5,000 AGL	1.1 Cruise	230	-3.3	-1200	102	-3.3 deg, -1180 fpm, 102 sec
c	10.47	3,000 AGL	1.2 Approach	170	-2.8	-700	123	-2.8 deg, -730 fpm, 123 sec
d	5.35	1,500 AGL	1.1 Approach	130	-1.4	-300	97	-1.4 deg, -310 fpm, 97 sec
e	1.97	1,000 AGL	1.08 Approach	120	-4.5	-1000	59	-4.5 deg, -960 fpm, 59 sec
f	0.00	50 AGL	1.08 Approach	120				

Flight Profile C7A1
C-17 Arrival

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000 48,000 52,000

Scale in Feet 1:154,000 (1 inch = 12,800 feet)



Flight Profile C7D1

Point	Distance NM	Height ft	Power EPR	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0.00	0 AGL	1.35 Derated Thrust	0	0.0	0	34	0.0 deg, 0 fpm, 34 sec
b	0.58	0 AGL	1.35 Derated Thrust	123	1.8	500	52	1.8 deg, 460 fpm, 52 sec
c	2.63	400 AGL	1.3 Derated Thrust	160	6.2	2200	35	6.2 deg, 2240 fpm, 35 sec
d	4.61	1,700 AGL	1.3 Derated Thrust	250	4.1	1800	33	4.1 deg, 1800 fpm, 33 sec
e	6.91	2,700 AGL	1.3 Derated Thrust	250	3.0	1300	137	3.0 deg, 1310 fpm, 137 sec
f	16.46	5,700 AGL	1.3 Derated Thrust	250	3.2	1400	181	2.5 deg, 1090 fpm, 237 sec
g	29.00	10,000 AGL	1.3 Derated Thrust	250				

Flight Profile C7D1
C-17 Departure

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000

Scale in Feet 1:58,800 (1 inch = 4,900 feet)

N

Flight Profile F3A1

Point	Distance NM	Height ft	Power % ETR	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	30.00	14,000 MSL	15 Variable	300	0.0	0	65	0.0 deg, 0 fpm, 104 sec
b	25.00	14,000 MSL	15 Flight Idle	250	-6.6	-2600	272	-6.6 deg, -2630 fpm, 272 sec
c	8.00	2,000 MSL	50 Parallel	200	-1.6	-500	57	-1.6 deg, -530 fpm, 57 sec
d	5.00	1,500 MSL	40 Parallel	180	4.2	1300	101	-2.7 deg, -850 fpm, 101 sec
e	0.00	50 AGL	40 Parallel	175				

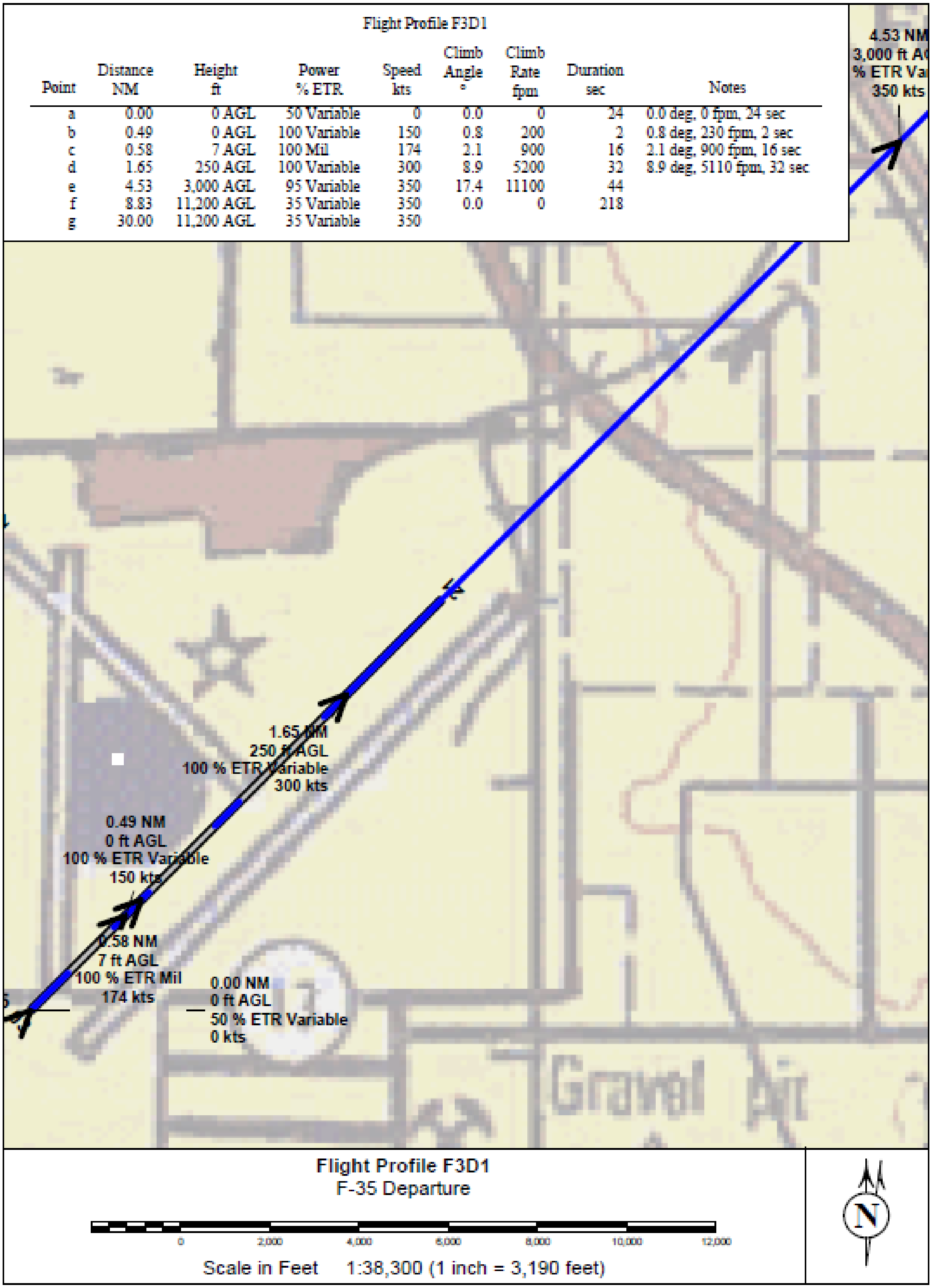
Flight Profile F3A1
F-35 Arrival

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000

Scale in Feet 1:85,700 (1 inch = 7,140 feet)

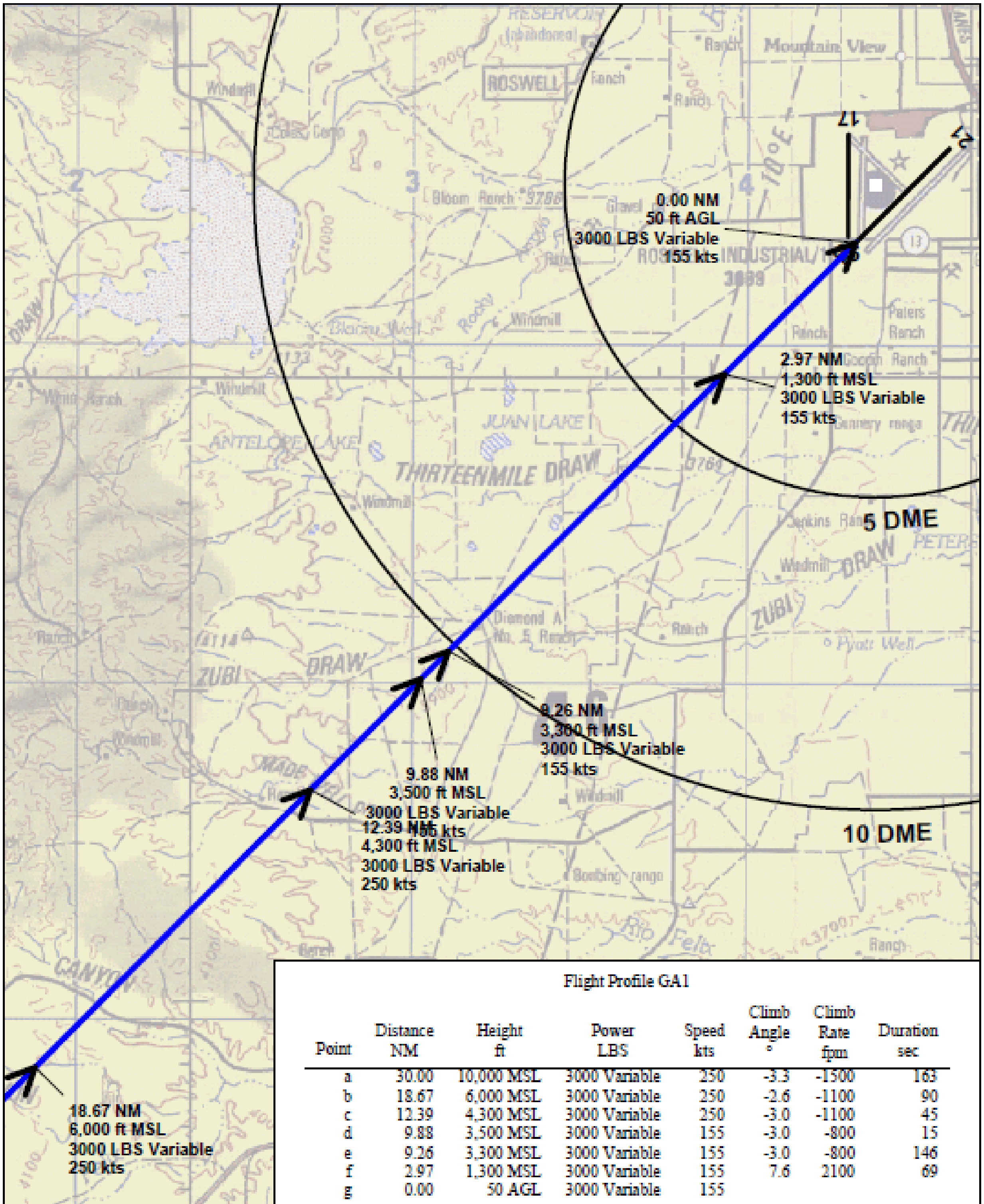
Flight Profile F3D1

Point	Distance NM	Height ft	Power % ETR	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0.00	0 AGL	50 Variable	0	0.0	0	24	0.0 deg, 0 fpm, 24 sec
b	0.49	0 AGL	100 Variable	150	0.8	200	2	0.8 deg, 230 fpm, 2 sec
c	0.58	7 AGL	100 Mil	174	2.1	900	16	2.1 deg, 900 fpm, 16 sec
d	1.65	250 AGL	100 Variable	300	8.9	5200	32	8.9 deg, 5110 fpm, 32 sec
e	4.53	3,000 AGL	95 Variable	350	17.4	11100	44	
f	8.83	11,200 AGL	35 Variable	350	0.0	0	218	
g	30.00	11,200 AGL	35 Variable	350				



Flight Profile F3D1
F-35 Departure

Scale in Feet 1:38,300 (1 inch = 3,190 feet)

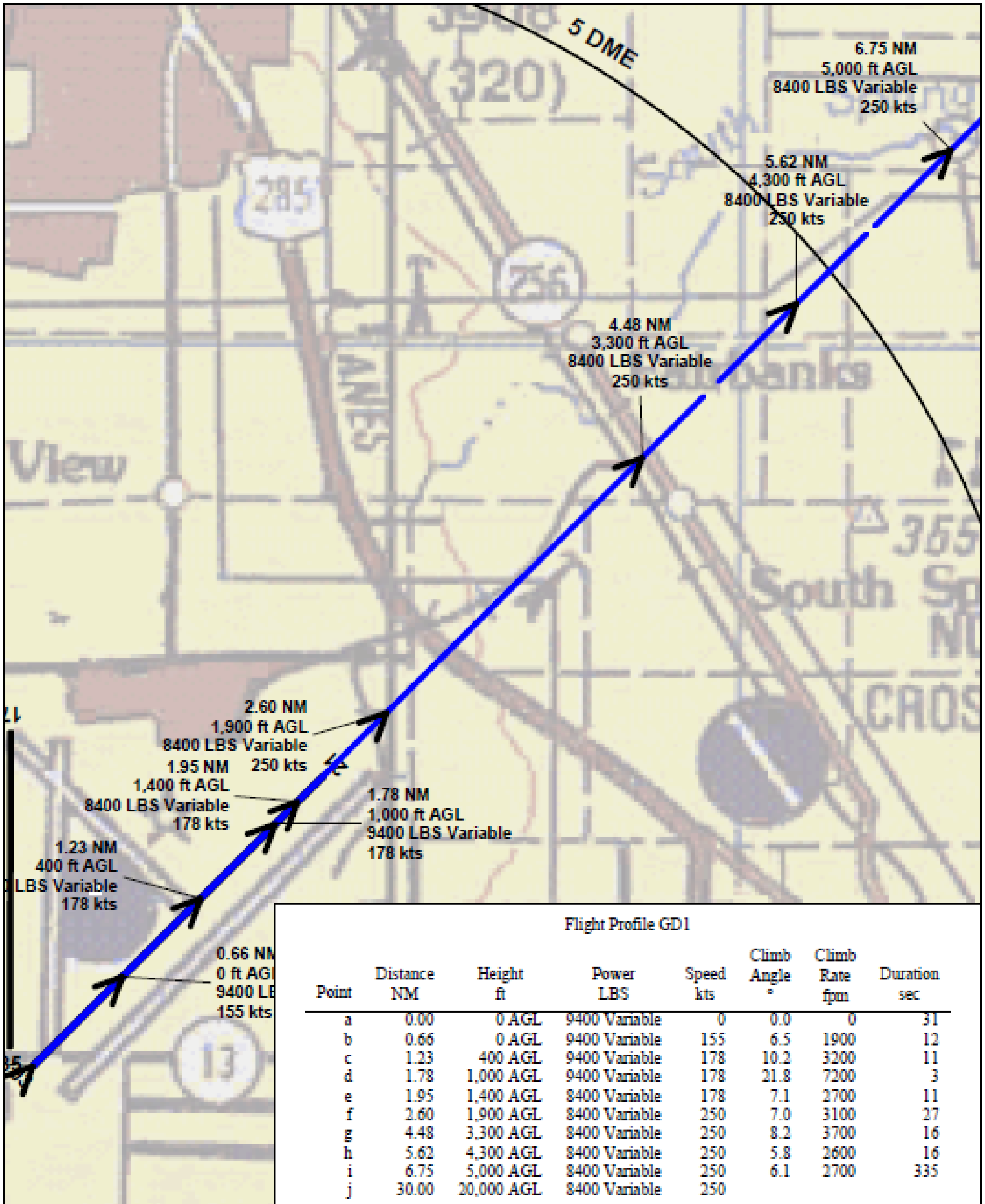


Flight Profile GA1

Point	Distance NM	Height ft	Power LBS	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	30.00	10,000 MSL	3000 Variable	250	-3.3	-1500	163
b	18.67	6,000 MSL	3000 Variable	250	-2.6	-1100	90
c	12.39	4,300 MSL	3000 Variable	250	-3.0	-1100	45
d	9.88	3,500 MSL	3000 Variable	155	-3.0	-800	15
e	9.26	3,300 MSL	3000 Variable	155	-3.0	-800	146
f	2.97	1,300 MSL	3000 Variable	155	7.6	2100	69
g	0.00	50 AGL	3000 Variable	155			

Flight Profile GA1
General Aviation Arrival

Scale in Feet 1:176,000 (1 inch = 14,700 feet)

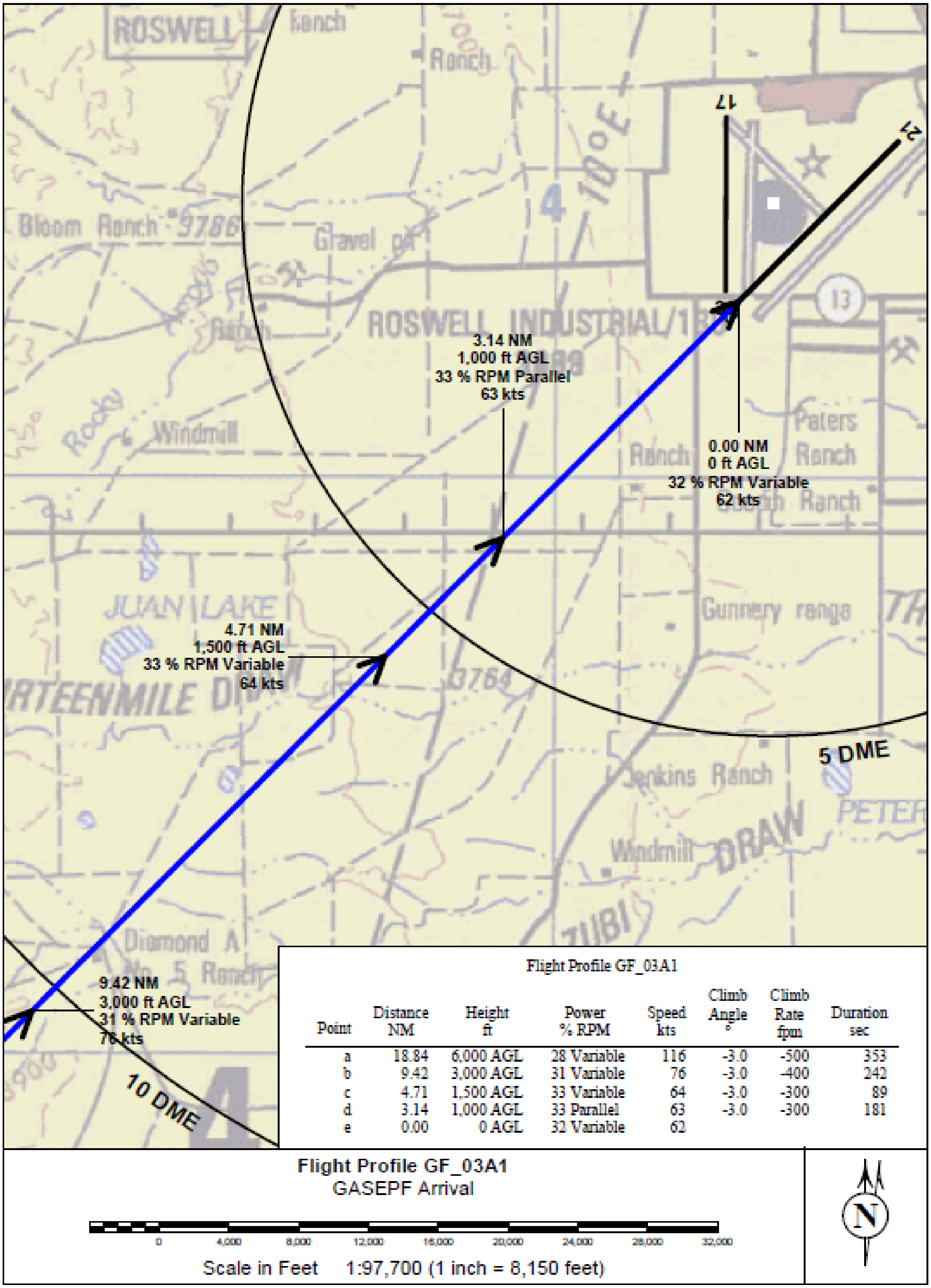


Flight Profile GD1

Point	Distance NM	Height ft	Power LBS	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0.00	0 AGL	9400 Variable	0	0.0	0	31
b	0.66	0 AGL	9400 Variable	155	6.5	1900	12
c	1.23	400 AGL	9400 Variable	178	10.2	3200	11
d	1.78	1,000 AGL	9400 Variable	178	21.8	7200	3
e	1.95	1,400 AGL	8400 Variable	178	7.1	2700	11
f	2.60	1,900 AGL	8400 Variable	250	7.0	3100	27
g	4.48	3,300 AGL	8400 Variable	250	8.2	3700	16
h	5.62	4,300 AGL	8400 Variable	250	5.8	2600	16
i	6.75	5,000 AGL	8400 Variable	250	6.1	2700	335
j	30.00	20,000 AGL	8400 Variable	250			

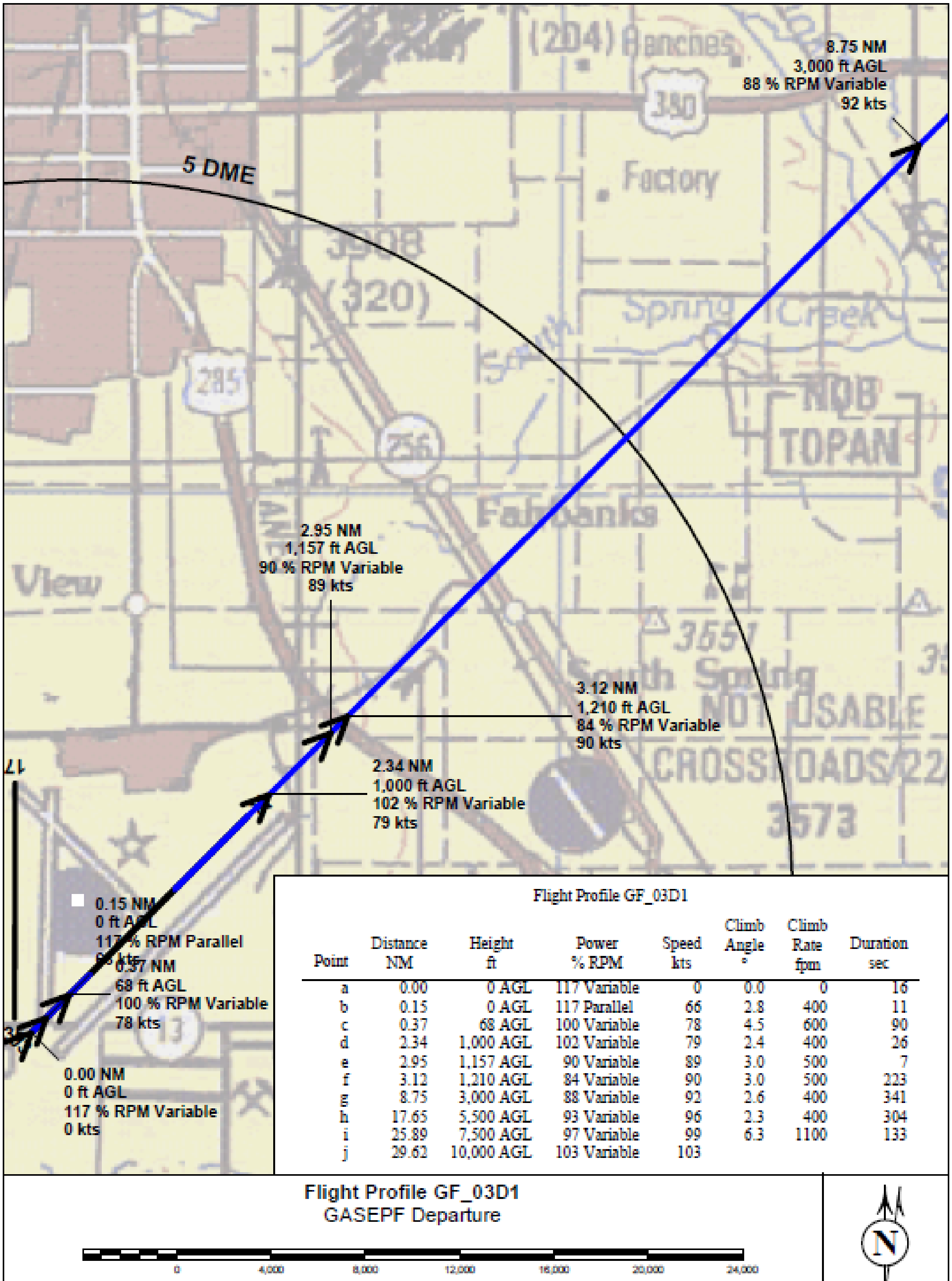
Flight Profile GD1
General Aviation Departure

Scale in Feet 1:57,100 (1 inch = 4,760 feet)



Flight Profile GF_03A1

Point	Distance NM	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	18.84	6,000 AGL	28 Variable	116	-3.0	-500	353
b	9.42	3,000 AGL	31 Variable	76	-3.0	-400	242
c	4.71	1,500 AGL	33 Variable	64	-3.0	-300	89
d	3.14	1,000 AGL	33 Parallel	63	-3.0	-300	181
e	0.00	0 AGL	32 Variable	62			

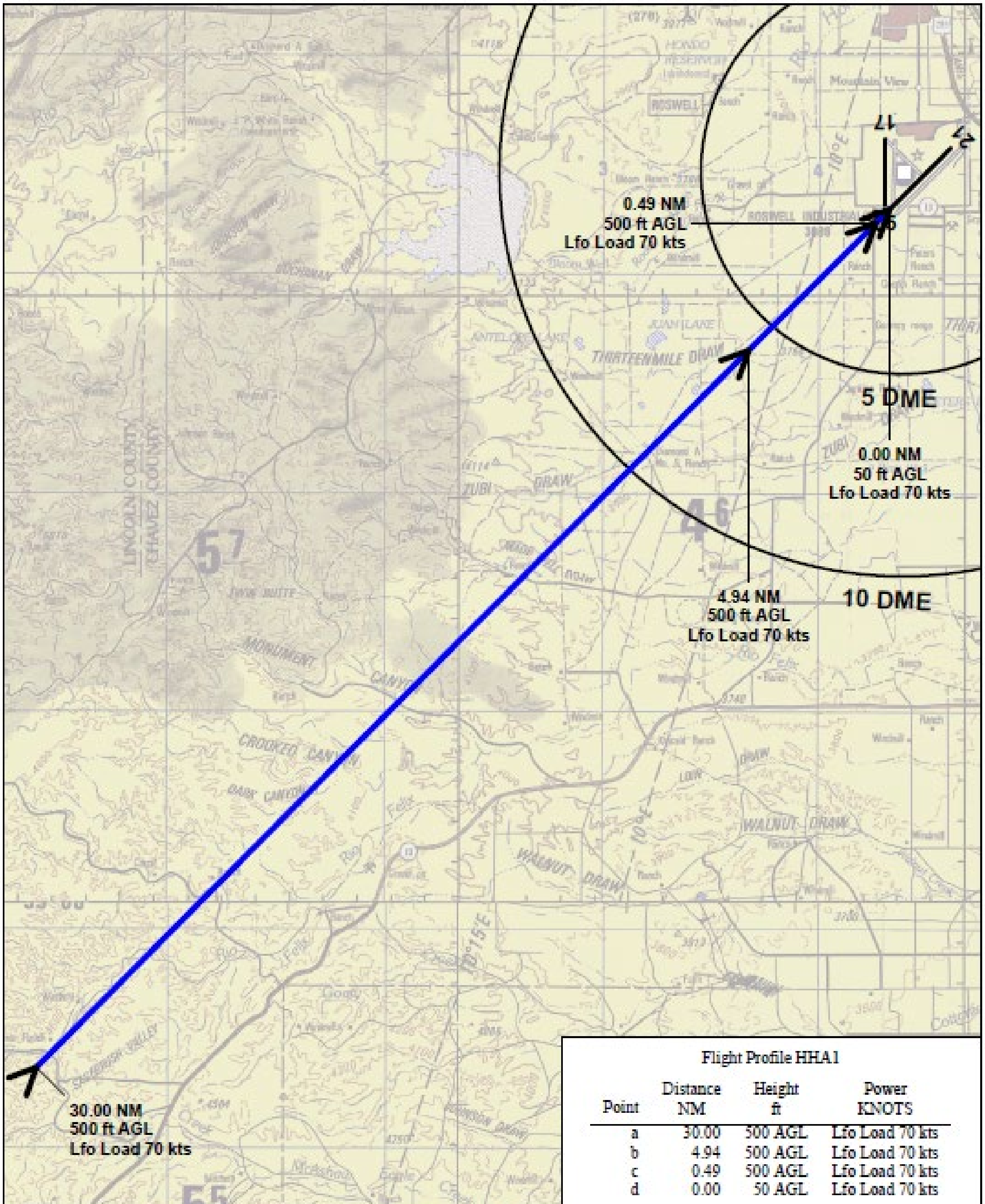


Flight Profile GF_03D1

Point	Distance NM	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0.00	0 AGL	117 Variable	0	0.0	0	16
b	0.15	0 AGL	117 Parallel	66	2.8	400	11
c	0.37	68 AGL	100 Variable	78	4.5	600	90
d	2.34	1,000 AGL	102 Variable	79	2.4	400	26
e	2.95	1,157 AGL	90 Variable	89	3.0	500	7
f	3.12	1,210 AGL	84 Variable	90	3.0	500	223
g	8.75	3,000 AGL	88 Variable	92	2.6	400	341
h	17.65	5,500 AGL	93 Variable	96	2.3	400	304
i	25.89	7,500 AGL	97 Variable	99	6.3	1100	133
j	29.62	10,000 AGL	103 Variable	103			

Flight Profile GF_03D1
GASEPF Departure

Scale in Feet 1:74,000 (1 inch = 6,170 feet)

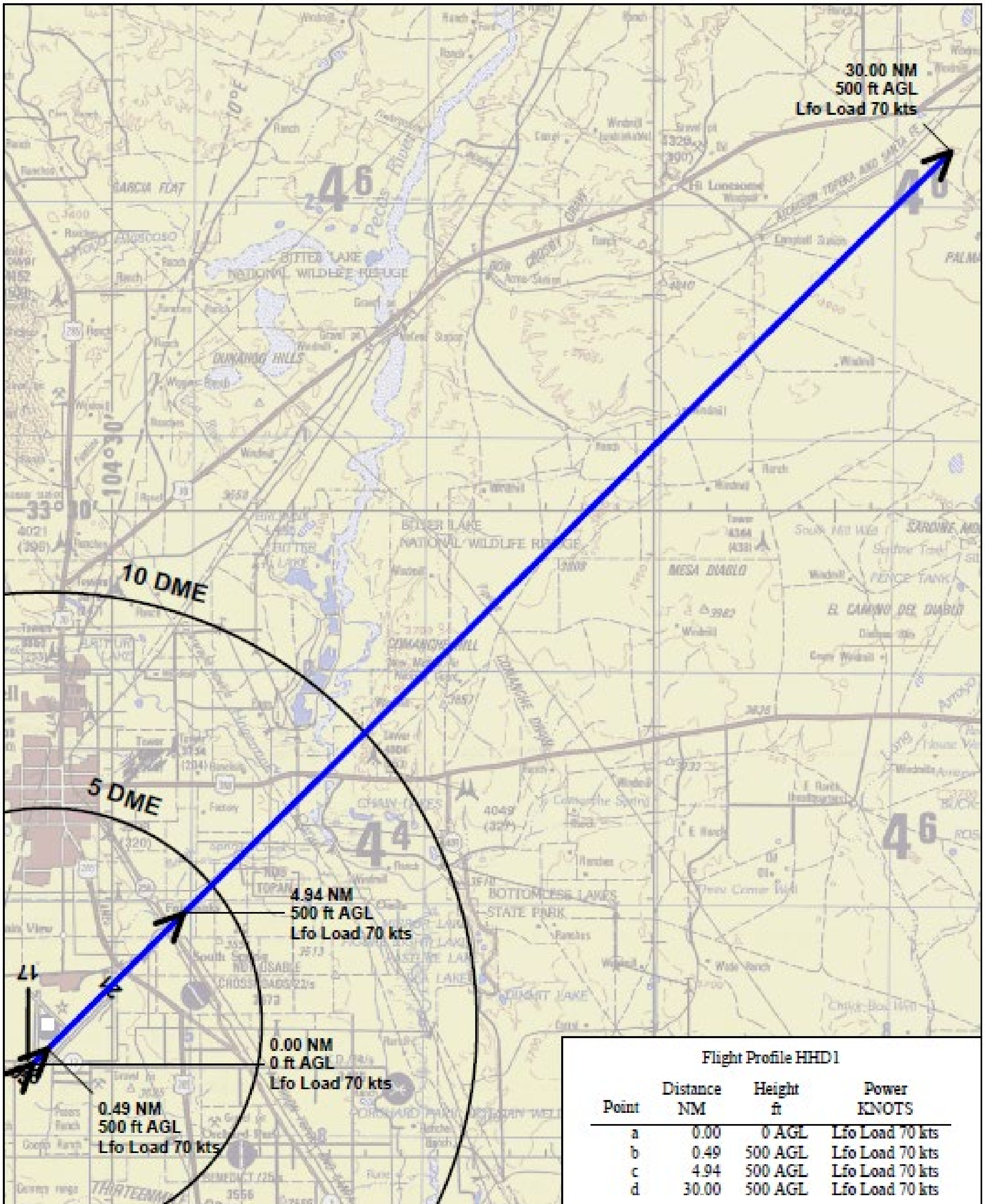


Flight Profile HHA1

Point	Distance NM	Height ft	Power KNOTS
a	30.00	500 AGL	Lfo Load 70 kts
b	4.94	500 AGL	Lfo Load 70 kts
c	0.49	500 AGL	Lfo Load 70 kts
d	0.00	50 AGL	Lfo Load 70 kts

Flight Profile HHA1
Helicopter Arrival

Scale in Feet 1:272,000 (1 inch = 22,600 feet)



Flight Profile HHD1

Point	Distance NM	Height ft	Power KNOTS
a	0.00	0 AGL	Lfo Load 70 kts
b	0.49	500 AGL	Lfo Load 70 kts
c	4.94	500 AGL	Lfo Load 70 kts
d	30.00	500 AGL	Lfo Load 70 kts

Flight Profile HHD1
Helicopter Departure

0 10,000 20,000 30,000 40,000 50,000 60,000 70,000 80,000

Scale in Feet 1:255,000 (1 inch = 21,200 feet)

N

Flight Profile T6A1

Point	Distance NM	Height ft	Power % Torque	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	30.00	15,000 AGL	60 Cruise	300	-6.3	-2900	200	
b	15.52	9,000 MSL	60 Cruise	220	-3.9	-1400	166	
c	5.86	5,000 MSL	60 Approach	200	-7.4	-2400	51	START TO CONFIGURE
d	3.34	3,000 MSL	60 Approach	160	3.9	1100	53	GEAR DOWN
e	0.99	300 AGL	60 Approach	160	-2.4	-700	23	
f	0.00	50 AGL	30 Approach	150				

Flight Profile T6A1
T-6 Arrival

Scale in Feet 1:67,700 (1 inch = 5,640 feet)

Flight Profile T6D1

Point	Distance NM	Height ft	Power % Torque	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec
a	0.00	0 AGL	98.1 100% Torque	0	0.0	0	26
b	0.33	0 AGL	99 Takeoff	90	2.9	700	44
c	1.97	500 AGL	99 Takeoff	180	3.3	1100	27
d	3.39	1,000 AGL	80 Variable	200	2.7	900	253
e	17.45	5,000 AGL	99 Variable	200	2.3	800	226
f	30.00	8,000 AGL	99 Variable	200			

Flight Profile T6D1
T-6 Departure

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000 48,000 52,000

Scale in Feet 1:148,000 (1 inch = 12,300 feet)

D.1.5 Ground/Maintenance Run-ups

This section details the number, type, and duration of the ground and maintenance engine run-up operations at the airfield. **Figure D-4** shows the location of all the static run-up locations at Holloman AFB. The locations at the ends of the runway are the locations for the arming and de-arming of the F-16C aircraft. **Table D-7** details the number, type, and duration of the on-field maintenance operations.

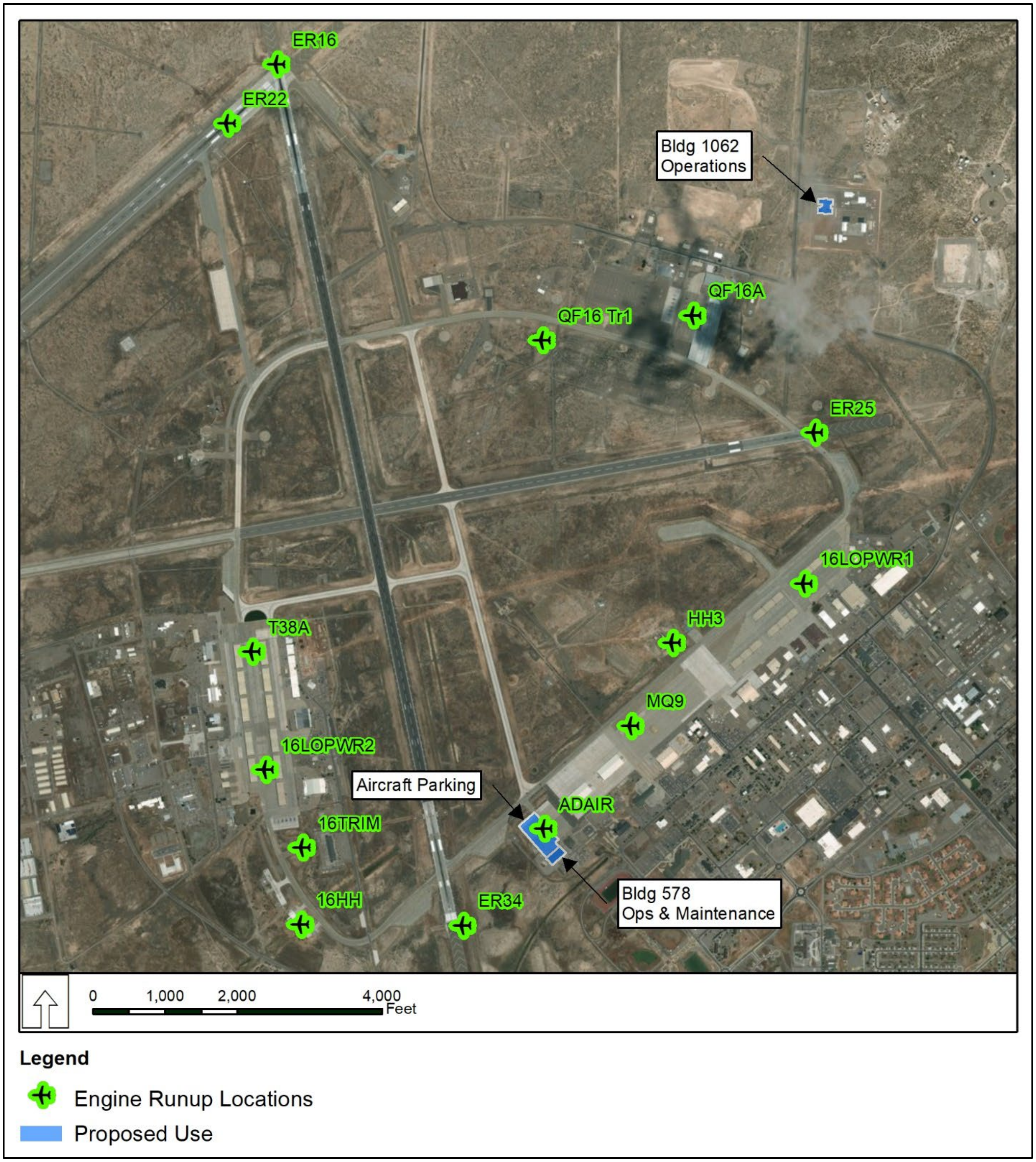


Figure D-4. Static Operations Locations.

Table D-7
Location, Type, and Duration of Ground/Maintenance Run-Up Operations at Holloman Air Force Base

Aircraft Type	Engine Type	Run-up Type	Annual Events	Percent Day (0700-2200)	Percent Night (2200-0700)	Run-up Pad ID	Percent Pad used	Magnetic Heading (degrees)	Engine Power Setting	Duration (Seconds) Per Event	# of Engines Running Per Event
54 FG F-16C	F100-PW-220/ F100-GE-100	Pre/Postflight Engine Run	1/sortie	95%	5%	16_LOPWR1/2	50%/50%	80/260	67%	900	1
		Oil Consumption, APU Check	66	100%	0%	16_LOPWR1/2	50%/50%	80/260	67% NC	600	1
									80% NC	150	
		Flight Controls and Engine Change	870	100%	0%	16_LOPWR1/2	50%/50%	80/260	67% NC	900	1
		Trim	104	100%	0%	16_HH	100%	80	67% NC	600	1
									80% NC	605	
									85% NC	300	
		Arming	1/sortie	95%	5%	Rwy 16 EOR F/ Rwy 34 EOR A/ Rwy 25 EOR B/ Rwy22 EOR F	70%/ 10%/ 15%/ 5%	160/ 220/ 250/ 340	67% NC	1200	1
		De-arming	1/sortie	93%	7%	Rwy 16 EOR F/ Rwy 34 EOR A/ Rwy 25 EOR B/ Rwy22 EOR F	84%/ 10%/ 1%/ 5%	160/ 220/ 250/ 340	67% NC	420	1
	GRADE III	Uninstalled	30	95%	5%	16_HH-hush house	100%	45%	80% NC	3000	1
									91.5% NC	780	
									Max A/B	120	
	GRADE III	Hush House	208	95%	5%	16_HH-hush house	100%	45%	80% NC	3000	1
									91.5% NC	780	
									Max A/B	120	
82 ATRS QF-16C	F110-GE-100	Pre/Postflight Engine Run	1/sortie	100.0%	0.0%	QF16A	100.00%	130	67% NC	3600	1
		Oil Consumption, APU Check	52	100%	0%	QF16A	50%/50%	130/260	67% NC	600	1
									80% NC	150	
		Flight Controls and Engine Change	208	100%	0%	QF16A	50%/50%	130/260	67% NC	900	1
		Trim	73	100%	0%	QF16_Trim	1	30	67% NC	600	1
									80% NC	605	
									85% NC	300	
	GRADE III	Hush House	104	95%	5%	16_HH-hush house	100%	45	80% NC	3000	1
									91.5% NC	780	
									Max A/B	120	
586 FLTS T-38Cs/ ACC AFACGS T-38As	J85-GE-5A	Pre/Postflight Engine Run	1/sortie	96%	4%	T38A	100%	140/320	48% RPM	1200	2
		Ops Check	52	100%	0%	T38A	100%	140/320	48% RPM	960	2
	GRADE III	Uninstalled	216	100%	0%	HH3	100%	135	48% RPM	300	1
									88% RPM	600	
									99.5% RPM	600	
									Max A/B	120	
	GRADE III	T-38 Suppressor	79	100%	0%	HH3	100%	135	48% RPM	300	1
									88% RPM	600	
									99.5% RPM	600	
									Max A/B	120	
MQ-9	TPE331-8	Preflight Engine Run	1/sortie	44%	56%	MQ-9 Parking	100%	0	65% RPM	900	1
		Postflight Engine Run	1/sortie	100%	0%				65% RPM	900	
		Ops Check	81	100%	0%				80% RPM	1800	
ADAIR Category B		Pre/Postflight Engine Run	1/sortie	95.0%	5.0%	ADAIR Parking	100%	230	Idle	600	All
		Trim	288	100%	0	16_HH	100%	30	Idle	720	1
									Approach	1620	
									Intermediate	540	
									Military	540	

D.2 AIR QUALITY

D.2.1 Detailed Air Conformity Applicability Model Report

Alternative 2-Holloman AFB

1. General Information

- Action Location
Base: HOLLOMAN AFB
State: New Mexico
County(s): Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: F 16 Formal Training Unit Permanent Beddown and Relocation, Holloman AFB, New Mexico

- Project Number/s (if applicable): N/A

- Projected Action Start Date: 1 / 2023

- Action Purpose and Need:

The purpose of the Proposed Action is to optimize fighter pilot production to meet the Air Education Training Command (AETC) mission of training and educating Airmen. Further, the Proposed Action would realign AETC assets to meet mission requirements specified in the F 16 Beddown and Relocation Plan to address fighter production shortfalls.

The need for the Proposed Action is to permanently base the F 16 FTU to increase proficiency and training readiness for the fighter pilots of the Combat Air Forces. Air Force readiness is currently affected by several issues including training, weapon system sustainment, and facilities. The Proposed Action would facilitate AETC's ability to fulfill its training mission.

- Action Description:

The Air Force is proposing to permanently beddown additional F 16 FTU squadrons in support of the Formal Training Unit Permanent Beddown and Relocation Plan. The Proposed Action will allow AETC to continue to optimize fighter pilot production in order to meet their mission.

The Proposed Action would include the permanent relocation of the F 16 aircraft; the pilot, maintenance, and support personnel; and support vehicles and equipment. The permanent relocation of the F 16 FTU may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities, as well as for administrative functions by FTU personnel.

Under Alternative 1, an additional squadron comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory (BAI) F 16 Block 40 aircraft, currently based at Holloman AFB on an interim basis, would be permanently relocated at Holloman AFB as the 8 FS.

Under Alternative 2, the squadron of F 16 aircraft FTU, comprised of 25 PAA with 2 BAI F 16 Block 40 aircraft currently based at Holloman AFB on an interim basis would be permanently relocated at Holloman AFB as the 8 FS and an additional F 16 aircraft FTU squadron, comprised of a 25 PAA of either Block 40 or 42 aircraft would be permanently relocated at Holloman AFB.

- Point of Contact
Name: Radhika Narayanan
Title: Environmental Scientist

Organization: Versar LLC
Email: rnarayanan@versar.com
Phone Number:

- Activity List:

Activity Type		Activity Title
2.	Aircraft	Holloman AFB, Alamogordo - Airfield Flight Operations
3.	Paint Booth	Additional aircraft maintenance activity (coatings)
4.	Paint Booth	Additional aircraft maintenance activity (solvents)
5.	Degreaser	Additional solvent degreasing activity
6.	Personnel	Additional Personnel Commute
7.	Tanks	Jet A Fuel Storage and Refueling-Tank 1
8.	Tanks	Jet A Fuel Storage and Handling-Tank 2
9.	Construction / Demolition	Building 297-Aircraft Maintenance Unit
10.	Construction / Demolition	Hangar 565-Vertical Storage System
11.	Construction / Demolition	Building 314-Refueler Maintenance
12.	Construction / Demolition	Main Ramp-Sunshades and Lighting
13.	Construction / Demolition	Building 1062-Fighter Squadron Command Section
14.	Construction / Demolition	Building 584-Permanent Party Dormitory
15.	Construction / Demolition	Building 588 Fitness Center
16.	Construction / Demolition	Building 647-Child Development Center
17.	Construction / Demolition	Building 648 Youth Center/School Age Program
18.	Heating	Building 297-Heating
19.	Heating	Hangar 565-Vertical Tank Storage System Heating
20.	Heating	Building 314-Refueler Maintenance
21.	Heating	Building 1062-Fighter Squadron Command Section
22.	Heating	Building 588-Fitness Center
23.	Heating	Building 647
24.	Heating	Building 648 Youth Center/School Age Program
25.	Construction / Demolition	Building 293 - Aircraft Maintenance Unit
26.	Heating	Building 293 – Heating

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Aircraft

2.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Holloman AFB, Alamogordo - Airfield Flight Operations

- Activity Description:
New Permanent Addition of 1 FTU
Aircraft/Engine Configuration: F16 (F110-GE-100)
Flight Operations include LTOs, TGOs, AGE & APU, Engine Testing and Trim Tests for the Permanent Beddown of Additional Squadron

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	11.168793
SO_x	8.441097
NO_x	92.674573
CO	112.836265
PM 10	12.051861

Pollutant	Emissions Per Year (TONs)
PM 2.5	8.189460
Pb	0.000000
NH_3	0.000000
CO_2e	21103.7

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	2.297487
SO_x	6.567844
NO_x	65.792841
CO	96.098484
PM 10	9.323052

Pollutant	Emissions Per Year (TONs)
PM 2.5	5.568046
Pb	0.000000
NH_3	0.000000
CO_2e	19491.0

- Activity Emissions [Test Cell part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.017803
SO_x	0.089792
NO_x	1.405450
CO	1.202686
PM 10	0.102572

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.073718
Pb	0.000000
NH_3	0.000000
CO_2e	271.4

- Activity Emissions [Aerospace Ground Equipment (AGE) part]:

Pollutant	Emissions Per Year (TONs)
VOC	8.853503
SO_x	1.783461
NO_x	25.476281
CO	15.535095
PM 10	2.626237

Pollutant	Emissions Per Year (TONs)
PM 2.5	2.547697
Pb	0.000000
NH_3	0.000000
CO_2e	1341.3

2.2 Aircraft & Engines

2.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: F-16C
Engine Model: F110-GE-100
Primary Function: Combat
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No

Original Aircraft Name:
Original Engine Name:

2.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	1111.00	0.22	1.07	3.77	24.11	2.60	1.12	3234
Approach	5080.00	0.03	1.07	9.78	5.77	1.37	0.91	3234
Intermediate	7332.00	0.05	1.07	16.92	3.47	0.58	0.41	3234
Military	11358.00	0.04	1.07	29.00	3.38	0.14	0.00	3234
After Burn	18088.00	1.21	1.07	14.26	67.41	3.35	2.98	3234

2.3 Flight Operations

2.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 27
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 5000
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 7500
Number of Annual Trim Test(s) per Aircraft: 12

- Default Settings Used: Yes

- Flight Operations TIMs (Time In Mode)
Taxi/Idle Out [Idle] (mins): 18.5 (default)
Takeoff [Military] (mins): 0.2 (default)
Takeoff [After Burn] (mins): 0.2 (default)
Climb Out [Intermediate] (mins): 0.8 (default)
Approach [Approach] (mins): 3.5 (default)
Taxi/Idle In [Idle] (mins): 11.3 (default)

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner. (Exception made for F-35 where KARNES 3.2 flight profile was used)

- Trim Test
Idle (mins): 12 (default)
Approach (mins): 27 (default)
Intermediate (mins): 9 (default)
Military (mins): 9 (default)
Afterburn (mins): 3 (default)

2.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)

NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year
$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year
$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year
$AEPS_{POL} = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000$

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year
$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)

$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

2.4 Auxiliary Power Unit (APU)

2.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: Yes

- Auxiliary Power Unit (APU) (default)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer
1	1	No	T-62T-40-8	

2.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
T-62T-40-8	272.6	0.493	0.289	1.216	3.759	0.131	0.037	910.8

2.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year
$APU_{POL} = APU * OH * LTO * EF_{POL} / 2000$

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

2.5 Aircraft Engine Test Cell

2.5.1 Aircraft Engine Test Cell Assumptions

- Engine Test Cell
Total Number of Aircraft Engines Tested Annually: 27

- Default Settings Used: No

- Annual Run-ups / Test Durations
Annual Run-ups (Per Aircraft Engine): 1
Idle Duration (mins): 12
Approach Duration (mins): 27
Intermediate Duration (mins): 9
Military Duration (mins): 9
After Burner Duration (mins): 3

2.5.2 Aircraft Engine Test Cell Emission Factor(s)

- See Aircraft & Engines Emission Factor(s)

2.5.3 Aircraft Engine Test Cell Formula(s)

- Aircraft Engine Test Cell Emissions per Pollutant & Power Setting (TONs)
$TestCellPS_{POL}$ = (TD / 60) * (FC / 1000) * EF * NE * ARU / 2000

$TestCellPS_{POL}$: Aircraft Engine Test Cell Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Total Number of Engines (For All Aircraft)
ARU: Annual Run-ups (Per Aircraft Engine)
2000: Conversion Factor pounds to TONs

- Aircraft Engine Test Cell Emissions per Year
TestCell = $TestCellPS_{IDLE}$ + $TestCellPS_{APPROACH}$ + $TestCellPS_{INTERMEDIATE}$ + $TestCellPS_{MILITARY}$ + $TestCellPS_{AFTERBURN}$

TestCell: Aircraft Engine Test Cell Emissions (TONs)
$TestCellPS_{IDLE}$: Aircraft Engine Test Cell Emissions for Idle Power Setting (TONs)
$TestCellPS_{APPROACH}$: Aircraft Engine Test Cell Emissions for Approach Power Setting (TONs)
$TestCellPS_{INTERMEDIATE}$: Aircraft Engine Test Cell Emissions for Intermediate Power Setting (TONs)
$TestCellPS_{MILITARY}$: Aircraft Engine Test Cell Emissions for Military Power Setting (TONs)
$TestCellPS_{AFTERBURN}$: Aircraft Engine Test Cell Emissions for After Burner Power Setting (TONs)

2.6 Aerospace Ground Equipment (AGE)

2.6.1 Aerospace Ground Equipment (AGE) Assumptions

- Default Settings Used: Yes

- AGE Usage
Number of Annual LTO (Landing and Take-off) cycles for AGE: 5000

- Aerospace Ground Equipment (AGE) (default)

Total Number of AGE	Operation Hours for Each LTO	Exempt Source?	AGE Type	Designation
1	0.33	No	Air Compressor	MC-1A - 18.4hp
1	1	No	Bomb Lift	MJ-1B
1	0.33	No	Generator Set	A/M32A-86D
1	0.5	No	Heater	H1
1	0.5	No	Hydraulic Test Stand	MJ-2/TTU-228 - 130hp
1	8	No	Light Cart	NF-2
1	0.33	No	Start Cart	A/M32A-60A

2.6.2 Aerospace Ground Equipment (AGE) Emission Factor(s)

- Aerospace Ground Equipment (AGE) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
MC-1A - 18.4hp	1.1	0.267	0.008	0.419	0.267	0.071	0.068	24.8
MJ-1B	0.0	3.040	0.219	4.780	3.040	0.800	0.776	141.2
A/M32A-86D	6.5	0.294	0.046	6.102	0.457	0.091	0.089	147.0
H1	0.4	0.100	0.011	0.160	0.180	0.006	0.006	8.9
MJ-2/TTU-228 - 130hp	7.4	0.195	0.053	3.396	0.794	0.089	0.086	168.8
NF-2	0.0	0.010	0.043	0.110	0.080	0.010	0.010	22.1
A/M32A-60A	0.0	0.270	0.306	1.820	5.480	0.211	0.205	221.1

2.6.3 Aerospace Ground Equipment (AGE) Formula(s)

- Aerospace Ground Equipment (AGE) Emissions per Year
$AGE_{POL} = AGE * OH * LTO * EF_{POL} / 2000$

AGE_{POL}: Aerospace Ground Equipment (AGE) Emissions per Pollutant (TONs)
AGE: Total Number of Aerospace Ground Equipment
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

3. Paint Booth

3.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Additional aircraft maintenance activity (coatings)

- Activity Description:
Additional aircraft maintenance activity (coatings use) due to proposed additional squadron.

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.150450
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

3.2 Paint Booth Assumptions

- Paint Booth
Coating throughput (gallons/year): 36

- Default Settings Used: No

- Paint Booth Consumption
Coating used: 8010-01-492-4701 (36118)
Specific gravity of coating: 1.1
Coating VOC content by weight (%): 91
Efficiency of control device (%): 0

3.3 Paint Booth Formula(s)

- Paint Booth Emissions per Year
PBE_{VOC}= (VOC / 100) * CT * SG * 8.35 * (1 - (CD / 100)) / 2000

PBE_{VOC}: Paint Booth VOC Emissions (TONs per Year)
VOC: Coating VOC content by weight (%)
(VOC / 100): Conversion Factor percent to decimal
CT: Coating throughput (gallons/year)
SG: Specific gravity of coating
8.35: Conversion Factor the density of water
CD: Efficiency of control device (%)
(1 - (CD / 100)): Conversion Factor percent to decimal (Not effected by control device)
2000: Conversion Factor pounds to tons

4. Paint Booth

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Additional aircraft maintenance activity (solvents)

- Activity Description:
Additional aircraft maintenance activity (solvent use) due to proposed additional squadron.

- Activity Start Date
Start Month: 1

Start Year: 2023

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.044526
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

4.2 Paint Booth Assumptions

- Paint Booth
Coating throughput (gallons/year): 13.5

- Default Settings Used: No

- Paint Booth Consumption
Coating used: 6810-00-855-6160 (Alcohol)
Specific gravity of coating: 0.79
Coating VOC content by weight (%): 100
Efficiency of control device (%): 0

4.3 Paint Booth Formula(s)

- Paint Booth Emissions per Year
PBE_{VOC}= (VOC / 100) * CT * SG * 8.35 * (1 - (CD / 100)) / 2000

PBE_{VOC}: Paint Booth VOC Emissions (TONs per Year)
VOC: Coating VOC content by weight (%)
(VOC / 100): Conversion Factor percent to decimal
CT: Coating throughput (gallons/year)
SG: Specific gravity of coating
8.35: Conversion Factor the density of water
CD: Efficiency of control device (%)
(1 - (CD / 100)): Conversion Factor percent to decimal (Not effected by control device)
2000: Conversion Factor pounds to tons

5. Degreaser

5.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Additional solvent degreasing activity

- Activity Description:
Additional solvent degreasing activity due to proposed additional squadron.

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.019539
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

5.2 Degreaser Assumptions

- Degreaser
Net solvent usage (total less recycle) (gallons/year): 6

- Default Settings Used: Yes

- Degreaser Consumption
Solvent used: Mineral Spirits CAS#64475-85-0 (default)
Specific gravity of solvent: 0.78 (default)
Solvent VOC content (%): 100 (default)
Efficiency of control device (%): 0 (default)

5.3 Degreaser Formula(s)

- Degreaser Emissions per Year
DE_{VOC}= (VOC / 100) * NS * SG * 8.35 * (1 - (CD / 100)) / 2000

DE_{VOC}: Degreaser VOC Emissions (TONs per Year)
VOC: Solvent VOC content (%)
(VOC / 100): Conversion Factor percent to decimal
NS: Net solvent usage (total less recycle) (gallons/year)
SG: Specific gravity of solvent
8.35: Conversion Factor the density of water
CD: Efficiency of control device (%)
(1 - (CD / 100)): Conversion Factor percent to decimal (Not effected by control device)
2000: Conversion Factor pounds to tons

6. Personnel

6.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Additional Personnel Commute

- Activity Description:
New employee/personnel commute activity due to the permanent beddown of additional squadron. Additional personnel consisting of 75 active-duty Air Force personnel and contractor equivalent of approximately 400 personnel to fill direct and indirect support functions.

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	1.073222
SO_x	0.007152
NO_x	0.976985
CO	11.931828
PM 10	0.023380

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.020502
Pb	0.000000
NH_3	0.065837
CO_2e	1024.7

6.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 75
Civilian Personnel: 0
Support Contractor Personnel: 400
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule
Active Duty Personnel: 5 Days Per Week (default)
Civilian Personnel: 5 Days Per Week (default)
Support Contractor Personnel: 5 Days Per Week (default)
Air National Guard (ANG) Personnel: 4 Days Per Week (default)
Reserve Personnel: 4 Days Per Month (default)

6.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

6.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

6.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year

$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

7. Tanks

7.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Jet A Fuel Storage and Refueling-Tank 1

- Activity Description:
Additional Jet A fuel use due to aircraft sorties (LTOs and airspace training), TGOs, trim tests, engine tests. Total fuel was estimated based on number of sorties or tests, fuel flow rates, time in mode, number of aircraft. Worst-case fuel use estimated. Fuel use assumed to be routed through 2 identical, existing, 268,800 gallon Jet A fuel tanks.

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.337714
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

7.2 Tanks Assumptions

- Chemical
Chemical Name: Jet kerosene (JP-5, JP-8 or Jet-A)
Chemical Category: Petroleum Distillates
Chemical Density: 7
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000170775135930213
Vapor Pressure: 0.00725
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank
Type of Tank: Vertical Tank
Tank Height (ft): 32.25
Tank Diameter (ft): 40
Annual Net Throughput (gallon/year): 3085011

7.3 Tank Formula(s)

- Vapor Space Volume
$VSV = (PI / 4) * D^2 * H / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

VVSF = 1 / (1 + (0.053 * VP * H / 2))

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
H: Tank Height (ft)

- Standing Storage Loss per Year

SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

NT = (7.48 * ANT) / ((PI / 4.0) * D * H)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

8. Tanks

8.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Jet A Fuel Storage and Handling-Tank 2

- Activity Description:
Additional Jet A fuel use due to aircraft sorties (LTOs and airspace training), TGOs, trim tests, engine tests. Total fuel was estimated based on number of sorties or tests, fuel flow rates, time in mode, number of aircraft. Worst-case fuel use estimated. Fuel use assumed to be routed through 2 identical, existing, 268,800 gallon Jet A fuel tanks.

- Activity Start Date
Start Month: 1
Start Year: 2023

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.337714
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

8.2 Tanks Assumptions

- Chemical
Chemical Name: Jet kerosene (JP-5, JP-8 or Jet-A)
Chemical Category: Petroleum Distillates
Chemical Density: 7
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000170775135930213
Vapor Pressure: 0.00725
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank
Type of Tank: Vertical Tank
Tank Height (ft): 32.25
Tank Diameter (ft): 40
Annual Net Throughput (gallon/year): 3085011

8.3 Tank Formula(s)

- Vapor Space Volume
$VSV = (PI / 4) * D^2 * H / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

VVSF = 1 / (1 + (0.053 * VP * H / 2))

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
H: Tank Height (ft)

- Standing Storage Loss per Year

SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

NT = (7.48 * ANT) / ((PI / 4.0) * D * H)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

9. Construction / Demolition

9.1 General Information & Timeline Assumptions

- Activity Location

County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 297-Aircraft Maintenance Unit

- Activity Description:

Project is to construct additional space onto the existing facility to enable pre-staging of aircraft maintenance equipment to facilitate sortie generation. The project would include the following:
-Grading: 4,000 sf (assumed entire additional space for construction to be graded); Assumed 10% total grading area, each, for material hauled in and material hauled out. Grading depth assumed to be 12in (1 ft).
-Trenching: Assumed 150 linear ft. for installing underground electrical services to the site. Assumed trench width to be 1ft. and trench depth to be 2 ft.
-Construction: Estimated Project size 4,000 sf.
-Architectural coating: Same area (sf) as for construction, assumed

No paving was assumed to be needed, based on site profile knowledge or site visit. Also, no demolition is assumed to be needed as construction is an add-on to an existing facility.

- Activity Start Date
Start Month: 1
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 8
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.145866
SO_x	0.001842
NO_x	0.540110
CO	0.745972
PM 10	0.060304

Pollutant	Total Emissions (TONs)
PM 2.5	0.019742
Pb	0.000000
NH_3	0.000451
CO_2e	178.4

9.1 Site Grading Phase

9.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 1
Number of Days: 0

9.1.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 4000
Amount of Material to be Hauled On-Site (yd^3): 15
Amount of Material to be Hauled Off-Site (yd^3): 15

- Site Grading Default Settings

Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors/Loaders/Backhoes Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

9.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

9.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
VMT_{VE} = (HA_{OnSite} + $HA_{OffSite}$) * (1 / HC) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

9.2 Trenching/Excavating Phase

9.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

9.2.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 150
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

9.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

9.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

VMT_{VE} = (HA_{OnSite} + $HA_{OffSite}$) * (1 / HC) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

9.3 Building Construction Phase

9.3.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 6
Number of Days: 0

9.3.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft²): 4000
Height of Building (ft): 14
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

9.3.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0754	0.0013	0.5027	0.3786	0.0181	0.0181	0.0068	128.79
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

9.3.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

9.4 Architectural Coatings Phase

9.4.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date

Start Month: 8
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

9.4.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category: Non-Residential
Total Square Footage (ft^2): 4000
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

9.4.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

9.4.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase
$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)

VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

10. Construction / Demolition

10.1 General Information & Timeline Assumptions

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Hangar 565-Vertical Storage System

- Activity Description:
Project is to construct a new pre-engineered metal building to house system equipment adjacent to existing hangar. Estimated project size 8,000 sf. The project would include the following:
-Grading: 8,000 sf (assumed entire additional space for construction to be graded); Assumed 10% total grading area, each, for material hauled in and material hauled out. Grading depth assumed to be 12in (1 ft).
-Trenching: Assumed 150 linear ft. for installing underground electrical services to the site. Assumed trench width to be 1ft. and trench depth to be 2 ft.
-Construction: Prefabricated building is assumed to be installed on a concrete pad. Assume construction of a concrete pad of 15" thick and 8000 sf area. For prefab building, assumed additional construction equipment and vehicles for moving and assembly.
-Architectural coating: Prefab metal building coating assumed.

No paving was assumed to be needed, based on site profile knowledge or site visit. Also, no demolition is assumed to be needed as construction is an add-on to an existing facility.

- Activity Start Date
Start Month: 1
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 11
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.265683
SO_x	0.003043
NO_x	0.973190
CO	1.247008
PM 10	0.115969

Pollutant	Total Emissions (TONs)
PM 2.5	0.035605
Pb	0.000000
NH_3	0.000933
CO_2e	301.3

10.1 Site Grading Phase

10.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 1
Number of Days: 0

10.1.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 8000
Amount of Material to be Hauled On-Site (yd^3): 30
Amount of Material to be Hauled Off-Site (yd^3): 30

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors/Loaders/Backhoes Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

10.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**Pb**	**NH_3**	**CO_2e**
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

10.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

10.2 Trenching/Excavating Phase

10.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

10.2.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 150
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust

Average Hauling Truck Capacity (yd^3): 20 (default)

Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

10.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

10.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)

20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

10.3 Building Construction Phase

10.3.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 6
Number of Days: 0

10.3.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 8000
Height of Building (ft): 1.25
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Aerial Lifts Composite	3	4
Cement and Mortar Mixers Composite	1	2
Cranes Composite	2	6
Forklifts Composite	3	6
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

10.3.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Aerial Lifts Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0207	0.0003	0.1524	0.1658	0.0062	0.0062	0.0018	34.768
Cement and Mortar Mixers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0085	0.0001	0.0534	0.0414	0.0020	0.0020	0.0007	7.2673
Cranes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0754	0.0013	0.5027	0.3786	0.0181	0.0181	0.0068	128.79
Forklifts Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

10.3.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)

0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

10.4 Architectural Coatings Phase

10.4.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 11
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

10.4.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category: Non-Residential
Total Square Footage (ft^2): 8000
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

10.4.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

10.4.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase
$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)

2000: Conversion Factor pounds to tons

11. Construction / Demolition

11.1 General Information & Timeline Assumptions

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 314-Refueler Maintenance

- Activity Description:
Project is to construct additional R11 staging area adjacent to existing building to increase refueling efficiency. Estimated Project size 15,000 square feet. The project would include the following:
-Grading: 15,000 sf (assumed entire additional space for construction to be graded); Assumed 10% total grading area, each, for material hauled in and material hauled out. Grading depth assumed to be 12in (1 ft).
-Trenching: Assumed 150 linear ft. for installing underground electrical services to the site. Assumed trench width to be 1ft. and trench depth to be 2 ft.
-Construction: Estimated Project size 15,000 sf.
-Architectural coating: Same area (sf) as for construction, assumed

No paving was assumed to be needed, based on site profile knowledge or site visit. Also, no demolition is assumed to be needed as construction is an add-on to an existing facility.

- Activity Start Date
Start Month: 1
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 10
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.297163
SO_x	0.002301
NO_x	0.675836
CO	0.924656
PM 10	0.174356

Pollutant	Total Emissions (TONs)
PM 2.5	0.024300
Pb	0.000000
NH_3	0.000695
CO_2e	223.6

11.1 Site Grading Phase

11.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 1
Number of Days: 0

11.1.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 15000
Amount of Material to be Hauled On-Site (yd^3): 56
Amount of Material to be Hauled Off-Site (yd^3): 56

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors/Loaders/Backhoes Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

11.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

11.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)

WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

11.2 Trenching/Excavating Phase

11.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

11.2.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 150
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

11.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

11.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

VMT_{VE} = (HA_{OnSite} + $HA_{OffSite}$) * (1 / HC) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)

HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

11.3 Building Construction Phase

11.3.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 8
Number of Days: 0

11.3.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 15000
Height of Building (ft): 20
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes

Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

11.3.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0754	0.0013	0.5027	0.3786	0.0181	0.0181	0.0068	128.79
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

11.3.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

11.4 Architectural Coatings Phase

11.4.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

11.4.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category: Non-Residential
Total Square Footage (ft^2): 15000
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

11.4.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

11.4.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase
$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

12. Construction / Demolition

12.1 General Information & Timeline Assumptions

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Main Ramp-Sunshades and Lighting

- Activity Description:
The project is to install an additional 16 sunshades on existing aircraft parking ramp. Estimated Project size 90,000 square feet.
The project would include the following:
-Trenching: Assumed 250 linear ft. for installing underground electrical services (lighting) to the site. Assumed trench width to be 1ft. and trench depth to be 2 ft.
-Construction: Sunshades are prefab structures, assumed additional construction equipment and vehicles for moving and assembly.

No demolition, grading or paving is assumed as prefab sunshades installation is on existing aircraft parking (concretised or asphalted) spots.

- Activity Start Date
Start Month: 1
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 10

End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.332990
SO_x	0.005642
NO_x	2.063909
CO	2.376025
PM 10	0.078857

Pollutant	Total Emissions (TONs)
PM 2.5	0.076550
Pb	0.000000
NH_3	0.002867
CO_2e	561.3

12.1 Trenching/Excavating Phase

12.1.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 20

12.1.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 250
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

12.1.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.604	000.007	000.679	005.119	000.013	000.012		000.033	00365.157
LDGT	000.784	000.010	001.171	008.128	000.015	000.013		000.034	00488.008
HDGV	001.315	000.015	003.118	025.189	000.035	000.031		000.045	00760.452
LDDV	000.249	000.003	000.329	003.517	000.007	000.006		000.008	00371.991
LDDT	000.550	000.005	000.880	007.137	000.008	000.008		000.008	00579.910
HDDV	000.934	000.014	009.704	002.987	000.373	000.344		000.031	01586.560
MC	002.847	000.008	000.870	014.993	000.028	000.025		000.051	00396.071

12.1.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase
$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

12.2 Building Construction Phase

12.2.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 10
Number of Days: 0

12.2.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 90000
Height of Building (ft): 27
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Aerial Lifts Composite	2	4
Cranes Composite	2	6
Forklifts Composite	2	6
Generator Sets Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8
Welders Composite	3	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

12.2.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Aerial Lifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0207	0.0003	0.1524	0.1658	0.0062	0.0062	0.0018	34.768
Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0754	0.0013	0.5027	0.3786	0.0181	0.0181	0.0068	128.79
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Generator Sets Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0320	0.0006	0.2612	0.2683	0.0103	0.0103	0.0028	61.065
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879
Welders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0242	0.0003	0.1487	0.1761	0.0067	0.0067	0.0021	25.657

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

12.2.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase

$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

13. Construction / Demolition

13.1 General Information & Timeline Assumptions

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 1062-Fighter Squadron Command Section

- Activity Description:
Construct additional space to house the additional Command Section. Estimated Project size 8,000 square feet. The project would include the following:
-Grading: 8,000 sf (assumed entire additional space for construction to be graded); Assumed 10% total grading area, each, for material hauled in and material hauled out. Grading depth assumed to be 12in (1 ft).
-Trenching: Assumed 150 linear ft. for installing underground electrical services to the site. Assumed trench width to be 1ft. and trench depth to be 2 ft.
-Construction: Estimated Project size 8,000 sf.
-Architectural coating: Same area (sf) as for construction, assumed

No paving was assumed to be needed, based on site profile knowledge or site visit. Also, no demolition is assumed to be needed as construction is an add-on to an existing facility.

- Activity Start Date
Start Month: 1
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 8
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.192930
SO_x	0.001857
NO_x	0.546698
CO	0.748199
PM 10	0.100293

Pollutant	Total Emissions (TONs)
PM 2.5	0.019923
Pb	0.000000
NH_3	0.000486
CO_2e	180.1

13.1 Site Grading Phase

13.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1

Start Year: 2023

- Phase Duration
Number of Month: 1
Number of Days: 0

13.1.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 8000
Amount of Material to be Hauled On-Site (yd^3): 30
Amount of Material to be Hauled Off-Site (yd^3): 30

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors/Loaders/Backhoes Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

13.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

13.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

VMT_{VE} = (HA_{OnSite} + $HA_{OffSite}$) * (1 / HC) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)

WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

13.2 Trenching/Excavating Phase

13.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

13.2.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 150
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

13.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

13.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

VMT_{VE} = (HA_{OnSite} + $HA_{OffSite}$) * (1 / HC) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)

HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

13.3 Building Construction Phase

13.3.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 6
Number of Days: 0

13.3.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 8000
Height of Building (ft): 15
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes

Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

13.3.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0754	0.0013	0.5027	0.3786	0.0181	0.0181	0.0068	128.79
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

13.3.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

13.4 Architectural Coatings Phase

13.4.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 8
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

13.4.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category: Non-Residential
Total Square Footage (ft^2): 8000
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

13.4.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

13.4.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase
$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

14. Construction / Demolition

14.1 General Information & Timeline Assumptions

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 584-Permanent Party Dormitory

- Activity Description:
Renovate existing dormitory facility. Estimated Project size 15,575 square feet. Renovation assumed to include carpeting, repainting of walls, doors; replacement of new light fixtures; repairing of existing old/damaged mechanical and plumbing systems. The project would include the following:
-Construction/renovation: Assumed additional equipment required for renovation, moving and assembly.

No demolition, grading, trenching, or paving is assumed as renovation project of interiors.

- Activity Start Date
Start Month: 1
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 6
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.316828
SO_x	0.002556
NO_x	0.704222
CO	1.245029
PM 10	0.025833

Pollutant	Total Emissions (TONs)
PM 2.5	0.025724
Pb	0.000000
NH_3	0.001082
CO_2e	248.3

14.1 Building Construction Phase

14.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 6
Number of Days: 0

14.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 15575
Height of Building (ft): 18
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Aerial Lifts Composite	2	4
Air Compressors Composite	1	4
Forklifts Composite	4	6
Pressure Washers Composite	1	4
Tractors/Loaders/Backhoes Composite	3	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

14.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Aerial Lifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0207	0.0003	0.1524	0.1658	0.0062	0.0062	0.0018	34.768
Air Compressors Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0389	0.0007	0.2458	0.3034	0.0119	0.0119	0.0035	63.695
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Pressure Washers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0071	0.0001	0.0589	0.0536	0.0022	0.0022	0.0006	9.4297
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

14.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)

(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

14.2 Architectural Coatings Phase

14.2.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 6
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 1
Number of Days: 0

14.2.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category: Non-Residential
Total Square Footage (ft^2): 15575
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

14.2.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

14.2.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase
$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

15. Construction / Demolition

15.1 General Information & Timeline Assumptions

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 588 Fitness Center

- Activity Description:
The proposed project is to construct an addition to the existing facility for additional gymnasium space. Estimated Project size 8,000 square feet.
The project would include the following:
-Grading: 8,000 sf (assumed entire additional space for construction to be graded); Assumed 10% total grading area, each, for material hauled in and material hauled out. Grading depth assumed to be 12in (1 ft).
-Trenching: Assumed 150 linear ft. for installing underground electrical services to the site. Assumed trench width to be 1ft. and trench depth to be 2 ft.
-Construction: Estimated Project size 8,000 sf.
-Architectural coating: Same area (sf) as for construction, assumed

No paving was assumed to be needed, based on site profile knowledge or site visit. Also, no demolition is assumed to be needed as construction is an add-on to an existing facility.

- Activity Start Date
Start Month: 1
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 8
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.194141
SO_x	0.001885
NO_x	0.558698
CO	0.752257
PM 10	0.100653

Pollutant	Total Emissions (TONs)
PM 2.5	0.020253
Pb	0.000000
NH_3	0.000550
CO_2e	183.3

15.1 Site Grading Phase

15.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 1
Number of Days: 0

15.1.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 8000
Amount of Material to be Hauled On-Site (yd^3): 30
Amount of Material to be Hauled Off-Site (yd^3): 30

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors/Loaders/Backhoes Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

15.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e

Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

15.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

VMT_{VE} = (HA_{OnSite} + $HA_{OffSite}$) * (1 / HC) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

15.2 Trenching/Excavating Phase

15.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

15.2.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 150
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

15.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

15.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)

EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

15.3 Building Construction Phase

15.3.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 6
Number of Days: 0

15.3.2 Building Construction Phase Assumptions

- General Building Construction Information

Building Category: Office or Industrial
Area of Building (ft^2): 8000
Height of Building (ft): 30
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

15.3.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0754	0.0013	0.5027	0.3786	0.0181	0.0181	0.0068	128.79
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

15.3.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

VMT_{VE} = BA * BH * (0.42 / 1000) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase

VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

15.4 Architectural Coatings Phase

15.4.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 8
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

15.4.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category: Non-Residential
Total Square Footage (ft^2): 8000
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

15.4.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

15.4.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase
VMT_{WT} = (1 * WT * PA) / 800

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

16. Construction / Demolition

16.1 General Information & Timeline Assumptions

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 647-Child Development Center

- Activity Description:
The project is to construct an addition to the current facility to add two additional classrooms. Estimated project size 5,000 square feet.
The project would include the following:
-Grading: 5,000 sf (assumed entire additional space for construction to be graded); Assumed 10% total grading area, each, for material hauled in and material hauled out. Grading depth assumed to be 12in (1 ft).
-Trenching: Assumed 150 linear ft. for installing underground electrical services to the site. Assumed trench width to be 1ft. and trench depth to be 2 ft.
-Construction: Estimated Project size 5,000 sf.
-Architectural coating: Same area (sf) as for construction, assumed

No paving was assumed to be needed, based on site profile knowledge or site visit. Also, no demolition is assumed to be needed as construction is an add-on to an existing facility.

- Activity Start Date
Start Month: 1
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 8
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.157814
SO_x	0.001850
NO_x	0.543560
CO	0.747138
PM 10	0.070355

Pollutant	Total Emissions (TONs)
PM 2.5	0.019837
Pb	0.000000
NH_3	0.000470
CO_2e	179.3

16.1 Site Grading Phase

16.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 1
Number of Days: 0

16.1.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 5000
Amount of Material to be Hauled On-Site (yd^3): 19
Amount of Material to be Hauled Off-Site (yd^3): 19

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors/Loaders/Backhoes Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

16.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

16.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase
$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

16.2 Trenching/Excavating Phase

16.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

16.2.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 150
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

16.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

16.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase
$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
VMT_{VE} = (HA_{OnSite} + $HA_{OffSite}$) * (1 / HC) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

16.3 Building Construction Phase

16.3.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 6
Number of Days: 0

16.3.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 5000
Height of Building (ft): 18
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips

Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

16.3.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0754	0.0013	0.5027	0.3786	0.0181	0.0181	0.0068	128.79
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

16.3.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds

EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

16.4 Architectural Coatings Phase

16.4.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 8
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

16.4.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information

Building Category: Non-Residential
Total Square Footage (ft^2): 5000
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

16.4.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

16.4.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase
$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

17. Construction / Demolition

17.1 General Information & Timeline Assumptions

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 648 Youth Center/School Age Program

- Activity Description:
The proposed project is to renovate the facility to increase efficiency. Construct an addition for two new instructional spaces. Estimated project size 8,000 square feet. Renovation assumed to include carpeting, repainting of walls, doors; replacement of new light fixtures; repairing of existing old/damaged mechanical and plumbing systems. For renovation, assumed additional moving and renovation equipment .
-Construction/renovation: Assumed additional equipment required for renovation, moving and assembly.

No demolition, grading, trenching, or paving is assumed as renovation project of interiors.

- Activity Start Date
Start Month: 1
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 8
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.228438
SO_x	0.002546
NO_x	0.700078
CO	1.242322
PM 10	0.025709

Pollutant	Total Emissions (TONs)
PM 2.5	0.025610
Pb	0.000000
NH_3	0.001053
CO_2e	247.1

17.1 Building Construction Phase

17.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 6
Number of Days: 0

17.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 8000
Height of Building (ft): 30

Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: No
Average Day(s) worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Aerial Lifts Composite	2	4
Air Compressors Composite	1	4
Forklifts Composite	4	6
Pressure Washers Composite	1	4
Tractors/Loaders/Backhoes Composite	3	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

17.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Aerial Lifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0207	0.0003	0.1524	0.1658	0.0062	0.0062	0.0018	34.768
Air Compressors Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0389	0.0007	0.2458	0.3034	0.0119	0.0119	0.0035	63.695
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Pressure Washers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0071	0.0001	0.0589	0.0536	0.0022	0.0022	0.0006	9.4297
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

17.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)

2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

17.2 Architectural Coatings Phase

17.2.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 8
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

17.2.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category: Non-Residential
Total Square Footage (ft^2): 8000
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

17.2.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

17.2.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase

$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase

$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

18. Heating

18.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 297-Heating

- Activity Description:
Assumed a new NG boiler for additional new space comfort heating.

- Activity Start Date
Start Month: 1
Start Year: 2024

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.000844
SO_x	0.000092
NO_x	0.015352
CO	0.012896
PM 10	0.001167

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.001167
Pb	0.000000
NH_3	0.000000
CO_2e	18.5

18.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 4000
Type of fuel: Natural Gas
Type of boiler/furnace: Commercial/Institutional (0.3 - 9.9 MMBtu/hr)
Heat Value (MMBtu/ft^3): 0.00105
Energy Intensity (MMBtu/ft^2): 0.0806

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

18.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000000 scf)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
5.5	0.6	100	84	7.6	7.6			120390

18.4 Heating Formula(s)

- Heating Fuel Consumption ft^3 per Year
FC_{HER}= HA * EI / HV / 1000000

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement (MMBtu/ft^2)
HV: Heat Value (MMBTU/ft^3)
1000000: Conversion Factor

- Heating Emissions per Year
HE_{POL}= FC * EF_{POL} / 2000

HE_{POL}: Heating Emission Emissions (TONs)

FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

19. Heating

19.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Hangar 565-Vertical Tank Storage System Heating

- Activity Description:
Assumed new NG boiler for new building comfort heating.

- Activity Start Date
Start Month: 1
Start Year: 2024

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.001902
SO_x	0.000208
NO_x	0.034590
CO	0.029056
PM 10	0.002629

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.002629
Pb	0.000000
NH_3	0.000000
CO_2e	41.6

19.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 8000
Type of fuel: Natural Gas
Type of boiler/furnace: Commercial/Institutional (0.3 - 9.9 MMBtu/hr)
Heat Value (MMBtu/ft^3): 0.00105
Energy Intensity (MMBtu/ft^2): 0.0908

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

19.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000000 scf)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
5.5	0.6	100	84	7.6	7.6			120390

19.4 Heating Formula(s)

- Heating Fuel Consumption ft³ per Year

FC_{HER}= HA * EI / HV / 1000000

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement ($MMBtu/ft^2$)
HV: Heat Value ($MMBTU/ft^3$)
1000000: Conversion Factor

- Heating Emissions per Year

HE_{POL}= FC * EF_{POL} / 2000

HE_{POL}: Heating Emission Emissions (TONs)
FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

20. Heating

20.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 314-Refueler Maintenance

- Activity Description:
Assumed new boiler for new building comfort heating.

- Activity Start Date
Start Month: 1
Start Year: 2024

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.002817
SO_x	0.000307
NO_x	0.051214
CO	0.043020
PM 10	0.003892

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.003892
Pb	0.000000
NH_3	0.000000
CO_2e	61.7

20.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 15000
Type of fuel: Natural Gas
Type of boiler/furnace: Commercial/Institutional (0.3 - 9.9 MMBtu/hr)
Heat Value (MMBtu/ft^3): 0.00105
Energy Intensity (MMBtu/ft^2): 0.0717

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

20.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000000 scf)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
5.5	0.6	100	84	7.6	7.6			120390

20.4 Heating Formula(s)

- Heating Fuel Consumption ft^3 per Year
FC_{HER}= HA * EI / HV / 1000000

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement (MMBtu/ft^2)
HV: Heat Value (MMBTU/ft^3)
1000000: Conversion Factor

- Heating Emissions per Year
HE_{POL}= FC * EF_{POL} / 2000

HE_{POL}: Heating Emission Emissions (TONs)
FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

21. Heating

21.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 1062-Fighter Squadron Command Section

- Activity Description:
Assumed NG heating for the additional new space comfort heating.

- Activity Start Date
Start Month: 1
Start Year: 2024

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.001902
SO_x	0.000208
NO_x	0.034590
CO	0.029056
PM 10	0.002629

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.002629
Pb	0.000000
NH_3	0.000000
CO_2e	41.6

21.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 8000
Type of fuel: Natural Gas
Type of boiler/furnace: Commercial/Institutional (0.3 - 9.9 MMBtu/hr)
Heat Value (MMBtu/ft^3): 0.00105
Energy Intensity (MMBtu/ft^2): 0.0908

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

21.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000000 scf)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
5.5	0.6	100	84	7.6	7.6			120390

21.4 Heating Formula(s)

- Heating Fuel Consumption ft^3 per Year
FC_{HER}= HA * EI / HV / 1000000

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement (MMBtu/ft^2)
HV: Heat Value (MMBTU/ft^3)
1000000: Conversion Factor

- Heating Emissions per Year
HE_{POL}= FC * EF_{POL} / 2000

HE_{POL}: Heating Emission Emissions (TONs)
FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

22. Heating

22.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 588-Fitness Center

- Activity Description:
Assumed NG heating for additional new space comfort heating.

- Activity Start Date
Start Month: 1
Start Year: 2024

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.001902
SO_x	0.000208
NO_x	0.034590
CO	0.029056
PM 10	0.002629

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.002629
Pb	0.000000
NH_3	0.000000
CO_2e	41.6

22.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 8000
Type of fuel: Natural Gas
Type of boiler/furnace: Commercial/Institutional (0.3 - 9.9 MMBtu/hr)
Heat Value (MMBtu/ft^3): 0.00105
Energy Intensity (MMBtu/ft^2): 0.0908

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

22.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000000 scf)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
5.5	0.6	100	84	7.6	7.6			120390

22.4 Heating Formula(s)

- Heating Fuel Consumption ft^3 per Year
FC_{HER}= HA * EI / HV / 1000000

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement (MMBtu/ft^2)
HV: Heat Value (MMBTU/ft^3)
1000000: Conversion Factor

- Heating Emissions per Year
HE_{POL}= FC * EF_{POL} / 2000

HE_{POL}: Heating Emission Emissions (TONs)
FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

23. Heating

23.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 647

- Activity Description:
Assumed NG heating for the additional new space comfort heating.

- Activity Start Date
Start Month: 1
Start Year: 2024

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.001506
SO_x	0.000164
NO_x	0.027381
CO	0.023000
PM 10	0.002081

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.002081
Pb	0.000000
NH_3	0.000000
CO_2e	33.0

23.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 5000
Type of fuel: Natural Gas
Type of boiler/furnace: Commercial/Institutional (0.3 - 9.9 MMBtu/hr)
Heat Value (MMBtu/ft^3): 0.00105
Energy Intensity (MMBtu/ft^2): 0.115

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

23.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000000 scf)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
5.5	0.6	100	84	7.6	7.6			120390

23.4 Heating Formula(s)

- Heating Fuel Consumption ft^3 per Year
FC_{HER}= HA * EI / HV / 1000000

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement (MMBtu/ft^2)
HV: Heat Value (MMBTU/ft^3)
1000000: Conversion Factor

- Heating Emissions per Year
HE_{POL}= FC * EF_{POL} / 2000

HE_{POL}: Heating Emission Emissions (TONs)
FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

24. Heating

24.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 648 Youth Center/School Age Program

- Activity Description:
Assumed NG heating for new additional space for comfort heating.

- Activity Start Date
Start Month: 1
Start Year: 2024

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.001902
SO_x	0.000208
NO_x	0.034590
CO	0.029056
PM 10	0.002629

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.002629
Pb	0.000000
NH_3	0.000000
CO_2e	41.6

24.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 8000
Type of fuel: Natural Gas
Type of boiler/furnace: Commercial/Institutional (0.3 - 9.9 MMBtu/hr)
Heat Value (MMBtu/ft^3): 0.00105
Energy Intensity (MMBtu/ft^2): 0.0908

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

24.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000000 scf)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
5.5	0.6	100	84	7.6	7.6			120390

24.4 Heating Formula(s)

- Heating Fuel Consumption ft^3 per Year
FC_{HER}= HA * EI / HV / 1000000

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement ($MMBtu/ft^2$)
HV: Heat Value ($MMBTU/ft^3$)
1000000: Conversion Factor

- Heating Emissions per Year
HE_{POL}= FC * EF_{POL} / 2000

HE_{POL}: Heating Emission Emissions (TONs)
FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

25. Construction / Demolition

25.1 General Information & Timeline Assumptions

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 293 - Aircraft Maintenance Unit

- Activity Description:
Project is to construct additional space onto the existing facility to enable pre-staging of aircraft maintenance equipment to facilitate sortie generation. The project would include the following:
-Grading: 4,000 sf (assumed entire additional space for construction to be graded); Assumed 10% total grading area, each, for material hauled in and material hauled out. Grading depth assumed to be 12in (1 ft).
-Trenching: Assumed 150 linear ft. for installing underground electrical services to the site. Assumed trench width to be 1ft. and trench depth to be 2 ft.
-Construction: Estimated Project size 4,000 sf.
-Architectural coating: Same area (sf) as for construction, assumed

No paving was assumed to be needed, based on site profile knowledge or site visit. Also, no demolition is assumed to be needed as construction is an add-on to an existing facility.

- Activity Start Date
Start Month: 1
Start Month: 2023

- Activity End Date
Indefinite: False
End Month: 8
End Month: 2023

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.145866
SO_x	0.001842
NO_x	0.540110
CO	0.745972
PM 10	0.060304

Pollutant	Total Emissions (TONs)
PM 2.5	0.019742
Pb	0.000000
NH_3	0.000451
CO_2e	178.4

25.1 Site Grading Phase

25.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 1
Number of Days: 0

25.1.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 4000
Amount of Material to be Hauled On-Site (yd^3): 15
Amount of Material to be Hauled Off-Site (yd^3): 15

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Tractors/Loaders/Backhoes Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

25.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**Pb**	**NH_3**	**CO_2e**
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

25.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

VMT_{VE} = (HA_{OnSite} + $HA_{OffSite}$) * (1 / HC) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

25.2 Trenching/Excavating Phase

25.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

25.2.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 150
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

25.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0757	0.0014	0.4155	0.5717	0.0191	0.0191	0.0068	132.91
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0483	0.0012	0.2497	0.3481	0.0091	0.0091	0.0043	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1830	0.0024	1.2623	0.7077	0.0494	0.0494	0.0165	239.49
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

25.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase
$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

25.3 Building Construction Phase

25.3.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 2
Start Year: 2023

- Phase Duration
Number of Month: 6

Number of Days: 0

25.3.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 4000
Height of Building (ft): 14
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

25.3.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0754	0.0013	0.5027	0.3786	0.0181	0.0181	0.0068	128.79
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0258	0.0006	0.1108	0.2145	0.0034	0.0034	0.0023	54.454
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	0.0032	66.879

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

25.3.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)

2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

25.4 Architectural Coatings Phase

25.4.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 8
Start Quarter: 1
Start Year: 2023

- Phase Duration
Number of Month: 0
Number of Days: 15

25.4.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category: Non-Residential
Total Square Footage (ft^2): 4000
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

25.4.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.309	000.002	000.239	003.421	000.007	000.006		000.023	00318.896
LDGT	000.374	000.003	000.418	004.700	000.009	000.008		000.024	00411.188
HDGV	000.696	000.005	001.076	015.187	000.021	000.019		000.044	00758.535
LDDV	000.115	000.003	000.139	002.492	000.004	000.004		000.008	00309.094
LDDT	000.250	000.004	000.394	004.238	000.007	000.006		000.008	00438.938
HDDV	000.572	000.013	005.669	001.917	000.170	000.156		000.030	01506.304
MC	002.734	000.003	000.845	013.302	000.027	000.023		000.055	00396.858

25.4.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase

$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase

$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

26. Heating

26.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 293 - Heating

- Activity Description:
Assumed a new NG boiler for additional new space comfort heating.

- Activity Start Date
Start Month: 1
Start Year: 2024

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.000844
SO_x	0.000092
NO_x	0.015352
CO	0.012896
PM 10	0.001167

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.001167
Pb	0.000000
NH_3	0.000000
CO_2e	18.5

26.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 4000
Type of fuel: Natural Gas
Type of boiler/furnace: Commercial/Institutional (0.3 - 9.9 MMBtu/hr)
Heat Value (MMBtu/ft^3): 0.00105
Energy Intensity (MMBtu/ft^2): 0.0806

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

26.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000000 scf)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
5.5	0.6	100	84	7.6	7.6			120390

26.4 Heating Formula(s)

- Heating Fuel Consumption ft^3 per Year
FC_{HER}= HA * EI / HV / 1000000

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement (MMBtu/ft^2)
HV: Heat Value (MMBTU/ft^3)
1000000: Conversion Factor

- Heating Emissions per Year
HE_{POL}= FC * EF_{POL} / 2000

HE_{POL}: Heating Emission Emissions (TONs)

FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

D.2.2 Summary Air Conformity Applicability Model Report Record of Air Analysis (ROAA)

Alternative 1-Holloman AFB

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: HOLLOMAN AFB
State: New Mexico
County(s): Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: F 16 Formal Training Unit Permanent Beddown and Relocation, Holloman AFB, New Mexico

c. Project Number/s (if applicable): N/A

d. Projected Action Start Date: 1 / 2023

e. Action Description:

The Air Force is proposing to permanently beddown additional F 16 FTU squadrons in support of the Formal Training Unit Permanent Beddown and Relocation Plan. The Proposed Action will allow AETC to continue to optimize fighter pilot production in order to meet their mission.

The Proposed Action would include the permanent relocation of the F 16 aircraft; the pilot, maintenance, and support personnel; and support vehicles and equipment. The permanent relocation of the F 16 FTU may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities, as well as for administrative functions by FTU personnel.

Under Alternative 1, an additional squadron comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory (BAI) F 16 Block 40 aircraft, currently based at Holloman AFB on an interim basis, would be permanently relocated at Holloman AFB as the 8 FS.

Under Alternative 2, the squadron of F 16 aircraft FTU, comprised of 25 PAA with 2 BAI F 16 Block 40 aircraft currently based at Holloman AFB on an interim basis would be permanently relocated at Holloman AFB as the 8 FS and an additional F 16 aircraft FTU squadron, comprised of a 25 PAA of either Block 40 or 42 aircraft would be permanently relocated at Holloman AFB.

f. Point of Contact:
Name: Radhika Narayanan
Title: Environmental Scientist
Organization: Versar LLC
Email: rnarayanan@versar.com
Phone Number:

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total net direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the start of the action through achieving "steady state" (i.e., net gain/loss upon action fully implemented) emissions. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the USAF Air Emissions Guide for Air Force Stationary Sources, the USAF Air Emissions Guide for Air Force Mobile Sources, and the USAF Air Emissions Guide for Air Force Transitory Sources.

"Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the National Ambient Air Quality Standards (NAAQSs). These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold for actions occurring in areas that are "Clearly Attainment" (i.e., not within 5% of any NAAQS) and the GCR de minimis values (25 ton/yr for lead and 100 ton/yr for all other criteria pollutants) for actions occurring in areas that are "Near Nonattainment" (i.e., within 5% of any NAAQS). These indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQSs. For further detail on insignificance indicators see chapter 4 of the Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide, Volume II - Advanced Assessments.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicator and are summarized below.

Analysis Summary:

2023

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.709	250	No
NOx	2.189	250	No
CO	2.918	250	No
SOx	0.007	250	No
PM 10	0.351	250	No
PM 2.5	0.080	250	No
Pb	0.000	25	No
NH3	0.002	250	No
CO2e	703.3		

2024

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance(Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.006	250	No
NOx	0.101	250	No
CO	0.085	250	No
SOx	0.001	250	No
PM 10	0.008	250	No
PM 2.5	0.008	250	No
Pb	0.000	25	No

2024

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance(Yes or No)
NH3	0.000	250	No
CO2e	121.8		

2025 - (Steady State)

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.006	250	No
NOx	0.101	250	No
CO	0.085	250	No
SOx	0.001	250	No
PM 10	0.008	250	No
PM 2.5	0.008	250	No
Pb	0.000	25	No
NH3	0.000	250	No
CO2e	121.8		

None of estimated annual net emissions associated with this action are above the insignificance indicators, indicating no significant impact to air quality. Therefore, the action will not cause or contribute to an exceedance on one or more NAAQSs. No further air assessment is needed.

Radhika

Radhika Narayanan, Environmental Scientist

8/29/2022
DATE

Alternative 2-Holloman AFB Airfield

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: HOLLOMAN AFB
State: New Mexico
County(s): Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: F 16 Formal Training Unit Permanent Beddown and Relocation, Holloman AFB, New Mexico

c. Project Number/s (if applicable): N/A

d. Projected Action Start Date: 1 / 2023

e. Action Description:

The Air Force is proposing to permanently beddown additional F 16 FTU squadrons in support of the Formal Training Unit Permanent Beddown and Relocation Plan. The Proposed Action will allow AETC to continue to optimize fighter pilot production in order to meet their mission.

The Proposed Action would include the permanent relocation of the F 16 aircraft; the pilot, maintenance, and support personnel; and support vehicles and equipment. The permanent relocation of the F 16 FTU may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities, as well as for administrative functions by FTU personnel.

Under Alternative 1, an additional squadron comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory (BAI) F 16 Block 40 aircraft, currently based at Holloman AFB on an interim basis, would be permanently relocated at Holloman AFB as the 8 FS.

Under Alternative 2, the squadron of F 16 aircraft FTU, comprised of 25 PAA with 2 BAI F 16 Block 40 aircraft currently based at Holloman AFB on an interim basis would be permanently relocated at Holloman AFB as the 8 FS and an additional F 16 aircraft FTU squadron, comprised of a 25 PAA of either Block 40 or 42 aircraft would be permanently relocated at Holloman AFB.

f. Point of Contact:
Name: Radhika Narayanan
Title: Environmental Scientist
Organization: Versar LLC
Email: rnarayanan@versar.com
Phone Number:

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total net direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the start of the action through achieving "steady state" (i.e., net gain/loss upon action fully implemented) emissions. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the USAF Air Emissions Guide for Air Force Stationary Sources, the USAF Air Emissions Guide for Air Force Mobile Sources, and the USAF Air Emissions Guide for Air Force Transitory Sources.

"Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the National Ambient Air Quality Standards (NAAQSs). These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold for actions occurring in areas that are "Clearly Attainment" (i.e., not within 5% of any NAAQS) and the GCR de minimis values (25 ton/yr for lead and 100 ton/yr for all other criteria pollutants) for actions occurring in areas that are "Near Nonattainment" (i.e., within 5% of any NAAQS). These indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQSs. For further detail on insignificance indicators see chapter 4 of the Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide, Volume II - Advanced Assessments.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicator and are summarized below.

Analysis Summary:

2023

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	15.264	250	No
NOx	100.958	250	No
CO	134.797	250	No
SOx	8.472	250	No
PM 10	12.828	250	No
PM 2.5	8.478	250	No
Pb	0.000	25	No
NH3	0.074	250	No
CO2e	24431.2		

*: CO and NOx exceedance column has been changed manually to indicate "No." ACAM erroneously indicated exceedance as "Yes" even though emissions were below indicator levels.

2024

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	13.145	250	No
NOx	93.884	250	No
CO	124.963	250	No
SOx	8.450	250	No
PM 10	12.093	250	No
PM 2.5	8.228	250	No
Pb	0.000	25	No
NH3	0.066	250	No
CO2e	22408.1		

*: CO Exceedance column has been changed manually to indicate "No." ACAM erroneously indicated exceedance as "Yes" even though emissions were below indicator levels.

2025 - (Steady State)

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	13.145	250	No
NOx	93.884	250	No
CO	124.963	250	No
SOx	8.450	250	No
PM 10	12.093	250	No
PM 2.5	8.228	250	No
Pb	0.000	25	No
NH3	0.066	250	No
CO2e	22408.1		

*: CO Exceedance column has been changed manually to indicate “No.” ACAM erroneously indicated exceedance as “Yes” even though emissions were below indicator levels.

The steady state estimated annual net emissions associated with this action exceed the insignificance indicators, indicating a potential for a significant impact to air quality. Therefore, the ACAM analysis is inconclusive and further air quality impact assessment is needed.

8/29/2022

Radhika Narayanan, Environmental Scientist — DATE

Alternative 2-ROW Airfield

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: HOLLOMAN AFB
State: New Mexico
County(s): Chaves
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: F 16 Formal Training Unit Permanent Beddown and Relocation, Holloman AFB, New Mexico

c. Project Number/s (if applicable): N/A

d. Projected Action Start Date: 1 / 2023

e. Action Description:

The Air Force is proposing to permanently beddown additional F 16 FTU squadrons in support of the Formal Training Unit Permanent Beddown and Relocation Plan. The Proposed Action will allow AETC to continue to optimize fighter pilot production in order to meet their mission.

The Proposed Action would include the permanent relocation of the F 16 aircraft; the pilot, maintenance, and support personnel; and support vehicles and equipment. The permanent relocation of the F 16 FTU may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities, as well as for administrative functions by FTU personnel.

Under Alternative 1, an additional squadron comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory (BAI) F 16 Block 40 aircraft, currently based at Holloman AFB on an interim basis, would be permanently relocated at Holloman AFB as the 8 FS.

Under Alternative 2, the squadron of F 16 aircraft FTU, comprised of 25 PAA with 2 BAI F 16 Block 40 aircraft currently based at Holloman AFB on an interim basis would be permanently relocated at Holloman AFB as the 8 FS and an additional F 16 aircraft FTU squadron, comprised of a 25 PAA of either Block 40 or 42 aircraft would be permanently relocated at Holloman AFB.

f. Point of Contact:
Name: Radhika Narayanan
Title: Environmental Scientist
Organization: Versar LLC
Email: rnarayanan@versar.com
Phone Number:

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total net direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the start of the action through achieving "steady state" (i.e., net gain/loss upon action fully implemented) emissions. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the USAF Air Emissions Guide for Air Force Stationary Sources, the USAF Air Emissions Guide for Air Force Mobile Sources, and the USAF Air Emissions Guide for Air Force Transitory Sources.

"Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the National Ambient Air Quality Standards (NAAQSs). These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold for actions occurring in areas that are "Clearly Attainment" (i.e., not within 5% of any NAAQS) and the GCR de minimis values (25 ton/yr for lead and 100 ton/yr for all other criteria pollutants) for actions occurring in areas that are "Near Nonattainment" (i.e., within 5% of any NAAQS). These indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQSs. For further detail on insignificance indicators see chapter 4 of the Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide, Volume II - Advanced Assessments.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicator and are summarized below.

Analysis Summary:

2023

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.449	250	No
NOx	18.544	250	No
CO	16.595	250	No
SOx	1.240	250	No
PM 10	1.469	250	No
PM 2.5	1.046	250	No
Pb	0.000	25	No
NH3	0.000	250	No
CO2e	3652.9		

2024 - (Steady State)

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.449	250	No
NOx	18.544	250	No
CO	16.595	250	No
SOx	1.240	250	No
PM 10	1.469	250	No
PM 2.5	1.046	250	No
Pb	0.000	25	No
NH3	0.000	250	No
CO2e	3652.9		

None of estimated annual net emissions associated with this action are above the insignificance indicators, indicating no significant impact to air quality. Therefore, the action will not cause or contribute to an exceedance on one or more NAAQSs. No further air assessment is needed.

Radhika

8/29/2022

Radhika Narayanan, Environmental Scientist | DATE

Alternative 2-Special Use irspace

McGregor Range

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: HOLLOMAN AFB
State: New Mexico
County(s): Otero
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: F 16 Formal Training Unit Permanent Beddown and Relocation, Holloman AFB, New Mexico

c. Project Number/s (if applicable): N/A

d. Projected Action Start Date: 1 / 2023

e. Action Description:

The Air Force is proposing to permanently beddown additional F 16 FTU squadrons in support of the Formal Training Unit Permanent Beddown and Relocation Plan. The Proposed Action will allow AETC to continue to optimize fighter pilot production in order to meet their mission.

The Proposed Action would include the permanent relocation of the F 16 aircraft; the pilot, maintenance, and support personnel; and support vehicles and equipment. The permanent relocation of the F 16 FTU may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities, as well as for administrative functions by FTU personnel.

Under Alternative 1, an additional squadron comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory (BAI) F 16 Block 40 aircraft, currently based at Holloman AFB on an interim basis, would be permanently relocated at Holloman AFB as the 8 FS.

Under Alternative 2, the squadron of F 16 aircraft FTU, comprised of 25 PAA with 2 BAI F 16 Block 40 aircraft currently based at Holloman AFB on an interim basis would be permanently relocated at Holloman AFB as the 8 FS and an additional F 16 aircraft FTU squadron, comprised of a 25 PAA of either Block 40 or 42 aircraft would be permanently relocated at Holloman AFB.

f. Point of Contact:
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Organization: Versar LLC
Email: rnarayanan@versar.com
Phone Number:

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total net direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the start of the action through achieving "steady state" (i.e., net gain/loss upon action fully implemented) emissions. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the USAF Air Emissions Guide for Air Force Stationary Sources, the USAF Air Emissions Guide for Air Force Mobile Sources, and the USAF Air Emissions Guide for Air Force Transitory Sources.

"Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the National Ambient Air Quality Standards (NAAQSs). These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold for actions occurring in areas that are "Clearly Attainment" (i.e., not within 5% of any NAAQS) and the GCR de minimis values (25 ton/yr for lead and 100 ton/yr for all other criteria pollutants) for actions occurring in areas that are "Near Nonattainment" (i.e., within 5% of any NAAQS). These indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQSs. For further detail on insignificance indicators see chapter 4 of the Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide, Volume II - Advanced Assessments.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicator and are summarized below.

Analysis Summary:

2023

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.157	250	No
NOx	16.746	250	No
CO	9.420	250	No
SOx	0.680	250	No
PM 10	0.453	250	No
PM 2.5	0.338	250	No
Pb	0.000	25	No
NH3	0.000	250	No
CO2e	1917.5		

2024 - (Steady State)

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.157	250	No
NOx	16.746	250	No
CO	9.420	250	No
SOx	0.680	250	No
PM 10	0.453	250	No
PM 2.5	0.338	250	No
Pb	0.000	25	No
NH3	0.000	250	No
CO2e	1917.5		

None of estimated annual net emissions associated with this action are above the insignificance indicators, indicating no significant impact to air quality. Therefore, the action will not cause or contribute to an exceedance on one or more NAAQSs. No further air assessment is needed.

8/29/2022

Radhika Narayanan, Environmental Scientist — DATE

Alternative 2-Special Use Airspace

Pecos Military Operation Areas

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: HOLLOMAN AFB
State: New Mexico
County(s): Chaves; De Baca; Lincoln; Guadalupe; Roosevelt
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: F 16 Formal Training Unit Permanent Beddown and Relocation, Holloman AFB, New Mexico

c. Project Number/s (if applicable): N/A

d. Projected Action Start Date: 1 / 2023

e. Action Description:

The Air Force is proposing to permanently beddown additional F 16 FTU squadrons in support of the Formal Training Unit Permanent Beddown and Relocation Plan. The Proposed Action will allow AETC to continue to optimize fighter pilot production in order to meet their mission.

The Proposed Action would include the permanent relocation of the F 16 aircraft; the pilot, maintenance, and support personnel; and support vehicles and equipment. The permanent relocation of the F 16 FTU may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities, as well as for administrative functions by FTU personnel.

Under Alternative 1, an additional squadron comprised of 25 Primary Aircraft Assigned (PAA) with 2 Backup Aircraft Inventory (BAI) F 16 Block 40 aircraft, currently based at Holloman AFB on an interim basis, would be permanently relocated at Holloman AFB as the 8 FS.

Under Alternative 2, the squadron of F 16 aircraft FTU, comprised of 25 PAA with 2 BAI F 16 Block 40 aircraft currently based at Holloman AFB on an interim basis would be permanently relocated at Holloman AFB as the 8 FS and an additional F 16 aircraft FTU squadron, comprised of a 25 PAA of either Block 40 or 42 aircraft would be permanently relocated at Holloman AFB.

f. Point of Contact:
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Email: rnarayanan@versar.com
Phone Number:

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total net direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the start of the action through achieving "steady state" (i.e., net gain/loss upon action fully implemented) emissions. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the USAF Air Emissions Guide for Air Force Stationary Sources, the USAF Air Emissions Guide for Air Force Mobile Sources, and the USAF Air Emissions Guide for Air Force Transitory Sources.

"Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the National Ambient Air Quality Standards (NAAQSs). These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold for actions occurring in areas that are "Clearly Attainment" (i.e., not within 5% of any NAAQS) and the GCR de minimis values (25 ton/yr for lead and 100 ton/yr for all other criteria pollutants) for actions occurring in areas that are "Near Nonattainment" (i.e., within 5% of any NAAQS). These indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQSs. For further detail on insignificance indicators see chapter 4 of the Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide, Volume II - Advanced Assessments.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicator and are summarized below.

Analysis Summary:

2023

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.005	250	No
NOx	0.533	250	No
CO	0.300	250	No
SOx	0.022	250	No
PM 10	0.014	250	No
PM 2.5	0.011	250	No
Pb	0.000	25	No
NH3	0.000	250	No
CO2e	61.1		

2024 - (Steady State)

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.005	250	No
NOx	0.533	250	No
CO	0.300	250	No
SOx	0.022	250	No
PM 10	0.014	250	No
PM 2.5	0.011	250	No
Pb	0.000	25	No
NH3	0.000	250	No
CO2e	61.1		

None of estimated annual net emissions associated with this action are above the insignificance indicators, indicating no significant impact to air quality. Therefore, the action will not cause or contribute to an exceedance on one or more NAAQSs. No further air assessment is needed.

Radhika

8/29/2022

Radhika Narayanan, Environmental Scientist

DATE

Alternative 2-Special Use Airspace

WSMR

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: HOLLOMAN AFB
State: New Mexico
County(s): Otero; Socorro; Dona Ana; Sierra; Lincoln; Torrance
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: F 16 Formal Training Unit Permanent Beddown and Relocation, Holloman AFB, New Mexico

c. Project Number/s (if applicable): N/A

d. Projected Action Start Date: 1 / 2023

e. Action Description:

The Air Force is proposing to permanently beddown additional F 16 FTU squadrons in support of the Formal Training Unit Permanent Beddown and Relocation Plan. The Proposed Action will allow AETC to continue to optimize fighter pilot production in order to meet their mission.

The Proposed Action would include the permanent relocation of the F 16 aircraft; the pilot, maintenance, and support personnel; and support vehicles and equipment. The permanent relocation of the F 16 FTU may require minor construction and interior modifications of the facilities selected for use for aircraft and back-shop maintenance and support activities, as well as for administrative functions by FTU personnel.

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f. Point of Contact:
Name: Radhika Narayanan
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Email: rnarayanan@versar.com
Phone Number:

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total net direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the start of the action through achieving "steady state" (i.e., net gain/loss upon action fully implemented) emissions. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the USAF Air Emissions Guide for Air Force Stationary Sources, the USAF Air Emissions Guide for Air Force Mobile Sources, and the USAF Air Emissions Guide for Air Force Transitory Sources.

"Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the National Ambient Air Quality Standards (NAAQSs). These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold for actions occurring in areas that are "Clearly Attainment" (i.e., not within 5% of any NAAQS) and the GCR de minimis values (25 ton/yr for lead and 100 ton/yr for all other criteria pollutants) for actions occurring in areas that are "Near Nonattainment" (i.e., within 5% of any NAAQS). These indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQSs. For further detail on insignificance indicators see chapter 4 of the Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide, Volume II - Advanced Assessments.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicator and are summarized below.

Analysis Summary:

2023

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.934	100	No
NOx	99.942	100	No
CO	56.221	250	No
SOx	4.056	250	No
PM 10	2.703	100	No
PM 2.5	2.018	250	No
Pb	0.000	25	No
NH3	0.000	250	No
CO2e	11443.9		

2024 - (Steady State)

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.934	100	No
NOx	99.942	100	No
CO	56.221	250	No
SOx	4.056	250	No
PM 10	2.703	100	No
PM 2.5	2.018	250	No
Pb	0.000	25	No
NH3	0.000	250	No
CO2e	11443.9		

None of estimated annual net emissions associated with this action are above the insignificance indicators, indicating no significant impact to air quality. Therefore, the action will not cause or contribute to an exceedance on one or more NAAQSs. No further air assessment is needed.

Radhika

8/29/2022

Radhika Narayanan, Environmental Scientist DATE

APPENDIX E
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LIST OF PREPARERS AND CONTRIBUTORS

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APPENDIX F
GLOSSARY OF TERMS

Above ground level (AGL): Altitude expressed in feet measured above the surface of the ground. Altitudes are referred to as mean sea level (MSL) when flying above water; while flying over land, both MSL and AGL are used to delineate airspace structure.

BDU-33: A 25-pound practice bomb used to simulate the delivery ballistics of a 500-pound MK-82 general purpose bomb in the low drag configuration. It is constructed with cast-iron and steel with a spotting charge that releases a cloud of smoke upon impact. The BDU-33 contains signal devices to aid in visual scoring that are generally “hot” or “cold.” The hot spot contains a phosphorus component that upon impact expels a short-lived flame followed by white smoke. The cold spot BDU-33 is a nonexplosive training munitions that use titanium tetrachloride and produce smoke. Unlike the “hot” signal, the “cold” signal does not produce a flame on impact; therefore, the “cold” signal is typically used when fire conditions are high, although the cold signal cannot be used for night scoring in training

Captive air training missiles (CATMs): A captive store carried by aircraft used to simulate aircraft-launched missiles. These assets are similar in weight, center of gravity and appearance of the live counterparts. While the rocket motors and warheads of these assets are inert, the guidance system is typically operational so that it can be interfaced with the aircraft for targeting training from the cockpit.

Class A Airspace: Controlled airspace of defined dimensions within which Air Traffic Control service is provided and all operations must occur under Instrument Flight Rules (IFR). Class A Airspace is generally from 18,000 feet (ft) MSL up to and including 60,000 ft MSL and includes airspace overlying waters within 12 nautical miles of the coast of the 48 contiguous US and Alaska.

Countermeasure Chaff: An electronic countermeasure designed to reflect radar waves and obscure aircraft, ships, and other equipment from radar tracking sources. Chaff bundles consist of millions of nonhazardous aluminum-coated glass fibers. When ejected from the aircraft, these fibers disperse widely in the air, forming an electromagnetic screen that temporarily hides the aircraft from radar and forms a radar decoy, allowing the aircraft to defensively maneuver or leave the area.

Countermeasure Flares: Magnesium pellets ejected from military aircraft and provide high-temperature heat sources that act as decoys for heat-seeking weapons targeting the aircraft. These defensive countermeasures are utilized to keep aircraft from being successfully targeted by or escape from weapons such as surface-to-air missiles, air-to-air missiles, antiaircraft artillery, and other aircraft.

Flight Level (FL): Flight level is vertical altitude expressed in hundreds of feet.

Flight Turn Pattern: An aircraft scheduling function designed to allow aircraft to fly, land, complete appropriate post flight inspections, refuel, and fly again. A turn pattern of 8 x 6 does not require 14 aircraft to execute but rather could be filled with only 8 aircraft (notwithstanding impacts of broken aircraft and airspace schedules). The turn pattern and total daily sorties are the same for environmental purposes, because they both indicate the number of takeoffs and landings for any given day. An 8 x 6 turn represents 14 total sorties for the day even though those sorties may have been flown with only 8 total aircraft.

Inert Training Munitions: These include BDU-50 and BDU-56 inert bombs, inert GBU-12 laser-guided bombs and GBU-38 Global Positioning System (GPS)-guided bombs (also known as the Joint Direct Attack Munition). The BDU-50 is a 500-pound concrete filled bomb casing that can be configured with a low-drag or high-drag tail fin configuration. The inert GBU-12 uses the same concert-filled bomb case with a laser guidance and steering unit attached to the nose and modified tail fins. The GBU-38 also uses the 500-pound concrete filled bomb case but is configured with a GPS antenna and the guidance unit and steering in the tail fin. The BDU-56 is a 2000-pound concrete filled bomb casing that can also be configured with low-drag or high-drag tail fins. F-16s also have a 20-millimeter (mm) cannon that can be used in aerial combat or ground support roles. Typically for training purposes, inert target practice 20 mm ammunition would be used and fired at targets on training ranges.

Inside plant infrastructure (IPI): Includes the cabling and equipment within a telecommunications facility.

Live Munitions: Training could also include the use of live munitions that may include Mk-82 500-pound bombs. These are similar to the BDU-50 bombs described above but instead of concrete they are filled with 192 pounds of high-explosives. These bombs can be configured with numerous fuse types depending on mission requirements. These can also be configured with low-drag and high-drag tail fins.

Mean sea level (MSL): Altitude expressed in feet measured above average (mean) sea level. MSL is most commonly used when operating at or below 18,000 ft where clearance from terrain is less a concern for aircraft operation. Altitudes are referred to as MSL when flying above water; while flying over land, both MSL and AGL are used to delineate airspace structure.

Military Operations Area (MOA): Designated airspace outside of Class A airspace to separate or segregate certain nonhazardous military activities from IFR traffic. Activities in MOAs include, but are not limited to, air combat maneuvers, air intercepts, and low altitude tactics. The defined vertical and lateral limits vary for each MOA. While MOAs generally extend from 1,200 ft AGL to 18,000 MSL, the floor may extend below 1,200 ft AGL if there is a mission requirement and there is minimal adverse aeronautical effect.

Outside plant infrastructure (OPI): The physical infrastructure to carry signals that Includes the cabling, conduit, cabinets, towers and poles, and the associated hardware that is located between two demarcation points in switching facilities or between a demarcation point and a switching center or facility or premises.

Restricted Area (R-): A restricted area is designated airspace that supports ground or flight activities that could be hazardous to nonparticipating aircraft.

Sortie: A single military aircraft flight from initial takeoff through final landing.

Special use airspace (SUA): Consists of airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of those activities, or both. SUA consists of MOAs, warning areas, restricted areas, and alert areas. SUA descriptions are contained in Federal Aviation Administration Order Joint Order 7400.8, *Special Use Airspace*.

Training Ranges: Land on military reservations set aside for training of air-to-ground munitions, operational testing and training, electronic combat testing, and support for military training exercises.