INTERIM DRAFT
ENVIRONMENTAL ASSESSMENT
FOR
RANDOLPH 2A LOW MILITARY OPERATIONS AREA
SPECIAL USE AIRSPACE

Prepared for:
Department of the Air Force

DECEMBER 2024

DELIBERATIVE WORK PRODUCT – DO NOT DISTRIBUTE

Privacy Advisory

This Draft Environmental Assessment (EA) has been provided for public comment in accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality NEPA Implementing Regulations (Title 40 Code of Federal Regulations [CFR] §§ 1500–1508), and 32 CFR § 989, Environmental Impact Analysis Process (EIAP), which provides an opportunity for public input on United States Department of the Air Force (DAF) decision-making, allows the public to offer input on alternative ways for DAF to accomplish what it is proposing, and solicits comments on DAF's analysis of environmental effects.

Public input allows DAF to make better-informed decisions. Letters or other written or verbal comments provided may be published in this EA. Providing personal information is voluntary. Private addresses will be compiled to develop a stakeholders inventory. However, only the names of the individuals making comments and specific comments will be disclosed. Personal information, home addresses, telephone numbers, and email addresses will not be published in this EA.

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COVER SHEET

ENVIRONMENTAL ASSESSMENT (EA) FOR RANDOLPH 2A LOW MILITARY OPERATIONS AREA SPECIAL USE AIRSPACE

a. *Responsible Agency*: Department of the Air Force (DAF)

b. *Cooperating Agency*: Federal Aviation Administration (FAA)

c. *Proposals and Actions:* The environmental assessment (EA) analyzes the Proposed Action to obtain new permanent low-altitude airspace for the 12th Flying Training Wing (12 FTW) at Joint Base San Antonio-Randolph Air Force Base (JBSA-Randolph), Texas to support Fighter Bomber Fundamentals (FBF) pilot training syllabus requirements. The proposed airspace would also be available for use by other transient DAF users as scheduling and operational requirements allow. The proposed airspace would be managed and scheduled by the 435th Fighter Training Squadron of the 12 FTW/12th Operations Group at JBSA-Randolph. Up to 2,968 sorties would occur annually in the proposed airspace.

d. *For Additional Information*: Nicolas Post, NEPA Program Manager, AFCEC/CIEE by email at nicolas.post@us.af.mil.

e. Designation: Draft EA

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

The purpose of the DAF's Proposed Action is to obtain new low-altitude airspace underneath existing airspace, managed by the 12 FTW, to afford independent scheduling of nonhazardous, low-altitude flight training in proximity to JBSA-Randolph and meet tactical flight training requirements at altitudes at or above 500 feet AGL. The need for the action is to minimize current 12 FTW aircraft commute times to access training airspace; maximize nonhazardous flying training syllabi execution; and produce pilots faster. This need is not tied to a basing or beddown proposal or support for a specific aircraft. The FAA's purpose and need for the Proposed Action is to provide the SUA to support the DAF undergraduate pilot training requirements while minimizing the impacts on the National Airspace System (NAS).

Under the Proposed Action, up to 2,968 annual sorties would be conducted within the proposed airspace. Training flights would be distributed throughout the proposed airspace, although most would be conducted between 500 feet AGL and 5,000 feet mean sea level (MSL). Training would also occur from 5,000 feet MSL up to, but not including, 9,000 feet MSL, but would primarily consist of transit and set up for training maneuvers. None of the training activities would involve the release of live or inert ammunition or ordnance (including defensive countermeasures such as chaff and flares). Aircraft would not exceed supersonic speeds while operating within the proposed airspace. Individual training activities in the proposed airspace would last approximately 20 minutes. Airspace activity would not be continuous but could occur at any time during existing JBSA-Randolph operational hours between 7:00 a.m. and 10:00 p.m. local time, Monday through Friday. Approximately 16 proposed sorties would occur between 7:00 p.m. and 10:00 p.m., representing approximately 0.5 percent of total annual sorties. Use of the proposed airspace after 10:00 p.m. is not anticipated and would only result from an in-flight emergency or other unforeseen circumstances.

Based on the analysis of the affected environment and potential environmental consequences presented in the Draft EA, the Proposed Action (Alternative 1) and Alternative 2 would have no significant adverse impacts on environmental resources in the region of influence.

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
12 FTW	12th Flying Training Wing
12 OG	12th Operations Group
435 FTS	435th Fighter Training Squadron
ACAM	Air Conformity Applicability Model
AETC	Air Education and Training Command
AFB	Air Force Base
AGL	above ground level
APE	Area of Potential Effect
AQCR	Air Quality Control Region
ARTCC	Air Route Traffic Control Center
ATC	air traffic control
ATCAA	Air Traffic Control-Assigned Airspace
BASH	bird/wildlife aircraft strike hazard
BGEPA	Bald and Golden Eagle Protection Act
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
DAF	Department of the Air Force
DAFMAN	Department of the Air Force Manual
dBA	A-weighted decibel
DNL	Day-Night Average Sound Level
DNWG	DoD Noise Working Group
EA	Environmental Assessment
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
E.O.	Executive order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FBF	Fighter Bomber Fundamentals
FL	flight level
FLIP	Flight Information Publication
FONSI	Finding of No Significant Impact
FY	fiscal year
GHG	greenhouse gases
GWP	Global Warming Potential
IFR	Instrument Flight Rules
JBSA-Randolph	Joint Base San Antonio-Randolph Air Force Base
L_{dn}	Day-Night Average Sound Level

L_{dnmr}	Onset-Rate Adjusted Monthly Day-Night Average Sound Level
Leq	equivalent sound level
MBTA	Migratory Bird Treaty Act
MOA	Military Operations Area
MOU	Memorandum of Understanding
MSL	mean sea level
MTR	Military Training Route
mton/yr	metric ton per year
NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA Fisheries	National Marine Fisheries Service
NPS	National Park Service
NRHP	National Register of Historic Places
PDARS	Performance Data Analysis and Reporting System
PM_{10}	particulate matter equal to or less than 10 microns
$PM_{2.5}$	particulate matter equal to or less than 2.5 microns
PSD	Prevention of Significant Deterioration
RAN2A	Randolph 2A
ROI	Region of Influence
SAT VORTAC	San Antonio Very High Frequency Omnidirectional Range/Tactical Aircraft Control
SC-GHG	social cost of greenhouse gases
SECAF	Secretary of the Air Force
SHPO	State Historic Preservation Officer
SNA	State Natural Area
SWIM	System Wide Information Management
SUA	Special Use Airspace
TAMU	Texas Agricultural and Mechanical University
tpy	tons per year
TxDOT	Texas Department of Transportation
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VFR	Visual Flight Rules

CHAPTER 1 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The Department of the Air Force (DAF) has prepared this Environmental Assessment (EA) to evaluate the potential environmental consequences from the Proposed Action and Alternatives (Proposed Action) to obtain a new permanent low-altitude airspace for the 12th Flying Training Wing (12 FTW) at Joint Base San Antonio-Randolph Air Force Base (JBSA-Randolph), Texas to support Fighter Bomber Fundamentals (FBF) pilot training syllabus requirements. The proposed airspace would also be available for use by other transient DAF users as scheduling and operational requirements allow. The proposed airspace would be managed and scheduled by the 435th Fighter Training Squadron (435 FTS) of the 12 FTW/12th Operations Group (12 OG) at JBSA-Randolph.

The Federal Aviation Administration (FAA) is the primary federal agency responsible for managing navigable airspace above the United States. Therefore, the FAA is participating as a cooperating agency during the development of this EA in accordance with the Memorandum of Understanding (MOU) between the DoD and the FAA for environmental review of Special Use Airspace (SUA) actions under FAA Order JO 7400.2P, *Procedures for Handling Airspace Matters* (FAA, 2023a).

This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] §§ 4321 - 4347, as amended), Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] Parts 1500 - 1508), the DAF Environmental Impact Analysis Process (EIAP) (32 CFR Part 989), and FAA Order JO 1050.1F, *Environmental Impacts: Policies and Procedures*. The requirements of other federal, state, and local regulations are also addressed in this EA, as applicable.

1.2 BACKGROUND

1.2.1 Airspace Overview

Four types of airspace are defined by the FAA: controlled, uncontrolled, special use, and other (FAA, 2023b). These types of airspace are defined based on the complexity or density of aircraft movements, nature of the operations conducted within the airspace, the level of safety required, and national and public interest. Airspace is defined with fixed horizontal and vertical boundaries to delineate where aircraft are allowed to operate.

SUA is airspace in which certain activities must be confined, or where limitations may be imposed on the operations of other aircraft that are not involved in those activities. MOAs are a type of SUA where nonhazardous military flight activities are conducted. Such activities include, but are not limited to, air combat maneuvers, air intercepts, and low-altitude tactics (DAF, 2020a). MOAs are SUA established outside of Class A airspace, (i.e. airspace typically below 18,000 feet mean sea level (MSL), to separate or segregate certain nonhazardous military flight activities from Instrument Flight Rules (IFR) aircraft and to identify Visual Flight Rules (VFR) aircraft where these activities are conducted). It should be noted that if VFR conditions are present, civilian aircraft may enter an active MOA and use “see-and-avoid” practices for deconfliction.

Air Traffic Control Assigned Airspace (ATCAA) is airspace of defined vertical/lateral limits, assigned by air traffic control (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, ATCAAs are blocks of airspace which start at flight level (FL)[1] 180 or 18,000 MSL and, in some cases, are contoured to the dimensions of the MOAs beneath them..

1.2.2 JBSA-Randolph and 435 FTS

JBSA-Randolph covers 2,894 acres in Bexar County, Texas approximately 13 miles northeast of San Antonio **(Figure 1.2-1)**. Originally established in 1931 as a flight training facility for the United States Army Air Corps, JBSA-Randolph is now the headquarters of the Air Education and Training Command (AETC), which was established in 1942 and administers training programs for most DAF personnel. JBSA-Randolph also hosts the 12 FTW, which is assigned to AETC and manages all airmanship programs for U.S. Air Force Academy cadets. The 12 FTW is also responsible for Initial Flight Training for all Air Force Airmen scheduled to enter pilot, combat systems officer, or remotely piloted aircraft training.

The 435 FTS of the 12 FTW/12 OG transitions new pilots and weapon system operators from the basic aircraft operations of Specialized Undergraduate Pilot Training and Undergraduate Navigator Training to the combat-oriented maneuvers of fighter aircraft. Introduction to Fighter Fundamentals is an approximately 2-month course taught by the 435 FTS that utilizes T-38C aircraft for training missions. The T-38C is a high-speed, highly maneuverable fighter-like jet trainer with avionics designed to simulate the tactical weapons delivery systems of actual fighter aircraft virtually, without releasing live ordnance.

The 435 FTS training syllabus is regularly updated and low-altitude training requirements continue to increase. Low-altitude training between 500 feet and 1,000 feet above ground level (AGL) equips pilots to avoid radar coverage and weapon systems of near-peer adversaries. The mission of the 435 FTS is at the forefront of then-Secretary of the Air Force (SECAF) Heather Wilson's mandate (2018) to train pilots for the "high-end fight" near-peer conflict with adversary nations. This type of training is considered one of the DAF's highest training priorities (DAF, 2023).

Beginning in 2027, the 12 FTW will begin transitioning to the DAF's newest flying trainer, the Boeing/Saab T-7A *Red Hawk* (T-7A). The T-7A is a single-engine, two-person, highly adaptable, jet-propelled training aircraft that is currently programmed to be a one-for-one replacement for the T-38C. The T-7A is projected to begin operating at JBSA-Randolph in fiscal year (FY) 2027. The 12 FTW will initially fly a mix of T-38C and T-7A aircraft until full transition to the T-7A, currently projected by FY31, is completed[2]. Potential environmental impacts from proposed operation of the T-7A at JBSA-Randolph and existing airspace were assessed in the *JBSA T-7A Recapitalization Final Environmental Impact Statement* (DAF, 2022).

[1] Fight level (FL) is an aircraft's altitude at standard air pressure, expressed in increments of 100 feet (e.g., FL180 = 18,000 feet). The air pressure is computed using an international standard atmosphere pressure at sea level and therefore, is not necessarily the same as the aircraft's actual altitude, either above sea level or above ground level.

[2] The Proposed Action analyzed in this EA to establish a low-altitude MOA is not associated with any specific basing action or the need to support the DAF's transition to the T-7A.

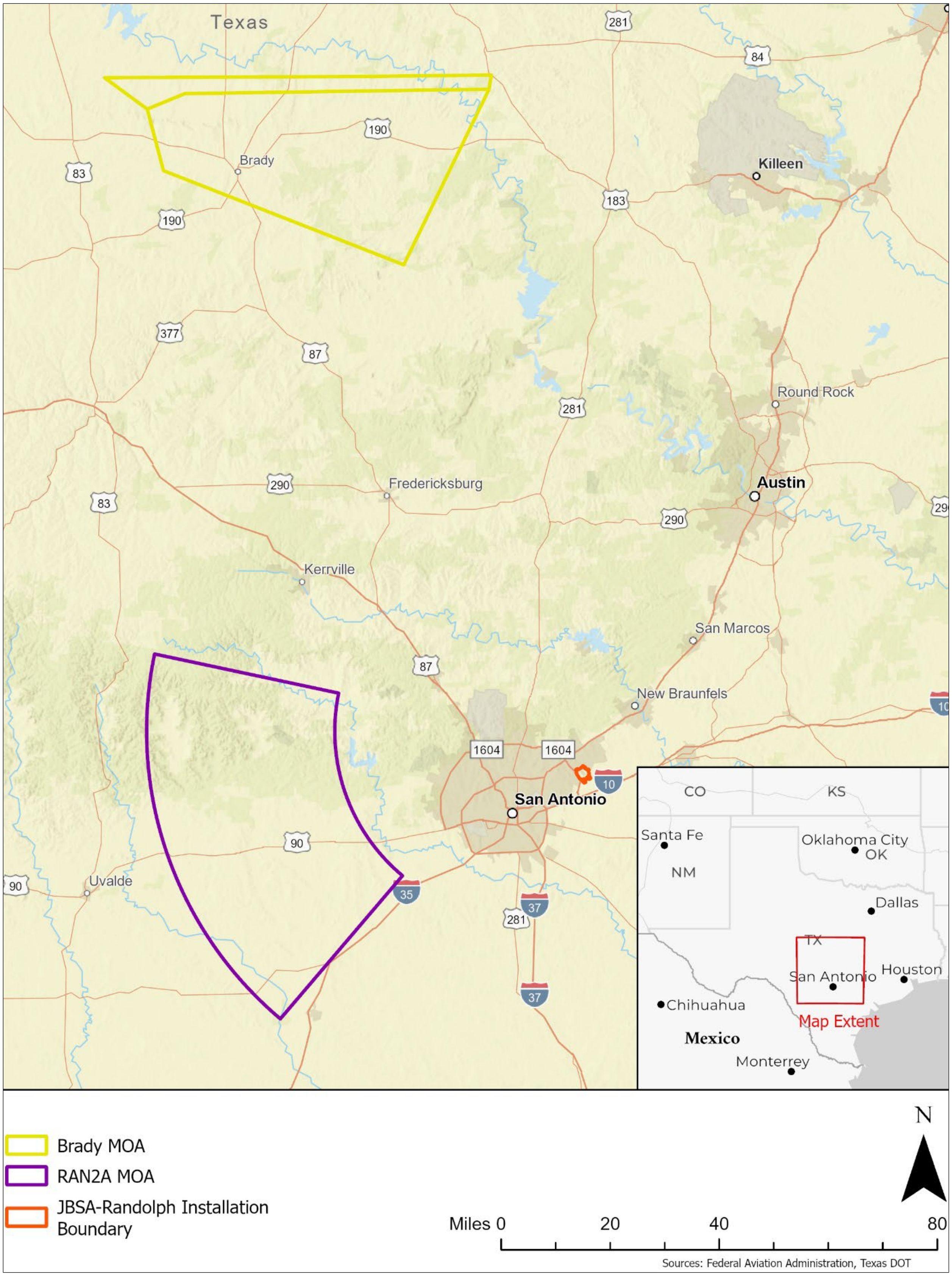


Figure 1.2-1 RAN2A and Brady MOAs, JBSA-Randolph

1.2.3 Brady MOA

Currently, the 12 FTW primarily conducts low-altitude tactical pilot training flights in the Brady MOA **(Figure 1.2-1)**. The Brady MOA is approximately 94 nautical miles (NM) northwest of JBSA-Randolph and encompasses approximately 1,486 square miles of airspace. The Brady MOA is the nearest MOA in proximity to JBSA-Randolph that supports low-altitude training at or above 500 feet AGL.

Operations in the Brady MOA are scheduled by the 301st Fighter Wing at Naval Air Station Fort Worth Joint Reserve Base Carswell Field, Texas. The 12 FTW cannot schedule this airspace autonomously and has third priority for its use after other DoD units. As a result, the 12 FTW is allocated an average of two to 2.5 hours of airspace time per day in the Brady MOA, which is substantially less than what is required to meet DAF and AETC fighter pilot training requirements. This limitation results in extensive periods of time throughout an average day when the Brady MOA, the only low-altitude MOA in proximity to JBSA-Randolph, cannot be utilized by the 12 FTW.

The Brady MOA also lacks the necessary scheduling flexibility to account for adverse weather conditions. The weather in South Texas can greatly impact training by lowering the ceiling of usable airspace. Poor weather requiring ceilings below 3,000 feet frequently results in the cancellation of training flights. Over 30 percent of planned surface attack training flights, a low-altitude, air-to-ground training activity, are cancelled or reprogrammed as air-to-air training missions prior to execution due to poor weather conditions. Nearly 50 percent of surface attack training missions flown are classified as “incomplete” or “noneffective” due to low ceilings and the need to use alternate fuel reserves due to poor weather conditions.

In addition, the distance between JBSA-Randolph to the Brady MOA (94 NM) means that approximately 55 to 60 percent of the flight time and fuel use is spent in transit to and from the airspace. The Brady MOA is the closest airspace that meets training requirements specified in the syllabus and established by the SECAF for simulated high-end fight, low-altitude surface attack training missions. However, the T-38C and T-7A are fuel-constrained aircraft, with typical sorties[3] lasting only 50 to 60 minutes; therefore, the 94 NM transit distance between JBSA-Randolph and the Brady MOA severely constrains operational time that can be spent within the MOA to meet the applicable training requirements. Reducing time spent in transit would substantially increase time devoted to meeting low-altitude pilot training requirements.

The 435 FTS trains Airmen in the basics they will use in subsequent training and potential future combat. The efficient use of available airspace, including location and proximity to JBSA-Randolph, has a direct impact on the quality and quantity of training that the 435 FTW provides to future pilots and weapon systems officers.

1.2.4 Randolph 2A MOA

The Randolph 2A (RAN2A) MOA encompasses approximately 1,925 square miles of airspace and is approximately 37 miles west of JBSA-Randolph **(Figure 1.2-2)**. The RAN2A MOA is managed and operated by the 12 FTW. Transit time from JBSA-Randolph to the RAN2A MOA is approximately 10 minutes.

[3] A sortie is a single military aircraft flight from initial takeoff through final landing.

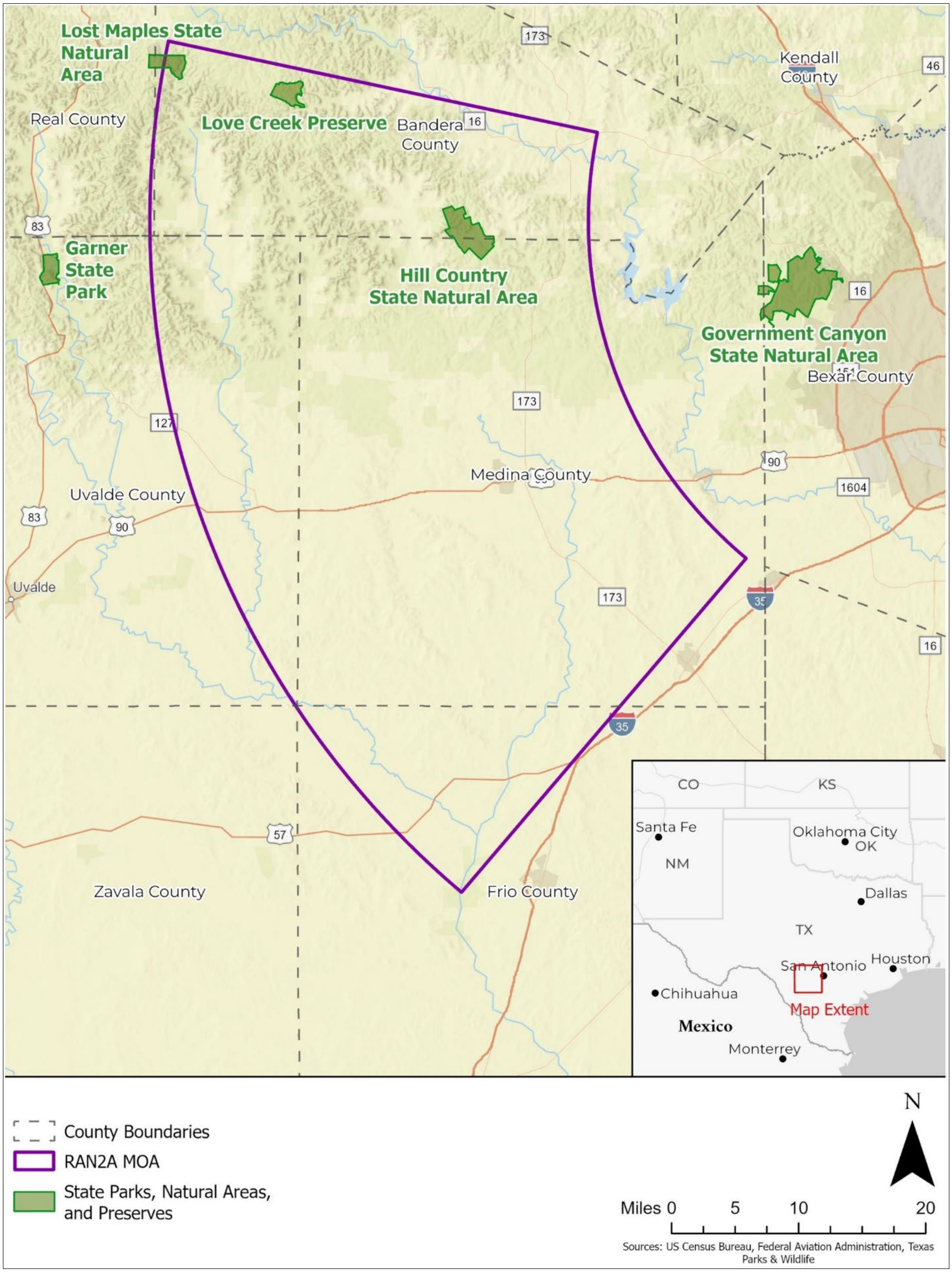


Figure 1.2-2 RAN2A MOA and Surrounding Area

Currently, the RAN2A MOA has a floor of 9,000 feet above MSL and a ceiling of up to, but not including, 18,000 feet MSL. The RAN2A ATCAA extends from FL 180 to FL 290. Aircraft operations below 9,000 feet MSL are not currently permitted in the RAN2A MOA.

1.3 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the DAF Proposed Action is to obtain new low-altitude airspace underneath existing airspace, managed by the 12 FTW, to afford independent scheduling of nonhazardous, low-altitude flight training in proximity to JBSA-Randolph and meet tactical flight training requirements at altitudes at or above 500 feet AGL.

The need for the action is to minimize current 12 FTW aircraft commute times to access training airspace; maximize nonhazardous flying training syllabi execution; and produce pilots faster. This need is not tied to a basing or beddown proposal or support for a specific aircraft.

The FAA's purpose and need for the Proposed Action is to provide the SUA to support the DAF undergraduate pilot training requirements while minimizing the impacts on the National Airspace System (NAS).

1.4 DECISION TO BE MADE

This EA evaluates potential environmental consequences associated with obtaining new permanent low-altitude MOA to support FBF training at JBSA-Randoph. Based on the analysis in this EA, the DAF will make one of three decisions regarding the Proposed Action:

1) Determine the potential environmental consequences associated with the Proposed Action or alternatives are not significant and issue a signed Finding of No Significant Impact (FONSI);
2) Initiate preparation of an Environmental Impact Statement (EIS) if it is determined that significant impacts would occur through implementation of the Proposed Action or alternatives; or
3) Select the No Action Alternative, whereby the Proposed Action would not be implemented at this time.

As required by NEPA and its implementing regulations, preparation of an environmental document must precede final decisions regarding the proposed project and be available to inform decision-makers of the potential environmental impacts.

1.5 INTERAGENCY AND INTERGOVERNMENTAL COORDINATION AND CONSULTATIONS

Scoping is an early and open process for developing the range of issues to be addressed in an EA and for identifying significant concerns related to an action. Per the requirements of NEPA, the Intergovernmental Cooperation Act of 1968 (42 U.S.C. § 4231[a]) and Executive Order (E.O.) 12372, Intergovernmental Review of Federal Programs (as amended by E.O. 12416), federal, state, and local agencies with jurisdiction over resources that could potentially be affected by the Proposed Action or alternatives were notified during the development of this EA.

The Intergovernmental Coordination Act and E.O. 12372 require federal agencies to cooperate with and consider state and local views in implementing a federal proposal. Through the coordination process, potentially interested and affected government agencies, government representatives, elected officials, and interested parties that could be affected by the Proposed Action and alternatives were notified during the development of this EA. The recipient mailing list and agency and intergovernmental coordination letters and responses are included in **Appendix A**.

1.5.1 Cooperating Agencies

A cooperating agency is defined by CEQ regulations as any federal agency other than a lead agency having jurisdiction by law or special expertise with respect to any environmental issue involved in a proposed action (40 CFR § 1508.5).

In accordance with the FAA's jurisdiction by law and the MOU between the DoD and the FAA for environmental review of SUA actions under FAA Order JO 7400.2P, *Procedures for Handling Airspace Matters* (FAA, 2023a), the DAF invited the FAA to participate as a cooperating agency during the preparation of this EA. The FAA accepted the DAF's invitation via letter dated April 18, 2023. The FAA's involvement and responsibilities as a cooperating agency during the preparation of this EA are further described in **Section 1.5.2**.

1.5.2 FAA Guidelines

The FAA is responsible for managing navigable airspace in the United States for public safety and ensuring its efficient use for commercial air traffic, general aviation, and national defense, including SUA utilized by the DoD. The FAA processes requests for the establishment or modification of airspace in accordance with procedures defined in FAA Order JO 7400.2P, *Procedures for Handling Airspace Matters*. The process for establishing (or modifying) airspace is two-fold, comprising both aeronautical and environmental analyses. The DAF will submit a formal airspace proposal to the FAA defining the proposed airspace. The FAA ensures the proposed airspace is compliant with airspace regulations and circulates the airspace proposal for public review.

In addition to the aeronautical analysis, the FAA is participating in this EA as a cooperating agency. The FAA may or may not adopt this EA, in whole or in part, to comply with its NEPA procedures defined in FAA Order JO 1050.1F, *Environmental Impacts: Policies and Procedures* and Chapter 32 of FAA Order JO 7400.2P, prior to making a decision to chart the proposed airspace addressed in this EA. If approved, the new airspace would be published in the current issue of FAA Order JO 7400.10F, *Special Use Airspace* and illustrated on sectional aeronautical charts, at which time it would be available for use as described in this EA. The airspace associated with the Proposed Action lies within the jurisdiction of the FAA Houston Air Route Traffic Control Center (Houston Center).

1.5.3 Agency Consultations

Compliance with NEPA and the DAF EIAP requires coordination and consultation with federal, state, and local agencies and Native American tribes to address regulatory requirements established under the National Historic Preservation Act (NHPA) (36 CFR Part 800; 40 CFR Part 1501), DoD Instruction 4710.02, *DoD Interactions with Federally Recognized Tribes*, DAF Instruction 90-2002, *Interactions with Federally Recognized Tribes*, and Section 7 of the Endangered Species Act (ESA) (16 U.S.C. § 1531 et seq.), and other laws and regulations. These requirements are summarized below. Other regulatory requirements are addressed throughout this EA, as applicable.

1.5.4 Government-to-Government Consultation

The NHPA directs federal agencies to consult with federally recognized Native American tribes when a Proposed Action has the potential to affect tribal lands or properties of religious and cultural significance. Consistent with the NHPA, DoD Instruction 4710.02, and DAF Instruction 90-2002, the DAF has initiated government-to-government consultation with Native American tribes having cultural, historical, or religious ties to the lands underlying areas where the Proposed Action would occur. The tribal consultation process is distinct from NEPA consultation and the interagency coordination process and requires separate notification to all relevant tribes. The timelines for tribal consultation are also distinct from those of other consultations.

The JBSA-Randolph point-of-contact for tribal consultation is the Base Commander, or designated Installation Tribal Liaison Officer. Correspondence regarding government-to-government consultation conducted for the Proposed Action is included in **Appendix A**.

1.5.5 Cultural Resources Guidance

Section 106 of the NHPA requires federal agencies to consider the effects of their proposed actions (or “undertakings”) on historic properties and to integrate historic preservation values into their decision-making process. Federal agencies must seek to avoid, minimize, or mitigate potential adverse effects on historic properties under Section 106 (36 CFR § 800.1[a]). Section 106 also requires agencies to consult with federally recognized Native American tribes with a vested interest in the undertaking. Other 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, and the Native American Graves Protection and Repatriation Act of 1990.

The Section 106 consultation process is integrated into the DAF EIAP for the Proposed Action evaluated in this EA. The DAF is consulting with the Texas State Historic Preservation Officer (SHPO) regarding potential effects on historic properties from the Proposed Action. The JBSA-Randolph Cultural Resources Manager is the point-of-contact for consultation with the SHPO and Advisory Council on Historic Preservation, as applicable.

1.5.6 Endangered Species Act

The ESA establishes protections for species listed as threatened and endangered and the ecosystems upon which those species depend. Endangered species are those in danger of extinction throughout all, or a large portion, of their range (16 U.S.C. § 1536). Threatened species are those likely to be listed as endangered in the foreseeable future. Section 7 of the ESA generally requires federal agencies to ensure that any action they authorize, fund, or carry out does not jeopardize listed species or adversely modify their designated critical habitat, including unauthorized “take.” This is accomplished through a well-defined consultation process with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NOAA Fisheries). If the DAF determines that a proposed action will not affect listed species or their designated critical habitat, Section 7 Consultation is not required with the USFWS and/or NOAA Fisheries. If the DAF determines that a proposed action may affect listed species or their designated critical habitat, either informal or formal consultation is necessary with USFWS and/or NOAA Fisheries. Informal consultation with USFWS and/or NOAA Fisheries would result from a DAF determination that a proposed action may affect, but is not likely to adversely affect listed species or their designated critical habitat. Formal consultation with USFWS and/or NOAA Fisheries would result from a DAF determination that a proposed action may affect, and is likely to adversely affect listed species or their designated critical habitat. Once formal consultation is complete, the USFWS and/or NOAA Fisheries will prepare a Biological Opinion that evaluates whether the DAF has ensured that the proposed action is not likely to jeopardize the continued existence of a listed species or adversely modify their critical habitat. The Biological Opinion generally includes an Incidental Take Statement, conservation recommendations to further the recovery of listed species, and may include reasonable and prudent measures to minimize any take of listed species.

The DAF is consulting with the USFWS in accordance with Section 7 of the ESA to determine potential effects on federally listed species that could result from the Proposed Action.

1.5.7 Other Executive Orders

E.O. 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires federal agencies to ensure that 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. Potential effects from the Proposed Action on minority populations, low-income populations, and other historically disadvantaged groups are addressed in this EA in accordance with E.O. 12898 and the DAF EIAP, as applicable.

1.6 APPLICABLE LAWS AND ENVIRONMENTAL REGULATIONS

1.6.1 National Environmental Policy Act

NEPA requires federal agencies to consider the potential environmental consequences of their proposed actions. The law's intent is to protect, restore, or enhance the environment through well-informed federal decisions. The CEQ was established by NEPA for the purpose of implementing and overseeing federal policies related to this process. In 1978, the CEQ issued regulations for Implementing the Procedural Provisions of the NEPA (40 CFR Parts 1500 – 1508). CEQ regulations specify that an EA be prepared to:

- briefly provide sufficient analysis and evidence for determining whether to prepare an EIS or a 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 DAF has prepared this EA in accordance with the updated NEPA rules, subject to congressional review, issued by CEQ on May 20, 2022 (87 *Federal Register* 23453-23470).

1.6.2 The Environmental Impact Analysis Process

The EIAP (32 CFR Part 989) is the DAF's process for conducting environmental impact analyses. To comply with NEPA and complete the EIAP, CEQ regulations and the EIAP are used together. To comply with NEPA and other relevant environmental requirements (e.g., the NHPA, ESA) and to assess potential environmental impacts, the EIAP and decision-making process for the Proposed Action involves a study and examination of all pertinent environmental issues, as documented in this EA.

Although the SECAF or their designated representative will decide whether to implement the Proposed Action, the FAA has final authority for approving or denying any proposal to modify, expand, or establish SUA (e.g., MOAs, ATCAA).

1.7 PUBLIC AND AGENCY REVIEW OF THE ENVIRONMENTAL ASSESSMENT

A Notice of Availability and proposed FONSI were published in the *San Antonio Express-News*, Hondo *Anvil Herald*, *The Devine News*, the *Frio-Nueces Current*, and the *Uvalde Leader News,* inviting the public to review and comment on the Draft EA during the 30-day review period. The Draft EA and proposed FONSI were available for review at the following public libraries:

- Hondo Public Library, 2003 Avenue K, Hondo, Texas 78861
- Driscoll Public Library, 202 East Hondo Avenue, Devine, Texas 78016
- Castroville Public Library, 802 London Street, Castroville, Texas 78009
- Medina Community Library, 13948 State Highway 16 North, Medina, Texas 78055
- El Progreso Memorial Library, 301 West Main Street, Uvalde, Texas 78801

The Draft EA and proposed FONSI were also available online at: https://www.jbsa.mil/Resources/Environmental/.

Persons unable to access the Draft EA and proposed FONSI via the methods listed above were directed to contact Alex Galdencio at 210 671-3952 or 802ces.ceie.nepateam@us.af.mil to arrange alternate access.

1.8 SCOPE OF THE ENVIRONMENTAL ANALYSIS

This EA analyzes the potential environmental consequences from the DAF's Proposed Action to obtain low-altitude airspace to support FBF training requirements at JBSA-Randolph. The EA analysis focuses on resources that would be measurably or meaningfully affected by the Proposed Action; detailed discussions of these resources and the Proposed Action's potential impacts on them are provided in **Chapter 3**. Cumulative impacts are also described for each resource, as applicable. Resources on which the Proposed Action would have no, or no more than, marginal effects are dismissed from detailed analysis in this EA and are briefly described in **Section 3.2**.

CHAPTER 2 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

Under the Proposed Action, the DAF would request the FAA to establish new, low-altitude training airspace under the existing RAN2A MOA **(Figure 2.1-1)**. The proposed low-altitude MOA underneath the existing RAN2A MOA would have a floor (i.e., minimum altitude) of 500 feet AGL to support low-altitude aircraft training operations. As needed, and based on applicable operational and ATC requirements, aircraft would continue to have access to the existing RAN2A MOA and RAN2A ATCAA for training above 9,000 feet MSL.

No changes are proposed to entry or exit point locations of the proposed airspace or the existing RAN2A MOA for aircraft originating from JBSA-Randolph. As established by Letter of Agreement, FAA, Houston Air Route Traffic Control Center (referred to as the FAA Houston Center) may restrict or permit military operations by quadrant within the existing or proposed airspace to route transiting air traffic, as needed.

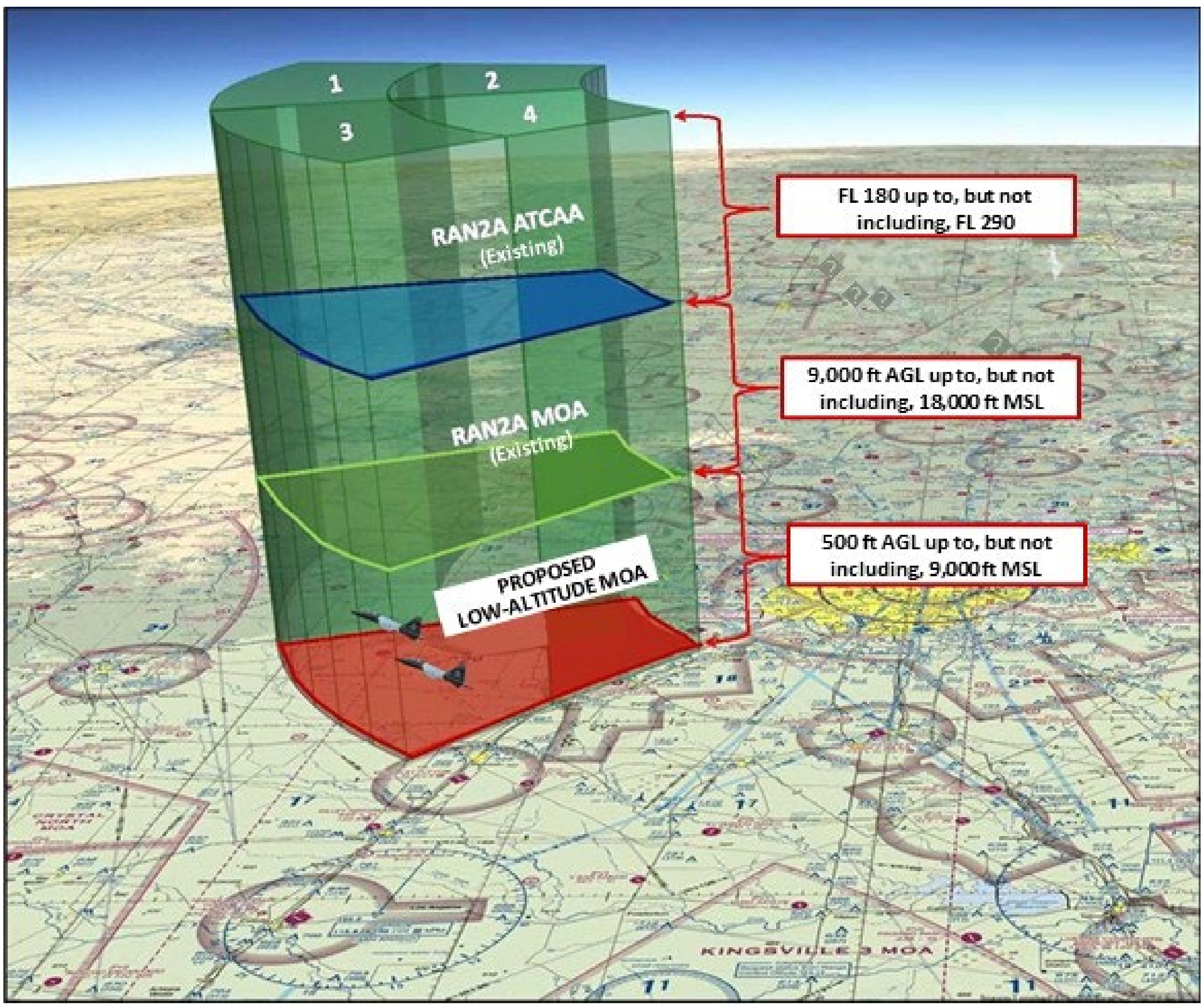


Figure 2.1-1 Representative View of Existing RAN2A MOA and ATCAA and Proposed Low-Altitude Airspace

The Proposed Action does not involve changes to the lateral or vertical extents of the existing RAN2A ATCAA or to the lateral extents of the existing RAN2A MOA. No demolition, construction, or other ground-disturbing activities would occur under the Proposed Action. The Proposed Action would not require changes to the number of personnel or to the number or types of aircraft assigned to JBSA-Randolph, or changes to the existing boundaries of that installation.

The Proposed Action assumes that the 12 FTW would operate the T-7A in the proposed airspace. The ratio and timeline for transition to the T-7A and phase-out of the T-38 at JBSA-Randolph is not currently known. Use of the T-7A by the 12 FTW was assumed as the basis for analysis of potential environmental consequences from the Proposed Action (Alternative 1) and Alternative 2.

2.1.1 Proposed Low-Altitude Training Activities

Under the Proposed Action, approximately 2,968 annual sorties would be conducted within the proposed airspace. Training flights would be distributed throughout the proposed airspace, although most would be conducted between 500 feet AGL and 5,000 feet MSL. Training would also occur from 5,000 feet MSL to 8,999 feet MSL, but would primarily consist of transit and setup for training maneuvers. None of the training activities would involve the release of live or inert ammunition or ordnance (including defensive countermeasures such as chaff and flares). Aircraft would not exceed supersonic speeds while operating within the proposed airspace.

Training activities within the proposed airspace would primarily consist of the following:

- **Low-Altitude Air-to-Air Training:** this type of training would support air-to-air combat against simulated enemy aircraft and would occur anywhere in the proposed airspace between 500 feet AGL and 5,000 feet MSL.
- **Low-Altitude Air-to-Ground Training:** this type of training would simulate attacks by training aircraft against simulated ground-based targets and would occur between 500 feet AGL and 3,000 feet MSL.
- **Low-Level Operations:** this type of training would allow pilots to gain familiarity with aircraft handling characteristics when operating at low altitudes, and would focus on elements such as fuel consumption, maneuvering, terrain avoidance, task management, low-altitude tactical navigation, and low-altitude tactical formation. These operations would primarily occur between 500 feet AGL and 1,000 feet MSL.

Table 2.1-1 summarizes the proposed number of annual sorties that would be conducted in the proposed airspace for each type of training listed above.

In addition to aircraft from the 12 FTW, the Proposed Action would support training requirements of other transient DAF users, such as Fighter Bomber Fundamentals for pilots flying T-38s from Laughlin Air Force Base (AFB) near Del Rio, Texas and F-16s from JBSA-Kelly Field in San Antonio. The number of sorties that would be flown by these units is included in the totals shown in **Table 2.1-1**.

Individual training activities in the proposed airspace would last approximately 20 minutes. Airspace activity would not be continuous but could occur at any time during existing JBSA-Randolph operational hours between 7:00 a.m. and 10:00 p.m. local time, Monday through

Friday[4]. Approximately 16 proposed sorties would occur between 7:00 p.m. and 10:00 p.m., representing approximately 0.5 percent of the total sorties shown in **Table 2.1-1**. Use of the proposed airspace after 10:00 p.m. is not anticipated and would only result from an in-flight emergency or other unforeseen circumstances.

Table 2.1-1 Annual Sorties that Would Occur in the Proposed Low-Altitude Airspace

Activity Type [1]	Altitude Range [2]	Proposed Number of Sorties
Low-Altitude Air-to-Air	500 feet AGL to 5,000 feet MSL	876
Low-Altitude Air-to-Ground	500 feet AGL to 3,000 feet MSL	876
Low-Level Operations	500 feet AGL to 1,000 feet MSL	1,168
Miscellaneous F-16 Operations	500 feet AGL to 5,000 feet AGL	48
	Total	**2,968**

Notes:

[1] None of the proposed training activities would involve releases of live or inert ammunition or ordnance (including defensive countermeasures such as chaff and flares).

[2] Training flights would be distributed throughout the proposed airspace; most would be conducted between 500 feet AGL and 5,000 feet MSL. Transit and setup for training maneuvers would occur between 5,000 and 8,999 feet MSL.

2.2 ALTERNATIVES DEVELOPMENT

2.2.1 Selection Standards

In accordance with 32 CFR § 989.8(c), selection standards were developed to establish a means for evaluating 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 meet the purpose of and need for the Proposed Action and were used to identify reasonable alternatives for analysis in the EA:

1. **Airspace size and configuration.** Provide a low-altitude MOA with vertical extents from approximately 500 feet AGL to 8,999 feet MSL to support an optimized training experience and meet current and anticipated future tactical flight training syllabus requirements, while minimizing potential conflicts with other users.
2. **Pilot production.** Provide suitable airspace that is adequately sized to expose new pilots to training needs on 4th-generation aircraft and beyond.
3. **Scheduling.** Provide DAF-scheduled airspace to allow for autonomous scheduling and less competition with other entities allowing more training time in the airspace.
4. **Maximize training time and minimize transit time.** Provide a low-altitude MOA closer to JBSA-Randolph to reduce aircraft transit time and maximize training efficiencies. Maximum transit time to and from the training airspace should be 20 minutes.
5. **Conserve fuel for training.** Utilize fuel for training sorties rather than in transit to and from the airspace. Less fuel burned per student during transit results in more training time per sortie and fewer sorties overall to produce a pilot.

[4] It is anticipated that aircraft would depart the proposed airspace no later than approximately 9:45 p.m. local time to ensure aircraft have returned and engine activity is concluded at JBSA-Randolph by 10:00 p.m.

6. **Limit impacts on civilian aviation.** The proposed airspace should limit or reduce the potential for conflicts with the structure and use of the current airspace system by civil aviation. Avoid or minimize potential conflicts with airports, Air Traffic Service routes, and other airspace users.

2.2.2 Alternatives Considered

The DAF considered the following alternatives that could potentially meet the Purpose and Need:

- **Alternative 1 – Request FAA to Establish the Randolph 2A Low-Altitude MOA.** Under this alternative, the DAF would request FAA to establish the proposed airspace as described in **Section 2.1**. The proposed airspace would have a vertical extent from 500 feet AGL up to, but not including 9,000 feet MSL (i.e., the floor of the existing RAN2A MOA). The new airspace would be designated as the Randolph 2A Low-Altitude (RAN2A Low) MOA and would be managed and operated as a separate airspace distinct from the existing RAN2A MOA and RAN2A ATCAA. This would allow FAA civilian ATC to restrict military operations in the airspace, when needed, to facilitate safe transit of the airspace by civilian aircraft. Based on training requirements, and in coordination with FAA civilian ATC, the proposed RAN2A Low MOA could be combined with the existing RAN2A MOA and RAN2A ATCAA to provide seamless flight operations from 500 feet AGL to FL 290.
- **Alternative 2 – Vertical Expansion of RAN2A MOA**. Under this alternative, the DAF would request FAA to modify the existing RAN2A MOA by lowering its floor from 9,000 feet MSL to 500 feet AGL to support low-altitude aircraft training operations. The modified airspace would continue to be operated as the RAN2A MOA rather than creating a new, separate airspace as proposed under Alternative 1. Aircraft operations within the modified airspace would be permitted from 500 feet AGL up to, but not including, FL180 (i.e., the floor of the existing RAN2A ATCAA). Based on training needs and in coordination with FAA civilian ATC, the modified airspace could be combined with the existing RAN2A ATCAA to provide seamless operations from 500 feet AGL to FL 290.
- **Alternative 3 – Use of Other Existing MOAs**. This alternative would use the RAN1A and RAN1B MOAs and Kingsville 4 and 5 MOAs located southeast of San Antonio.
- **Alternative 4 – Use of Other Airspace Types.** This alternative would utilize other airspace types including military training routes (MTRs) and restricted areas in proximity to JBSA-Randolph.
- **Alternative 5 – Forward Deployment.** This alternative includes forward deployment to Robert Gray Army Airfield, approximately 108 miles northeast of JBSA-Randolph, to utilize the Brady MOA and/or other low-altitude regional airspace. Under this alternative, forward deployment would include temporarily relocating pilots, operations, maintainers, and aircraft for one or more rotations of 6 months to Robert Gray Army Airfield.

2.2.3 Alternatives Screening

The alternatives listed in **Section 2.2.2** were compared against the selection standards described in **Section 2.2.1**. A summary of the alternatives screening is presented in **Table 2.2-1**.

Table 2.2-1 Comparison of Alternatives

Selection Standard	Alternatives Considered				
	ALT 1 RAN2A Low MOA	ALT 2 Vertical Expansion of RAN2A MOA	ALT 3 Use of Other Existing MOAs	ALT 4 Use of Other Airspace Types	ALT 5 Forward Deployment
1. Airspace Size and Configuration	Yes	Yes	Yes	No	Yes
2. Pilot Production	Yes	Yes	Yes	No	Yes
3. Scheduling	Yes	Yes	No	No	No
4. Maximize Training Time and Minimize Transit Time	Yes	Yes	No	No	Yes
5. Conserve Fuel for Training	Yes	Yes	No	No	Yes
6. Limit Impacts on Civilian Aviation	Yes	Yes	Yes	Yes	Yes
Meets Selection Standards	**Yes**	**Yes**	**No**	**No**	**No**

Notes:
ALT = Alternative

2.2.4 Alternatives Considered but Not Carried Forward for Detailed Analysis

Based on the alternatives screening summarized in **Section 2.2.3**, the following alternatives were considered and eliminated from detailed analysis because they failed to meet one or more of the selection standards and would not meet the purpose and need.

- **Alternative 3 – Use of Other Existing MOAs.** The existing RAN1A MOA has a floor of 8,000 feet MSL and a ceiling of 18,000 feet MSL and RAN1B has a floor of 7,000 feet MSL and a ceiling of 18,000 feet. These MOAs do not provide adequate training space to meet the training syllabus requirements. The lateral limits of the airspace are too small to permit the types of maneuvering required. Further, entering these airspaces would require the establishment of new routes and entry/exit points. The airspace is currently utilized by other units that have priority in scheduling. While the airspace is near JBSA-Randolph, it is highly utilized by commercial aircraft. Low-altitude sorties may be incompatible with established population centers under the airspace. Kingsville MOAs 4 and 5 have floors of 9,000 feet MSL and ceilings of 18,000 feet MSL and present the same challenges as RAN1A and RAN1B. As discussed in **Section 1.2.3**, Brady MOA is 94 miles from JBSA-Randolph and is already heavily used by other units that have priority in scheduling.
- **Alternative 4 – Use of Other Airspace Types.** Restricted Area 6312 (R-6312) is located approximately 80 NM from JBSA-Randolph and is currently utilized by other units including Naval Air Station Kingsville and the 149th Fighter Wing, which have priority in scheduling. Its small size precludes low-altitude tactical maneuvers required to meet the training syllabus. Further, low-altitude MTRs located throughout the region do not permit the type of maneuvering required by the training syllabus.
- **Alternative 5 – Forward Deployment.** Temporary relocation to Robert Gray Army Airfield would maximize training time and minimize transit time to the Brady MOA and could greatly

increase the fuel available for tactical low-altitude training. However, given the frequency of required syllabus missions and the scheduling priorities of the airspace, forward deployment would be cost-prohibitive in terms of both temporary duty travel funding and associated logistics and maintenance requirements. Forward deployment would not resolve current issues with scheduling autonomy and would ultimately reduce constructive training time, increasing the overall time to produce qualified pilots.

2.2.5 Alternatives Analyzed in the Environmental Assessment

2.2.5.1 Alternative 1

Alternative 1 would implement the Proposed Action described in **Section 2.1**. The DAF would request FAA to establish a new low-altitude airspace under the existing RAN2A MOA. The new airspace would be designated as the RAN2A Low MOA. A conceptual view of this alternative is shown on **Figure 2.2-1**. The proposed RAN2A Low MOA would be managed and operated separately from the existing RAN2A MOA and RAN2A ATCAA but could be combined with those airspaces, as needed, to support seamless flight operations from 500 feet AGL to FL 290. Training activities would occur in the new RAN2A Low MOA as described in **Section 2.1.1.**

2.2.5.2 Alternative 2

Alternative 2 would implement the Proposed Action by lowering the floor of the existing RAN2A MOA from 9,000 feet MSL to 500 feet AGL. The modified airspace would continue to be managed and operated as the RAN2A MOA. A conceptual view of this alternative is shown on **Figure 2.2-2**. As needed, the modified airspace could be combined with the existing RAN2A ATCAA to support seamless flight operations from 500 feet AGL to FL 290. Training activities would occur within the modified RAN2A MOA as described in **Section 2.1.1**.

2.2.5.3 No Action Alternative

Under the No Action Alternative, the proposed low-altitude airspace would not be established and existing conditions would continue. Pilots from JBSA-Randolph would continue to transit to the Brady MOA to conduct low-altitude training, resulting in operational inefficiencies and continuing to limit time spent in actual training. Low-altitude training in the Brady MOA would also continue to be susceptible to adverse weather conditions because no alternative low-altitude training MOA is available. Finally, pilots from JBSA-Randolph would continue to receive third-level priority for training time in the Brady MOA over other DoD units. The No Action Alternative assumes that the 12 FTW transition to the T-7A would occur by FY31 (DAF, 2022).

The No Action Alternative does not meet the purpose and need but is carried forward for detailed analysis in accordance with CEQ NEPA regulations at 40 CFR Parts 1500-1508 and 32 CFR Part 989. The No Action Alternative provides a baseline for the evaluation of potential impacts from the Proposed Action and also represents a potential and viable decision to not implement the Proposed Action.

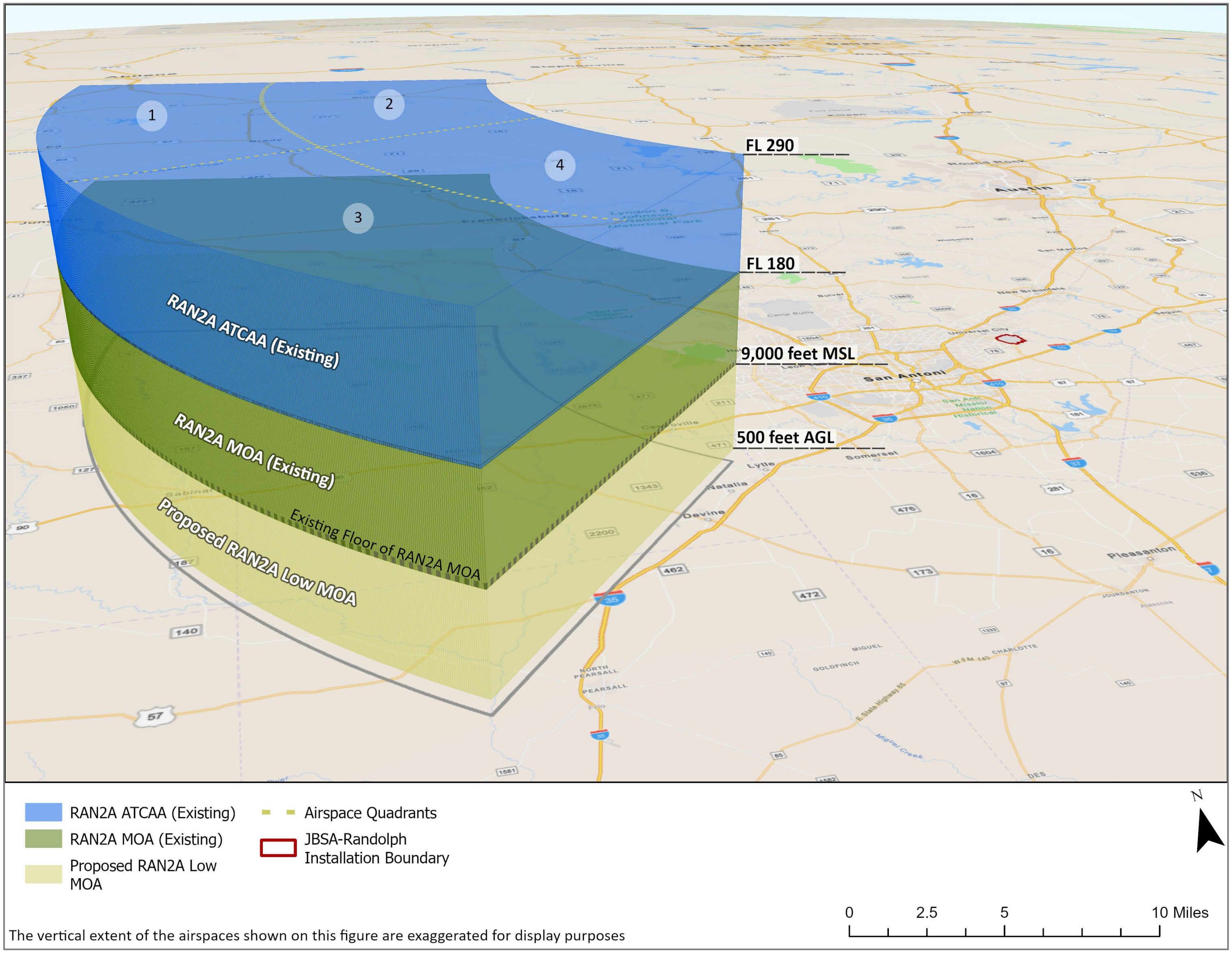


Figure 2.2-1 Conceptual View of Alternative 1 – Establish RAN2A Low MOA

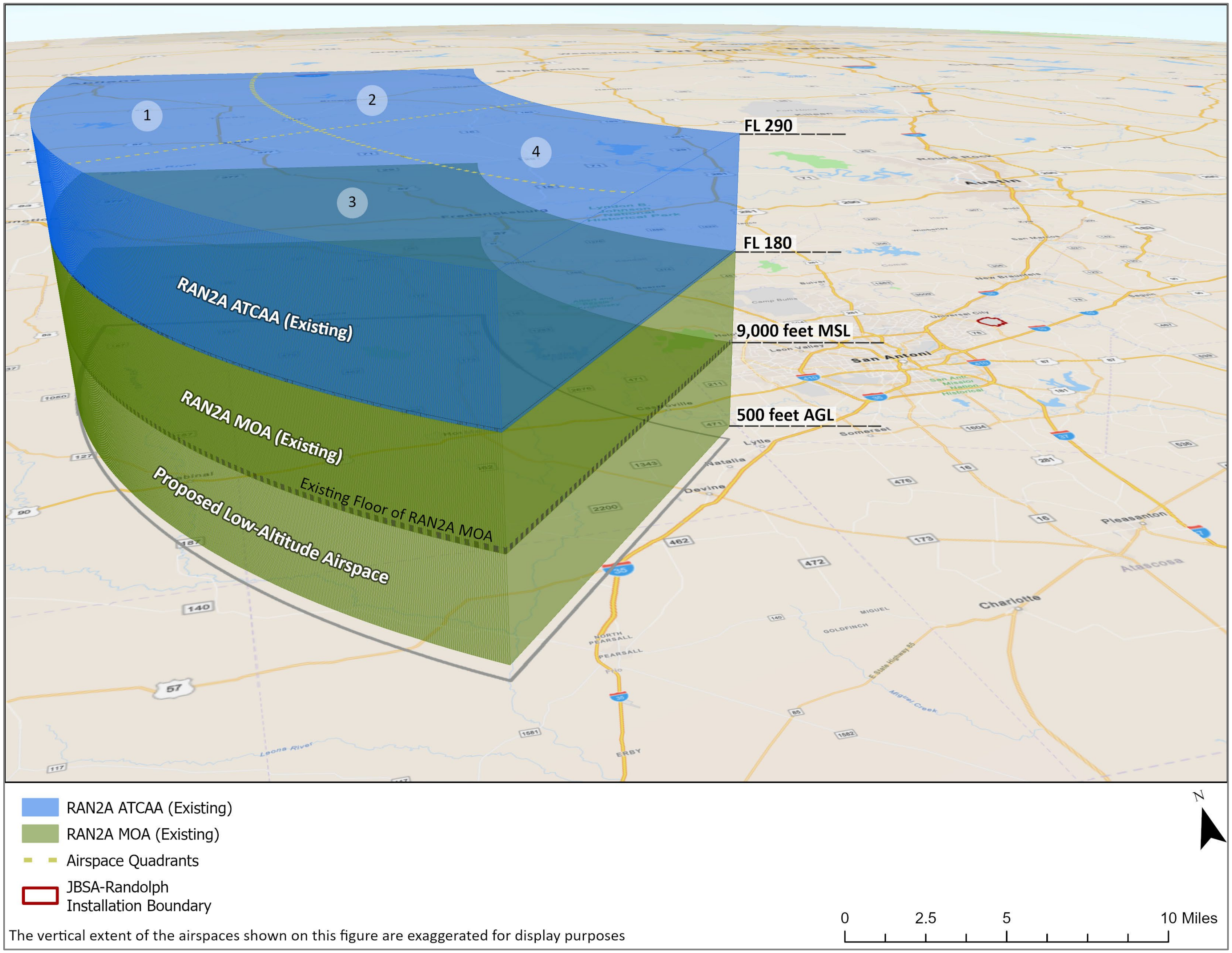


Figure 2.2-2 Conceptual View of Alternative 2 – Lower Floor of Existing RAN2A MOA to 500 Feet AGL to Support Low-Altitude Aircraft Operations

2.3 SUMMARY OF POTENTIAL ENVIRONMENTAL CONSEQUENCES

The potential impacts associated with the Proposed Action are summarized in **Table 2.3-1**. This summary is based on the detailed analysis of each resource presented in **Chapter 3**.

Table 2.3-1 Comparison of Potential Environmental Impacts of the Proposed Action

Resource	Proposed Action (Alternative 1 and Alternative 2)	No Action Alternative
Airspace Management and Use	No significant adverse long-term impacts on airspace, including any adjacent military training airspace or other local civil or military operations.	No change
Noise	No significant adverse long-term impacts from noise associated with proposed aircraft operations.	No change.
Land Use	No significant adverse impacts on land use.	No change.
Air Quality	No significant adverse long-term impacts on air quality, greenhouse gases (GHG) and climate change from increases in criteria pollutant emissions from aircraft operations. Net changes in criteria pollutant emissions would be less than the indicator of significance and would not interfere with the ability to maintain the attainment status of the Air Quality Control Region (AQCR) that would contain the proposed airspace. No impacts on Class 1 areas because no such areas are within 62 miles of the proposed airspace. The annual net change in GHG emissions would be below the GHG insignificance indicator; therefore, there would be no significant impact on climate change at a regional or global scale.	No (or minimal) change.
Biological Resources	No significant adverse impacts on biological resources. The DAF determined that the Proposed Action may affect but is not likely to adversely affect federally listed threatened and endangered species, and would not jeopardize the continued existence of federal proposed or candidate species. USFWS concurrence with this determination is pending.	No change.
Cultural Resources	No significant adverse physical impacts on archaeological or architectural resources because the Proposed Action does not involve construction, demolition, or other ground-disturbing activities. Increased noise levels associated with the Proposed Action would be low and would have no potential to affect the character, setting, or historic integrity of historic properties in the Area of Potential Effects (APE). No impacts on traditional cultural properties or Indian sacred sites because no such properties or sites have been identified in the APE. In September 2024, the Texas SHPO concurred with the DAF's determination that the Proposed Action would have no adverse effects on historic properties, including archaeological sites.	No change.
Safety	No significant adverse impacts on safety, including potential aircraft mishaps, aircraft collisions with birds and wildlife, and obstructions to flight, through adherence to all applicable safety and health procedures.	No change.
Socioeconomics	No significant adverse impacts on socioeconomic conditions.	No change.

Table 2.3-1 Comparison of Potential Environmental Impacts of the Proposed Action

Resource	Proposed Action (Alternative 1 and Alternative 2)	No Action Alternative
Environmental Justice and Protection of Children	No disproportionately adverse effects on minority populations, low-income populations, persons younger than 18 years, or persons older than 65 years.	No change.
Visual Resources	No significant adverse impacts on visual resources, including from light emissions.	No change.

CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the existing conditions of environmental resources in or underlying the existing RAN2A MOA and potential impacts on those resources from the Proposed Action and No Action Alternative. Potential effects were evaluated for each resource in terms of type, duration, and degree. Descriptions of the criteria used to evaluate impacts are included in the environmental consequences sections of each resource. The effects of reasonably foreseeable future actions are also considered. Through this EA, the terms "impact" and "effects" are used interchangeably and mean the same thing.

The Proposed Action assumes that the 12 FTW would operate the T-7A in the proposed airspace. The ratio and timeline for transition to the T-7A and phase-out of the T-38 at JBSA-Randolph is not currently known. Use of the T-7A by the 12 FTW was assumed as the basis for analysis of potential environmental consequences from the Proposed Action (Alternative 1) and Alternative 2.

3.1 ANALYZED RESOURCES

Table 3.1-1 lists the environmental resources analyzed in this EA and the Region of Influence (ROI) for each resource. The ROI is the geographic area where potential impacts on a particular resource could occur or be experienced as a result of the Proposed Action or No Action Alternative. The area and extent of the ROI varies for each resource based on the characteristics of the particular resource being evaluated.

Table 3.1-1 Resources Analyzed in the EA and ROI

Resource	Region of Influence
Airspace Management and Use	Airspace underlying and within the existing RAN2A MOA and ATCAA.
Noise	Airspace within, and lands underlying the existing RAN2A MOA.
Land Use	Lands underlying the existing RAN2A MOA.
Air Quality	Air Quality Control Regions containing Texas counties underlying the existing RAN2A MOA.
Biological Resources	Airspace within and lands underlying the existing RAN2A MOA.
Cultural Resources	Contiguous with the Area of Potential Effects which consists of lands underlying or intersected by the boundaries of the existing RAN2A MOA.
Safety	Airspace within and below, and lands underlying the existing RAN2A MOA.
Socioeconomics	Texas counties underlying the existing RAN2A MOA.
Environmental Justice and Protection of Children	Texas counties underlying the existing RAN2A MOA.
Visual Resources	Lands directly underlying the proposed low-altitude airspace and adjacent lands where viewers may observe aircraft activity within the proposed airspace.

3.2 Resources Eliminated from Further Analysis

In compliance with NEPA, CEQ guidelines, and DAF guidance in 32 CFR Part 989, as amended, the analysis presented in this EA focuses on those resources that may be meaningfully affected by the Proposed Action. Resources that would experience no or only marginal effects were identified through a preliminary screening process and dismissed from detailed analysis. These resources, and the rationale for their dismissal, are summarized in **Table 3.2-1**.

Table 3.2-1 Resources Dismissed from Analysis in the EA

Resource Dismissed from Analysis	Rationale for Dismissal
Water Resources	The Proposed Action does not include ground disturbing activities nor activities that would occur in or near surface water bodies, wetlands, and floodplains; require the channeling, diversion or alteration of surface water bodies; require new or additional withdrawals of or discharges to surface water and groundwater; or have the potential to indirectly affect water quality (e.g., the sedimentation and pollution from ground disturbance and associated runoff, or the intentional or accidental release of pollutants or hazardous substance to surface and groundwater). The Proposed Action would not increase or otherwise change the use of water resources in the Region of Influence. Therefore, this resource was dismissed from detailed analysis in the EA.
Earth Resources	Activities included in the Proposed Action would occur entirely within airspace above the Earth's surface and would not involve the disturbance of soils or geological strata, or the alteration of topography. Therefore, this resource is not analyzed further in this EA.
Hazardous Materials and Waste	Under the Proposed Action, hazardous materials and hazardous waste would continue to be used, handled, stored, and disposed of in accordance with all applicable DoD and DAF regulations and other federal and state regulatory requirements. The quantities and types of these materials and wastes used and generated by the DAF would not change under the Proposed Action. No hazardous materials or hazardous waste would be used, stored, generated, disposed of, or released in areas underlying the RAN2A MOA. Therefore, this resource is not analyzed further in the EA.
Infrastructure / Utilities	The Proposed Action would not exceed the capacity of existing utility and infrastructure systems and does not involve the installation of new, or the alteration of, existing infrastructure and utilities. Therefore, this resource was dismissed from detailed analysis in the EA.
Coastal Zone Management	The Proposed Action would not occur or have the potential to affect resources within Texas's coastal zone, which contains portions of Texas counties adjacent to the Gulf of Mexico between the Texas-Louisiana border and the Texas-Mexico border, and nearshore waters of the Gulf of Mexico adjacent to those counties. Therefore, this resource was dismissed from detailed analysis in the EA.
Section 4(f) of the U.S. Department of Transportation Act (49 USC § 303(c))	The U.S. Department of Transportation Act (49 U.S.C. § 303(c)) requires projects funded or authorized by the U.S. Department of Transportation to avoid or minimize the use of or adverse effects on public parks, recreation areas, or wildlife and waterfowl refuges of national, state, or local significance, or land of an historic site of national, state, or local significance. (In this context, such lands or sites are typically referred to as "Section 4(f) resources.") Section 1079 of the National Defense Authorization Act for FY98 (Public Law 105-85, November 18, 1997) states that "No military flight operation (including a military training flight), or designation of airspace for such an operation, may be treated as a transportation program or project for purposes of" 49 U.S.C. § 303(c). Therefore, Section 4(f) considerations are not addressed further in this EA.

Table 3.2-1 Resources Dismissed from Analysis in the EA

Resource Dismissed from Analysis	Rationale for Dismissal
Prime and Unique Farmland, and Land of Statewide or Local Importance	The Proposed Action would not involve the nonagricultural development or use of prime and unique farmland as defined by the U.S. Department of Agriculture, or land of statewide or local importance as defined by applicable state and local agencies, because no construction, demolition, or other ground-disturbing activities would occur. Aircraft noise associated with the Proposed Action would have no potential to impede or prevent agricultural activities currently occurring on or planned for such lands. Therefore, this resource was dismissed from analysis in the EA.

3.3 AIRSPACE MANAGEMENT AND USE

3.3.1 Definition of the Resource

3.3.1.1 Airspace Regulations

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 U.S. government has exclusive sovereignty over the nation's airspace. The FAA is solely responsible for developing plans and policy for airspace use and management to ensure the safety of flight and that all users of the NAS can operate in a safe, secure, and efficient manner. The NAS is made up of a network of air navigation facilities, ATC facilities, airports, technology, and appropriate rules and regulations that are needed to operate the system and establish how and where aircraft may fly.

Airspace for military use is established by the FAA in coordination with the DoD to meet operational needs for military readiness; the DoD requests airspace from the FAA and schedules and uses airspace as described in DoD Directive 5030.19, *DoD Responsibilities on Federal Aviation*. In this process, the FAA is routinely a cooperating agency in developing airspace actions. SUA identified for military activities is charted and published by the National Aeronautical Navigation Services in accordance with FAA Order JO 7400.2P, *Procedures for Handling Airspace Matters* (FAA, 2023a). Procedures governing the use of airspace operated and controlled by the DAF are included in Air Force Policy Directive 13-2, *Air Traffic Control, Airfield, Airspace, and Range Management*. The DAF manages airspace in accordance with processes and procedures detailed in Department of the Air Force Manual (DAFMAN) 13-201, *Airspace Management*, which also provides the guidance and procedures for developing and processing SUA actions including aeronautical matters governing the efficient planning, acquisition, use, and management of airspace required to support DAF and United States Space Force operations.

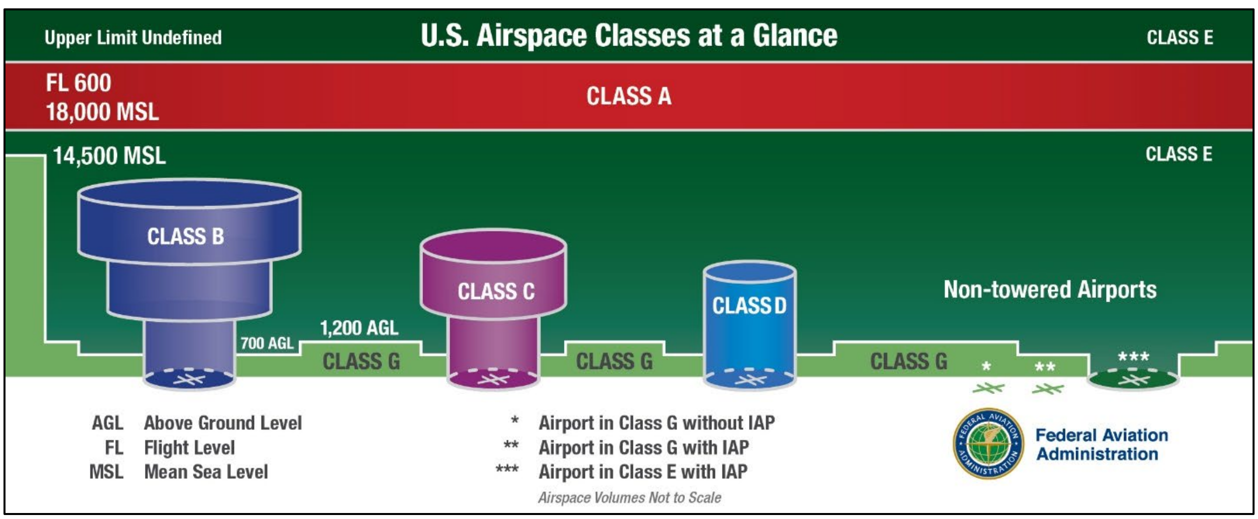
3.3.1.2 Airspace Classification

The FAA categorizes airspace as either regulatory or nonregulatory. Regulatory airspace includes Class A, B, C, D, and E airspace, restricted areas, and prohibited areas. Nonregulatory airspace includes MOAs, warning areas, alert areas, controlled firing areas, and national security areas. These two categories are divided into four airspace types: controlled, uncontrolled, special use, and other airspace. These airspace categories and types are determined by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and national and public interest in the airspace.

Controlled airspace includes different classifications of airspace (Class A, Class B, Class C, Class D, and Class E airspace) and defined dimensions where ATC service is provided to IFR flights and VFR flights according to airspace classification. IFR operations in any class of controlled airspace requires that a pilot must file an IFR flight plan and receive an appropriate ATC clearance. VFR operations require the pilot to ensure that ATC clearance or radio communication requirements are met prior to entry into Class B, Class C, or Class D airspace. Class A is the most restrictive airspace. The altitudes associated with the controlled airspace classes vary. FAA Order JO 7400.11J, *Airspace Designations and Reporting Points* (September 2024) specifies the airspace altitude ranges for airspaces designated for public and military airports.

Uncontrolled (Class G) airspace is the portion of airspace that has not been designated as Class A, Class B, Class C, Class D, or Class E airspace and is therefore not provided ATC service. Generally, Class G airspace extends from the surface up to but does not include the Class E airspace floor.

Figure 3.3-1 shows the altitude ranges and airspace relationship of the controlled and uncontrolled airspace classes (FAA, 2024a). Additional information regarding the airspace classes is provided in **Appendix C, Section C.1.1.**



Source: FAA, 2023c

Figure 3.3-1 U.S. Airspace Classes

SUA is the designation for airspace in which certain activities must be confined, or where limitations may be imposed on aircraft operations that are not part of those activities. SUA generally consists of prohibited areas, restricted areas, warning areas, MOAs, alert areas, controlled firing areas, and national security areas. MOAs are considered joint use airspace consisting of defined vertical and lateral limits established outside of Class A airspace to separate or segregate certain nonhazardous military flight activities from IFR aircraft and to identify for VFR aircraft where these activities are conducted. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through the MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic. Nonparticipating pilots are permitted to operate by VFR in active MOAs using see-and-avoid flying to prevent conflicts. Restricted Areas are regulated under 14 CFR Part 73 as designated airspace supporting ground or flight activities that can be hazardous to nonparticipating aircraft, such as artillery firing, aerial gunnery, guided missiles, or other air-to-ground or ground-to-ground ordnance training activities. All general aviation and nonparticipating military aircraft are prohibited from active Restricted Areas, but they can be authorized for Restricted Area transit when the area is not being activated by the using agency.

Other airspace refers to most of the remaining airspace including, but not limited to MTRs, temporary flight restrictions, published VFR routes, national security areas, and flight restricted zones (FAA, 2023c). MTRs are established by joint venture between the FAA and the DoD for use by the military for the purpose of conducting low-altitude, high-speed (exceeding 250 knots) training. The routes above 1,500 feet AGL are developed to be flown, to the maximum extent possible, under IFR. Most routes at 1,500 feet AGL and below are developed to be flown under VFR using see-and-avoid flying.

As stated in 14 CFR § 91.119, Minimum Safe Altitudes*,* aircraft operating in the NAS must abide by the following standard altitude restrictions to avoid hazards to persons or property damage. Except when necessary for takeoff or landing, no person may operate an aircraft below the following altitudes: an altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface; over any congested area of a city, town, or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft; over uncongested areas, aircraft must maintain an altitude of 500 feet above the surface, except over open water or sparsely populated areas, and no closer than 500 feet to any person, vessel, vehicle, or structure.

The ROI for airspace management and use is primarily the airspace designated for the proposed RAN2A Low MOA but also includes the existing, adjacent RAN2A MOA and RAN2A ATCAA, as well as the local airports located under the proposed low MOA, and civilian air traffic and MTRs that cross the proposed low MOA. This area is located about 25 miles west of San Antonio, Texas, as shown on **Figure 1.2-2**. Times of use for the SUAs and ATCAAs are from Monday to Friday, sunrise to sunset, other times by Notice to Air Missions (NOTAM). The controlling agency is FAA Houston Center and the using agency is DAF, 12 FTW, JBSA-Randolph (DoD, 2024). These are the airspace that would potentially be impacted by the Proposed Action and which require assessment of the effects on airspace resources.

Additional information regarding the definition of the resource is provided in **Appendix C, Section C.1**.

3.3.1.3 Airspace Traffic Analysis

An extensive airspace traffic analysis was conducted as part of this EA to identify and characterize all existing flight activity in and around the proposed RAN2A Low MOA (DAF, 2024a). This study analyzed existing air traffic operations based on recorded flight data from 2022, from available radar tracking data and associated aircraft type and flight plan information. Archived information was collected from the FAA Houston Center using the Performance Data Analysis and Reporting System (PDARS) and System Wide Information Management (SWIM) data were collected from Houston Terminal Radar Approach Control Facilities TRACON (I90). The airspace elements included in this study and some of the data processing assumptions are briefly described in this section as a basis for understanding the air traffic results obtained for the proposed RAN2A Low MOA, the airspace that would primarily be affected by the Proposed Action.

The complete air traffic analysis focused on evaluating 2022 PDARS and SWIM traffic flows within the proposed RAN2A Low MOA and SUA and other airspace that are adjacent to or near the proposed low MOA. Flight track data for individual flights were associated with aircraft type and flight plan information and these data were subsequently filtered to identify the specific flights that occurred in each airspace analyzed; these data were also entered into the SkyViewer visualization tool to develop data analytics and create graphics for illustrating flights.

The airspace analyzed in the complete traffic analysis include the RAN2A and RAN2B MOAs, RAN2A and RAN2B ATCAA, Aerial Refueling track 614, and Airborne Warning and Control System areas AW107 and AW108. These airspace are summarized in **Table 3.3-1** which, for each, specifies the altitudes and lateral boundaries used in the traffic analysis. Of note are the flight altitudes; the proposed RAN2A Low MOA altitude range is from 500 feet AGL to 8,999 feet MSL, whereas all the other airspace flight altitudes are 9,000 feet MSL or above.

Table 3.3-1 Study Airspace Definitions

Airspace	Altitudes Used for Analysis	Lateral Boundaries
Proposed RAN2A Low MOA	500 feet AGL to 8,999 feet MSL	As defined in FAA Order JO 7400.10F *Special Use Airspace*
RAN2A MOA	9,000 feet MSL to FL180	
RAN2A ATCAA	FL180 to FL290	
RAN2B MOA	14,000 feet MSL to FL180	
RAN2B ATCAA	FL180 to FL220	
Aerial Refueling (AR614)	FL250 to FL270	As defined in DoD Flight Information Publication (FLIP) AP/1B, *Area Planning Special Use Airspace North and South America*
Airborne Warning and Control System (AW107)	FL310 to FL330	29.645°N/ -98.70666667°W 29.27277778°N/ -98.49388889°W 28.89527778°N/ -99.34222222°W 29.2675°N/ -99.55833333°W
Airborne Warning and Control System (AW108)		29.71611111°N/ -99.98277778°W 29.58916667°N/ -98.84416667°W 29.09166667°N/ -98.91944444°W 29.21861111°N/ -100.0522222°W

The proposed RAN2A Low MOA is anticipated to be scheduled with the RAN2A MOA and RAN2A ATCAA such that training flights would be able to transition seamlessly between these vertically adjacent airspace. Therefore, in defining the affected environment, results for air traffic operations within these three airspace components are presented in **Section 3.3.2** with the primary affected environment being the airspace for the proposed RAN2A Low MOA **(Figure 2.1-1)**. Flight operations in the primary affected environment include civilian and military traffic that transit the proposed RAN2A Low MOA including flight operations at local civilian airports located under this airspace and military flights on several MTR segments that cross this airspace.

Results from analyzing the other existing, higher-altitude flight operations in the RAN2B MOA, RAN2B ATCAA, AR614, AW107, and AW108, are summarized in the Randolph *Final Report* *for Airspace Analysis* (DAF, 2024a). However, these higher-altitude operations are not expected to be notably affected by the Proposed Action; therefore, they are not discussed further in this airspace assessment.

3.3.2 Affected Environment

Randolph AFB was established in Texas in 1931 and training in military airspace has occurred over south-central Texas, including the areas containing the RAN2A MOA, for more than 90 years. MOAs may overlap or be crossed by other types of military and nonmilitary airspace, and have been historically compatible with nonmilitary aviation operations including commercial passenger aviation and local or regional operations such as medical transport, crop dusting, pest control, aerial assessments for farming and wildlife management purposes, and similar activities. Military and nonmilitary pilots flying VFR and transiting through MOAs as part of their routine flight operations and patterns must use "see and avoid" techniques to prevent conflicts with military aircraft actively using the MOAs. Pilots flying under IFR also rely on their instruments and communications with ATC when cleared to transit nonactive parts of MOAs.

Existing flight operations in the affected environment, as identified in the 2022 air traffic analysis, are summarized by category in the following sections:

- Proposed RAN2A Low MOA **(Section 3.3.2.1)**
- RAN2A MOA (**Section 3.3.2.2**)
- RAN2A ATCAA (**Section 3.3.2.3**)
- Local civilian airports with flight operations in the proposed RAN2A Low MOA **(Section 3.3.2.4)**
- Military airfields with flight operations in the proposed RAN2A Low MOA **(Section 3.3.2.5)**
- MTRs that cross the proposed RAN2A Low MOA **(Section 3.3.2.6)**

Note that the flight operations are summarized in the categories above to help differentiate the primary sources of air traffic in the study area that characterize the affected environment. All flight operations reported in the proposed RAN2A Low MOA, RAN2A MOA, and RAN2A ATCAA are the totals for each airspace; those totals include all flights from local and regional civilian airports and military airfields that transit each airspace. In addition, MTR operations were provided by JBSA-Randolph and JBSA Kelly Field, separate from the 2022 air traffic analysis.

Potential impacts on existing flight operations are discussed in **Section 3.3.3**.

3.3.2.1 Proposed RAN2A Low MOA

Existing flight operations in the proposed RAN2A Low MOA are presented in a series of tables from the Randolph *Final Report for Airspace Analysis*. Four graphic plots are presented below to illustrate various elements of the Performance Data Analysis and Reporting System radar data analysis, performed to filter the data into different categories (the same types of analysis were performed for the RAN2A MOA and RAN2A ATCAA). **Figure 3.3-2** shows the sample of radar tracks (2022) crossing the proposed RAN2A Low MOA, color coded by operator type to identify civilian (blue), military (green), and unknown (red) operators. Likewise, **Figure 3.3-3** and **Figure 3.3-4** show civilian traffic flows and military traffic flows, respectively, in the proposed RAN2A Low MOA, color coded by altitude band. **Figure 3.3-5** shows local airport traffic flows by altitude band. The primary information available from these analyses for each airspace include (for each flight track data point) aircraft location, altitude, and airspeed, merged with aircraft type and flight plan information; from which additional study metrics can be derived, such as flight category (VFR or IFR) and time in airspace.

Filtering and analysis of the air traffic data associated with the proposed RAN2A Low MOA yielded the operations listed in **Tables 3.3-2** through **3.3-9**. Air traffic crossings by operator type are listed in **Table 3.3-2** which indicates that the majority (86 percent) of the 26,334 total crossings are by civilian aircraft operators, 8 percent by military operators, and 6 percent by unknown operators (for which aircraft type and flight plan could not be associated with tracking data).

Table 3.3-2 Crossings of the Proposed RAN2A Low MOA by Operator Type and Category

Operator Type/Category		Count	Percent
Civilian	Air Carrier	136	1
	Air Taxi	2,010	8
	General Aviation	20,398	77
Military		2,235	8
Unknown		1,555	6
Total		**26,334**	**100**

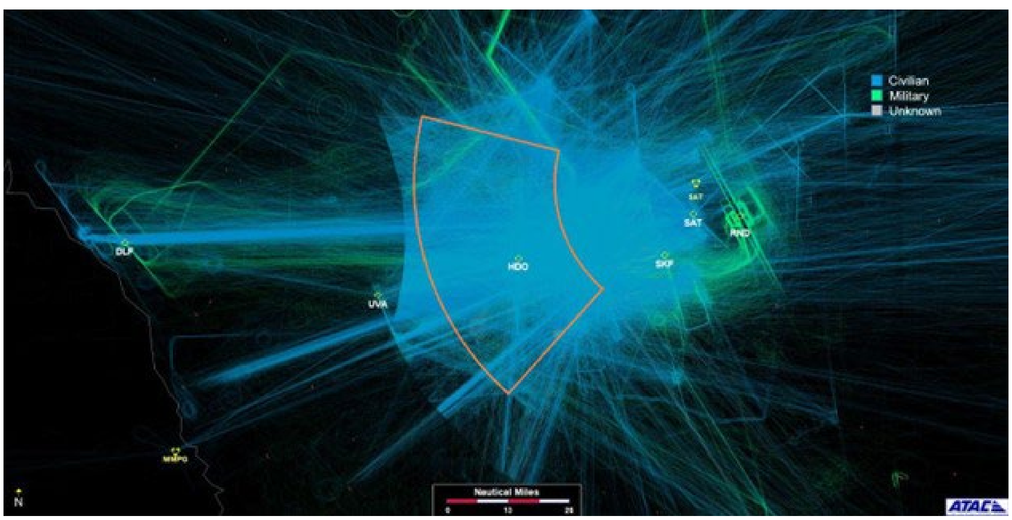


Figure 3.3-2 Radar Flight Tracks by Operator Type – Proposed RAN2A Low MOA

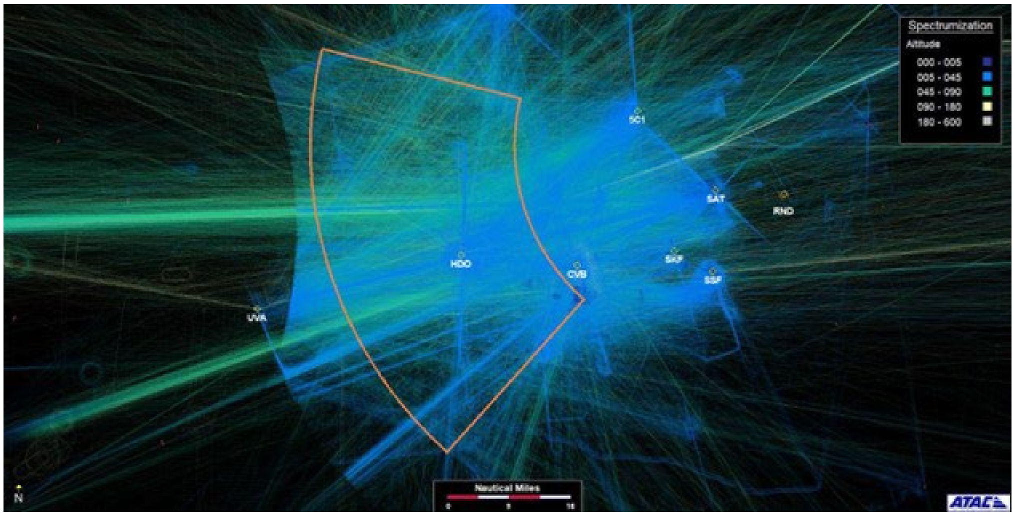


Figure 3.3-3 Civilian Traffic Flows – Proposed RAN2A Low MOA

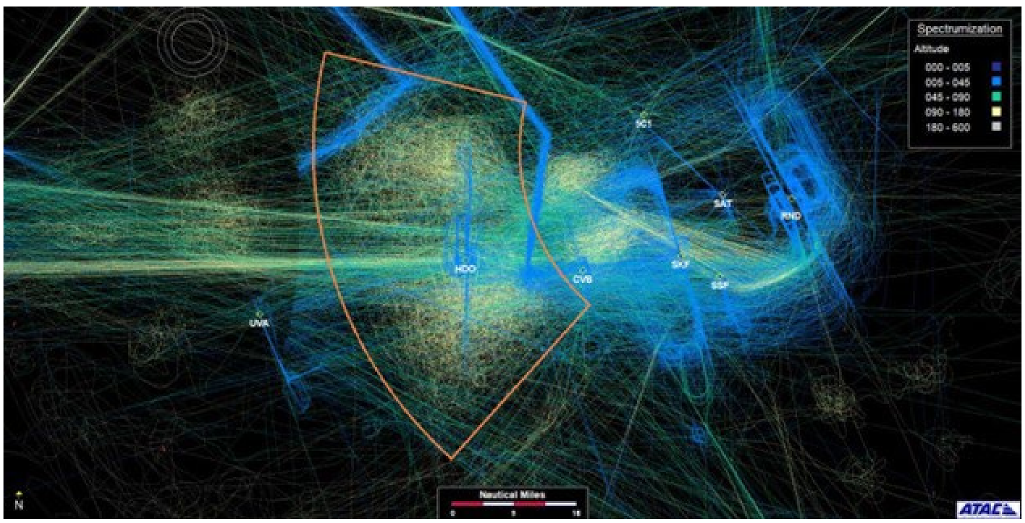


Figure 3.3-4 Military Traffic Flows – Proposed RAN2A Low MOA

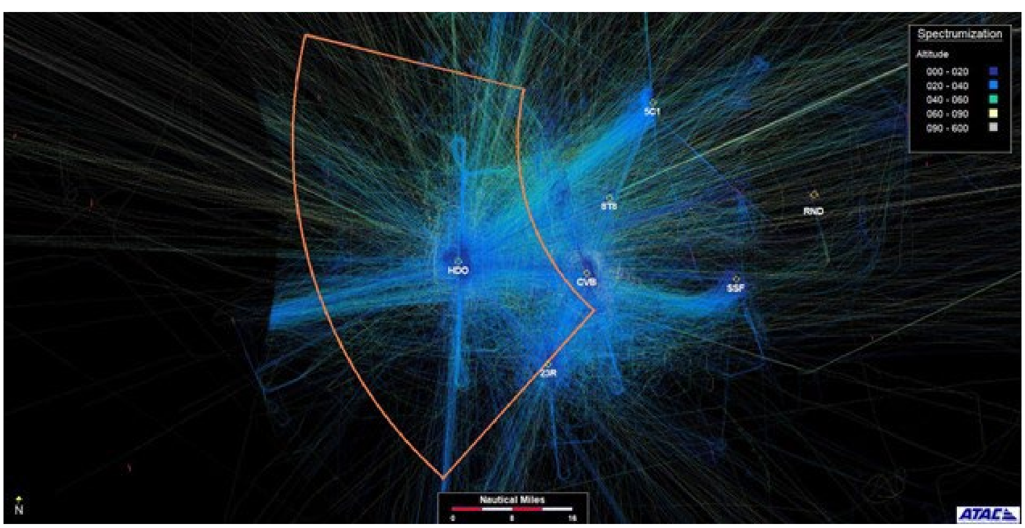


Figure 3.3-5 Local Airport Traffic Flows – Proposed RAN2A Low MOA

Table 3.3-3 lists the crossings in the proposed RAN2A Low MOA by operator type and flight category (IFR or VFR). IFR operations have the potential to be impacted the most from the Proposed Action when the RAN2A Low MOA is active.

Table 3.3-3 IFR and VFR Crossings of the Proposed RAN2A Low MOA

Flight Category	Civilian			Military	Unknown	Total	Percent
	Air Carrier	Air Taxi	General Aviation				
IFR	136	2,004	6,787	1,499	0	10,426	40
VFR	0	6	13,611	736	1,555	15,908	60
Total	**136**	**2,010**	**20,398**	**2,235**	**1,555**	**26,334**	**100**

The monthly, daily, and hourly crossings in the proposed RAN2A Low MOA are listed in **Tables 3.3-4** through **3.3-6**, respectively for the different operator categories. The combined information in these tables indicates the number of crossings for different periods throughout the year. In this sample, the busiest months are September and October **(Table 3.3-4)**, the busiest weekdays are Wednesday through Friday **(Table 3.3-5)**, and the busiest times of day are from 10:00 a.m. to 4:00 p.m., with peak hours from noon to 2:00 p.m. **(Table 3.3-6)**. In **Section 3.3.3**, this existing airspace usage information, estimated for IFR operations, is compared with the anticipated activity schedule for the proposed RAN2A Low MOA to estimate potential impacts on existing operations.

Table 3.3-4 Monthly Crossings of the Proposed RAN2A Low MOA

Month	Air Carrier	Air Taxi	General Aviation	Military	Unknown	Total	Daily Average
Jan	5	161	1,709	194	168	2,237	72
Feb	6	151	1,547	173	186	2,063	74
Mar	5	161	1,744	173	178	2,261	73
Apr	21	176	1,356	190	115	1,858	62
May	14	173	1,652	182	155	2,176	70
Jun	11	159	1,843	215	169	2,397	80
Jul	13	167	1,896	209	90	2,375	77
Aug	19	159	1,576	172	73	1,999	64
Sep	23	181	2,158	215	91	2,668	89
Oct	4	159	2,010	227	144	2,544	82
Nov	11	171	1,409	147	115	1,853	62
Dec	4	192	1,498	138	71	1,903	61
Total	**136**	**2,010**	**20,398**	**2,235**	**1,555**	**26,334**	**72**

Table 3.3-5 Daily Crossings of the Proposed RAN2A Low MOA

Day of Week	Air Carrier	Air Taxi	General Aviation	Military	Unknown	Total	Daily Average
Mon	38	271	2,347	321	167	3,144	60
Tues	14	375	2,866	431	169	3,855	74
Wed	12	393	2,981	479	215	4,080	78
Thurs	19	384	3,097	442	203	4,145	80
Fri	14	407	3,047	370	193	4,031	78
Sat	32	147	3,175	75	296	3,725	70

Table 3.3-5 Daily Crossings of the Proposed RAN2A Low MOA

Day of Week	Air Carrier	Air Taxi	General Aviation	Military	Unknown	Total	Daily Average
Sun	7	33	2,885	117	312	3,354	64
Total	**136**	**2,010**	**20,398**	**2,235**	**1,555**	**26,334**	**72**

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Table 3.3-6 Hourly Crossings of the Proposed RAN2A Low MOA

Hour	Air Carrier	Air Taxi	General Aviation	Military	Unknown	Total	Daily Average
0	1	1	191	4	13	210	1
1	3	1	131	2	9	146	0
2	0	2	116	1	12	131	0
3	1	1	99	1	13	115	0
4	1	2	85	0	4	92	0
5	0	5	92	0	11	108	0
6	0	42	144	9	32	227	1
7	0	428	418	8	55	909	2
8	2	161	824	111	80	1,178	3
9	1	67	1,298	199	128	1,693	5
10	0	32	1,737	135	156	2,060	6
11	6	44	1,822	201	156	2,229	6
12	14	31	1,828	279	132	2,284	6
13	10	29	1,880	231	140	2,290	6
14	10	25	1,852	191	141	2,219	6
15	19	22	1,765	305	110	2,221	6
16	23	22	1,593	200	104	1,942	5
17	9	177	1,388	49	103	1,726	5
18	8	51	1,068	64	45	1,236	3
19	8	406	783	69	36	1,302	4
20	2	448	536	67	42	1,095	3
21	4	6	295	91	15	411	1
22	6	6	230	14	13	269	1
23	8	1	223	4	5	241	1
Total	**136**	**2,010**	**20,398**	**2,235**	**1,555**	**26,334**	**72**

Aircraft crossing durations are listed in **Table 3.3-7** by operator category with 77 percent of the crossings occurring in 15 minutes or less and most of the remaining crossings (19 percent) occurring over a 15 to 30-minute period. Crossing durations could be used to estimate potential impacts (delays) to IFR flights by comparing the crossing times of existing flights with estimated times for any future flights that would potentially be rerouted due to the Proposed Action.

Table 3.3-7 Distribution of Aircraft Crossing Durations in the Proposed RAN2A Low MOA

Time (minutes)	Air Carrier	Air Taxi	General Aviation	Military	Unknown	Total	Percent
0-15	134	1,998	14,842	2,092	1,320	20,386	77
15-30	2	12	4,547	112	210	4,883	19
30-45	0	0	664	19	17	700	3

Table 3.3-7 Distribution of Aircraft Crossing Durations in the Proposed RAN2A Low MOA

Time (minutes)	Air Carrier	Air Taxi	General Aviation	Military	Unknown	Total	Percent
45-60	0	0	215	9	6	230	1
60-75	0	0	82	1	0	83	0
75-90	0	0	32	1	1	34	0
90-105	0	0	11	0	0	11	0
105-120	0	0	1	0	0	1	0
> 120	0	0	4	1	1	6	0
Total	**136**	**2,010**	**20,398**	**2,235**	**1,555**	**26,334**	**100**

The distribution of aircraft crossings by altitude is listed for each operator category in **Table 3.3-8**. Overall, the data show a roughly even distribution of crossings in 1,000-foot altitude bands, from 1,000 to 8,000 feet MSL. Approximately 13 percent of all aircraft crossings occur at or below 1,000 feet MSL and 21 percent occur in the 2,000 to 3,000 feet MSL band. The majority (96 percent) of the crossings are by civilian, general aviation aircraft; approximately 4 percent are by military aircraft.

Table 3.3-8 Distribution of Aircraft Crossings by Altitude in the Proposed RAN2A Low MOA

Altitude (MSL)	Air Carrier	Air Taxi	General Aviation	Military	Unknown	Total	Percent
0	0	0	96	0	9	105	0
1,000	0	1	2,969	140	219	3,329	13
2,000	0	14	4,660	509	468	5,651	21
3,000	2	10	3,328	194	369	3,903	15
4,000	2	40	2,481	155	179	2,857	11
5,000	3	373	2,391	166	144	3,077	12
6,000	12	940	1,809	321	83	3,165	12
7,000	51	377	1,521	307	53	2,309	9
8,000	66	255	1,143	443	31	1,938	7
Total	**136**	**2,010**	**20,398**	**2,235**	**1,555**	**26,334**	**100**

A summary of the air traffic crossing data for the proposed RAN2A Low MOA shown in the previous tables, is presented in **Table 3.3-9**. This summary table provides high-level information for each of the air traffic metrics shown and characterizes the air traffic existing conditions for the proposed RAN2A Low MOA that primarily define the affected environment.

Similarly, air traffic summary tables are provided for the other SUA (RAN2A MOA) in **Table 3.3-10** and RAN2A ATCAA in **Table 3.3-11**, that are also considered part of the affected environment. These airspace could potentially be affected during times when the proposed RAN2A Low MOA would be active, causing a shift in traffic flows from the low MOA to these higher altitude airspace (though the need for this type of traffic shift is currently unknown).

Included in the military air traffic reported for the RAN2A MOA and RAN2A ATCAA are the existing 8,000 annual T-38C flight operations conducted by the 12 FTW at JBSA-Randolph and 144 annual F-16C flight operations (those determinable from the radar data analysis) conducted by the 149 FW at JBSA-Kelly Field. The 12 FTW schedules and uses the RAN2A MOA and

RAN2A ATCAA simultaneously, Monday through Friday, normally during three periods each day:

- 8:30 a.m. to 10:30 a.m.
- 11:30 a.m. to 1:15 p.m.
- 2:15 p.m. to 4:15 p.m.

These three flying periods also occur during the busiest period of air traffic, each day, in the existing airspace designated for the proposed RAN2A Low MOA, 8:00 a.m. to 6:00 p.m. **(Table 3.3-6)**.

Table 3.3-9 Summary of Air Traffic Crossings in the Proposed RAN2A Low MOA (2022)

Air Traffic Metric	Summary Information
Total Aircraft Crossings	26,334 aircraft transited the proposed RAN2A Low MOA with 86% civilian operators (77% by general aviation), 8% military, and 6% unknown operators.
VFR / IFR	60% VFR and 40% IFR.
Monthly Aircraft Crossings (High / Low)	Air traffic peaked in September with 2,668 total aircraft crossings and the lowest traffic counts were in November with 1,853 total aircraft crossings.
Daily Aircraft Crossings (High / Low)	On average, 72 aircraft per day transited the proposed RAN2A Low MOA with the highest on Thursdays and the lowest on Mondays.
Civilian Air Traffic, Flight Paths, and Arrival Departure Airports	Civilian traffic was busiest on Saturdays between 10:00 a.m. and 4:00 p.m. General aviation traffic counts were highest from 10:00 a.m. to 4:00 p.m. Air taxi traffic counts peaked from 7:00 to 8:00 a.m. and 7:00 to 9:00 p.m. Civilian flight tracks showed aircraft landing and departing from local airports, flying approaches at South Texas Regional Airport at Hondo (HDO), and transiting the proposed RAN2A Low MOA. The two most common arrival and departure airports for civilian traffic were San Antonio International Airport (SAT) and HDO.
Military Air Traffic, Flight Paths, and Arrival Departure Airports	Military activity was concentrated to mid-week, with most flights occurring from 9:00 to 10:00 a.m., noon to 2:00 p.m., and 3:00 to 4:00 p.m. Military flight paths through the proposed low MOA show aircraft flying approaches at HDO, flying on low-level training routes, and transiting the airspace to nearby airports. The most common arrival and departure airports for military traffic were Randolph AFB (RND), Laughlin AFB (DLF), and Kelly Field (SKF).

3.3.2.2 RAN2A MOA

Table 3.3-10 Summary of Air Traffic Crossings in the Existing RAN2A MOA (2022)

Air Traffic Metric	Summary Information
Total Aircraft Crossings	14,983 aircraft transited the RAN2A MOA with 37% civilian operators, 62% military operators, and 1% unknown operators.
VFR / IFR	11% VFR, 62% IFR, and 27% unknown; 53% of IFR crossings were made by civilian operators and 47% by military operators.
Monthly Aircraft Crossings (High / Low)	Air traffic peaked during May with 1,475 total aircraft crossings. The lowest traffic counts occurred during August with 953 total aircraft crossings.
Daily Aircraft Crossings (High / Low)	On average, 41 aircraft per day transited the RAN2A MOA. Overall daily crossings were highest on Tuesdays and lowest on Saturdays.

Table 3.3-10 Summary of Air Traffic Crossings in the Existing RAN2A MOA (2022)

Air Traffic Metric	Summary Information
Civilian Air Traffic and Arrival Departure Airports	Civilian traffic was busiest Monday through Friday between 7:00 p.m. and 8:00 p.m. due to air cargo feeder flights transiting the airspace between SAT and Del Rio International Airport (DRT). Civilian traffic was also heavy on Sundays between 10:00 a.m. and 5:00 p.m. Air carrier crossings were highest in the afternoons, between 3:00 and 5:00 p.m. The most common origin and destination airports for civilian traffic were SAT, Garner Field (UVA), and DRT.
Military Air Traffic and Arrival Departure Airports	Military aircraft produced the largest number of crossings mid-week, with the fewest military crossings occurring on the weekends. The most common arrival and departure airport for military traffic was RND.

3.3.2.3 RAN2A ATCAA

Table 3.3-11 Summary of Air Traffic Crossings in the RAN2A ATCAA (2022)

Air Traffic Metric	Summary Information
Total Aircraft Crossings	12,612 aircraft transited the RAN2A ATCAA with 47% identified as civilian operators and 58% as military operators.
Monthly Aircraft Crossings (High / Low)	Air traffic in RAN2A ATCAA peaked during May with 1,344 total aircraft crossings. The lowest traffic counts occurred during February with 918 total aircraft crossings.
Daily Aircraft Crossings (High / Low)	On average, 35 aircraft per day transited into the RAN2A ATCAA. Overall daily crossings were highest on Thursdays and lowest on the weekends.
Civilian Air Traffic and Arrival Departure Airports	Civilian traffic was busiest on Monday afternoons between 1:00 and 4:00 p.m., late Thursday afternoons, Thursday through Sunday mornings, and Sundays between 10:00 a.m. and 5:00 p.m. The most common origin airports for civilian operators were Laredo International Airport (LRD), SAT, and UVA. The most common destination airports were Dallas Fort Worth International Airport (DFW) and Austin-Bergstrom International Airport (AUS).
Military Air Traffic and Arrival Departure Airports	Military activity in the RAN2A ATCAA was highest mid-week from 9:00 to 10:00 a.m., 11:00 a.m. to noon, and 2:00 to 3:00 p.m. The predominant origin or destination airport for military traffic was RND.

3.3.2.4 Local Civilian Airports with Flight Operations in the Proposed RAN2A Low MOA

Civilian flight operations at airports located underneath the proposed RAN2A Low MOA, are summarized in **Table 3.3-12** by operator category at the most prevalent origin and destination airports. In most cases, these flight operations are counted as transiting the proposed RAN2A Low MOA and thus identify the local civilian airports that would be most affected by the Proposed Action. South Texas Regional Airport at Hondo followed by Castroville Municipal Airport are the largest civilian airport operators in the study area. For safety and deconfliction purposes, DAF has letters of agreement with civilian airports, including HDO, and the FAA's Houston Center, that establish no fly buffer zones around each airport with 3 NM lateral and 1,500 feet AGL extent.

Table 3.3-12 Civilian Origin and Destination Airport Operators in the Proposed RAN2A Low MOA

Origin Airport	Air Taxi	General Aviation	Military	Unknown	Total
South Texas Regional Airport at Hondo (HDO)	27	2,201	43	53	2,324
Castroville Municipal Airport (CVB)	0	1,002	3	27	1,032
Devine Municipal Airport (23R)	0	243	2	39	284
Total	**27**	**3,446**	**48**	**119**	**3,640**
Destination Airport	**Air Taxi**	**General Aviation**	**Military**	**Unknown**	**Total**
South Texas Regional Airport at Hondo (HDO)	32	2,328	62	109	2,531
Castroville Municipal Airport (CVB)	0	1,154	13	93	1,260
Devine Municipal Airport (23R)	0	341	5	66	412
Total	**32**	**3,823**	**80**	**268**	**4,203**

Civilian flight operations at local and regional airports that transit the proposed RAN2A Low MOA are summarized by origin and destination airport and prevalence of flight operations in **Table 3.3-13**. San Antonio International Airport followed by South Texas Regional Airport at Hondo are the largest operators that have flight traffic in the proposed RAN2A Low MOA.

Table 3.3-13 Local and Regional Airports Operators in the Proposed RAN2A Low MOA

Origin Airport	Prevalence
San Antonio International Airport (SAT)	12%
South Texas Regional Airport at Hondo (HDO)	10%
Boerne Stage Field (5C1)	7%
Castroville Municipal (CVB)	4%
Stinson Municipal (SSF)	4%
Del Rio International Airport (DRT)	4%
Garner Field (UVA)	2%
Kerrville Municipal/Louis Schreiner Field (ERV)	2%
Other/Unknown	55%
Destination Airport	**Prevalence**
San Antonio International Airport (SAT)	11%
South Texas Regional Airport at Hondo (HDO)	10%
Garner Field (UVA)	8%
Boerne Stage Field (5C1)	7%
Castroville Municipal (CVB)	5%
Del Rio International Airport (DRT)	4%
Stinson Municipal (SSF)	4%
Other/Unknown	51%

There are also multiple private airfields operating within the proposed RAN2A Low MOA including:

- Cinco B Ranch Airport (87XS)
- 4D Ranch Airport (04TT)
- Lobo Mountain Ranch Airport (TE21)
- Hidden Valley Ranch (TS90)
- Flying L Airport (TE90)
- Foster Ranch Airport (2XS6)
- Thunder Creek Airport (95TA)
- Waresville Airport (TS41)

- Rancho Sabino Grande (6TX2)
- Rusty's Flying Service (4TS8)
- T-Ranch Airport (XS86)
- Haass Field (TE57)
- Squirrel Creek Ranch Airport (4TE9)

These airports have operations; however, many of the aircraft flying out of these airports are not on flight plans and do not appear in the radar data.

3.3.2.5 Military Airfields with Flight Operations in the Proposed RAN2A Low MOA

Military airfields that have air traffic through the proposed RAN2A Low MOA are summarized by the origin and destination airfields and prevalence of flight operations in **Table 3.3-14**. Randolph AFB has the most air traffic through the proposed Low MOA followed by Laughlin AFB and Kelly Field.

Table 3.3-14 Origin and Destination Airfield Military Operators in the Proposed RAN2A Low MOA

Origin Airfield	Prevalence
Randolph AFB (RND)	27%
Laughlin AFB (DLF)	9%
Kelly Field (SKF)	8%
San Antonio International Airport (SAT)	5%
Easterwood Field (CLL)	3%
Naval Air Station Corpus Christi (NGP)	3%
Austin-Bergstrom International Airport (AUS)	2%
Other/Unknown	43%
Destination Airfield	**Prevalence**
Randolph AFB (RND)	27%
Laughlin AFB (DLF)	17%
Kelly Field (SKF)	11%
Garner Field (UVA)	4%
San Antonio International Airport (SAT)	3%
Naval Air Station Corpus Christi (NGP)	3%
South Texas Regional Airport at Hondo (HDO)	3%
Other/Unknown	32%

3.3.2.6 Military Training Routes that Cross the Proposed RAN2A Low MOA

There are four currently active MTRs that include route segments that cross the proposed RAN2A Low MOA: VR-1122 segments B-D**,** VR-1123 segments D-F (which is the same airspace segment in the reverse direction of VR-1122 segment B-D), VR-140 segment D-E, and VR-168 segment D-E **(Figure 3.3-6)**.

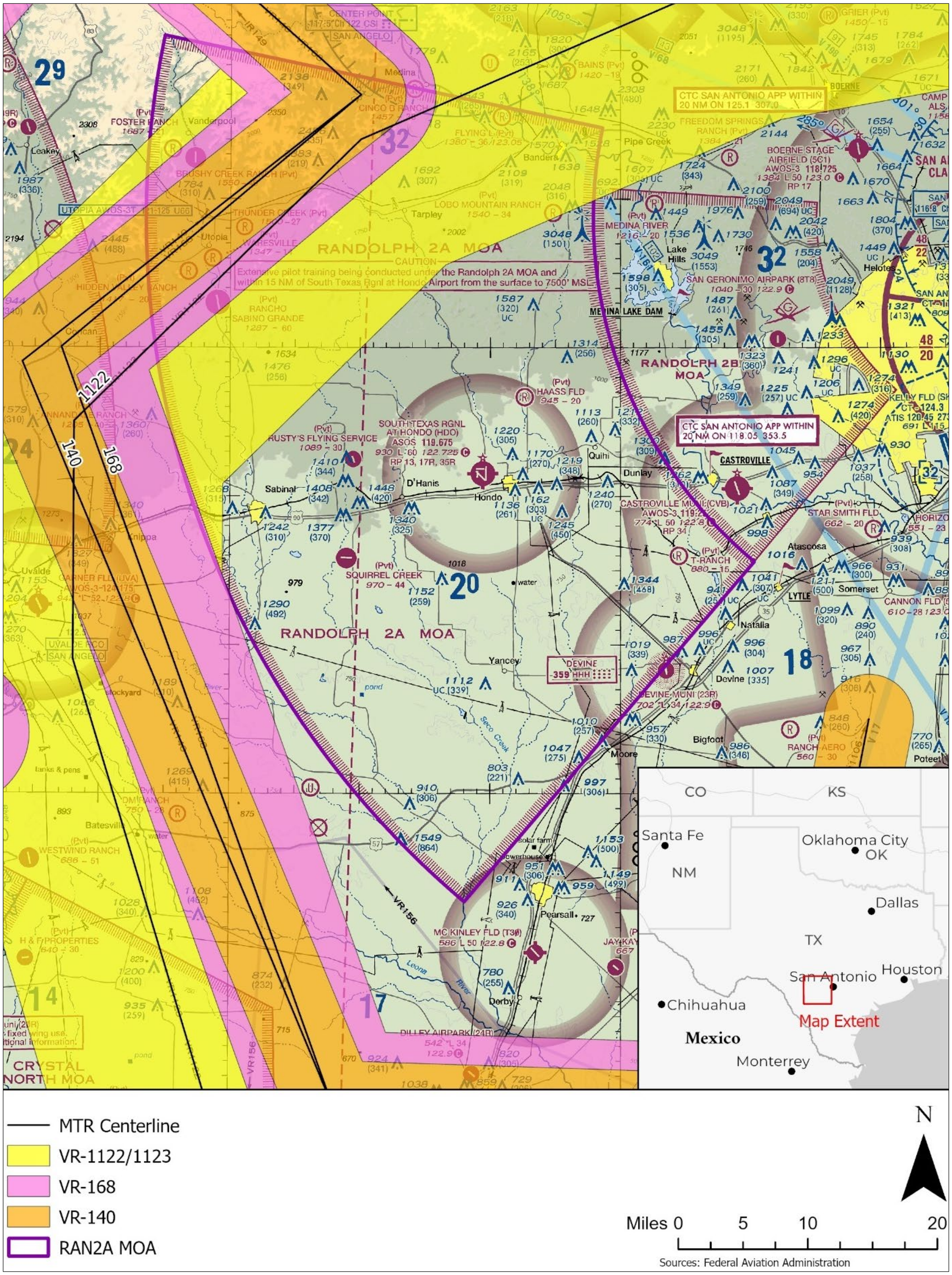

Figure 3.3-6 MTR segments that Cross the Proposed RAN2A Low MOA

The existing annual flight operations on these routes by aircraft type are listed in **Table 3.3-15** (Randolph AFB, 2023). Aircraft operating in segments of VR-1122/1123 and VR-168 within the ROI are authorized to fly as low as surface level (VR-168) or 100 feet AGL (VR-1122/1123); however, based on the altitude utilization data provided by the DAF **(Appendix C)**, most aircraft typically fly at or above 500 feet AGL on these MTRs. All four MTRs have route ceilings that are well above the floor of the proposed RAN2A Low MOA (500 feet AGL), such that operations on these routes have the potential to be affected by the Proposed Action.

Table 3.3-15 Existing Annual Flight Operations on MTR Segments

	VR-1122 Segments B-D	VR-1123 Segments D-F	VR-140 Segments D-E	VR-168 Segments D-E	
Aircraft	F-16C	F-16C	T-38C	T-44C	T-45
Airfield	Kelly Field	Kelly Field	Randolph AFB	Naval Air Station - Kingsville	
Existing Floor (feet)	100 AGL	100 AGL	500 AGL	Surface	
Existing Ceiling (feet)	1,500 AGL	1,500 AGL	4,000 MSL	4,000 MSL	
Day Operations [1]	16	16	197	13	5
Night Operations [2]	0	0	0	0	0

Notes:
One annual operation is one sortie flying the route.
[1] Day Operations hours are 7:00 a.m. to 10:00 p.m. local
[2] Night Operations hours are 10:00 p.m. to 7:00 a.m. local

3.3.3 Environmental Consequences

3.3.3.1 Evaluation Criteria

Impacts on airspace and airspace management would be considered adverse if the Proposed Action encroached on or caused disruptions to existing aviation traffic in the study airspace (or adjacent/nearby) airspace. An adverse impact would be considered significant if the Proposed Action permanently reduced the volume of an airspace (or adjacent/nearby airspace) or required changes to the lateral or horizontal extents of such airspace to continue operation. Additionally, any impact on airspace management would be considered significant if implementation of the Proposed Action were to substantially increase risks associated with flying activities; safety of personnel, contractors, military personnel, or the local community; hinder the ability to respond to an emergency; or introduce new health or safety risks for which the DAF or the surrounding community is not prepared or does not have adequate management and response plans in place.

The consequences of implementing the proposed RAN2A Low MOA are considered in the following sections. Potential impacts on the existing airspace and flight operations are assessed in terms of several measures, including:

(1) airspace size (does the proposed airspace have adequate size and vertical and lateral dimensions to accommodate the additional Proposed Action flight operations along with the existing flight operations)

(2) airspace capacity (can airspace controllers effectively manage the increased workload due to the additional flight operations)

(3) impacts on existing flight operations, including flight delays, that would potentially result from rerouting traffic to avoid the RAN2A Low MOA when it is active, instead of crossing through it.

Potential impacts on flight safety are addressed in **Section 3.11**.

3.3.3.2 Alternative 1

Alternative 1 would establish the RAN2A Low MOA as described in **Section 2.1**. Training activities would be as described in **Section 2.1.1.**

While there is an FAA regulatory prohibition on nonparticipating flying in an active MOA during IFR conditions, there is no such prohibition when it is active under VFR conditions. Nonparticipating civilian and military aircraft operating in this area using VFR procedures would have the same mutual obligation to use "see and avoid" flying to prevent conflicts. The FAA Houston Center would procedurally deconflict civilian and military IFR flights during times when the RAN2A Low MOA is active and, in some cases, flights may be rerouted around the Low MOA.

Airspace Size and Capacity

In evaluating potential impacts, the approach is to assess the size of the airspace, existing traffic flow, additional traffic flow that would result from the Proposed Action, and consider the additional airspace deconfliction procedures required by FAA Houston Center.

The area of the proposed RAN2A Low MOA perimeter is just over 1,900 square statute miles and the vertical extent is from 500 feet AGL to, but not including 9,000 feet MSL. As shown in **Table 3.3-2**, 26,334 aircraft transited the proposed RAN2A Low MOA in 2022 (86 percent civilian operators [77 percent by general aviation], 8 percent military, and 6 percent unknown operators). Overall, there was an average of 72 crossings per day (28 IFR and 44 VFR) in the airspace. Further, the busiest traffic periods occurred between 10:00 a.m. and 4:00 p.m., with an average of six aircraft crossings per hour. The Proposed Action would add 2,920 flight operations per year in the proposed RAN2A Low MOA, an increase of just over 11 percent. T-7A sorties would include one to four aircraft in the proposed MOA at a time. Should the Proposed Action be implemented with the establishment of the RAN2A Low MOA, the potential for spill outs (military aircraft unintentionally and temporarily flying beyond the airspace boundaries) would increase; however, spill outs, in general, occur infrequently since DAF military radar units prioritize making boundary calls so aircraft remain within the MOA/ATCAA airspace structures per their Letter of Agreement with the FAA.

Existing aircraft crossings total 72 per day or 6 crossings per hour during the busiest traffic periods. These operations are easily accommodated by the airspace and FAA Houston Center controllers. The proposed RAN2A Low MOA would also likely accommodate all the aircraft traffic that would result if the Proposed Action were to be implemented; resulting in about 80 flights per day, based on 365 days, or 84 flights per day based on 240 T-7A flying days per year. On average, about 8 aircraft would be in the RAN2 A Low MOA per hour during the busiest traffic periods (with the maximum estimated to be 10 aircraft per hour in cases when four T-7As would use the airspace at the same time). Civilian aircraft operators would continue to conduct most of the crossings in the airspace. Based on size and the number of hourly and daily crossings, the proposed RAN2A Low MOA would be more than adequate to absorb the additional traffic flow associated with the Proposed Action.

The FAA considers airspace nominal capacity to be the maximum demand per hour a controller can safely handle in a particular sector (FAA, 2024a). Airspace capacity measures could include the maximum number of aircraft entering an airspace sector in a given time period or the maximum number of aircraft within an airspace sector in a given time period. The capacity of an airspace changes routinely based on a variety of dynamic factors including weather, temporary restrictions, and sectorization (virtual division of airspace to balance controller workload with respect to traffic flows). While the capacity of the existing airspace may be able to absorb an 11 percent traffic increase due to the Proposed Action, the FAA would review controller workload at FAA Houston Center to ensure the safe and efficient handling of this increase in traffic.

These assessments of the proposed RAN2A Low MOA, based on 2022 air traffic flows, suggest that it would have the size and capacity to accommodate the proposed additional air traffic. A third measure used to evaluate potential impacts on existing aviation activity is the potential for flight conflicts that would result from the Proposed Action when the RAN2A Low MOA is active. These conflicts could potentially cause IFR flights to be rerouted, with associated delays, or require schedule adjustments that may be impractical. However, these types of conflicts are routinely addressed throughout the NAS primarily through FAA procedural deconfliction (as would be the case for IFR flights requesting to cross the proposed RAN2A Low MOA, if established, when it would be operational). A secondary means to resolve certain types of conflicts could involve some local operators making flight schedule adjustments. The potential for flight conflicts between military operations in the proposed RAN2A Low MOA and existing civilian and military air traffic, and how these conflicts would be addressed, are described in the following sections.

Proposed RAN2A Low MOA

As reported in **Table 3.3-3,** approximately 40 percent of the 26,334 crossings in the proposed RAN2A Low MOA are IFR. This includes 8,927 of 22,544 civilian crossings (40 percent) and 1,499 of 2,235 military aircraft crossings (67 percent) flying IFR. Potential impacts on future flights in the proposed RAN2A Low MOA would include all IFR flights that occur during the two time periods expected to be scheduled daily by the 12 FTW (8:30 to 10:30 a.m. and 11:30 a.m. to 1:15 p.m.). As established by FAA letter of agreement with Randolph AFB and the 12 FTW, FAA Houston Center would procedurally deconflict IFR traffic by restricting military operations by quadrant, using the four-sector naming convention depicted on **Figure 2.1-1**, or by altitude band, as needed to route crossing air traffic through the remaining airspace. This would be the most efficient approach to deconflict IFR crossings from military operations in the proposed RAN2A Low MOA. A less efficient alternative would be to reroute the IFR traffic, to the north or south, around the proposed RAN2A Low MOA which could result in substantial delays for some flights. VFR traffic in the proposed RAN2A Low MOA, if established, would continue to use "see and avoid" flying to prevent conflicts. FAA deconfliction of the IFR traffic in the proposed RAN2A Low MOA would result in impacts on air traffic that would be expected to be minor and not significant.

Special Use Airspace (Existing RAN2A MOA)

Table 3.3-10 summarizes the existing crossings in the existing RAN2A MOA as 11 percent VFR, 62 percent IFR, and 27 percent unknown. The IFR crossings, 53 percent by civilian operators and 47 percent by military operators, already require FAA procedural deconfliction with existing military operations in the RAN2A MOA, using either airspace restrictions by quadrant **(Figure 2.1-1)** or altitude band. Impacts on future air traffic in the existing RAN2A MOA would potentially include all IFR flights that occur during the three time periods scheduled daily by the 12 FTW (8:30 to 10:30 a.m., 11:30 a.m. to 1:15 p.m., and 2:15 to 4:15 p.m.). These impacts are expected to be minor and significantly reduced via FAA procedural deconfliction. As such, impacts on air traffic in the existing RAN2A MOA are expected to be minor and not significant.

Air Traffic Control-Assigned Airspace (RAN2A ATCAA)

There were 12,612 existing crossings in the existing RAN2A ATCAA **(Table 3.3-11)**, with 47 percent identified as civilian operators and 58 percent as military operators. The percentage of civilian and military crossings is close to those reported for the RAN2A MOA, though the percentage of IFR flights was not reported for the ATCAA. Regardless, all future IFR flights in the RAN2A ATCAA are expected to be handled using FAA deconfliction procedures, similar to the RAN2A MOA, such that impacts on these flights would be minor and not significant.

Local Civilian Airports with Flight Operations in the Proposed RAN2A Low MOA

The two most prevalent determinable arrival and departure airports for civilian traffic transiting the proposed RAN2A Low MOA in 2022 were San Antonio International Airport and South Texas Regional Airport at Hondo. The most prevalent local civilian airports operating under the proposed RAN2A Low MOA were South Texas Regional Airport at Hondo (2,324 departures and 2,531 landings), Castroville Municipal (1,032 departures and 1,260 landings), and Devine Municipal (284 departures and 412 landings). Local airport traffic counts are associated with flight tracks that started or ended at one of these airports or these airports were listed in the flight plan; thus, there may be more unidentified flights landing or departing these airports for which radar data did not extend to the airport or for which flight plan data were not available. Aircraft were seen to be transiting between these three local airports and Boerne Stage Airfield, Stinson Municipal Airport, or San Geronimo Airpark. Many aircraft were observed to be flying instrument approaches at South Texas Regional Airport at Hondo. In addition, there are multiple private airfields operating within the proposed RAN2A Low MOA that have aircraft departing that are not on flight plans and do not appear in the radar data. Therefore, the number of local airport IFR flights is not known; however, a substantial number of IFR approaches to South Texas Regional Airport at Hondo were observed in the data (hundreds to over 1,000 IFR approaches are estimated). As stated above, approximately 40 percent of the 22,544 civilian crossings (8,927) were flying IFR, most of which would be from local airports. These local airport IFR flights operating within the proposed RAN2A Low MOA could be affected by the Proposed Action whereas VFR flights would continue to use "see and avoid" flying to prevent conflicts. Since the proposed RAN2A Low MOA would typically be scheduled simultaneously with the existing higher altitude RAN2A MOA and RAN2A ATCAA, FAA procedural deconfliction of local airport IFR flights would occur by the same restricting of military flights to certain airspace quadrants or altitude bands to provide available airspace for these local flights to cross the Low MOA. Additionally, the existing no fly buffer zones around each airport (3 NM lateral and 1,500 feet AGL) would be maintained. As a result, potential impacts on local airport IFR operators would be minor and not significant.

Military Airfields with Flight Operations in the Proposed RAN2A Low MOA

Most of the military flights that crossed the proposed RAN2A Low MOA, and were identified in the 2022 data sample, originated from JBSA-Randolph (27 percent), followed by Laughlin AFB Airport (9 percent), and JBSA-Kelly Field (8 percent). Of the total number of existing military aircraft crossings in the proposed RAN2A Low MOA (2,235), 1,499 were IFR (67 percent) and 736 were VFR (33 percent). Deconfliction of the affected military (IFR) flights would be required when the proposed RAN2A Low MOA is active. As with civilian IFR flights, FAA Houston Center would be required to perform procedural deconfliction of these transiting military IFR operations from active RAN2A Low MOA operations. Some military IFR flights might also fly around the MOAs. The resulting potential impact on military airfield IFR operators is expected to be minor and not significant.

Military Training Routes that Cross the Proposed RAN2A Low MOA

The four active MTRs that cross the proposed RAN2A Low MOA (and the total number of annual operations on each) include VR-1122 (16), VR-1123 (16), VR-140 (197), and VR-168 (18). These MTR operations are a relatively low number of annual flight operations, compared with other existing flight activity in the proposed RAN2A Low MOA. Future MTR operations representing the Proposed Action are expected to have about the same annual operations as existing conditions, only the T-38C flight operations would be gradually replaced by T-7A flight operations. All four MTRs have route ceilings well above the floor of the proposed RAN2A Low MOA (500 feet AGL), such that future operations on these routes have the potential to be affected by the Proposed Action. However, VFR are used on all four MTRs to prevent potential conflicts, and the low number of annual operations may offer some flexibility to schedule these MTRs during periods when the RAN2A Low MOA is inactive. As such, deconfliction of these routes may not be required regularly; although should this become necessary, appropriate MTR deconfliction procedures from proposed RAN2A Low MOA operations would need to be codified in an approved written agreement with JBSA-Randolph scheduling authorities to schedule these operations safely and effectively, as required. Potential impacts on MTR operations, due to the Proposed Action, are expected to be minor and not significant.

3.3.3.3 Alternative 2

Impacts on airspace and airspace management from Alternative 2 would be the same as those described for Alternative 1. Impacts on users in the modified RAN2A MOA would be minor and not significant.

3.3.3.4 No Action Alternative

Under the No Action Alternative, the proposed low-altitude airspace would not be obtained and existing conditions would continue. The existing RAN2A MOA would continue to be used and its dimensions would remain unchanged. T-38C and F-16C operations would remain the same as existing conditions or potentially decrease. This would have no impact on airspace use or airspace management.

3.3.3.5 Reasonably Foreseeable Future Actions and Other Environmental Considerations

As airspace demand in the region increases, the DAF, in conjunction with FAA and other managing agencies, would continue coordination to limit and reduce potential impacts. Therefore, potential impacts on airspace from the Proposed Action, when considered with other reasonably foreseeable future actions, would be minor and not significant.

3.4 NOISE

3.4.1 Definition of the Resource

Military aircraft noise consists of sound events from subsonic flight operations, which occur in MOAs and are discussed in this section, and supersonic flight operations (when aircraft exceed the speed of sound and generate a sonic boom; no supersonic operations would occur under the Proposed Action). Several metrics are used to describe noise events. The primary metrics used for policy decisions, based on guidelines for aircraft noise compatibility, are cumulative, average day metrics including day-night average sound level (DNL or L_{dn}) and onset-rate adjusted monthly day-night average sound level (L_{dnmr}). Other supplemental metrics that are useful to characterize the noise environment in MOAs from individual military aircraft overflights are the maximum sound level (L_{max}) and sound exposure level (SEL). These noise metrics are briefly described in **Table 3.4-1**.

Table 3.4-1 Descriptions of Noise Metrics Used in the Noise Analysis

Noise Metric	Description
Maximum Sound Level (L_{max})	L_{max} is the highest A-weighted sound level measured during a single event in which the sound changes with time. L_{max} is the maximum level that occurs over a fraction of a second. L_{max} is important in determining 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.
Sound Exposure Level (SEL)	SEL combines both the intensity of a sound and its duration into a single metric. 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. Mathematically, it represents the sound level of the constant sound that would, in one second, generate the same acoustic energy, as did the actual time-varying noise event. Since aircraft overflights usually last longer than a few seconds, the SEL of an overflight is usually greater than the L_{max} of the overflight.
Equivalent Sound Level (L_{eq})	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 sound exposure level (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 period.
Day-Night Average Sound Level (DNL or L_{dn})	DNL is a cumulative metric that accounts for all noise events in a 24-hour period. A 10-decibel (dB) penalty is applied to events during the nighttime period (defined as 10:00 p.m. to 7:00 a.m.) to account for the increased sensitivity of humans to noise occurring at night.
Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr})	L_{dnmr} is a cumulative daily noise metric devised to account for the "surprise" effect of the sudden onset of aircraft noise events on humans associated with the sporadic nature aircraft operations in training and operational airspace. 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).

L_{dn} and L_{dnmr} are the primary noise metrics used in this noise analysis. Aircraft operations in the proposed RAN2A Low MOA would include flights at altitudes as low as 500 feet AGL and airspeeds of up to 450 knots. Analysis has shown that, for most flight conditions, L_{dnmr} is the same as L_{dn} or only 0.1-0.2 dB higher for a few flight conditions in the proposed RAN2A Low MOA due to the onset rate penalty. Since these estimated noise levels are reported as whole numbers, values for L_{dnmr} are reported to represent both metrics. L_{max} and SEL are used to characterize noise that would result from individual T-38C, F-16C, and T-7A aircraft overflights in the MOAs. Noise metrics presented in this EA were calculated using the MR_NMAP (Lucas and Calamia, 1997) and (Ikelheimer and Downing, 2013), NOISEMAP (Czech and Plotkin, 1998), and NMPLot (Wasmer and Maunsell, 2022a, 2022b) software and are reported as A-weighted decibels (dBA). Detailed information regarding noise metrics, noise models, and other acoustic principles is provided in **Appendix C.2**.

This analysis considers noise levels associated with current T-38C and F-16C operations in the existing RAN2A MOA, which represent existing conditions, as well as noise levels associated with proposed future operations of T-7A and F-16C aircraft under the Proposed Action (see **Section 2.2**). This analysis focuses on the military aircraft that regularly utilize the RAN2A MOA and ATCAA; other civilian and military aircraft fly through these airspace, however, were not modeled. The ROI consists of airspace within and lands underlying the proposed RAN2A Low MOA and existing RAN2A MOA and ATCAA under Alternative 1 or the vertical extension of the RAN2A MOA under Alternative 2. Flight operations on the MTRs that cross the existing RAN2A MOA are also part of this noise analysis.

3.4.2 Affected Environment

3.4.2.1 Background Noise Levels

Background noise levels were estimated for areas under the RAN2A MOA using the methods in American National Standard Institute – *Quantities and Procedures for Description and Measurement of Environmental Sound Part 3: Short-Term Measurements with an Observer Present* which provides estimated background noise levels for different land use categories. **Table 3.4-2** shows the levels (DNL and L_{eq}) estimated for rural or remote areas for several different categories of suburban and urban residential land use which can be used to represent background levels occurring under the RAN2A MOA and surrounding areas (i.e., observed levels not including aircraft flights or other identifiable noise sources). Land areas under the RAN2A MOA are mostly rural but include several small towns and cities. These populated areas have relatively low levels of ambient noise, and background sound levels without aircraft normally do not exceed 54 dBA L_{eq} in the daytime, or 44 dBA L_{eq} at night. Background sound levels are typically lower in rural areas and much lower in remote areas. According to these estimates, many of the remote areas under the RAN2A MOA would be expected to have a DNL less than 49 dBA while active parts of the city of Hondo would be expected to have a DNL in the range of 55-60 dBA.

Table 3.4-2 Estimated Background Sound Levels

Land Use Category	DNL Range (dBA)	Typical DNL (dBA)	L_{eq}	
			Daytime	Nighttime
Normal suburban residential	50-55	52.0	50.0	44.0
Quiet suburban residential	45-50	47.0	45.0	39.0
Rural residential	< 45	42.0	40.0	34.0
Rural/Remote	< 45	<42	<40	<34

3.4.2.2 RAN2A MOA

The primary source of noise within the existing RAN2A MOA is aircraft operations. Existing T-38C and F-16C operations in the RAN2A MOA are summarized in **Table 3.4-3**. Eight thousand T-38C operations and 144 F-16C operations occur annually in the MOA during the daytime period (7:00 a.m. to 10:00 p.m.). Ninety-five percent of these operations occur between 9,000 MSL and FL180; the remaining 5 percent occur in the ATCAA (FL180 to FL290). These operations and their associated average airspeeds, power settings, time in airspace, and altitudes are the primary inputs to the noise models used in this analysis.

Table 3.4-3 Summary of Existing T-38C and F-16C Operations in the RAN2A MOA (2022)

	Aircraft	T-38C	F-16C
	Number of Day[1] Sorties	8,000	144
	Number of Night[2] Sorties	0	0
	Time in Airspace per Sortie (minutes)	25	20
	Altitude Utilization (feet MSL)		
	0-8,999	0%	0%
Existing RAN2A MOA	9,000-12,000	5%	30%
	12,000-15,000	10%	30%
	15,000-FL180	80%	35%
ATCAA	FL180-FL290	5%	5%

Notes:
[1] Day hours are from 7:00 a.m. to 10:00 p.m. local time.
[2] Night hours are from 10:00 p.m. to 7:00 a.m. local time.

Table 3.4-4 shows cumulative noise levels from existing T-38C and F-16C operations in the RAN2A MOA and existing F-16C, T-38C, T-44C, and T-45 operations on existing MTR segments underlying the RAN2A MOA (such that noise on the ground from both MOA and MTR operations would be additive). The estimated L_{dn} and L_{dnmr} for the existing RAN2A MOA is 35 dBA and for each MTR segment is less than 35 dBA, the lower limit reported by the MR_NMAP program, which is used to estimate noise from aircraft operations in MOAs and MTRs, and is described further in **Appendix C.2**. As shown in **Table 3.4-4**, estimated cumulative aircraft noise levels do not exceed 65 dBA under any part of the existing RAN2A MOA and therefore, do not exceed the threshold for compatibility of aircraft noise with underlying land uses. Estimated noise levels less than 35 dBA shown in **Table 3.4-4** are primarily due to existing high-altitude flight operations in the MOA **(Table 3.4-3)** and the low number of annual aircraft operations in each MTR **(Appendix C.2.2.3)**.

Table 3.4-4 Estimated Cumulative Noise Levels in the RAN2A MOA from Existing Aircraft Operations in the MOA and MTRs

Aircraft	MTR Segment and Aircraft	RAN2A MOA		MTRs		Total (MOA+MTRs)	
		L_{dn} (dBA)	L_{dnmr} (dBA)	L_{dn} (dBA)	L_{dnmr} (dBA)	L_{dn} (dBA)	L_{dnmr} (dBA)
T-38C and F-16C	VR-1122 B-D and VR-1123 D-F (F-16C)	35	35	< 35	< 35	38	38
	VR-140 D-E (T-38C)			< 35	< 35	38	38
	VR-168 D-E (T-44C and T-45)			< 35	< 35	38	38
	IR-149 A-B (no current utilization)			< 35	< 35	38	38

Potential noise-sensitive receptors underlying or near the existing RAN2A MOA are listed in **Table 3.4-5** and shown on **Figure 3.4-1**. As with the estimated cumulative noise levels shown in **Table 3.4-4**, estimated cumulative noise levels from existing T-38C and F-16C operations at potential noise-sensitive receptors listed in **Table 3.4-5** are less than 35 dBA and do not exceed the 65 dBA compatibility threshold for underlying land uses.

Table 3.4-5 Estimated Noise Levels from Existing T-38C and F-16C Operations at Potential Noise-Sensitive Receptors Under or Near the RAN2A MOA

Potential Noise-Sensitive Receptor	Map / Region	Latitude (degrees)	Longitude (degrees)	L_{dn} (dBA)	L_{dnmr} (dBA)
Hill Country State Natural Area	North	29.628274	-99.183395	< 35	< 35
Hill Country Wilderness Camp Area	North	29.635107	-99.211243	< 35	< 35
Crossgate Equestrian Center	North	29.637681	-99.074594	< 35	< 35
Flying L Ranch Resort	North	29.712774	-99.047551	< 35	< 35
Medina	North	29.796895	-99.248835	< 35	< 35
Lone Hollow Ranch - Young Life Camp	North	29.726174	-99.515697	< 35	< 35
Lost Maples State Natural Area	North	29.807091	-99.572560	< 35	< 35
Hondo	Center	29.346897	-99.141948	< 35	< 35
Sabinal	Center	29.317658	-99.467551	< 35	< 35
D'Hanis	Center	29.330532	-99.279730	< 35	< 35
Diamond-L-Ranch	Center	29.516896	-99.289517	< 35	< 35
Yancey	South	29.139598	-99.144931	< 35	< 35
Perlitz Ranch	South	29.197863	-99.137491	< 35	< 35
Legacy Ranch	South	29.230647	-99.213308	< 35	< 35
Biry Ranch	South	29.256844	-98.974176	< 35	< 35
Cowden Ranch	South	28.992282	-99.129863	< 35	< 35

Individual Overflight Noise.

Noise from individual overflights is considered here, in addition to DNL, to more completely describe the noise environment from existing military aircraft operations in the RAN2A MOA. While DNL is used to assess land use compatibility for airfield and airspace actions, the FAA and DAF support the use of supplemental metrics, typically based on L_{max} or SEL, to describe other potential noise effects such as hearing loss, sleep and speech interference, and structural damage. Supplemental metrics are useful to assess the noise impacts of airfield flight activity, but perhaps even more so for airspace flight activity; this is because the DNL or average noise exposure tends to be lower, due to flight operations being spread throughout the airspace, whereas individual overflights can generate potentially higher noise levels at sensitive receptors, certainly for direct overflights. The NOISEMAP program was used to calculate L_{max} and SEL for individual overflights beneath the RAN2A MOA to assess the potential for causing speech or sleep interference to more fully understand the potential noise effects. Structural damage from aircraft flight events is more typically caused by supersonic flights that generate sonic booms with peak overpressures above 2 pounds per square foot, rather than from subsonic flight events. Since there are no supersonic flight operations in the RAN2A MOA, the potential for structural damage is low.

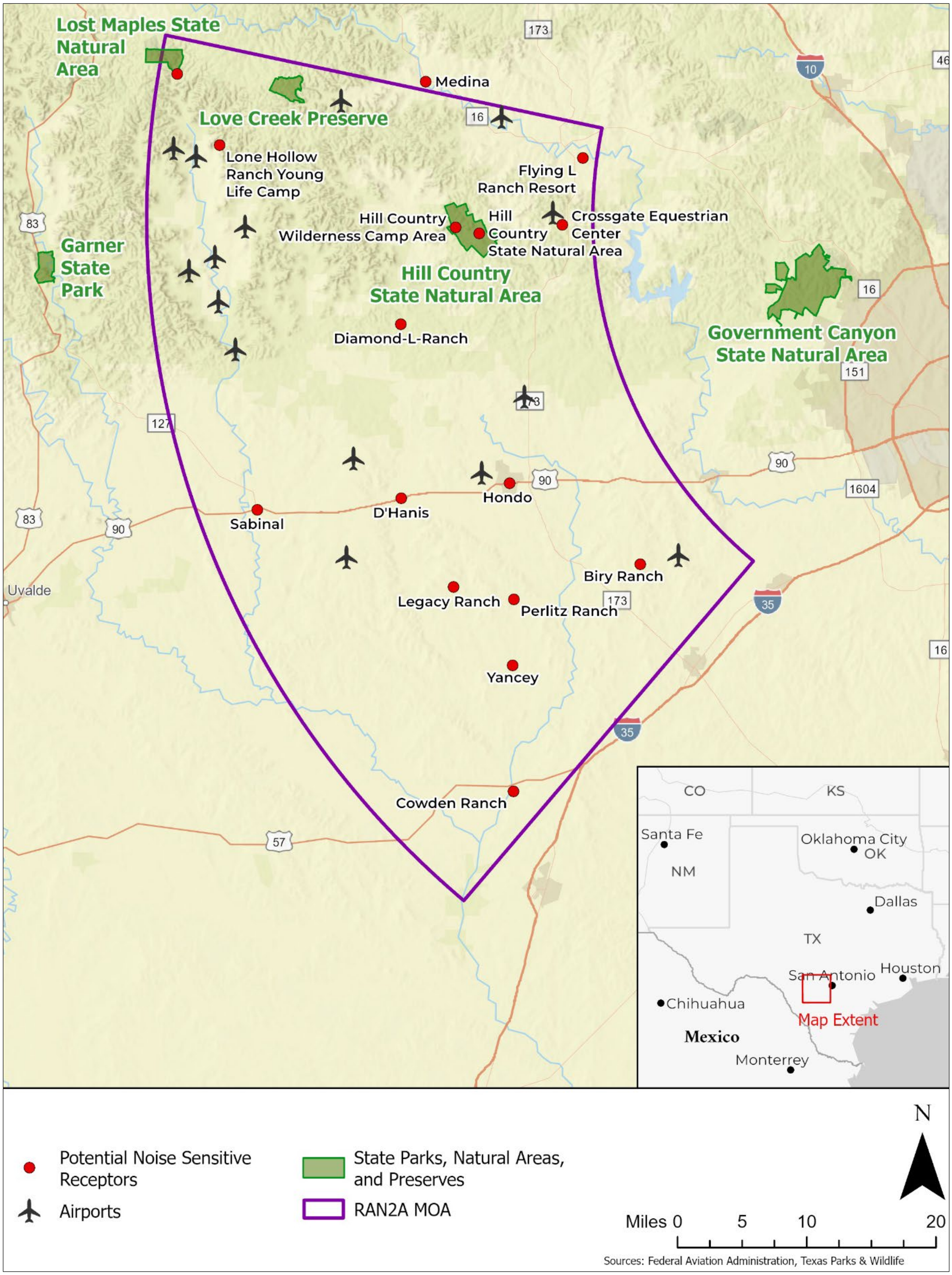

Figure 3.4-1 Potential Noise-Sensitive Receptors Under the RAN2A MOA

Hearing Loss.

Considerable data on hearing loss have been collected and analyzed by the scientific/medical community, and it has been well established that continuous exposure to high noise levels will damage human hearing. People exposed to high noise environments may experience temporary or permanent hearing loss; those exposed over a long period of time are at an increased risk of experiencing permanent hearing loss. While various government organizations have defined noise thresholds based on L_{eq}, to protect workers from noise exposure during their lifetime working period (40 hours per week over 40-years), the DoD uses a screening threshold for residences of DNL 80 dB to ensure a conservative approach to assessing the potential for hearing loss (DNWG, 2012). If residences are identified within the DNL 80 dB exposure area, then additional analysis should be performed using Leq. Estimates of DNL, made under the RAN2A MOA, indicate that existing operations on the MOA and MTRs that cross the MOA are well below the DNL threshold for potential hearing loss.

Additionally, the Occupational Safety and Health Administration and Air Force Occupational Safety and Health guidelines are to protect human hearing from long-term, continuous exposures to high noise levels and aid in the prevention of noise-induced hearing loss. Both guidelines have permissible daily noise exposure limits including a L_{max} of 115 dBA for a duration of 15 minutes or less. This level and duration indicate when a hearing conservation program should be implemented at a given site. As shown below, overflights in the RAN2A MOA, individually or together, are not expected to exceed 115 dBA for 15 minutes or longer on any given day.

Table 3.4-6 shows estimated single event noise levels (L_{max} and SEL), directly under the flight path, for T-38C and F-16C aircraft at representative altitudes in the existing RAN2A MOA up to 15,000 feet MSL. For each altitude, the estimated SEL values are higher than the L_{max} values as the SEL includes both the overflight noise levels and the event duration. For both metrics, estimated noise levels are loudest for aircraft at an altitude of 9,000 feet MSL (that is, the floor of the existing RAN2A MOA) and levels decrease accordingly at higher altitudes. **Table 3.4-6** shows the expected range of levels estimated to occur for T-38C and F-16C overflights in the RAN2A MOA with the highest levels including L_{max} of 62.1 dBA and SEL of 70.5 dBA. Overflights above 9,000 feet MSL in the MOA are audible to individuals on the ground, but do not normally interfere with communication at ground level. Note that flight paths would typically be distributed within the MOA such that these highest overflight levels, estimated directly under the flight path, would not be expected to occur repeatedly at a single location on the ground. Noise generated by aircraft within the boundaries of the RAN2A MOA is occasionally audible in areas beyond the MOA boundary. Military aircraft may fly close to the MOA boundary for training purposes and there is a small potential for aircraft spill outs (military aircraft unintentionally and temporarily flying beyond the airspace boundaries) that may cause noise events to be heard outside the MOA boundary. However, loud overflight noise events are experienced less frequently outside the MOA boundary, than within the boundary, and are limited to some extent by the higher altitudes being flown. In general, people would need to be within about 5 miles of a military aircraft overflight to hear it clearly above the ambient noise levels.

Table 3.4-6 Estimated Noise Levels for T-38C and F-16C Overflights in the RAN2A MOA at Various Altitudes

Altitude (feet MSL)	T-38C		F-16C	
	L_{max} [1] (dBA)	SEL [1] (dBA)	L_{max} [1] (dBA)	SEL [1] (dBA)
9,000	62.1	70.5	41.4	50.4
12,000	56.6	65.0	36.3	45.9
15,000	52.2	60.3	< 35.0	42.6

Notes:
[1] Noise levels (L_{max} and SEL) were calculated using NOISEMAP.

Speech Interference.

In general, low- to mid-altitude aircraft overflights can interfere with communication on the ground, and in homes, schools or other buildings directly under their flight path. The disruption of routine activities in the home, such as radio or television listening, telephone use, or family conversation, can cause annoyance. The quality of speech communication is also important in classrooms, offices, and industrial settings and can cause fatigue and vocal strain in those who attempt to communicate over the noise. The threshold at which aircraft noise may begin to interfere with speech and communication is established at 75 dBA outdoors (DNWG, 2012) which corresponds to roughly 50 dBA indoors assuming 25 dB of structural noise reduction. This level is consistent with the thresholds outlined in the ANSI's *Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools*. None of the individual overflight levels shown in **Table 3.4-6** exceed L_{max} 75 dBA, therefore speech interference, on the ground, is not expected due to the existing overflights in the RAN2A MOA.

Sleep Interference.

Sleep interference is another source of annoyance associated with louder low altitude aircraft overflights. This is especially true due to the intermittent nature of aircraft noise, which can be more disturbing than continuous noises. Sleep disturbance is not just a factor of the loudness, but also the duration, of each noise event; therefore, sleep disturbance is best reflected with the SEL metric, which captures the total energy (i.e., level and duration) of each noise event. The threshold at which aircraft noise may begin to interfere with sleep is 90 dBA SEL (DNWG, 2012). Existing T-38C or F-16C aircraft activities on the RAN2A MOA are not conducted between 10:00 p.m. and 7:00 a.m.; therefore, sleep interference during nighttime hours is not anticipated.

3.4.3 Environmental Consequences

3.4.3.1 Evaluation Criteria

Potential impacts from noise associated with the Proposed Action would be beneficial if the number of sensitive receptors exposed to unacceptable noise levels is reduced. Adverse impacts would occur if noise associated with the Proposed Action permanently exceeded the 65 dBA cumulative noise threshold below which most types of land use are compatible.

The FAA defines a threshold for significant noise impacts as an increase in noise by 1.5 dB DNL or more in a noise sensitive area that is exposed to noise at or above the 65 dB DNL noise exposure level, or that will be exposed at or above the 65 dB DNL level due to a 1.5 dB or greater increase, when compared to the No Action Alternative for the same timeframe (FAA Order JO 1050.1F).

For airspace actions, FAA requires that an action proponent identify where noise will change by the following specified amounts in noise sensitive areas (FAA Order JO 1050.1F):

- For DNL 65 dB and higher: +/- DNL 1.5 dB (significant)
- For DNL 60 dB to <65 dB: +/- DNL 3 dB (reportable)
- For DNL 45 dB to <60 dB: +/- DNL 5 dB (reportable)

Per FAA Order JO 1050.1F, a noise sensitive area is defined as an area where noise interferes with normal activities associated with its use. Normally, noise sensitive areas include residential, educational, health, and religious structures and sites, cultural and historical sites, and parks, recreational areas, wilderness areas, and wildlife refuges. The FAA recognizes that there are settings where the 65 dB DNL standard for land use compatibility may not apply. These areas would likely be areas of extreme quiet, very rural areas, or natural areas with little human activity, such as wilderness areas or other protected natural areas.

The primary effect of recurring aircraft noise on exposed communities is long-term annoyance. The scientific community has adopted the use of long-term annoyance as a primary indicator of community response because it attempts to account for all negative aspects of effects from noise, including sleep disturbance, speech interference, and distraction from other human activities. Attitudinal surveys conducted over the past 30 years show a consistent relationship between DNL and the percentages of people who express annoyance. DNL estimates for the RAN2A MOA and RAN2A Low MOA addressed in this EA can be evaluated using **Table 3.4-7** to provide an estimate of the percentage of the population that would be "highly annoyed" by the noise.

Table 3.4-7 Relationship of Annoyance to DNL

DNL (dBA)	Percent Highly Annoyed
45	0.83
50	1.66
55	3.31
60	6.48
65	12.29
70	22.10

3.4.3.2 Alternative 1

Proposed T-7A and F-16C operations on the RAN2A Low MOA and RAN2A MOA are summarized in **Table 3.4-8**. Three types of T-7A training missions (low-altitude air-to-air training, low-altitude air-to-ground training, and low-level operations) were analyzed using the flight parameters shown in **Table 3.4-9**.

Table 3.4-8 RAN2A (Low and High) MOA Proposed Action Flight Operations

Aircraft	Annual Operations (Sorties)[1]			Time in Airspace per Sortie (minutes)
	MOA	Day (7:00 a.m. to 10:00 p.m. local)	Night (10:00 p.m. to 7:00 a.m. local)	
T-7A	RAN2A Low MOA	2,920	0	20
	RAN2A (High) MOA	8,000	0	25
	Total	**10,920**	**0**	**45**
F-16C	RAN2A Low MOA	48	0	20
	RAN2A (High) MOA	432	0	20
	Total	**480**	**0**	**40**

Notes:
[1]One annual operation is one sortie flying the MOA.

T-7A annual operations would consist of 2,920 daytime flights in the RAN2A Low MOA and 8,000 daytime flights in the RAN2A MOA (High). F-16C annual operations would consist of 48 daytime flights in the RAN2A Low MOA and 432 daytime flights in the RAN2A ATCAA (High). These operations and associated average airspeeds, power settings, time in airspace, and altitudes are the primary inputs to the noise models used in this analysis.

Table 3.4-9 Altitude Band Utilization for Proposed Action Flight Training Altitudes

Altitude Band Utilization		T-7A Low-Altitude Air-to-Air Training	T-7A Low-Altitude Air-to-Ground Training	T-7A Low-Level Operations	F-16C Operations
Number of Proposed Sorties		876	876	1,168	48
Percent of Low MOA Sorties		30	30	40	100
Altitude Utilization (percent)					
Proposed RAN2A Low MOA	(feet) 500-1,000 AGL	70	20	80	25
	1,000-2,000 AGL	15	71	5	25
	2,000-3,000 AGL	5	3	5	25
	3,000-5,000 AGL	5	3	5	25
	5,000 AGL-8,999 MSL	5	3	5	0
Existing RAN2A MOA	9,000-12,000 MSL	0	0	0	30
	12,000-15,000 MSL	0	0	0	30
	15,000-FL180 MSL	0	0	0	35
ATCAA	FL180-FL290 MSL	0	0	0	5

Estimated cumulative noise levels (L_{dn} and L_{dnmr}) from proposed aircraft operations in the RAN2A Low MOA and RAN2A MOA under Alternative 1, and estimated noise levels from aircraft operations on MTR segments that cross the RAN2A Low MOA and RAN2A MOA, would not exceed 50 dBA **(Table 3.4-10)**. Estimated noise levels from aircraft operations in the MTR segments would not contribute to the overall noise level under the RAN2A Low and High MOAs. All areas under the proposed RAN2A Low MOA would remain well below the 65 dBA threshold below which most types of land uses are compatible with aircraft noise. However, all noise level changes in **Table 3.4-10** range from 11.5 dBA to 14.4 dB. These changes (increases) in noise levels from Alternative 1 would be considered "reportable" but not significant in accordance with FAA Order JO 1050.1F.

Table 3.4-10 Estimated Cumulative Noise Levels Under the RAN2A Low MOA and RAN2A MOA from Proposed Action Aircraft Operations in the MOAs, ATCAA, and MTRs

Aircraft	RAN2A Low MOA, RAN2A MOA, and ATCAA		MTRs			Total		Change		FAA Determination of Impact in Noise Sensitive Areas
	L_{dn} dBA)	L_{dnmr} (dBA)	MTR/ Segment	L_{dn} (dBA)	L_{dnmr} (dBA)	L_{dn} (dBA)	L_{dnmr} (dBA)	L_{dn} (dBA)	L_{dnmr} (dBA)	
T-7A and F-16C	49.3	49.4	VR-1122 B-D / VR-1123 D-F	< 35	< 35	49.5	49.6	11.5	11.6	Reportable
			VR-140 D-E	< 35	< 35	49.5	49.6	11.5	11.6	Reportable
			VR-168 D-E	< 35	< 35	49.5	49.6	11.5	11.6	Reportable
			IR-149 A-B	< 35	< 35	49.5	49.6	11.5	11.6	Reportable
			MOAs/ATCAA Levels Only			49.3	49.4	14.3	14.4	Reportable

Estimated noise levels from proposed aircraft operations that would occur at potential noise-sensitive receptors under or near the RAN2A Low MOA and RAN2A MOA under Alternative 1 are presented in **Table 3.4-11** and shown on **Figure 3.4-1**. These estimated noise levels would not exceed 50 dBA at any potential noise-sensitive receptor and would remain well below the 65 dBA threshold below which most types of land uses are compatible with aircraft noise. All noise level changes at the noise sensitive receptors in **Table 3.4-11** would range from 11.5 dBA to 14.4 dB. Most of these changes (increases) in noise levels from Alternative 1 would be considered "reportable" but not significant in accordance with FAA Order JO 1050.1F.

Table 3.4-11 Estimated Noise Levels from Proposed Action T-7A and F-16C Operations at Potential Noise-Sensitive Receptors Under or Near the RAN2A Low MOA and RAN2A MOA

Potential Noise-Sensitive Receptor	Map / Region	Latitude (degrees)	Longitude (degrees)	L_{dn} (dBA)	L_{dnmr} (dBA)	Change		FAA Determination of Impact in Noise Sensitive Areas
						L_{dn} (dBA)	L_{dnmr} (dBA)	
Hill Country SNA	North	29.628274	-99.183395	49.3	49.4	14.3	14.4	Reportable
Hill Country Wilderness Camp	North	29.635107	-99.211243	49.3	49.4	14.3	14.4	Reportable
Crossgate Equestrian Center	North	29.637681	-99.074594	49.1	49.1	14.1	14.1	Reportable
Flying L Ranch Resort	North	29.712774	-99.047551	48.3	48.4	13.3	13.4	Reportable
Medina	North	29.796895	-99.248835	< 35	< 35	0	0	Not significant
Lone Hollow Ranch - Young Life Camp	North	29.726174	-99.515697	49.3	49.4	14.3	14.4	Reportable
Lost Maples SNA	North	29.807091	-99.57256	48.2	48.3	13.2	13.3	Reportable
Hondo	Center	29.346897	-99.141948	49.3	49.4	14.3	14.4	Reportable
Sabinal	Center	29.317658	-99.467551	49.3	49.3	14.3	14.3	Reportable
D'Hanis	Center	29.330532	-99.27973	49.3	49.4	14.3	14.4	Reportable
Diamond-L-Ranch	Center	29.516896	-99.289517	49.3	49.4	14.3	14.4	Reportable

Table 3.4-11 Estimated Noise Levels from Proposed Action T-7A and F-16C Operations at Potential Noise-Sensitive Receptors Under or Near the RAN2A Low MOA and RAN2A MOA

Potential Noise-Sensitive Receptor	Map / Region	Latitude (degrees)	Longitude (degrees)	L_{dn} (dBA)	L_{dnmr} (dBA)	Change		FAA Determination of Impact in Noise Sensitive Areas
						L_{dn} (dBA)	L_{dnmr} (dBA)	
Yancey	South	29.139598	-99.144931	49.3	49.4	14.3	14.4	Reportable
Perlitz Ranch	South	29.197863	-99.137491	49.3	49.4	14.3	14.4	Reportable
Legacy Ranch	South	29.230647	-99.213308	49.3	49.4	14.3	14.4	Reportable
Biry Ranch	South	29.256844	-98.974176	49.3	49.4	14.3	14.4	Reportable
Cowden Ranch	South	28.992282	-99.129863	48.8	48.9	13.8	13.9	Reportable

The number of aircraft operations in the MOAs would show a minor increase under Alternative 1, relative to existing conditions, and noise levels would increase primarily due to replacing the T-38C with the T-7A. However, noise from proposed aircraft operations under Alternative 1 would not be expected to temporarily or permanently impede or prevent the continued occupation of any land use underlying the RAN2A Low MOA and RAN2A MOA. Therefore, long-term impacts from noise under Alternative 1 would not be adverse.

Under Alternative 1, estimated L_{max} and SEL values for proposed T-7A and F-16C operations in the RAN2A Low and High MOAs would be highest at altitudes of 500 feet and would decrease accordingly at higher altitudes **(Table 3.4-12)**. Estimated SEL values for both types of aircraft are somewhat higher at each representative altitude relative to the corresponding L_{max} values because SEL includes both the overflight noise levels and the event duration. Flight paths would typically be distributed across the MOAs such that these highest overflight levels (estimated directly under the flight path) would not be expected to occur repeatedly at a single location on the ground.

Table 3.4-12 Estimated Noise Levels from Proposed Aircraft Overflights in the RAN2A Low MOA and RAN2A MOA at Various Altitudes

Proposed Aircraft Overflights	Altitude (feet AGL)							
	500	1,000	5,000	10,000	500	1,000	5,000	10,000
	L_{max} (dBA) [1]				SEL (dBA) [1]			
T-7A Low-Altitude Air-to-Air Training	103.9	96.9	77.5	81.3	104.9	99.7	83.5	88.3
T-7A Low-Altitude Air-to-Ground Training	103.9	96.9	77.5	75.1	105.2	100.0	83.8	82.1
T-7A Low-Level Operations	103.9	96.9	77.5	75.1	105.2	100.0	83.8	82.1
F-16C Low and High MOA Training	93.7	86.3	66.3	39.2	96.2	90.6	74.1	48.1

Notes:
[1] Noise levels (L_{max} and SEL) shown in this table were calculated using NOISEMAP.

Individual noise events from proposed aircraft operations under Alternative 1 would be heard at various locations under the RAN2A Low MOA and RAN2A MOA. However, most annual training flights would occur in the High MOA at high altitudes. Seventy-three percent of annual T-7A flights (8,000 of 10,920) would occur in the RAN2A MOA, at altitudes above 9,000 feet MSL, and 90 percent of annual F-16C flights (432 of 480) would occur in the RAN2A MOA. Most of the flights would therefore not be expected to cause annoyance or disrupt common activities any more than typical everyday sound events (e.g., automobile noise, lawn mowing, other civil aircraft flyovers). Of the remaining flights in the proposed RAN2A Low MOA under the Proposed Action, individual noise events would occasionally be heard, though flight paths in the proposed RAN2A Low MOA (like the RAN2A MOA) would typically be distributed throughout the airspace such that the highest expected overflight levels would not occur repeatedly, at a single location on the ground. Noise from individual military overflights within the boundaries of the RAN2A Low MOA would increase due to the requirements for low altitude training. Most of the noise generated by T-7A aircraft would be contained within the RAN2A Low MOA boundary, however, these aircraft may fly close to the MOA boundary and there is a small potential for aircraft spill outs to occur. Randolph AFB and the 12 FTW radar units prioritize the prevention of spill outs such that a very limited number of these events would be expected to occur. Occasionally, noise events from military aircraft overflights would be expected to be heard outside the Low MOA boundary. In general, people would need to be within about 5 miles of a military aircraft overflight to hear it clearly above the ambient noise levels.

No residences would be identified within the DNL 80 dB exposure area, such that Proposed Action noise levels are below the DNL threshold for potential hearing loss.

Table 3.4-12 indicates L_{max} values of up to 105 dBA for individual T-7A low level training flights, however these, individually or cumulatively throughout the day, would not exceed 115 dB or the associated exposure duration 15 minutes. As such, overflights in the RAN2A Low MOA, RAN2A MOA, and MTRs, individually or together, do not have the potential to cause hearing loss.

These same aircraft, however, would be loud enough to occasionally interfere with speech occurring indoors, such as in residences or schools. Direct overflights from T-7A and F-16C activity on the low MOA would generate levels that exceed L_{max} 75 dBA **(Table 3.4-12)**, such that, occasionally, speech interference would occur, but not last long due to the brief nature of these events. Flights would also be dispersed throughout the RAN2A Low and High MOAs, limiting the number of overflights of a particular area on the ground.

3.4.3.3 Alternative 2

Impacts from noise under Alternative 2 would be the same as those described for Alternative 1. Noise impacts associated with Alternative 2 would not be adverse.

3.4.3.4 No Action Alternative

Under the No Action Alternative, the proposed low-altitude airspace would not be obtained and existing conditions would continue. The existing RAN2A MOA would continue to be used and its dimensions would remain unchanged. This would have no adverse impact on noise.

3.4.3.5 Reasonably Foreseeable Future Actions and Other Environmental Considerations

Reasonably foreseeable actions summarized in **Appendix B** could result in short-term and long-term impacts from noise. These impacts would vary based on the location of the noise source, duration and intensity of the noise that would be generated, and proximity to potential receptors. However, through consultation with applicable regulatory agencies and in accordance with applicable regulatory requirements, those projects would incorporate best management practices and other measures to prevent or minimize noise and ensure impacts from noise remain less than significant. Therefore, when considered with other reasonably foreseeable future actions, the Proposed Action would not contribute to cumulatively significant adverse impacts from noise.

3.5 LAND USE

3.5.1 Definition of the Resource

The term "land use" generally refers to real property classifications that indicate either natural conditions or the types of human activity occurring on a parcel. Land use descriptions are often 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.

The land use ROI consists of lands underlying the existing RAN2A MOA **(Figure 1.2-2)**. Given the large geographic area covered by the existing RAN2A MOA, data from the U.S. Geological Survey's (USGS) National Land Cover Database (USGS, 2021) is used to characterize existing land use in the ROI. Although more generalized than locality-specific land use data, the National Land Cover Database data is generally indicative of existing land use conditions and appropriate to characterize potential impacts from the Proposed Action at this scale of analysis.

3.5.2 Affected Environment

Land cover in the ROI varies and includes mostly rural and natural areas that serve as undeveloped rangeland, support recreational uses, and provide wildlife habitat. Land cover types in the ROI are summarized in **Table 3.5-1**. Vegetated, uncultivated, and undeveloped lands combined with wetlands account for 92.3 percent of the total land cover in the ROI. Agricultural, cropland, and cultivated lands represent 7.2 percent of the land cover while developed and urbanized areas, where people tend to reside or work, represent approximately 0.5 percent of lands in the ROI.

Table 3.5-1 Land Cover Types in the ROI

Land Cover Type	Area in ROI (acres)	Percent of ROI
Developed / Urbanized Land	5,500.2	0.5
Agricultural / Cropland / Cultivated Land	80,101.0	7.2
Vegetated / Uncultivated / Undeveloped Land	1,024,355.3	92.0
Wetlands / Open Water	3,340.5	0.3
Total	**1,113,297**	**100.0**

Source: USGS 2023; TXNRIS, 2023

Designated natural areas fully or partially located within the ROI include Lost Maples State Natural Area (SNA), Love Creek Preserve, and Hill Country SNA **(Figure 1.2-2)**. Lost Maples SNA encompasses 2,906 acres and provides recreational opportunities such as hiking, camping, fishing and nature watching (TPWD, n.d.a). This area was designated as a National Natural Landmark by the National Park Service (NPS) in 1980 (NPS, n.d.). Love Creek Preserve, covering 2,845 acres in Bandera County, provides suitable habitat for the endangered golden cheeked warbler (*Dendroica chrysoparia*) and supports the threatened Tobusch fishhook cactus *(Sclerocactus brevihamatus ssp. tobuschi)* **(Section 3.7.2.5)**. Hill Country SNA covers 5,370 acres in Bandera and Medina Counties and provides recreational opportunities such as camping, hiking, nature watching, and multiuse trails for backpacking, mountain biking, and horseback riding (TPWD, n.d.b.). Two additional natural areas, Garner State Park and Government Canyon SNA, are within approximately 10 and 15 miles of the ROI, respectively. Love Creek Preserve is crossed by segments existing MTRs VR-1122/1123, VR-140, and VR-168, while Hill Country SNA is crossed by a segment of VR-1122/1123 (**Figure 3.5-1**). Approximately 247 annual operations are flown in these MTRs by military aircraft (e.g., F-16C, T-38C) typically operating at or above 500 feet AGL (although aircraft are authorized to fly as low as surface level in VR-168 and 100 feet AGL in VR-1122/1123).

The South Texas Regional Airport at Hondo is located in and owned by the city of Hondo in Medina County, approximately 26 miles west of San Antonio (FAA, 2024b). The South Texas Regional Airport at Hondo was originally constructed as an Army air navigation school in 1942 during World War II and served as a U.S. Air Force flight training base from the 1970s through the early 2000s. Currently, the South Texas Regional Airport at Hondo operates primarily as an industrial, business, and recreational flight service center for general aviation, serving the FAA, TxDOT, and on- and off-airport businesses.

The DAF identifies wind turbines, local airfields, airports, towers, and other vertical structures as avoidance areas that are factored into flight plans. The U.S. Wind Turbine Database, which provides the location of land-based and offshore wind turbines in the United States, does not identify any wind turbines in the ROI. Further, adequate sites for wind speeds are those that have an annual average wind speed of at least 9 miles per hour for small wind turbines and 13 miles per hour for utility-scale turbines (Shoemaker, 2007; USEIA, 2024). Wind speed modeling estimates do not indicate that optimum wind speeds for siting wind turbines occur within the ROI (USEIA, 2024; USDOE, n.d.).

The DoD is supportive of renewable energy where it is compatible with the DoD mission to test, train, and operate. The DAF is a member of the DoD Siting Clearinghouse established by Congress in January 2011 in Section 358 of the Ike Skelton National Defense Authorization Act for FY11 (Public Law 111-383). That authority was amended and codified in 2017 as 10 U.S.C. § 183a. The Clearinghouse provides a timely, transparent, and repeatable process that can evaluate potential impacts and explore mitigation options, while preserving the DoD mission through collaboration with internal and external stakeholders.

3.5.3 Environmental Consequences

3.5.3.1 Evaluation Criteria

Potential impacts on land use would be considered adverse if the Proposed Action resulted in one or more of the following:

- 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
- conflicts with planning criteria established to ensure the safety and protection of human life and property

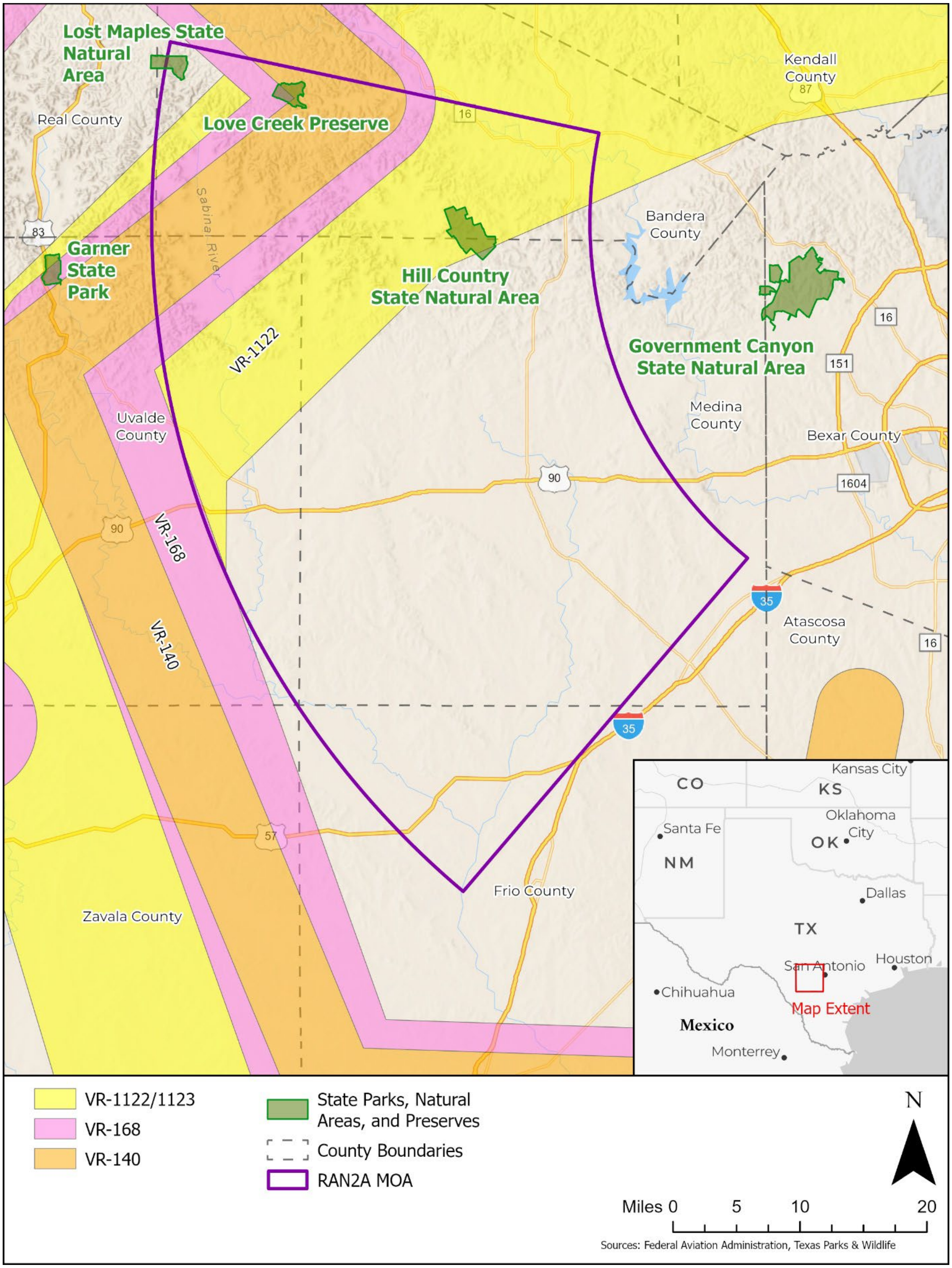

Figure 3.5-1 Existing MTR Segments that Cross Hill Country State Natural Area and Love Creek Preserve in the ROI

3.5.4 Environmental Consequences

3.5.4.1 Evaluation Criteria

Potential impacts on land use would be considered adverse if the Proposed Action resulted in one or more of the following:

- 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
- conflicts with planning criteria established to ensure the safety and protection of human life and property

3.5.4.2 Alternative 1

Establishment of the proposed RAN2A Low MOA would have no significant potential to result in development activities or population changes in the ROI that would require changes to existing or proposed land use patterns or be inconsistent with existing land use plans and policies. Aircraft operations in the proposed RAN2A Low MOA would result in minor increases in noise experienced at underlying land uses **(Section 3.4.3)**. Cumulative noise levels from proposed aircraft operations under Alternative 1 would be similar to existing ambient noise conditions in the ROI and would not exceed the 65 dBA threshold below which most types of land use are compatible with aircraft noise. Of the operations in the proposed RAN2A Low MOA under Alternative 1, individual noise events would be heard, but would be distributed throughout the airspace such that the highest expected overflight levels would not occur repeatedly at a single location on the ground. This includes Hill Country SNA, which is currently crossed by a segment of VR-1122/1123 in which military aircraft are authorized to operate as low as 100 feet AGL (**Section 3.5.2**). Due to the locations of Lost Maples State Natural Area and Love Creek Preserve along or near the lateral boundaries of the proposed low-altitude airspace, it is unlikely that the Proposed Action would contribute to additional overflights of those areas because military pilots would adjust their flight patterns to prevent unintentional "spill outs" of their aircraft beyond the airspace boundary (**Section 3.3.3.2**). Overall, Alternative 1 would have no significant potential to require temporary or permanent changes to existing or proposed land uses, prevent the continued use and occupation of existing land uses, or result in incompatibilities with existing or planned land use plans and policies except the ability to site large wind turbines under the proposed airspace.

The DoD Siting Clearinghouse works with industry to overcome risks to national security while promoting compatible domestic energy development. Under the 2011 statute that set up the DoD Energy Siting Clearinghouse process, DoD must evaluate each siting proposal and meet with wind farm project developers to try to find feasible and affordable mitigation before objecting to a project. Because of the statutory mandate to try to reach compromise before objecting, the DAF cannot prejudge wind farm sitings. The potential for overflight obstruction hazards is a shared concern for all aviation users, including the DoD, commercial, business, and general aviation users. As with any large vertical construction project, such as telecommunication towers or wind turbines, the DoD considers potential impacts of wind farm development on flight safety from obstructions introduced near DoD airfields, training ranges, and in areas used for military flight operations. In addition to the DoD Clearinghouse process, all structures constructed taller than 200 feet trigger a review from the FAA (through the Obstruction Evaluation / Airport, Airspace, Analysis process).

In most cases, the DoD Energy Siting Clearinghouse, through its mitigation response team process, finds a compromise where turbines can proceed under the airspace if some or many of the turbines are moved laterally or other types of mitigation strategies are implemented. In the 13-year history of the DoD Energy Siting Clearinghouse process, only a few objections have been issued out of thousands of proposed wind farms. Moreover, there are currently no wind farms in the ROI and the wind speed modeling estimates do not indicate that optimum wind speeds for siting wind turbines occur within the ROI (USEIA, 2024; USDOE, n.d.). Therefore, Alternative 1 would have no significant adverse impacts on land use, including the ability to site new wind farms in the areas below the proposed airspace.

3.5.4.3 Alternative 2

Impacts on land use from Alternative 2 would be the same as those described for Alternative 1. Alternative 2 would have no significant adverse impacts on land use, including the ability to site new wind farms in the areas below the proposed airspace.

3.5.4.4 No Action Alternative

Under the No Action Alternative, the proposed airspace would not be obtained and existing conditions would continue. This would have no impact on land use.

3.5.4.5 Reasonably Foreseeable Future Actions and Other Environmental Considerations

Reasonably foreseeable future actions listed in **Appendix B** could affect land use in the ROI. The Proposed Action would not impede or interact with the reasonably foreseeable future actions. The proposed RAN2A Low MOA would not alter, prohibit, or otherwise limit the public’s access to the recreational areas beneath the airspace and therefore would not contribute to significant cumulative impacts to these resources.

3.6 AIR QUALITY

3.6.1 Definition of the Resource

Ambient air quality in a specified area or region is measured by the concentration of various pollutants in the atmosphere. Pollutant concentrations are affected by both the amount of pollutants in the atmosphere and the extent to which these pollutants can be transported and diluted in the air.

National Ambient Air Quality Standards

The Clean Air Act (CAA) authorizes the U.S. Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) for select air pollutants, referred to as “criteria pollutants,” that are known to affect human health and the environment (40 CFR Part 50). Criteria pollutants regulated by the NAAQS consist of ozone, carbon monoxide (CO), nitrogen dioxide, sulfur dioxide, 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.

The USEPA has established AQCRs throughout the United States to evaluate compliance with the NAAQS. Regulatory areas within each AQCR that exceed the NAAQS for a pollutant are classified nonattainment for that pollutant. Regulatory areas where air pollutant concentrations are within an applicable NAAQS are designated attainment/unclassifiable for that NAAQS. Areas that have transitioned from nonattainment to attainment are designated as maintenance, and as such are required to follow requirements in the state's maintenance plans to ensure continued compliance with NAAQS.

The ROI for air quality includes the RAN2A MOA that overlay portions of Bandera, Frio, Medina, Real, Uvalde, and Zavala Counties in Texas, all of which are in the Metropolitan San Antonio Intrastate AQCR (40 CFR § 81.40). The ROI also includes the airspace over portions of Uvalde and Zavala Counties that are crossed by certain segments of the MTRs, VR-140 and VR-1122. The AQCR comprising of these underlying counties in the ROI are in attainment (or is unclassifiable) for each of the criteria pollutants regulated under the NAAQS (40 CFR 81.344).

Air quality permits are not required for flight operations in airspace. Additionally, under the Proposed Action there would be no stationary sources of air emissions and air quality permits are not an issue.

Clean Air Act General Conformity

Under the CAA, the USEPA established the General Conformity rule (40 CFR Part 93), which applies to federal actions occurring in nonattainment or maintenance areas. Proposed federal actions are evaluated to determine if the total indirect and direct net emissions from those actions would be below de minimis levels (that is, too trivial or minor to merit consideration) for each of the pollutants as specified in 40 CFR § 93.153. If de minimis levels would not be exceeded for any of the pollutants, no further evaluation is required. Additional analysis would be required if net emissions from the proposed project would exceed the de minimis thresholds for one or more of the specified pollutants.

The CAA provides special protections for air quality in pristine areas of the country known as Class 1 areas. Class 1 areas include National Parks greater than 6,000 acres or National Wilderness Areas greater than 5,000 acres. Any deterioration of air quality, based on Prevention of Significant Deterioration (PSD) criteria established by USEPA, is considered significant in Class 1 areas. The USEPA has also established regional haze regulations that require states to make initial improvements in visibility within their Class 1 areas.

Greenhouse Gases and Climate Change

GHG are gases, occurring from natural processes and human activities, that trap heat in the atmosphere. GHG makes the Earth warmer and is believed to contribute to global climate change. Climate change is the variation in the Earth's climate (including temperature, precipitation, humidity, wind, and other meteorological variables) over time. Climate change is primarily driven by accumulation of GHG in the atmosphere caused by the increased consumption of fossil fuels (such as coal, petroleum, and natural gas) (IPCC, 2021).

The USEPA regulates GHG emissions via permitting and reporting requirements that are applicable mainly to large stationary sources of emissions. Emissions from GHG are expressed in terms of the carbon dioxide equivalent emissions (CO_2e), which is a measure used to compare the emissions from various GHG 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. Analysts cumulatively compare emission estimates of different gases using standardized GWPs.

Detailed information on air quality regulations, general conformity, climate change, and GHG is provided in **Appendix C.3**.

3.6.2 Affected Environment

Regional Climate

The general climate conditions for Hondo, in south-central Texas (location chosen to represent the ROI), are classified as humid subtropical. Such areas are characterized by elevated temperatures with evenly distributed precipitation throughout the year. Summers generally tend to be hot and muggy, and winters, cold and short. Typically, the annual precipitation in the area comes as a result of very violent spring and early summer thunderstorms. The annual average temperature in Hondo is 69.3 degrees Fahrenheit (°F). The warmest month, on average, is July with an average temperature of 84.7°F. The coolest month on average is January, with an average temperature of 52.1°F. The average amount of annual precipitation in Hondo is 30.3 inches. In Hondo, there is an average of 0.4 inches of snow in a year. The annual average wind speed is 9 miles per hour (Weatherbase, 2024).

Regional Air Quality

The counties underlying RAN2A MOA and crossed by certain segments of the MTRs are in attainment (or are unclassifiable) for each of the criteria pollutants regulated under the NAAQS (ACAM, 2023). Therefore, the General Conformity Rule does not apply to the Proposed Action.

The RAN2A MOA and the MTR airspace that would be utilized under the Proposed Action are not located within 100 kilometers (62 miles) of any USEPA-designated Class 1 areas protected by the Regional Haze Rule. No Class 1 areas would be affected by emissions associated with the Proposed Action. The two designated Class 1 areas in Texas, Big Bend National Park, and Guadalupe Mountains National Park are approximately 300 miles from the ROI and would not be affected by emissions associated with the Proposed Action.

Greenhouse Gases and Climate Change

Texas's climate is changing, and the state has warmed 1.5°F in the past century. Rainstorms are becoming more intense, and floods are becoming more severe. As warmer temperatures increase evaporation and water use by plants, soils are likely to continue to become drier. Warmer and drier conditions promote the formation of ground-level ozone and can result in larger, more frequent wildfires in forested areas. Wildfires producing smoke and particulate matter can travel longer distances and can affect air quality across the region and increase the risk of causing respiratory and heart problems (USEPA, 2016). As per a 2019 climate vulnerability DoD report, JBSA-Randolph is particularly vulnerable to drought, recurrent flooding, and wildfires as a result of a changing climate and could potentially result in damage to infrastructure, and delays in training and testing programs (DoD, 2019).

Statewide emissions of CO_2 in Texas totaled 663.5 million metric tons of energy-related CO_2 in 2021. This total includes CO_2 emissions from direct fuel use across all sectors, including residential, commercial, industrial, and transportation, as well as primary fuels consumed for electricity generation (USEIA, 2021).

3.6.3 Environmental Consequences

3.6.3.1 Evaluation Criteria

The land areas underlying airspaces that are proposed for use under the Proposed Action are in attainment (or is unclassifiable) for each of the criteria pollutants regulated under the NAAQS. As such, the General Conformity Rule is not applicable to emissions from the Proposed Action and is not addressed in this air quality analysis.

Based on guidance in Chapter 4 of the *Air Force Air Quality EIAP Guide, Volume II – Advanced Assessments*, estimated criteria pollutant emissions from the Proposed Action were compared against the insignificance indicator of 250 tons per year (tpy) (25 tpy for lead) PSD major source permitting threshold for actions occurring in areas that are in attainment for all criteria pollutants (Air Force, 2020). These “Insignificance Indicators” were used in the analysis to provide an indication of the significance of potential impacts on air quality based on current ambient air quality relative to the NAAQS. These insignificance indicators do not define a significant impact; rather, they provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for a criteria pollutant indicates that the action would not cause or contribute to emissions that would exceed one or more NAAQSs. Although PSD and Title V permit requirements are not applicable to mobile sources, the PSD major source thresholds provide a benchmark for the comparison of estimated emissions and description of potential impacts.

The Air Conformity Applicability Model (ACAM) Version 5.0.23a (ACAM, 2023) was used to estimate the total direct and indirect emissions from the Proposed Action. Impacts from the Proposed Action are evaluated based on the estimated net change in emissions compared against insignificance indicators for each pollutant.

Air quality evaluation accounts for operations of T-38Cs and T-7As based on a transition schedule starting in 2028 (AETC, 2024) when the use of T-7As would come into effect, and ending in 2033 when T-38Cs would be completely phased out. The projected timeline for estimating emissions is based on the anticipated delivery schedule of the T-7As to JBSA-Randolph (AETC, 2023). The projected number of aircraft and aircraft operations are based on the *JBSA T-7A Recapitalization Final Environmental Impact Statement* (DAF, 2022). The projected number of aircrafts and flight operations calculated for use in air quality analysis is presented in **Table C-11**, **Appendix C**.

<u>Greenhouse Gases and Climate Change</u>

ACAM Version 5.0.23a was also used to evaluate GHG emissions from the Proposed Action. The GHG Emissions Evaluation calculates potential GHG emissions (CO_2e) from the action, determines if the action’s emissions are insignificant, and provides a relative significance comparison. For the analysis, the PSD threshold for GHG of 75,000 tpy of CO_2e (or 68,039 metric ton per year, [mton/yr] was used as an indicator or "threshold of insignificance" for NEPA air quality impacts in all areas. This indicator does not define a significant impact; however, it provides a threshold to identify actions that are insignificant (de minimis). Actions with a net change in GHG (CO_2e) emissions below the insignificance indicator (threshold) are considered too insignificant on a global scale to warrant further analysis. Note that actions with a net change in GHG (CO_2e) emissions above the insignificance indicator (threshold) are only considered potentially significant and require further assessment to determine if the action would have a significant impact. Action-related GHG have no significant impact on local air quality. However, from a global perspective, GHG emissions from individual actions each make a relatively small addition to global atmospheric GHG concentrations that collectively may have a large effect on climate change. If activities have de minimis (insignificant) GHG emissions, then on a global scale they are effectively zero and irrelevant (AFCEC, 2023).

Note, even though GHG are accounted for above the mixing height, that portion of emissions is not needed for analysis because of the global effect of GHG emissions. Since these operations were flown in the Brady MOA, the global effect would remain the same.

ACAM model assumptions, detailed emissions calculations, and summary results for the Proposed Action are provided in **Appendix C.3.7**.

3.6.3.2 Alternative 1

Under Alternative 1, a new RAN2A Low MOA would be established. **Table 3.6-1** presents the net change in annual emissions associated with Alternative 1. ACAM estimates in **Table 3.6-2** represent proposed changes in operations (including reductions) of T-38C, T-7A and F-16C expected to occur in the reconfigured RAN2A MOA.

Emissions for each pollutant would change as a result of proposed operations under Alternative 1, but the net change in emissions for each criteria pollutant would be less than the insignificance indicator values. As shown in **Table 3.6-1**, the highest annual net change in emissions would be for CO in 2028 (74.1 tpy), which would be well below the insignificance indicator value of 250 tpy (25 tpy for lead). Therefore, estimated net increases in criteria pollutant emissions would not be significant under Alternative 1. Impacts on air quality in the ROI would be moderate, adverse, and long term. Emissions from Alternative 1 would have no impact on regional air quality or the attainment status of the AQCR comprising the ROI.

The ACAM Report Record of Air Analysis and the Detailed ACAM Report are provided in **Appendix C.3.7**.

Table 3.6-1 Net Change in Criteria Pollutant Emissions from Alternative 1

Pollutant	Emissions (tons/year)[1]						Insignificance Indicator	Exceeds Indicator Level in any Year?
	2028	2029	2030	2031	2032	2033 and Beyond (Steady State)		
VOC	3.4	3.7	4.2	4.6	5.2	7.3	250	No
NO_x	3.6	6.6	13.1	18.4	26.9	54.0	250	No
CO	74.1	70.1	61.1	53.8	42.2	5.2	250	No
SO_x	1.4	1.5	1.8	2.0	2.4	3.5	250	No
PM_{10}	2.1	2.0	1.8	1.6	1.3	0.5	250	No
$PM_{2.5}$	1.9	1.8	1.6	1.4	1.2	0.4	250	No
Pb	0.0	0.0	0.0	0.0	0.0	0.0	25	No
NH_3	0.0	0.0	0.0	0.0	0.0	0.0	N/A	N/A

Notes:
[1] Estimated ACAM output results (see **Appendix C.3.7**)
N/A = not applicable; NH_3 = ammonia; NO_x = nitrogen oxides; Pb = lead; SO_x = sulfur oxides; VOC = volatile organic compound

<u>GHG and Climate Change</u>

Table 3.6-2 summarizes estimated annual GHG emissions through the projected life cycle of the Proposed Action Alternative 1 and provides its relative significance in a global context. **Table 3.6-2** also presents the estimates of the action-related social cost of greenhouse gases (SC-GHG). The SC-GHG is the monetary value (in terms of 2020 dollars) of the net harm to society from emitting GHG into the atmosphere. Generally, individual projects are not large enough to have an impact on climate change but cumulatively can have an impact. Estimated annual GHG emissions of 9,501 mton/yr CO_2e from the Proposed Action Alternative would be low, amounting to only a small fraction (0.14 percent) of the insignificance indicator value. If estimated GHG emissions from a proposed activity are de minimis (insignificant), then on a global scale they are effectively zero and irrelevant (including the theoretical SC-GHG).

Table 3.6-2 Annual GHG Emissions Associated with Alternative 1 Compared to Insignificance Indicator and Total SC-GHG

Year	CO_2 (mton/yr)[1]	CH_4 (mton/yr)[1]	N_2O (mton/yr)[1]	CO_2e (mton/yr)[1]	Threshold (mton/yr)[2]	Exceedance
2028	3,734	0.15699406	0.03062958	3,747	68,039	No
2029	4,072	0.17120461	0.03340206	4,086	68,039	No
2030	4,815	0.20246306	0.03950059	4,832	68,039	No
2031	5,424	0.22806202	0.04449495	5,443	68,039	No
2032	6,387	0.2685635	0.0523968	6,409	68,039	No
2033	9,468	0.39811143	0.07767163	9,501	68,039	No
2034 [SS Year]	9,468	0.39811143	0.07767163	9,501	68,039	No
Total GHG (CO_2e) Relative Significance (mton)[1]						
% of State Totals	0.00122803					
% of U.S. Totals	0.00016751					
Total SC-GHG ($K [In 2020 $])						
Action (2028-2054)	$24,622.28	$32.09	$76.81	$24,731.18	N/A	

Notes:
[1] ACAM output results for GHG emissions and action-related total SC-GHG (see **Appendix C.3.7**).
[2] Air Force PSD threshold for GHG of 75,000 tons per year of CO_2e (or 68,039 mton/yr) as an indicator or "threshold of insignificance" for NEPA air quality impacts in all areas.
CH_4 = methane; N_2O = nitrous oxide; SS = steady-state.

Based on the total GHG relative significance values in **Table 3.6-2**, estimated GHG emissions (including the estimated SC-GHG) from the Proposed Action Alternative would also be negligible relative to GHG emissions at both the state and national levels. At such low levels, the Proposed Action Alternative would not be expected to result in a significant impact on climate change at a regional or global scale.

The ACAM SC-GHG Report for Alternative 1 is included in **Appendix C**.

3.6.3.3 Alternative 2

Under Alternative 2, existing RAN2A MOA would be modified by lowering its floor from 9,000 feet MSL to 500 feet AGL to support low-altitude aircraft training operations. The modified airspace would continue to be operated as the RAN2A MOA rather than creating a new, separate airspace as proposed under Alternative 1.

Alternative 2, from an air quality standpoint, is identical to Alternative 1 and the net change in criteria pollutant emissions from Alternative 2 would be the same as shown in **Table 3.6-1**. Emissions for Alternative 2 are the same as for Alternative 1 because irrespective of the airspace being split into 2 layers (Alternative 1), or the floor of the existing MOA being lowered to form one seamless layer (Alternative 2), the number of sorties and the operating altitudes are not being proposed to change under Alternative 2. The amount of pollutants generated and the affected airshed under Alternative 2 would remain the same as that for Alternative 1.

Similar to Alternative 1, emissions from Alternative 2 operations would change, but the potential net change would be less than the indicator values for insignificance. Therefore, the increases in criteria pollutant emissions would not be significant. Similar to Alternative 1, impacts on air quality in the ROI from Alternative 2 would be moderate, adverse, and long term. Emissions from Alternative 2 would have no impact on regional air quality or the attainment status of the AQCR comprising the ROI.

GHG and Climate Change

Alternative 2, from an air quality standpoint, is identical to Alternative 1 and the net change in GHG emissions from Alternative 2 would be the same as shown in **Table 3.6-2** and impacts on air quality would be the same as for Alternative 1.

3.6.3.4 No Action Alternative

Under the No Action Alternative, the proposed low-altitude airspace would not be obtained and existing conditions would continue. This would have no impact on air quality.

3.6.3.5 Reasonably Foreseeable Future Actions and Other Environmental Considerations

Criteria pollutants regulated by the NAAQs would be emitted during the respective construction and operational phases of the reasonably foreseeable future projects listed in **Appendix B**. Quantities of criteria pollutants emitted during each project would vary widely; however, these emissions would be regulated in accordance with applicable regulatory and permitting requirements to ensure that they do not contribute to the substantial degradation of local or regional air quality or result in a change to an AQCR attainment designation. Therefore, when considered with these reasonably foreseeable future actions, the Proposed Action would not contribute to significant cumulative impacts on air quality.

The operations included in the Proposed Action would generate very low levels of GHG emissions and is not anticipated to contribute to climate change in any meaningful way. In a global context, its contribution would be negligible when considered with reasonably foreseeable future actions.

3.7 BIOLOGICAL RESOURCES

3.7.1 Definition of the Resource

Biological resources include native, invasive, and nonnative or naturalized living plant and animal species and the habitats within which they occur. Vegetation types include all existing terrestrial plant communities as well as their individual component species that occur or may occur within the project area. Wildlife includes all fish, amphibian, reptile, bird, and mammal species except for those identified as special status species, which are addressed separately. Wildlife also includes bird species protected under the federal Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA), and other species-specific conservation legal authorities.

Special status species are plant and animal species that are listed as endangered, threatened, candidate, or proposed for listing under the federal ESA. Federal candidate species and species proposed for listing are those species that could be federally listed as threatened or endangered in the near-term but receive no statutory protection under the ESA. Critical habitat consists of federally designated geographic areas that contain essential features or areas that are essential to conserve federally listed species (USFWS, 2017a).

The ROI for the assessment of biological resources consists of lands underlying the existing RAN2A MOA as well as airspace within and beneath.

3.7.2 Affected Environment

3.7.2.1 Vegetation

The ROI includes the Edwards Plateau and Southern Texas Plains Level III EPA Ecoregions (Griffith et al., 2007) and the Balcones Canyonlands and North Nueces Alluvial Plains Level IV EPA Ecoregions of Texas (McNab and Avers, 1994; McNab et al., 2007; Cleland et al., 2007).

The Level IV Ecoregion Balcones Canyonlands is distinctive because its broken topography discourages intensive human development and supports diverse habitats, high species diversity, wildlife, and refugia for endemic and endangered species. A distinguishing characteristic of the region is the abundance of running water. Typical woodland vegetation in the region includes:

- Texas oak *(Quercus buckleyi)*
- plateau live oak *(Quercus fusiformis)*
- Vasey oak *(Quercus vaseyana)*
- Texas persimmon *(Diospyros texana)*
- Ashe juniper *(Juniperus ashei)*
- cedar elm *(Ulmus crassifolia)*

Predominant species of vegetation within minimally disturbed grasslands includes:

- little bluestem *(Schizachyrium scoparium)*
- yellow Indiangrass *(Sorghastrum nutans)*
- sideoats grama *(Bouteloua curtipendula)*

Riparian vegetation includes:

- bald cypress *(Taxodium distichum)*
- American sycamore *(Platanus occidentalis)*
- black willow *(Salix nigra)*
- slippery elm *(Ulmus rubra)*
- Ohio buckeye *(Aesculus glabra)*
- boxelder *(Acer negundo)*
- bigtooth maple *(Acer grandidentatum)*
- Carolina basswood *(Tilia americana var. caroliniana)*

Remnant vegetation in grazed areas includes Texas wintergrass (*Nassella leucotricha*) and threeawns (*Aristida purpurea*).

Agricultural areas within the North Nueces Alluvial Plains are known as the Winter Garden region of Texas. Large areas of this ecoregion are used as rangeland and hunting leases are an important source of income for ranchers. Mesquite-acacia savanna is a dominant natural vegetation community and is characterized by:

- scattered honey mesquite *(Prosopis glandulosa)*
- granjeno (spiny hackberry) *(Celtis ehrenbergiana)*
- blackbrush *(Coleogyne ramosissima)*
- guajillo acacia *(Acacia berlandieri)*
- plateau live oak
- little bluestem
- sideoats grama
- plains bristlegrass *(Setaria leucopila)*
- multiflowered false rhodesgrass *(Trichloris pluriflora)*
- lovegrass tridens *(Tridens eragrostoides)*

Riparian areas of streams originating from the Edwards Plateau commonly contain:

- sugar hackberry *(Celtis laevigata)*
- plateau live oak
- pecan *(Carya illinoinensis)*
- cedar elm
- black willow
- eastern cottonwood *(Populus deltoides)*

3.7.2.2 Wildlife

At least 26 common species of mammals, 46 species of birds, and 16 reptile and amphibian species potentially occur in the ROI. Those species are listed in **Table 3.7-1**.

Table 3.7-1 Common Wildlife Species Potentially Occurring in the RAN2A MOA ROI

Common Name	Scientific Name	Common Name	Scientific Name
Mammals			
American badger	*Taxidea taxus*	nine-banded armadillo	*Dasypus novemcinctus*
black-tailed jackrabbit	*Lepus californicus*	North American beaver	*Castor canadensis*
bobcat	*Lynx rufus*	North American porcupine	*Erethizon dorsatum*
cave myotis	*Myotis velifer*	North American river otter	*Lontra canadensis*
collared peccary	*Pecari tajacu*	raccoon	*Procyon lotor*
coyote	*Canis latrans*	red fox	*Vulpes vulpes*
desert cottontail	*Sylvilagus audubonii*	ringtail	*Bassariscus astutus*
eastern cottontail	*Sylvilagus floridanus*	rock squirrel	*Otospermophilus variegatus*
eastern gray squirrel	*Sciurus carolinensis*	striped skunk	*Mephitis mephitis*
fox squirrel	*Sciurus niger*	tricolored bat	*Perimyotis subflavus*
gray fox	*Urocyon cinereoargenteus*	Virginia opossum	*Didelphis virginiana*
Mexican free-tailed bat	*Tadarida brasiliensis*	white-tailed deer	*Odocoileus virginianus*
mountain lion	*Puma concolor*	wild boar	*Sus scrofa*

Table 3.7-1 Common Wildlife Species Potentially Occurring in the RAN2A MOA ROI

Common Name	Scientific Name	Common Name	Scientific Name
Birds			
American coot	*Fulica americana*	merlin	*Falco columbarius*
American crow	*Corvus brachyrhynchos*	northern harrier	*Circus hudsonius*
American kestrel	*Falco sparverius*	mourning dove	*Zenaida macroura*
black vulture	*Coragyps atratus*	northern bobwite	*Colinus virginianus*
black-capped vireo	*Vireo atricapilla*	osprey	*Pandion haliaetus*
blue-winged teal	*Spatula discors*	pied-billed grebe	*Podilymbus podiceps*
burrowing owl	*Athene cunicularia*	prairie falcon	*Falco mexicanus*
Canada goose	*Branta canadensis*	peregrine falcon	*Falco peregrinus*
cattle egret	*Bubulcus ibis*	red-headed woodpecker	*Melanerpes erythrocephalus*
cedar waxwing	*Bombycilla cedrorum*	red-tailed hawk	*Buteo jamaicensis*
common grackle	*Quiscalus quiscula*	red-shouldered hawk	*Buteo lineatus*
common raven	*Corvus corax*	red-winged blackbird	*Agelaius phoeniceus*
Cooper's hawk	*Accipiter cooperii*	ring-necked pheasant	*Phasianus colchicus*
ferruginous hawk	*Buteo regalis*	rock pigeon	*Columba livia*
golden-fronted woodpecker	*Melanerpes aurifrons*	sandhill crane	*Antigone canadensis*
great blue heron	*Ardea herodias*	scaled quail	*Callipepla squamata*
great horned owl	*Bubo virginianus*	snowy egret	*Egretta thula*
greater roadrunner	*Geococcyx californianus*	Swainson's hawk	*Buteo swainsoni*
Harris's hawk	*Parabuteo unicinctus*	turkey vulture	*Cathartes aura*
Harris's sparrow	*Zonotrichia querula*	western barn owl	*Tyto alba*
house sparrow	*Passer domesticus*	wild turkey	*Meleagris gallopavo*
killdeer	*Charadrius vociferus*	Wilson's snipe	*Gallinago delicata*
mallard	*Anas platyrhynchos*	wood duck	*Aix sponsa*
Reptiles and Amphibians			
Couch's spadefoot toad	*Schaphiopus couchii*	Texas diamond-back	*Crotalus atrox*
western narrow-mouthed toad	*Gastrophryne olivacea*	Texas spiny lizard	*Sceloporus olivaceus*
Great Plains rat snake	*Pantherophis emoryi*	common spotted whiptail	*Aspidoscelis gularis*
Great Plains skink	*Plestiodon obsoletus*	Texas toad	*Bufo speciosus*
Gulf Coast toad	*Incilius nebulifer*	eastern hognose snake	*Heterodon platirhinos*
ornate box turtle	*Terrapene ornate*	Texas salamander	*Eurycea neotenes*
red-spotted toad	*Anaxyrus punctatus*	yellow mud turtle	*Kinosternon flavescens*
spotted chorus frog	*Pseudacris clarkii*	rock rattlesnake	*Crotalus lepidus*

Sources: McNab and Avers, 1994; iNaturalist, 2024a; iNaturalist, 2024b.

In addition to the species listed in **Table 3.7-1**, big and exotic game hunting ranches are within the ROI and found in west Texas and offer hunting opportunities for mule deer *(Odocoileus* *hemionus)*, whitetail deer *(Odocoileus virginianus)*, aoudad *(Ammotragus lervia)*, axis *(Axis axis)*, blackbuck *(Antilope cervicapra)*, sika *(Cervus nippon)*, javelina *(Pecari tajacu)*, and various quail, dove, duck, and predator species (West Texas Hunt Organization, 2024).

3.7.2.3 Domestic Animals

A portion of the land area within the ROI supports ranching, agriculture, and aquaculture **(Table 3.5-1)**. Domestic livestock supported in the region includes cattle, horses, sheep, goats, pigs, and poultry (USDA, 2017).

3.7.2.4 Migratory Flyways

Because of its varied habitat (desert to mountains) and location within the Central Flyway, the Edwards Plateau and Southern Texas Plains Ecoregions support many migratory birds. The Central Flyway is a migration route used by birds migrating to and from breeding grounds. The following migratory bird species of conservation concern have been identified as using the Central Flyway overlapping the ROI (USFWS, 2024a):

- American golden plover (*Pluvialis dominica*)
- bald eagle (*Haliaeetus leucocephalus*)
- black-capped vireo (*Vireo atricapilla*)
- chimney swift (*Chaetura pelagica*)
- eastern meadowlark (*Sturnella magna*)
- field sparrow (*Spizella pusilla*)
- lesser yellowlegs (*Tringa flavipes*)
- long-billed curlew (*Numenius americanus*)
- mountain plover (*Charadrius montanus*)
- orchard oriole (*Icterus spurius*)
- painting bunting (*Passerina ciris*)
- pectoral sandpiper (*Calidris melanotos*)
- Sprague's pipit (*Anthus spragueii*)

To identify risks and minimize the potential for collisions between aircraft and birds, JBSA-Randolph adheres to bird/wildlife aircraft strike hazard (BASH) programs whereby information and assistance is shared between pilots, operations, civil engineering staffs, and local air traffic controllers.

3.7.2.5 Threatened and Endangered Species, Critical Habitat, and Other Species of Concern

Federally Listed, Proposed, and Candidate Species and Federally Designated Critical Habitat

The purpose of the ESA is to conserve the ecosystems upon which threatened and endangered species depend and to recover listed species. Section 7 of the ESA requires action proponents to consult with USFWS (and/or the NOAA Fisheries, as applicable) to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species or result in the destruction or adverse modification of designated critical habitat. The USFWS has primary responsibility for terrestrial and freshwater organisms, while NOAA Fisheries is primarily responsible for marine organisms and anadromous fish. Under the ESA, species may be listed as either endangered or threatened. "Endangered" means a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means a species is likely to become endangered within the foreseeable future.

Federally listed, proposed, and candidate species known or having potential to occur in the ROI include one mammal, three bird, two amphibian, one fish, three insect, one crustacean, and four plant species (USFWS, 2024a). These species are listed in **Table 3.7-2**. No federal critical habitat has been designated in the ROI for any of these species.

Table 3.7-2 Federally Listed, Proposed, and Candidate Species Known or Having Potential to Occur in the ROI

Common and Scientific Name	Federal Status	Critical Habitat Present in the ROI?	Description
Mammals			
tricolored bat *Perimyotis subflavus*	Proposed Endangered	No	During the spring, summer, and fall, tricolored bats are found in forested habitats where they roost in trees, primarily among leaves. During the winter, tricolored bats hibernate in caves and mines. Where caves are infrequent, tricolored bats often hibernate in culverts, tree cavities, and abandoned wells. Tricolored bats emerge early in the evening and forage at treetop level or above but may forage closer to ground later in the evening.
Birds			
golden-cheeked warbler *Dendroica chrysoparia*	Endangered	No	The breeding range of this species is restricted to Texas. This species nests in tall, closed canopy, dense, mature stands of Ashe juniper frequently mixed with deciduous hardwood trees. This type of woodland grows in moist areas such as steep-sided canyons, slopes, and adjacent uplands. Trees required for nesting habitat are typically 15 feet tall with a trunk diameter of about 6 inches at 2 feet above the ground.
piping plover *Charadrius melodus*	Threatened in the ROI; Endangered within the Great Lakes Watershed	No	This species may potentially be present in the ROI as a transient during migration.
rufa red knot *Calidris canutus rufa*	Threatened	No	This species may potentially be present in the ROI as a transient during migration. Although critical habitat for this species has been proposed, none of the designated units are present in the ROI.
Amphibians			
San Marcos salamander *Eurycea nana*	Threatened	No	This species is endemic to the San Marcos Springs and nearby surface and subterranean aquatic habitats. It is strictly aquatic and retains its external gills throughout life. It preys on amphipods, midge fly larvae and pupae, other small insect pupae and naiads, and small aquatic snails.
Texas blind salamander *Eurycea rathbuni*	Endangered	No	This species is restricted in its distribution to the Edwards aquifer artesian and recharge zone near San Marcos, Texas. It is subterranean but individuals may reach the surface via springs. It feeds on small aquatic organisms including amphipods, blind shrimp, daphnia, small snails, and other invertebrates.

Table 3.7-2 Federally Listed, Proposed, and Candidate Species Known or Having Potential to Occur in the ROI

Common and Scientific Name	Federal Status	Critical Habitat Present in the ROI?	Description
Fishes			
fountain darter *Etheostoma fonticola*	Endangered	No	This species is endemic to the Comal Springs-River system in New Braunfels and the San Marcos Springs-River system in Texas. In general, this darter prefers vegetated stream-floor habitats with constant water temperature feeding upon copepods, cladocerans, and dipteran and ephemeropteran larvae.
Insects			
Comal Springs dryopid beetle *Stygoparnus comalensis*	Endangered	No	Comal Springs dryopid beetle adults inhabit subterranean spaces associated with springs issuing from the Edwards Aquifer. On the surface, they inhabit gravel and cobble-dominated substrates with aquatic vegetation and submerged wood present at Comal and Fern Bank springs in Texas. It eats organic matter off the roots and wood.
Comal Springs riffle beetle *Heterelmis comalensis*	Endangered	No	This fully aquatic beetle cannot fly and does not have gills. It lives in and out of the bubbling, boiling spring openings found in the headwaters of the San Marcos and Comal Spring. It eats organic matter off the roots and wood.
monarch butterfly *Danaus plexippus*	Candidate	No	Monarchs lay their eggs on their obligate milkweed host plant (primarily *Asclepias* spp.), and larvae emerge after 2 to 5 days. Monarchs breed year-round in many regions. Individual monarchs in temperate climates undergo long-distance migration and live for an extended period. Monarchs that migrate south return to their breeding grounds restarting the cycle of generational migration.
Crustaceans			
Peck's Cave amphipod *Stygobromus* (=*Stygonectes*) *pecki*	Endangered	No	This endemic eyeless, unpigmented amphipod lives in and out of the bubbling, boiling spring openings found in the headwaters of the Comal Spring complex and Hueco Springs fed by the Edwards Balcones Fault Zone Aquifer groundwater. The species is omnivorous, and can feed as a predator, scavenger, or detritivore. Food sources may include living materials, detritus, leaf litter, and decaying roots. The species may also feed on bacteria and fungi associated with decaying plant material.
Flowering Plants			
black lace cactus *Echinocereus reichenbachii* var. *albertii*	Endangered	No	This species is endemic to Texas. The habitat for this cactus is characterized as openings in mesquite brush occurring along streams of the coastal plain. Typical soils underlying the habitat are sandy loam or silt. No critical habitat has been designated for this species in the ROI.
bracted twistflower *Streptanthus bracteatus*	Threatened	No	Bracted twistflower is endemic to the juniper-oak woodlands of the Edwards Plateau of central Texas. It is a winter annual plant; seeds germinate from late summer to early winter, forming basal rosettes of leaves, and flower stalks emerge the following spring.

Table 3.7-2 Federally Listed, Proposed, and Candidate Species Known or Having Potential to Occur in the ROI

Common and Scientific Name	Federal Status	Critical Habitat Present in the ROI?	Description
Flowering Plants *(continued)*			
Texas wild-rice *Zizania texana*	Endangered	No	Texas wild rice is a submergent aquatic perennial grass with leaves that are 3 to 6.5 feet long. This species requires clear, relatively cool, thermally constant flowing water of about 72°F. This plant prefers gravel and sand substrates overlying Crawford black silt and clay and is endemic to the San Marcos River.
Tobusch fishhook cactus *Sclerocactus brevihamatus* ssp. *tobuschi*	Threatened	No	Named for its unique hooked spines, this cactus spends the first 5 years of its life smaller than the size of a quarter before even producing its first flowers. The cactus is endemic to eight counties on the Edwards Plateau, where drought conditions are common.

Sources: Kroll, 1980; USFWS,1987; 1996; 2017b; 2023a; 2023b; 2024b; 2024c

The Nature Conservancy's Love Creek Preserve is a 2,845-acre protected area representing one of the most diverse habitats in the nation and some of the most scenic land in Texas. Located in Bandera County, the Preserve provides suitable habitat for the endangered golden-cheeked warbler and supports the threatened Tobusch fishhook cactus (The Nature Conservancy, n.d.). Love Creek Preserve is crossed by segments of three existing MTRs (VR-140, VR-168, and VR-1122/1123) in which military aircraft are authorized to operate as low as surface level or 100 feet AGL (**Section 3.5.2**).

The Bandera Corridor Conservation Bank is a USFWS-approved species conservation bank for the golden-cheeked warbler. This conservation bank provides offsetting conservation credits for actions requiring mitigation offsets under Section 7 and Section 10 of the ESA, such as land use change, development, and infrastructure activities. These conservation credits can be used for mitigation impacts to golden-cheeked warbler habitat in 13 counties (Bandera, Bexar, Blanco, Comal, Edwards, Gillespie, Kendall, Kerr, Kimble, Kinney, Medina, Real, and Uvalde) (Bandera Corridor Conservation Bank, n.d.).

Migratory Bird Treaty Act

Most bird species are protected under the MBTA, and their protection by federal agencies is mandated by E.O. 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. Under the MBTA, it is illegal for anyone, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, [or] possess migratory birds or their nests or eggs at any time, unless permitted by regulation. Under E.O. 13186, federal agencies taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations are directed to develop and implement a MOU with the USFWS that promotes the conservation of migratory bird populations.

An MOU between DoD and USFWS signed in July 2006 identified specific activities (e.g., Partners in Flight and Integrated Natural Resources Plans) where cooperation between the DoD and USFWS would contribute to the conservation of migratory birds and their habitats. In February

2022, 50 CFR § 21.42 authorized the take of migratory birds incidental to military readiness activities. It states that the Armed Forces may take migratory birds incidental to military readiness activities provided that, for those ongoing or proposed activities that the Armed Forces determine may result in a significant adverse effect on a population of a migratory bird species, the Armed Forces must confer and cooperate with the USFWS to develop and implement appropriate conservation measures to minimize or mitigate such significant adverse effects. Military readiness activities include all training and operations of the 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 (PL 107-314, section 315(f) of the 2003 National Defense Authorization Act).

Bald and Golden Eagle Protection Act

The BGEPA prohibits anyone, without a permit issued by the Secretary of the Interior, from taking eagles, including their parts, nests, or eggs. The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. “Disturb” means “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, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (16 U. S. C. §§ 668-668d).

No nesting bald eagles (*Haliaeetus leucocephalus*) have been identified within the six-county area underlying the ROI (Texas Agricultural and Mechanical University [TAMU], 2007a). Bald eagles have potential to occur in the ROI, primarily during the winter when they are known to nest between October and July. Bald eagles are primarily found near water sources as they feed primarily on fish, but also eat a variety of waterfowl, small mammals, and turtles (Campbell, 2003). This species is reported as a potential migrant through the Central Flyway (USFWS, 2024a). Although golden eagles *(Aquila chrysaetos)* are residents in Texas (breeding pairs have been observed in the Davis Mountains area more than 300 miles west-northwest of San Antonio), this species primarily occurs in mountainous and canyon habitats and has not been documented within the ROI, (TAMU, 2007b).

3.7.3 Environmental Consequences

3.7.3.1 Evaluation Criteria

Potential impacts on biological resources would be adverse if the Proposed Action resulted in the inadvertent injury or death of individual animals of common wildlife species, or the temporary removal of suitable habitat for one or more common wildlife species; temporarily impeded or prevented the continued foraging, breeding, nesting, or migration of common wildlife at the community, population, or species level; reduced the distribution of one or more common wildlife species; resulted in the spread of invasive or nonnative species; or were determined through consultation with USFWS that they could affect, but would not be likely to adversely affect federally listed threatened and endangered species under the ESA. Adverse impacts on biological resources would be considered significant if the Proposed Action permanently impeded or prevented the continued foraging, breeding, nesting, or migration of common wildlife at the community, population, or species level; resulted in the permanent destruction of suitable habitat for common wildlife species; or if adverse effects on special status species or critical habitat could not be mitigated through consultation with USFWS.

As required by the ESA, federal agencies must determine that their proposed actions do not adversely affect the existence of any threatened or endangered species. Federal agencies must avoid unauthorized "take" of federally threatened or endangered species or adverse modification of designated critical habitat. The ESA Section 7 consultation process would result in either USFWS concurrence with the DAF's determination of "may affect, but not likely to adversely affect" federally listed species, or a biological opinion with either an Incidental Take Statement that authorizes a specified amount of "take" (or adverse modification of designated critical habitat) or a jeopardy determination.

3.7.3.2 Alternative 1

Alternative 1 would have no effect on vegetation (including invasive species), or habitat because no construction, demolition, or other ground-disturbing activities would occur. Alternative 1 would have no effect on federally designated critical habitat because none is present within the ROI.

Several factors, including direct strikes and visual effects associated with approaching aircraft could potentially impact wildlife in the ROI. Any impacts from visual sightings of approaching aircraft would most likely occur within the ROI below 1,000 feet AGL, the altitude accounting for most reactions to visual stimuli by wildlife (Bowles, 1995). Studies investigating the effects of overflight noise on wildlife suggest that impacts vary depending on the species, as well as a variety of other factors such as type of aircraft, duration of overflight, frequency of overflights, and aircraft speed. In addition, natural factors that affect impacts include age and sex, reproductive condition, group size, season, terrain, weather, and temperament (Bowles,1995). Responses to aircraft noise include no response, increased heart rate, turning toward stimuli, or fleeing (mammals) and flushing (birds) (NPS, 1995).

Studies on the effects of noise on wildlife have been predominantly conducted on mammals and birds. Studies of subsonic aircraft disturbances on ungulates (e. g., pronghorn, bighorn sheep, elk, and mule deer), in both laboratory and field conditions, have shown that effects are transient and of short duration, and suggest that the animals habituate to the sounds (Bowles, 1995; Larkin, 1994; Weisenberger et al., 1996; Gladwin et al., 1988).

Noise that is close, loud, and sudden and is combined with a visual stimulus produce the most intense reactions in animals. Rotary-wing aircraft (helicopters) generally induce startle effects more frequently than fixed-wing aircraft (Manci et al., 1988). Some species habituate to repetitive noises, especially noise associated with overflight of fixed-wing aircraft, better than other species (Krausman et al., 1999). Physiological and behavioral reactions to aircraft overflights are indications of temporary stress upon wildlife and domestic animals; however, the long-term implications to individuals have not been studied extensively.

Portions of the land area in the ROI supports ranching and agriculture. The effects of aircraft overflights and their accompanying noise on domestic livestock (such as cattle and horses) have been the subject of numerous studies since the late 1950s (Gladwin et al., 1988; U.S. Forest Service [USFS], 1992). These studies have examined the effects on a wide range of livestock including poultry, cattle, sheep, pigs, goats, and mink. Exposure to multiple overflights at all altitudes provided the basis for testing the animal's response. Several general conclusions are drawn from these studies:

- Overflights do not increase death rates and abortion rates or reduce productivity rates (e.g., birth rates and weights) and do not lower milk production among domestic livestock.
- Animals take care not to damage themselves and do not run into obstructions, unless confined or traversing dangerous ground at a high rate if overflown by aircraft 163 to 325 feet AGL (USFS, 1992).
- Domestic livestock habituate to overflights and other noise. Although they may look or startle at a sudden onset of aircraft noise, they resume normal behavior within 2 minutes after the disturbance.

Inconclusive results have been obtained in some cases because the effect observed is no different than any other disturbance livestock experience daily, such as from vehicles or blowing vegetation. Historical interactions between cattle and numerous overflights have not indicated a problem. For example, cattle have grazed under heavily used military airspace at Avon Park Range in Florida, Saylor Creek and Juniper Butte Ranges in Idaho, and Smoky Hill Air National Guard Range in Kansas for decades. At these training ranges, grazing cattle have been subject to upwards of 100 overflights per day, many as low as 100 feet AGL. No evidence exists that the health or well-being of the cattle have been threatened. The animals, including calves, show all indications of habituating to the noise and overflights.

The effects of fixed-wing aircraft flying below 1,000 feet AGL upon flight capable wildlife due to visual approach and noise are dependent upon species demeanor, time of day, migration cycle, and behavioral activity. These are largely BASH considerations accommodated by flight scheduling. No ground disturbance is associated with the Proposed Action, and it is anticipated that wildlife and domestic animals would generally habituate to noise and visual elements associated with aircraft operating in the proposed RAN2A Low MOA. Therefore, noise and visual effects associated with the Proposed Action would have no significant adverse effects on wildlife and domesticated animals.

The low floor (500 feet AGL) in the proposed RAN2A Low MOA may increase the potential for bird strikes; however, given the large area where the training would occur, that most training would occur during daytime hours, and the relatively low numbers of sorties proposed (approximately 11 sorties per day distributed between 7 a.m. and 10 p.m. local time, Monday through Friday), the likelihood for birds to encounter aircraft during training operations would remain low. When BASH risk increases, additional avoidance procedures would be followed during low-altitude training. The inadvertent injury or death of birds from collisions with aircraft operating in the proposed RAN2A Low MOA would represent an adverse impact. However, such impacts would occur at the individual level and would not permanently impede or prevent the continued foraging, breeding, nesting, or migration of common bird species wildlife at the community, population, or species level. Therefore, adverse impacts on birds would not be significant. Any "take" of birds protected by the MBTA would be small on an annual basis and would be considered incidental to military readiness activities in accordance with 50 CFR § 21.42.

Given the low frequency of proposed flight operations in the proposed RAN2A Low MOA and the large area covered by the proposed RAN2A Low MOA, the DAF has determined that Alternative 1 may affect, but is not likely to adversely affect the rufa red knot, piping plover, and golden-cheeked warbler; and would not jeopardize the continued existence of the tricolored bat and monarch butterfly. USFWS concurrence with this determination is pending. Alternative 1 would have no effect on federally listed or proposed terrestrial species because no activities involving disturbance of land or water bodies would occur.

3.7.3.3 Alternative 2

Adverse effects from Alternative 2 on vegetation, domesticated animals, common wildlife species, and birds protected by the MBTA would be the same as those described for Alternative 1. Alternative 2 may affect, but is not likely to adversely affect the rufa red knot, piping plover, and golden-cheeked warbler; and would not jeopardize the continued existence of the tricolored bat and monarch butterfly. USFWS concurrence with this determination is pending.

3.7.3.4 No Action Alternative

Under the No Action Alternative, the proposed low-altitude airspace would not be obtained and existing conditions would continue. This would have no effect on biological resources.

3.7.3.5 Reasonably Foreseeable Future Actions and Other Environmental Considerations

When considered with the reasonably foreseeable actions occurring in, above, under, or adjacent to RAN2A MOA listed in **Appendix B**, the Proposed Action would not be anticipated to contribute to cumulatively significant adverse impacts on biological resources.

3.8 CULTURAL RESOURCES

3.8.1 Definition of the Resource

Cultural resources include archaeological and architectural sites that provide essential information to understand the prehistory and historical development of the United States. The primary federal law protecting cultural resources is the National Historic Preservation Act of 1966. Under Section 106 of the NHPA, federal agencies must consider the effects of their proposed actions (or undertakings) on any historic property (i.e., any district, site, building, structure, or object that is listed or eligible for listing in the National Register of Historic Places [NRHP]). To the extent possible, adverse effects on historic properties must be avoided, minimized, or mitigated in consultation with the SHPO and other consulting parties, as appropriate. The Texas Historical Commission is the SHPO for the state of Texas.

Generally, if under Section 106 an action would have an adverse effect on a historic property listed in or eligible for the NRHP, the action would also have an adverse impact under NEPA. An adverse effect that is mitigated in consultation with the SHPO and other parties, as appropriate, can generally be considered not significant under NEPA.

The Proposed Action is considered an undertaking for the purposes of Section 106. The APE for this undertaking consists of lands underlying or intersected by the boundaries of the existing RAN2A MOA **(Figure 1.2-1, Figure 1.2-2)**. In August 2024, the DAF initiated consultation for the proposed undertaking with the Texas SHPO in accordance with Section 106 and requested concurrence with the APE. Section 106 correspondence is provided in **Appendix A**.

Properties of traditional religious and cultural importance, also referred to as traditional cultural properties are places eligible for inclusion in the NRHP because of their association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. E.O. 13007, *Indian Sacred Sites* defines Indian sacred sites as “specific, discrete, narrowly delineated locations on Federal land that are identified by an Indian tribe…as sacred by virtue of their established religious significance to, or ceremonial use by, an Indian religion. . . .” Indian sacred sites are strictly religious places and can be recent in age, in contrast with traditional cultural properties which can be secular and must meet stricter NRHP eligibility criteria (BLM, 2012). An Indian sacred site can be a traditional cultural property but not all traditional cultural properties are sacred sites. Indian sacred sites are considered under the NEPA process as part of the human environment.

Under the Native American Graves Protection and Repatriation Act, federal agencies are required to plan for and protect Native American human remains or cultural items that may be removed from federal lands and return such remains or items to lineal descendants or tribes (NPS, 2024a). DoD Instruction 4710.2, *DoD Interactions with Federally Recognized Tribes* (September 24, 2018) establishes policy, assigns responsibilities, and provides procedures for DoD interactions with federally recognized Native American tribes. The *2021 DoD Plan of Action on Tribal Consultation* (May 2021) outlines the DoD’s commitment to improving implementation of E.O. 13175, Consultation and Coordination With Indian Tribal Governments.

The DAF has initiated government-to-government consultation with Native American tribes having historic, cultural, and religious ties to lands underlying the proposed airspace. Government-to-government correspondence is included in **Appendix A**.

The Proposed Action would occur entirely within airspace above the earth’s surface and does not include construction, demolition, or other ground-disturbing activities. Therefore, archaeological sites and architectural resources not formally listed or determined eligible for listing in the NRHP or not identified as traditional cultural properties are not addressed in this EA.

3.8.2 Affected Environment

The existing RAN2A MOA overlies approximately 1,900 square miles of land within south central Texas, straddling the interface of the interior coastal plain and the Edwards Plateau. This region is characterized by low rolling to nearly flat terrain, underlain by unconsolidated sands, muds, limestones, and dolomites (Bureau of Economic Geology, 1996). Vegetation consists of grasslands with live oak-ashe juniper communities grading westward to creosote bush–tarbush shrub communities. From north to south, the plains are dissected by tributaries of the Nueces and San Antonio Rivers. Elevations vary between 800 and 3,000 feet above MSL.

One historic district and four architectural resources listed in the NRHP are within the APE (NPS, 2024b; Texas Department of Transportation [TxDOT], 2023). These districts and resources are listed in **Table 3.8-1** and shown on **Figure 3.8-1**. The historic district represents the original mid-to-late 19th century town of D’Hanis, one of the first European-American settlements in Medina County. The architectural resources consist of residential and courthouse buildings and jails. These NRHP-listed resources are located in Medina and Bandera Counties.

Table 3.8-1 NRHP-Listed and NRHP-Eligible Resources in the APE by County

Map ID	Listed Resources	County	Reference No.
1	Saathoff House	Medina	82004515
2	Jureczki House	Bandera	80004075

Table 3.8-1 NRHP-Listed and NRHP-Eligible Resources in the APE by County

Map ID	Listed Resources	County	Reference No.
3	Bandera County Courthouse and Jail	Bandera	79002911
4	Langford, B.F., Jr. and Mary Hay House	Bandera	04000229
5	D'Hanis Historic District	Medina	76002051
Map ID	**Eligible Resources**	**County**	**Property Number**
6	Folk Victorian House	Medina	1
7	Armstrong Hotel	Medina	16
8	Shed	Medina	17
9	Wood Frame House	Medina	20
10	Wood Sided House	Medina	32
11	Craftsman Bungalow	Medina	42
12	Masonry City Hall	Uvalde	8
13	Commercial Block	Uvalde	11
14	Commercial Block	Uvalde	16
15	Commercial Block	Uvalde	17
16	Commercial Block	Uvalde	20
17	Commercial Block	Uvalde	23
18	Bungalow	Frio	48A
19	Train Depot	Medina	61a
20	Texas Reg Church (Grace Lutheran)	Bandera	8a
21	Bandera Cemetery (BN-C002)	Bandera	9

Sources: NPS, 2024b; TxDOT, 2023

In addition, 16 NRHP-eligible historic properties are within the APE (TxDOT, 2023). These properties include residences, local government facilities, a church, a railroad depot, a cemetery, and commercial buildings **(Table 3.8-1, Figure 3.8-1)**. These properties are distributed across Medina, Uvalde, Frio, and Bandera Counties. Additionally, the El Camino Real De Los Tejas National Historic Trail underlies the southern portion of the APE within Frio and Medina Counties (NPS, 2024c). This resource consists of a series of trails that extend from the Mexican border near Laredo through San Antonio to Natchitoches, Louisiana, roughly following US-57 and I-35. The trails were established during the Spanish Colonial period to connect Mexico City with settlements in Texas and Louisiana with portions currently maintained as recreational trails.

No federally recognized tribal lands are present within the APE (Bureau of Indian Affairs, 2016). Native American tribes with ancestral ties to land underlying the APE are listed in **Appendix A**. The DAF initiated government-to-government consultation with these tribes in August 2024. To date, no tribal consultation responses have been received, and no traditional cultural properties or Indian sacred sites have been identified on lands underlying the APE.

3.8.3 Environmental Consequences

3.8.3.1 Evaluation Criteria

Adverse impacts on cultural resources could include altering characteristics of the resource that make it eligible for listing in the NRHP. Such impacts could 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 the purposes of this EA, an effect is considered adverse if it would alter the integrity of a NRHP-listed or eligible resource or if it has the potential to adversely affect traditional cultural properties or Indian sacred sites and the practices associated with the property or sacred site.

3.8.4 Environmental Consequences

3.8.4.1 Evaluation Criteria

Adverse impacts on cultural resources could include altering characteristics of the resource that make it eligible for listing in the NRHP. Such impacts could 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 the purposes of this EA, an effect is considered adverse if it would alter the integrity of a NRHP-listed or eligible resource or if it has the potential to adversely affect traditional cultural properties or Indian sacred sites and the practices associated with the property or sacred site.

3.8.4.2 Alternative 1

Noise analysis conducted for the Proposed Action indicates that noise levels associated with Alternative 1 would not exceed 49 dBA in any area of the APE and would remain well below the 65 dBA threshold below which most types of land uses are compatible with aircraft noise (see **Section 3.4**). Noise levels that can negatively affect buildings and structures typically exceed 130 dBA (U.S. Navy, 2018), and noise levels at or below 49 dBA would not be expected to introduce audible elements that would alter the character, setting, or integrity of a historic property. Although some individual locations within the APE could experience noise levels from Alternative 1 that could exceed 45 dBA, these occurrences would be brief and relatively infrequent and would be unlikely to affect the integrity or character-defining features of any historic property. No ground disturbance would take place as part of Alternative 1; therefore, no archaeological resources (surface or subsurface) would be disturbed or otherwise affected. Likewise, Alternative 1 would not physically disturb or otherwise affect the NRHP-listed historic districts and individual historic structures underlying the APE. Alternative 1 would have no potential to affect traditional cultural properties or Indian sacred sites, as no such properties or sites have been identified in the APE.

Therefore, per guidance set forth in 36 CFR § 800.5, the DAF has determined that Alternative 1 would have no adverse effect on historic properties. In an email dated September 20, 2024 the Texas SHPO concurred that the Proposed Action would have no adverse effects on historic properties, including archaeological sites. The Texas SHPO's response is included in **Appendix A**. To date, no tribal consultation responses have been received.

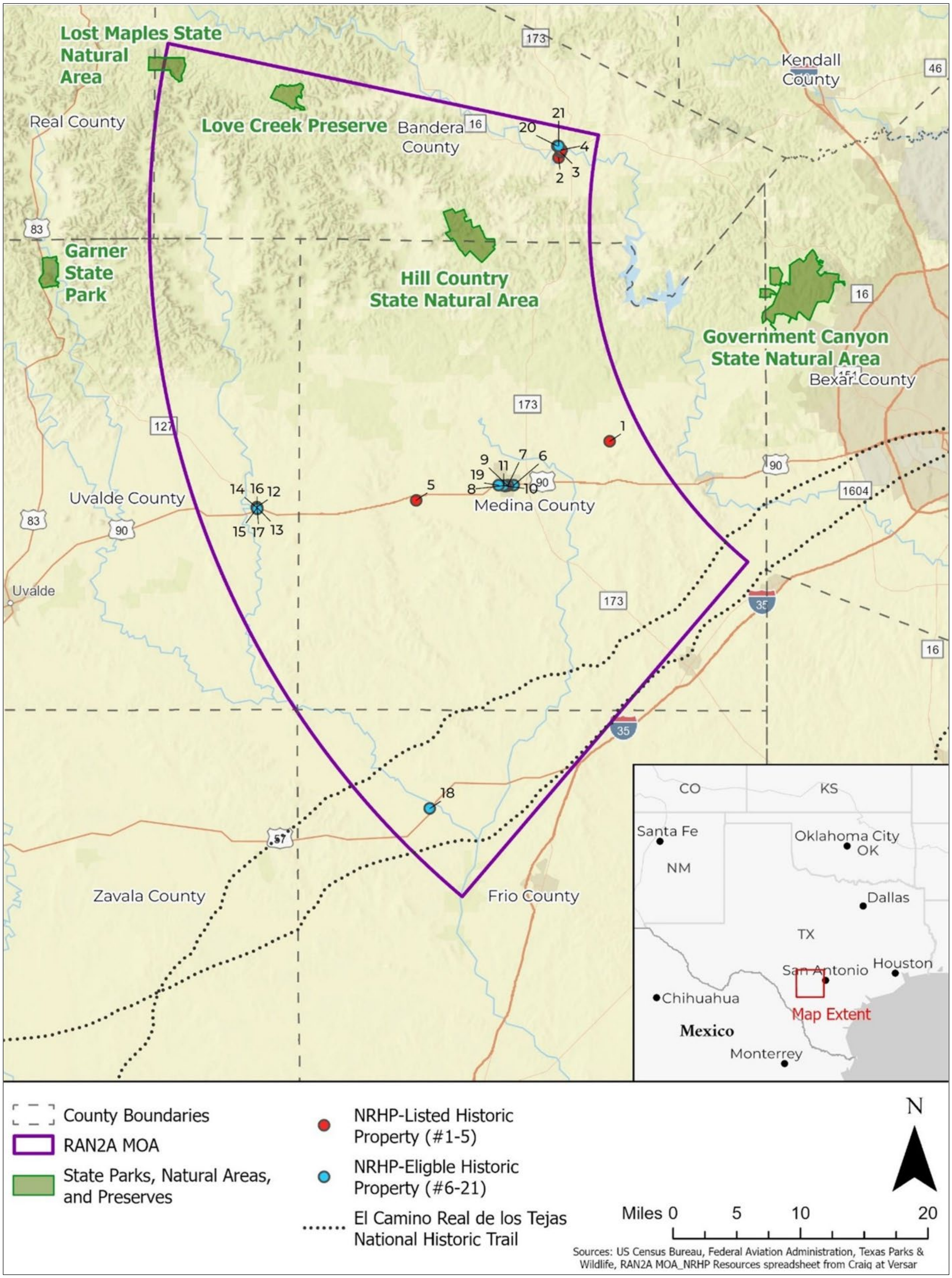

Figure 3.8-1 Locations of NRHP-Listed and NRHP-Eligible Historic Resources in the APE

3.8.4.3 Alternative 2

Potential impacts on historic properties from Alternative 2 would be the same as those described for Alternative 1. Concurrence with this determination by the Texas SHPO was received in an email dated September 20, 2024 **(Appendix A)**. To date, no tribal consultation responses have been received.

3.8.4.4 No Action Alternative

Under the No Action Alternative, the proposed low-altitude airspace would not be obtained and existing conditions would continue. This would have no impact on historic properties.

3.8.4.5 Reasonably Foreseeable Future Actions and Other Environmental Considerations

Reasonably foreseeable future actions listed in **Appendix B** would have the potential to affect historic properties, including architectural and archaeological resources, and/or traditional cultural properties. The projects in **Appendix B** are also subject to NEPA compliance and Section 106 of the NHPA consultation prior to project start. It is anticipated that potential adverse effects on historic properties from these projects would be identified, avoided, minimized, or mitigated to less than significant levels through consultation with the Texas SHPO, tribal governments, local authorities, and/or the Advisory Council on Historic Preservation, if applicable. Therefore, when considered with these reasonably foreseeable future actions, the Proposed Action would not be anticipated to contribute to cumulatively significant impacts on historic properties.

3.9 SAFETY

3.9.1 Definition of the Resource

Safe, effective, and disciplined flying training operations are a critical priority of the DAF. Safety concerns associated with MOA flight activities are considered in this section and address issues related to the health and well-being of both military personnel operating in and civilians living under or near the RAN2A MOA.

The primary aspect of flight safety addressed in this section is the potential for aircraft accidents. Such accidents could include mid-air collisions involving two or more aircraft, collisions with terrain or manmade structures, collisions with birds or other wildlife, weather-related accidents, mechanical failure, or pilot error. Flight risks apply to civilian and military aircraft. Analysis of flight risks correlates mishap rates **(Section 3.9.2.2)** and BASH **(Section 3.9.2.3)** with airspace utilization.

The ROI for safety consists of areas in and under the existing RAN2A MOA and ATCAA, including areas above 500 feet AGL where the proposed low-altitude MOA would be established under the Proposed Action. The Proposed Action does not involve changes to and would have no impacts on ground safety, which pertains to the safety of personnel and facilities supporting flight operations at installations; therefore, ground safety is not addressed further.

3.9.2 Affected Environment

3.9.2.1 MOA Operating Procedures

Military aircraft flight training operations in MOAs are governed by standard rules of flight and may be conducted on a scheduled basis. MOAs are charted so nonparticipating aircraft may be aware of these operations. Additional information and operational procedures applicable to MOAs, including the existing RAN2A MOA, are provided in FLIP AP/1A (DoD, 2024). Units responsible for scheduling flight training activities on MOAs must ensure that airspace information and procedures listed in FLIP AP/1A are complete and accurate for the safe and efficient operation of aircraft in the MOAs for which they are responsible. At a minimum, operational procedures or remarks provided in FLIP AP/1A typically include the following:

A. Scheduling and Coordination:

1. Each MOA has a designated military office responsible for scheduling all military flights for use of that area. Areas shall not be used for military training unless scheduled.
2. Special conditions of use and procedures for each MOA are established by letter of agreement between the local military authority and concerned ATC facility. The scheduling office will advise all scheduled military users of the operating procedures contained in the letter of agreement.
3. Military operations in excess of 250 knots below 10,000 feet should be conducted in Special Use Airspace to the maximum extent possible.

B. Flight Procedures:

1. Military training operations within MOAs shall be conducted in accordance with the letter of agreement.
2. Although not required, ATC or a military radar unit may provide advisory/monitoring/separation services within the MOA. However, the pilot is responsible for remaining within the area and exercising "see and avoid" during visual conditions.

Basic airmanship procedures exist for handling any deviations from air traffic control procedures due to an in-flight emergency; these procedures are defined in Air Force Manual 11-202 Volume 3, *Flight Operations* and established aircraft flight manuals. The Flight Crew Information File is a safety resource for aircrew day-to-day operations which includes flight operation rules and procedures.

3.9.2.2 Aircraft Mishaps

Aircraft mishaps and their prevention represent a prime concern of the DAF. A mishap is an unplanned occurrence or series of occurrences, that result in damage or injury and meets Class A, B, C, D, and Class E event reporting criteria as defined in DAFMAN 91-224, *Ground Safety Investigations and Reports*. Class A mishaps are the most severe with total property damage of $2 million or more or a fatality and/or permanent total disability. Mishap classes are defined in **Table 3.9-1**.

Table 3.9-1 Aircraft Class Mishaps

Mishap Class	Mishap Criteria[1]
A	1. Direct mishap cost totaling $2,000,000 or more. 2. A fatality or permanent total disability. 3. Destruction of a Department of Defense aircraft. 4. Permanent loss of primary mission capability of a space vehicle.
B	1. Direct mishap cost totaling $600,000 or more but less than $2,500,000. 2. A permanent partial disability. 3. Inpatient hospitalization of three or more personnel. This does not include individuals hospitalized for observation, diagnostic, or administrative purposes that were treated and released. 4. Permanent degradation of primary or secondary mission capability of a space vehicle or the permanent loss of secondary mission capability of a space vehicle.
C	1. Direct mishap cost totaling $50,000 or more but less than $500,000. 2. Any injury or occupational illness that causes loss of one or more days away from work not including the day or shift it occurred. 3. An occupational injury or illness resulting in permanent change of job. 4. Permanent loss or degradation of tertiary mission capability of a space vehicle.
D	On-duty mishap resulting in one or more of the following: 1. Direct mishap cost totaling $20,000 or more but less than $50,000. 2. A recordable injury cost or illness not otherwise classified as a Class A, B, or C mishap. 3. Any work-related mishap resulting in a recordable injury or illness not otherwise classified as a Class A, B, or C mishap.
E	A work-related mishap that falls below Class D criteria. Most Class E mishap reporting is voluntary; however, see discipline-specific safety manuals for a list of events requiring mandatory reporting.

Notes:
[1] Mishap criteria defined as resulting in one or more item listed by Class.
Source: DAF, 2024b

Based on historical data on mishaps at all DoD installations, and under all conditions of flight, the military services calculate mishap rates per 100,000 flying hours for each type of aircraft in the inventory. Over the last decade, the Air Force Safety Center reports of Class A mishaps for all manned aviation (excluding flight related ground operations) have ranged from 7 in 2014 (a rate of 0.44 per 100,000 flight hours) to 23 in 2018 (a rate of 1.51 per 100,000 flight hours) (HQ AFSEC, 2023a). Similarly, the Air Force Safety Center reports of Class B mishaps for all manned aviation (excluding flight related ground operations) have ranged from 23 in 2019 (a rate of 1.54 per 100,000 flight hours) to 38 in 2016 (a rate of 2.34 per 100,000 flight hours) (HQ AFSEC, 2023b). In comparison, from 2012 through 2021, T-38 aircraft have had 8 Class A mishaps (a rate of 0.79 per 100,000 flight hours) and 6 Class B mishaps (a rate of 0.59 per 100,000 flight hours) (Air Force Safety Center, 2021a). Over the same period, F-16 aircraft have had 35 Class A mishaps (a rate of 0.1.81 per 100,000 flight hours) and 24 Class B mishaps (a rate of 1.24 per 100,000 flight hours) (Air Force Safety Center, 2021b).

The 502D ABW JBSA Mishap Response Plan for Safety Investigations (502D ABW, 2021) is implemented following any major (Class A or B) Aviation, Occupational, Weapons or other category of mishap in the JBSA area of responsibility. Class A and B mishaps are the two categories with the most severe outcomes with regard to property damage, including destroyed aircraft, and fatalities and injuries. Over the last 4 years JBSA-Randolph reviewed data concerning bird strikes and near midair collisions and reported three bird strikes on VR-140.

3.9.2.3 Bird/Wildlife Aircraft Strike Hazard

Aircraft collisions with birds and wildlife present 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 feet MSL; however, most birds fly close to the ground. Approximately 52 percent of strikes occur from birds flying below 400 feet and 88 percent occur at less than 2,000 feet AGL (Air Force Safety Center, 2016).

The Air Force BASH program was established to minimize the risk for collisions of aircraft with birds and wildlife and the potential for subsequent human injury or loss of life, and property damage. In accordance with DAF Instruction 91-202, *The Department of the Air Force (DAF) Mishap Prevention Program* (DAF, 2020b), each DAF flying unit is required to develop a BASH plan to reduce hazardous bird/wildlife activity relative to airfield flight operations. The intent of each plan is to reduce BASH risks at airfields by establishing an integrated hazard abatement program through monitoring, avoidance, and actively controlling bird and animal population movements. JBSA-Randolph is located on the western edge of the Central Migratory Bird Flyway, resulting in the increased potential for in-flight encounters with birds during migration.

Areas near the existing RAN2A MOA in south-central Texas are classified by the Avian Hazard Advisory System as having generally low bird-strike risk during the night and moderate risk during the day throughout most of the spring and summer months. From October through February, the risk increases to moderate-to-severe during the morning hours. The JBSA BASH Plan (502D ABW, 2021) establishes a program designed to minimize local and transient aircraft exposure to potentially hazardous bird/wildlife strikes at or near JBSA-Randolph and JBSA-Kelly Field, in addition to other areas owned or managed by JBSA, including MOAs, where JBSA local and transient aircraft operate on a regular basis. BASH incidents that occur in MOAs are reported and included in each installation’s BASH statistics; however, no recent BASH incidents have been reported associated with flight operations in the existing RAN2A MOA.

3.9.2.4 Obstructions to Flight

A flight obstruction is any obstruction in navigable airspace that applies to existing and proposed human-made objects, objects of natural growth, and terrain.

Flight operations in the proposed RAN2A Low MOA would begin and end outside the airfield traffic pattern airspace area or Class B, C, and D airspace areas. FAA considerations/guidance for evaluating obstructions in airspace where aircraft are operating under VFR (such as the MOAs) include (FAA, 2023a):

- A structure would have an adverse effect upon VFR air navigation if its height is greater than 500 feet above the surface at its site, and within 2 statute miles of any regularly used VFR route.
- Evaluation of obstructions located within MOAs or VFR routes must recognize that pilots may, and sometimes do, operate below the floor of controlled airspace during low ceilings and 1-mile flight visibility. When operating in these weather conditions and using pilotage

navigation, these flights must remain within 1 mile of the identifiable landmark to maintain visual reference. Even if made more conspicuous by the installation of high intensity white obstruction lights, a structure placed in this location could be a hazard to air navigation because after sighting it, the pilot may not have the opportunity to safely circumnavigate or overfly the structure.

- Operations in MOAs and MTRs provide military aircrews low altitude, high speed navigation and tactics training, and are a basic requirement for combat readiness (see FAA Order JO 7610.14, *Non-Sensitive Procedures and Requirements for Special Operations*). Surface structures have their greatest impact on VFR operations when ceiling and visibility conditions are at or near basic VFR minimums. Accordingly, the guidelines for a finding of substantial adverse effect on en route VFR operations are based on consideration for those operations conducted under 14 CFR Part 91 that permits flight clear of clouds with 1-mile flight visibility outside controlled airspace. A proposed structure's location within the boudaries of a MOA is not a basis for determining it to be a hazard to air navigation; however, in recognition of the military's requirement to conduct low-altitude training, the Air Force would disseminate Part 77 notices and aeronautical study information to military representatives. Additionally, attempts are made to persuade the sponsor to lower or relocate a proposed structure that exceeds obstruction standards and has been identified by the military as detrimental to its training requirement.

Flight safety concerns include obstacle avoidance which varies by aircraft and is published for each aircraft's associated 11-series publication. For example, Air Force Instruction 11-2F-16 Volume 3, *F-16 Operations Procedures* directs flight leads who are unable to visually acquire or ensure lateral separation from known vertical obstructions in the route of flight, to direct a climb to an altitude that ensures vertical separation, no later than 3 nautical miles prior to the obstruction.

With low, rolling plains in and around the ROI, potential flight obstructions in or near these airspaces include commercial wind turbines and cellular towers which are both prevalent throughout central Texas. The U.S. Wind Turbine Database, which provides the location of land-based and offshore wind turbines in the United States, does not identify any wind turbines in the ROI. The Federal Communications Commission, which maintains a database of cellular towers in the United States, indicates there are two granted towers at the northern edge of the study area (i.e., mobile companies were granted operating licenses; however, the towers have yet to be constructed).

3.9.3 Environmental Consequences

3.9.3.1 Evaluation Criteria

Impacts on safety from 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 may include modifying the airspace such that aircraft overfly populated areas at lower altitudes or implementing new flight procedures that result in greater flight safety risk; both types of changes would result in the establishment of the proposed RAN2A Low MOA. For the purposes of this EA, an impact is considered significant if the proposed safety measures are not consistent with Air Force Office of Safety and Health and Occupational Safety and Health Administration standards resulting in unacceptable safety risks. Analysis of aircraft flight safety risks correlates projected Class A mishaps and potential collisions between birds with current airspace use to consider the magnitude of the change in risk associated with the Proposed Action.

3.9.3.2 Alternative 1

Aircraft Mishaps

Under Alternative 1, DAF pilots would utilize the proposed RAN2A Low MOA, with vertical extents from 500 feet AGL up to, but not including 9,000 feet MSL possibly along with the existing RAN2A MOA and RAN2A ATCAA. The proposed RAN2A Low MOA would be managed and operated as a separate airspace distinct from the existing RAN2A MOA and RAN2A ATCAA. This would allow FAA civilian ATC to restrict military operations in the airspace, when needed, to facilitate safe transit of the airspace by civilian aircraft (including civil airports such as the South Texas Regional Airport at Hondo, located directly below the airspace). The proposed RAN2A Low MOA could be combined with the existing RAN2A MOA and RAN2A ATCAA to provide seamless flight operations from 500 feet AGL to FL 290, which would increase the space for vertical maneuverability and improve flight safety in that respect. However, the Proposed Action includes several other reasons why flight safety could potentially deteriorate. First, there would be a higher number of annual military flights in the proposed RAN2A Low MOA and RAN2A MOA and ATCAA (10,920 T-7As and 480 F-16Cs total) compared with existing flights in the RAN2A MOA (8,000 T-38Cs and 144 F-16Cs). Second, approximately 26 percent of the military flights would be in the proposed RAN2A Low MOA (2,920 T-7As and 48 F-16s), flying at much lower altitudes down to 500 feet AGL, compared with existing higher altitude flights in the existing RAN2A MOA and ATCAA (above 9,000 feet MSL). Aircraft mishaps due to BASH incidents, weather-related accidents, mechanical failure, or pilot error would therefore have the potential to increase.

The limited amount of time an aircraft would be over any specific location, combined with sparsely populated areas under the proposed RAN2A Low MOA and existing RAN2A MOA and ATCAA, including limited areas that would be crossed by existing MTRs (VR-1122/VR-1123, VR-140, VR-168, and IR-149), would minimize the probability that an aircraft mishap would occur over a populated area. All MOA flight operations would continue to be conducted in accordance with procedures established in the applicable DAF regulations and orders with the safety of its pilots and people in the surrounding communities as the primary concern. Strict control and use of established safety procedures would minimize the potential for aircraft mishaps and safety risks in general and would ensure that any potential adverse impacts would not be significant.

Bird/Wildlife-Aircraft Strike Hazards

Military aircrews operating within the proposed RAN2A Low MOA and existing RAN2A MOA and ATCAA would continue to follow applicable procedures outlined in the JBSA-Randolph, JBSA-Kelly Field, and Laughlin AFB BASH plans. General flight safety risks and BASH risks would be assessed for flights lower than 1,000 feet AGL, and additional avoidance procedures outlined in the installation BASH plans would be followed during low-altitude training as applicable. Continued adherence to current safety procedures, and taking preventive action when BASH risk increases, would ensure that potential impacts from BASH under Alternative 1 would not be significant.

Obstructions to Flight

Under Alternative 1, with the establishment of the proposed RAN2A Low MOA and implementation of low altitude flying as low as 500 feet AGL, pilots would exercise "see and avoid" actions during visual conditions to avoid potential obstructions in accordance with all applicable DAF procedures and requirements. As such, potential adverse impacts on safety from flight obstructions under Alternative 1 would not be significant.

All MOA flight operations would continue to be conducted in accordance with procedures established in the applicable DAF regulations and orders with the safety of its pilots and people in the surrounding communities as the primary concern. Therefore, Alternative 1 would have no adverse impacts on flight safety.

3.9.3.3 Alternative 2

Aircraft Mishaps

Under Alternative 2, the existing RAN2A MOA would be modified by lowering its floor from 9,000 feet MSL to 500 feet AGL to support low-altitude training operations. The modified airspace would continue to be operated as the RAN2A MOA with a floor of 500 feet AGL rather than creating a new, separate airspace as proposed under Alternative 1. Flight training would effectively be the same as for Alternative 1, although the extended RAN2A MOA would be scheduled as a single airspace. The preceding discussion regarding the potential for increased mishaps under Alternative 1 would also apply to Alternative 2. All MOA flight operations would continue to be conducted in accordance with procedures established in the applicable DAF regulations and orders with the safety of its pilots and people in the surrounding communities as the primary concern. Strict control and use of established safety procedures would minimize the potential for aircraft mishaps and safety risks in general and would ensure that any potential adverse impacts would not be significant.

Bird/Wildlife Aircraft Strike Hazard

The potential for BASH under Alternative 2 would be similar to the potential for such hazards described for Alternative 1 (**Section 3.9.3.2**). Military aircrews operating within the extended RAN2A MOA and overlying ATCAA would continue to follow applicable procedures outlined in the JBSA BASH Plan. General flight safety risks and BASH risks would be assessed for flights lower than 1,000 feet AGL, and additional avoidance procedures outlined in the installation BASH plans would be followed during low-altitude training as applicable. Continued adherence to current safety procedures, and taking preventive action when BASH risk increases, would ensure that adverse impacts from BASH under Alternative 2 would not be significant.

Obstructions to Flight

Under Alternative 2, pilots would exercise "see and avoid" actions during visual conditions to avoid potential obstructions in accordance with all applicable DAF procedures and requirements. As such, potential impacts on safety from flight obstructions under Alternative 2 would not be significant.

All MOA flight operations would continue to be conducted in accordance with procedures established in the applicable DAF regulations and orders with the safety of its pilots and people in the surrounding communities as the primary concern. Therefore, Alternative 2 would have no adverse impacts on flight safety.

3.9.3.4 No Action Alternative

Under the No Action Alternative, the proposed low-altitude airspace would not be obtained and existing conditions would continue. Flight training operations would continue in the existing RAN2A MOA and ATCAA in accordance with all applicable safety requirements. The No Action Alternative would have no adverse impacts on safety.

3.9.3.5 Reasonably Foreseeable Future Actions and Other Environmental Considerations

No reasonably foreseeable future projects or aircraft operations were identified in or near the proposed RAN2A Low MOA and existing RAN2A MOA that would contribute to cumulatively significant impacts on safety when considered with the Proposed Action.

3.10 SOCIOECONOMICS

3.10.1 Definition of the Resource

Socioeconomic resources addressed in this section include regional demographics and economic activity. Demographics include the number, distribution, and composition of population and households. Economic activity is represented by the region's major industries, employment, and income characteristics. Impacts on either of these two fundamental socioeconomic indicators are typically accompanied by changes in other components, such as altered housing availability, property values, demand for public services, and/or local and regional trends in economy and industry. Socioeconomic data represented in this chapter are presented at county and state level to characterize existing socioeconomic conditions in the context of regional and state trends.

The socioeconomics ROI consists of the six Texas counties that are crossed by the boundaries of the existing RAN2A MOA: Bandera, Frio, Medina, Real, Uvalde, and Zavala. These counties are shown on **Figure 1.2-2**.

3.10.2 Affected Environment

3.10.2.1 Population and Housing

The population of the ROI and individual counties within the ROI, and population changes that occurred between 2020 and 2022, are presented in **Table 3.10-1**. The change in population for the state of Texas is provided for comparison. Medina and Uvalde Counties had the largest countywide populations in 2020 and 2022 while Real and Zavala had the smallest in both years. Between 2020 and 2022, the ROI population grew at a similar rate as that of the state (3 percent), with Bandera County experiencing the largest rate of growth (6.1 percent) while the populations of Frio and Zavala Counties declined during that period (-3.1 percent and -3.0 percent, respectively). Overall, the 2022 ROI population represents less than 1 percent of the total state population.

Table 3.10-1 Population Change in the ROI, 2020 to 2022

Counties in the ROI	2020 Population	2022 Population	Percent Change
Bandera County	20,843	22,115	6.1
Frio County	18,392	17,815	-3.1
Medina County	50,739	53,723	5.9

Table 3.10-1 Population Change in the ROI, 2020 to 2022

Counties in the ROI	2020 Population	2022 Population	Percent Change
Real County	2,751	2,840	3.2
Uvalde County	24,564	24,940	1.5
Zavala County	9,670	9,377	-3.0
ROI	**126,959**	**130,810**	**3.0**
Texas	**29,145,428**	**30,029,572**	**3.0**

Source: U.S. Census Bureau, 2023

In Texas, property is required to be assessed at market value unless otherwise specified by law. Market value is defined as the price at which a property could transfer for cash or its equivalent under prevailing market conditions (Texas Comptroller, 2024). Several factors can affect the market value of property, including ambient noise levels (see **Section 3.4**). Factors directly related to the property, such as the size, improvements, and location of the property, as well as current conditions in the real estate market, interest rates, and housing sales in the area, are more likely to have a direct adverse impact on property values. A regression analysis of property values as they relate to aircraft noise at two military installations found that, while aircraft noise at installations may have had minor impacts on property values, it was difficult to quantify that impact (Fidell et al., 1996). Other factors, such as the quality of the housing near the installations and the local real estate market, had a larger impact on property values.

Housing characteristics in the ROI are presented in **Table 3.10-2**. The ROI contains 53,654 housing units, of which approximately 83 percent are occupied and 16 percent are vacant. Homeowner and rental vacancy rates in the ROI (1.6 percent and 9.6 percent, respectively) are comparable to those of the state.

Table 3.10-2 Housing Occupancy in the ROI (2020)

Counties in ROI	Total Housing Units	Occupied Housing Units	Vacant Housing Units	Homeowner Vacancy (percent)	Rental Vacancy Rate (percent)
Bandera County	11,574	8,847	2,553	2.0	10.0
Frio County	6,421	5,190	1,150	1.1	10.1
Medina County	19,903	17,359	2,235	1.4	8.3
Real County	1,681	1,164	492	2.1	8.8
Uvalde County	10,108	8,624	1,410	1.3	11.9
Zavala County	3,967	3,355	565	1.4	8.6
ROI	**53,654**	**44,539**	**8,405**	**1.6**	**9.6**
Texas	**11,589,324**	**10,491,147**	**1,098,177**	**1.6**	**9.8**

Source: U.S. Census Bureau, 2020

3.10.2.2 Economic Activity

The labor force in the ROI includes 50,069 employable persons, of whom 48,161 are employed **(Table 3.10-3)**. The unemployment rate in the ROI is 4.2 percent. Median household income in the existing ROI in 2022 was $58,525 and per capita income was $27,122, both of which are substantially lower than the state as a whole. Medina County had the highest median household income ($73,060) while Real County had the lowest ($46,842).

Table 3.10-3 Employment and Income of County Populations in the ROI

Counties in ROI	Median Household Income (dollars)	Per Capita Income (dollars)	Number in Labor Force	Number Employed	Unemployment Rate (percent)
Bandera County	70,965	39,162	2,044	1,994	3.4
Frio County	56,042	22,779	9,145	8,849	3.2
Medina County	73,060	31,516	23,350	22,488	3.7
Real County	46,842	22,725	1,156	1,099	4.9
Uvalde County	55,000	26,141	10,900	10,475	3.9
Zavala County	49,243	20,409	3,474	3,256	6.3
ROI	**58,525**	**27,122**	**50,069**	**48,161**	**4.2**
Texas	**73,035**	**37,514**	**15,162,138**	**14,536,773**	**4.1**

Source: U.S. Census Bureau, 2022; U.S. Bureau of Labor Statistics, 2023

3.10.2.3 Air Travel and Transport

Aviation Industry

The Texas aviation industry includes 289 airports, making it one of the largest airport systems in the country. It consists of 25 commercial service airports and 264 general aviation airports. In 2017, the Texas aviation industry employed nearly 780,000 people with a total payroll of over $30 billion (TxDOT, 2018).

Local civilian airports are described in **Section 3.4.2**. Eight general aviation airports are within the ROI (TxDOT, n.d.):

- Castroville Municipal Airport
- Garner Field Airport
- Crystal City Municipal
- Dilley Airpark
- South Texas Regional Airport at Hondo
- McKinley Field
- Devine Municipal
- Real County Airport

Services provided by these airports include local and regional passenger and cargo transport, medical support, glider services, pilot training, crop dusting, local travel, sightseeing, and varied capacities for accommodating (with fuel, oxygen, and parking) aircraft transiting the region.

3.10.3 Environmental Consequences

3.10.3.1 Evaluation Criteria

Impacts on socioeconomics would be considered significant if they resulted in either substantial changes in the local or regional population, housing, community general services (health, police, and fire services), or social conditions from the demands of additional population/population shifts, (e.g., local or regional economy, employment, or spending or earning patterns).

3.10.3.2 Alternative 1

Alternative 1 would not include changes to the number of personnel assigned to any DoD or DAF installation; construction, demolition, or other ground-disturbing activities in the ROI; or any other associated activities that could involve changes to existing employment or other social, business, or economic conditions in the ROI. Sustained aircraft noise levels associated with Alternative 1 would not exceed 65 dBA in any given location in the ROI and as such, would be unlikely to directly result in either population growth or loss within the ROI. Therefore, Alternative 1 would have no potential to result in changes in population, employment, income, or other social or economic activity within the ROI.

Increased noise levels from aircraft operating at lower altitudes in the proposed RAN2A Low MOA would be comparable to existing conditions and not frequent enough, or loud enough, in the ROI to impede or prevent the continued operation of existing businesses or other economic activities, prevent the establishment of new businesses in the ROI, or adversely affect land use or property values. Civilian and commercial flights may be delayed slightly or may be required to deviate for avoidance of military training activities in the airspace. However, airspace deconfliction procedures by FAA Houston Center would occur and as such, would not affect the economic activity or output of regional airfields or notably impede the movement of people and goods. Therefore, impacts on socioeconomics from Alternative 1 would not be significant.

3.10.3.3 Alternative 2

Potential impacts on socioeconomics from Alternative 2 would be the same as those described for Alternative 1. Impacts on socioeconomics would not be significant.

3.10.3.4 No Action Alternative

Under the No Action Alternative, the proposed low-altitude airspace would not be obtained and existing conditions would continue. This would have no impact on socioeconomics.

3.10.3.5 Reasonably Foreseeable Future Actions and Other Environmental Considerations

Reasonably foreseeable future projects with the potential to contribute to cumulative impacts on socioeconomics are summarized in **Appendix B**. The Proposed Action would not be expected to affect population, housing, or employment or to contribute to significant cumulative effects on socioeconomics.

3.11 ENVIRONMENTAL JUSTICE AND PROTECTION OF CHILDREN

3.11.1 Definition of the Resource

Environmental justice is 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 (USEPA, 2024). E.O. 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (February 11, 1994), directs all federal departments and agencies to incorporate environmental justice considerations in achieving their mission. Each federal department or agency should accomplish this by conducting programs, policies, and activities that substantially affect human health or the environment in a manner that does not exclude communities from participation in, deny communities the benefits of, nor subject communities to discrimination under such actions because of their race, color, or national origin. E.O. 14008, Tackling the Climate Crisis at Home and Abroad (January 27, 2021) directs federal agencies to make environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.

E.O. 13045, Protection of Children from Environmental Health Risks and Safety Risks (April 21, 1997) 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."

E.O. 13985, Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (January 20, 2021) directs the head of each federal agency to produce a plan for addressing any barriers that limit full and equal participation for underserved communities and individuals seeking to enroll or access federal benefits, services or programs; and any barriers that limit full and equal participation for underserved communities and individuals seeking to take advantage of agency procurement and contracting opportunities.

E.O. 14091, Further Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (February 16, 2023) targets specific barriers still faced by underserved communities by requiring federal agencies to integrate equity into planning and decision-making. The E.O. outlines a multi-pronged approach to advancing equity through the federal government, including establishing equity-focused leadership across the federal government; delivering equitable outcomes through government policies, programs, and activities; and developing, establishing, and implementing other measures and practices.

E.O. 13990, Protecting Public Health and the Environmental and Restoring Science to Tackle the Climate Crisis (January 20, 2021) directs federal agencies to immediately review, and take action to address federal regulations promulgated and other actions taken during the last 4 years that conflict with national objectives to improve public health and the environment; ensure access to clean air and water; limit exposure to dangerous chemicals and pesticides; hold polluters accountable, including those who disproportionately harm communities of color and low-income communities; reduce GHG emissions; bolster resilience to the impacts of climate change; restore and expand our national treasures and monuments; and prioritize both environmental justice and employment.

E.O. 14096, Revitalizing Our Nation's Commitment to Environmental Justice For All (April 21, 2023) establishes policy to pursue a whole-of-government approach to environmental justice. This E.O. also supplements E.O. 12898 to address environmental justice.

According to CEQ guidance on E.O. 12898, "minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) 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 […] Low income populations in an affected area should be identified using the annual statistical poverty thresholds from the Bureau of the Census." Environmental justice is evaluated in DAF NEPA documents in accordance with guidance set forth in the *Guide for Environmental Justice (EJ) Analysis Under the Environmental Impact Analysis Process* (DAF, 2020c).

Given the large geographic areas covered by the existing MOA and proposed low-altitude training airspace, the environmental justice analysis presented in this EA is based on U.S. Census Bureau data at the county level. Therefore, the ROI for this environmental justice analysis is the same as the socioeconomics ROI defined in **Section 3.10**.

3.11.2 Affected Environment

3.11.2.1 Race and Ethnicity

The percentage of the population identifying as White in the ROI is greater than 85 percent and exceeds the statewide percentage of 76.8 percent **(Table 3.11-1)**. The populations of all counties in the ROI are comparable to or below the corresponding statewide percentages for persons identifying as Black or African American, American Indian or Alaska Native, Asian, Native Hawai'ian or Other Pacific Islander, and Two or More Races. Frio, Medina, Uvalde, and Zavala Counties exceed the statewide percentage of 39.8 percent for persons identifying as Hispanic / Latino at 77.7 percent, 52.1 percent, 71.1 percent, and 92.7 percent, respectively. The percentage of persons identifying as Hispanic or Latino in Bandera and Real Counties (21.6 percent and 27.7 percent, respectively) are below the corresponding statewide percentage.

Table 3.11-1 Race and Ethnicity as a Percent of the Total Population in the ROI

Counties in ROI	White Alone (percent)	Black or African American (percent)	American Indian or Alaska Native (percent)	Asian (percent)	Native Hawai'ian or Other Pacific Islander (percent)	Two or More Races (percent)	Hispanic / Latino[1] (percent)
Bandera County	94.1	1.7	1.6	0.7	0.1	1.8	21.6
Frio County	89.4	5.1	1.3	2.8	Z	1.4	77.7
Medina County	91.7	4.2	1.2	0.9	0.2	1.8	52.1
Real County	91.9	2.1	2.6	0.6	0.5	2.5	27.7
Uvalde County	94.5	1.5	1.3	1.3	0.1	1.3	71.1
Zavala County	95.2	1.9	1.5	0.4	0.2	0.9	92.7
ROI Average	**92.8**	**2.7**	**1.6**	**1.1**	**0.2**	**1.6**	**57.1**
Texas	**76.8**	**13.6**	**1.1**	**6.0**	**0.2**	**2.3**	**39.8**

Notes:
Source: U.S. Census Bureau, 2023
[1] Persons identifying as Hispanic and Latino may be of any race and are included in the percentages of the other categories shown.
Z = Value greater than zero but less than half unit of measure shown.

3.11.2.2 Age

The average percentage of persons younger than 18 years in the ROI (23.3 percent) is generally comparable to the statewide percentage (24.8 percent) **(Table 3.11-2)**. The percentage of persons older than 18 years in Bandera County (16.9 percent) and Real County (18.4 percent) are substantially below the statewide percentage. This indicates that populations of children in counties underlying the proposed MOA are not unusually high relative to the statewide percentage. However, higher concentrations of children could potentially be present at particular schools, day care facilities, recreation centers (including parks and other public areas), or similar child-oriented facilities in the ROI.

The average percentage of persons older than 65 years in counties comprising the ROI (20.2 percent) exceeds the statewide percentage of 13.7. The percentage of persons older than 65 years in Frio County is 12.2 percent, which is lower than the statewide percentage; while the percentage of persons older than 65 years in Bandera (29.7 percent) and Real (30.5 percent) Counties exceed the statewide percentage by more than 15 percent indicating that counties underlying the RAN2A MOA have higher concentrations of persons older than 65 years relative to other Texas counties.

Table 3.11-2 Percent of Persons Younger Than 18 Years and Older Than 65 Years in the ROI

Counties in ROI	Persons Younger Than 18 Years (percent)	Persons Older Than 65 Years (percent)
Bandera County	16.9	29.7
Frio County	25.8	12.2
Medina County	22.5	17.8
Real County	18.4	30.5
Uvalde County	26.5	16.4
Zavala County	29.5	14.7
ROI Average	**23.3**	**20.2**
Texas	**24.8**	**13.7**

Source: U.S. Census Bureau, 2023

3.11.2.3 Income and Poverty

Median household income and per capita income in the ROI are approximately $15,000 and $10,000 less, respectively, than the state of Texas **(Table 3.11-3)**. In the ROI, Medina County has the highest median household income ($73,060) which is comparable to the state, while per capita income in Bandera County ($39,162) exceeds that of the state by more than $1,600. Real County has both the lowest median household income ($46,842) and per capita income ($22,725) within the ROI.

With the exception of Bandera (11.7 percent) and Medina (11.8 percent) Counties, all counties in the ROI exceed the statewide percentage of persons in poverty (14 percent). These exceedances range from approximately 3 percentage points above the statewide percentage in Real County (16.6 percent) to more than 15 percentage points in Zavala County (29.1 percent). On average, the percentage of persons in poverty in counties in the ROI exceeds the statewide percentage by approximately 6 percent, indicating that economic conditions in the ROI are generally less prosperous relative to the overall state.

Table 3.11-3 Median Household Income, Per Capita Income, and Persons in Poverty in the ROI

Counties in ROI	Median Household Income (2018-2022)	Per Capita Income in Past 12 Months (2018-2022)	Persons in Poverty (percent)
Bandera County	$70,965	$39,162	11.7
Frio County	$56,042	$22,779	24.6
Medina County	$73,060	$31,516	11.8
Real County	$46,842	$22,725	16.6
Uvalde County	$55,000	$26,141	24.9
Zavala County	$49,243	$20,409	29.1
ROI Average	**$58,525**	**$27, 122**	**19.8**
Texas	**$73,035**	**$37,514**	**14.0**

Source: U.S. Census Bureau, 2023

3.11.3 Environmental Consequences

3.11.3.1 Evaluation Criteria

Adverse effects on minority and low-income populations, persons younger than 18 years, or persons older than 65 years would be disproportionately high and adverse, and therefore significant, if the Proposed Action resulted in one or more of the following:

- Sustained or long-term exposure to noise levels at or above 65 dBA.
- Disproportionately increased permanent exposure to the effects of GHG and climate change.
- Temporary or permanent interference with or impediment to the continued use of occupation of an existing residential, business, or educational land use or site of cultural, religious, or historic importance.
- Temporary or permanent exposure to hazardous and toxic substances that exceeds applicable federal or state regulatory standards.
- Increased exposure to hazardous or dangerous safety conditions that cannot be mitigated through adherence to established safety standards and operational procedures.
- Changes in local or regional demography or socioeconomic conditions that result in unequal access by or the exclusion of minority or low-income populations, children under 18 years of age, or persons 65 years of age and older from affordable housing, employment, or community facilities and services (including health care, police, fire, and emergency services, and educational programs or facilities).

3.11.3.2 Alternative 1

Alternative 1 consists entirely of activities that would occur in airspace above the earth's surface and would not involve changes in the number of personnel assigned to any DoD or DAF installation or the construction, renovation, or demolition of facilities or infrastructure on DoD or DAF lands or in the ROI. As such, Alternative 1 would have no potential to affect local demography or socioeconomic conditions or result in new or increased financial expenditures in the ROI. Therefore, Alternative 1 would have no potential to create or exacerbate conditions that would result in unequal or disproportionate economic conditions in the ROI.

Noise generated by aircraft using the proposed RAN2A Low MOA under Alternative 1 would have the potential to temporarily disturb or interfere with underlying land uses, including residential, educational, and business uses, and sites of cultural, religious, or historic importance **(Section 3.4)**. However, the duration of increased noise levels associated with the overflight of aircraft would be brief and would dissipate quickly. Furthermore, such increased noise levels would be distributed throughout the 1,925-square mile MOA such that increases would be unlikely to be experienced repeatedly at the same receptor. Therefore, noise increases associated with proposed aircraft operations under Alternative 1 would not result in the sustained or long-term exposure to noise levels at or above 65 dBA and would be unlikely to permanently prevent, impede, or otherwise interfere with activities occurring at existing land uses in the ROI, including sites of historic, religious, or cultural importance, or those where minority or low-income populations, or persons under the age of 18 or 65 years or age or older could be present.

As noted in **Section 3.6.3.2**, estimated GHG emissions (including the estimated SC-GHG) from Alternative 1 would be negligible relative to GHG emissions at both the state and national levels and as such, would not be expected to result in disproportionately adverse effects on minority or low-income populations, or persons under the age of 18 or 65 years or age or older.

For these reasons, Alternative 1 would have no significant adverse impacts on minority and low-income populations, persons younger than 18 years, or persons older than 65 years.

3.11.3.3 Alternative 2

Potential impacts on minority and low-income populations, person younger than 18 years, and persons older than 65 years from Alternative 2 would be the same as those described for Alternative 1.

3.11.3.4 No Action Alternative

Under the No Action Alternative, the proposed low-altitude airspace would not be obtained and existing conditions would continue. This would have no disproportionately adverse impacts on minority and low-income populations, persons younger than 18 years, and persons 65 years of age and older.

3.11.3.5 Reasonably Foreseeable Future Actions and Other Environmental Considerations

The Proposed Action would not result in significant adverse impacts on any resources that would adversely impact the health or environment of minority or low-income populations, persons younger than 18 years, and persons 65 years of age and older, in the ROI. No ongoing or future activities have been identified that would create impacts that would disproportionately or adversely affect minority and low-income populations, persons younger than 18 years, and persons 65 years of age and older.

3.12 VISUAL RESOURCES

3.12.1 Definition of the Resource

The assessment of visual effects broadly addresses the extent to which a proposed action would either 1) produce light emissions that create annoyance or interfere with activities or 2) contrast with, or detract from, the visual resources and/or the visual character of the existing environment. Light emissions are defined as "any light that emanates from a light source into the surrounding environment." Visual resources include buildings, sites, traditional cultural properties, and other natural or manmade landscape features that are visually important or have unique characteristics. Visual resources may include structures or objects that obscure or block other landscape features. In addition, visual resources can include the cohesive collection of various individual visual resources that can be viewed at once or in concert from the area surrounding the site of the proposed action or alternative(s). In some circumstances, the nighttime sky may be considered a visual resource.

Visual character refers to the overall visual makeup of the existing environment where the proposed action would occur. For example, areas in close proximity to densely populated areas generally have a visual character that could be defined as urban, whereas less developed areas could have a visual character defined by the surrounding landscape features, such as open grass fields, forests, mountains, or deserts. The assessment of visual effects involves subjectivity (FAA, 2023d). For simplicity, the term "visual resources" is used to refer to both visual resources and visual character in this analysis and is inclusive of both those terms as described above.

Potential effects on visual resources are evaluated in this EA in accordance with FAA Order JO 1050.1F. The ROI for the analysis of visual resources consists of lands directly underlying the proposed low-altitude airspace and adjacent lands where viewers may observe aircraft activity within the proposed airspace.

3.12.2 Affected Environment

The visual character of land in the ROI is characterized by flat or gently rolling topography bisected by relatively shallow valleys and ravines; natural features such as low-lying scrub-shrub vegetation, open fields and grasses, and stands of low-growing trees; widely distributed and generally two-lane paved roads (such as U.S. Highway 90), and other widely distributed transportation and utility infrastructure such as railroad tracks and overhead utility lines on wooden, concrete, or metal poles and towers; occasional houses and agriculture-related structures such as barns, sheds, and fencing; and widely scattered small towns or similarly small urbanized areas. Given the area's arid climate and infrequent rainfall, daytime weather conditions are generally fair with clear blue skies, bright sunlight, and occasional clouds. During clear conditions in rural or less-developed areas, and depending on factors such as elevation, surrounding topography, and vegetation, visibility may extend for several miles in any direction. At night, during clear conditions, it is likely that light pollution in rural and less-developed areas is minimal and that the night sky offers relatively unobstructed viewing of a vast array of stars and celestial bodies.

Parks and natural areas within the ROI, including Hill Country SNA, Garner State Park, Lost Maples SNA, and Love Creek Preserve, place a value on maintaining and preserving natural features that contribute to a natural, rural, or rustic visual character. Such features include native vegetation and wildlife, naturally occurring topography and landscape features, and minimal buildings, structures, lighting, roads and infrastructure, and other features associated with human development. These areas are primarily within the northern portion of the ROI, although small local parks may also be present in towns and communities, particularly along U.S. Highway 90.

Training in military airspace has occurred over south-central Texas, including the areas containing the RAN2A MOA, for more than 90 years **(Section 3.3.2)**. The northwestern portion of the ROI is crossed by segments of four MTRs in which a variety of military aircraft, including F-16Cs and T-38Cs, conduct 247 annual operations at altitudes typically at or above 500 feet AGL (although aircraft are authorized to operate as low as surface level or 100 feet AGL) **(Section 3.3.2.6)**. Additionally, in 2022, more than 26,000 aircraft, including both civilian and military aircraft, transited the proposed low-altitude airspace overlying the ROI at altitudes ranging from less than 1,000 feet to 8,000 feet **(Section 3.3)**. This annual total equates to an average of more than 70 aircraft crossings per day. The majority (77 percent) of aircraft are present within the airspace for 15 minutes or less, while 19 percent are in the airspace between 15 and 30 minutes **(Table 3.3-7)**. Although the perceived size and appearance of aircraft occurring in the proposed airspace likely varies considerably depending on the actual aircraft type, its altitude and speed, and a viewer's location, the temporary presence of aircraft transiting the overlying airspace at altitudes under 8,000 feet contributes to the existing visual environment in the ROI. Given the geographic area covered by the RAN2A MOA (approximately 1,925 square miles) and the small population of the

ROI (approximately 130,810 people in 2022, for a population density of approximately 68 persons per square mile), it is likely that aircraft currently operating in the proposed airspace are observed by a relatively small number of people at any given time or location. Because most aircraft operations (93 percent) in the airspace occur during daytime hours (7:00 a.m. to 10:00 p.m.), it is likely that light emissions from transiting aircraft are infrequently observed in the ROI during nighttime hours.

Animals within the ROI, including both wildlife and domestic animals, are likely conditioned to the visual presence of aircraft operating in the overlying airspace **(Section 3.7)**.

3.12.3 Environmental Consequences

3.12.3.1 Evaluation Criteria

The FAA has not established a significance threshold for light emissions or visual resources. However, factors considered in determining whether effects on visual resources from the Proposed Action would be considered significant include the following:

- The Proposed Action would affect the nature of the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources.
- The Proposed Action would contrast with the visual resources and/or visual character in the ROI.
- The Proposed Action would block or obstruct the views of visual resources, including whether these resources would still be viewable from other locations.
- Light emissions associated with the Proposed Action would create annoyance or interfere with normal activities, or would affect the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources.

3.12.3.2 Alternative 1

Alternative 1 does not involve construction, demolition, or other earth-disturbing activities and therefore, would not introduce new permanent or temporary buildings, structures, light sources, or other constructed, inanimate features that would alter or block visual resources in the existing visual landscape of the ROI, nor would it change, modify, remove, or otherwise alter existing topography, vegetation, or other naturally occurring features. Therefore, Alternative 1 would have no permanent impacts from light emissions, and no permanent impacts on visual resources, in the ROI.

Aircraft operating in the proposed airspace at altitudes as low as 500 feet AGL would likely be visible to viewers in the ROI, given the relatively clear weather conditions that occur most days in the area; however, given that these operations would consist of jet aircraft traveling at hundreds of miles per hour, their appearance in the overlying airspace would be brief (likely less than a few minutes) at any given time as observed from a particular location. The distribution of proposed low-altitude aircraft operations throughout an approximately 1,925-square mile area, combined with the low population density of the ROI, would further minimize the appearance of aircraft to viewers at any particular location in the ROI. Additionally, Alternative 1 would be unlikely to contribute to additional overflights of Lost Maples State Natural Area and Love Creek Preserve, given their locations along or near the lateral boundaries of the proposed airspace and the need for pilots to adjust their flight patterns to prevent unintentional “spill outs” of those boundaries (**Section 3.3.3.2**, **Section 3.5.3.2**). Aircraft operations at altitudes ranging from surface level to 8,000 feet are already a common occurrence throughout the year in the proposed airspace; therefore, aircraft passing overhead are already part of the existing visual landscape in the ROI, and aircraft operations under Alternative 1 would not introduce a new visual element that is not already commonly observed within the affected environment. Wildlife and domestic animals in the ROI are likely conditioned to the presence of aircraft transiting the airspace; in the event that the visual appearance of an aircraft in the proposed airspace elicited a startle response in animals within the ROI, it is anticipated that they would quickly resume typical behaviors within a few minutes of the aircraft’s passing. Therefore, effects on visual resources from Alternative 1 would be temporary and not significant.

Light emissions from aircraft operating at night would be visible to observers in the ROI but any such lighting would be small in the context of the overlying airspace; would be visible only for brief periods (likely less than a few minutes when viewed from any particular location) given the operating speeds of the jet aircraft; would be widely distributed throughout the 1,925-square mile airspace; and would be infrequent given the small percentage of proposed aircraft operations that would occur between 7:00 p.m. and 10:00 p.m. (approximately 16 annual sorties, or 0.5 percent of all proposed annual aircraft operations). As such, effects from light emissions during nighttime aircraft operations under Alternative 1 would be infrequent, temporary, and not significant.

Aircraft operations under Alternative 1 would have no effect on traditional cultural properties or Indian sacred sites, as no such properties or sites have been identified in the APE. The Texas SHPO has concurred that the Proposed Action would have no adverse effect on historic properties, including archaeological sites.

For these reasons, adverse impacts on visual resources in the ROI from Alternative 1 would be temporary and not significant.

3.12.3.3 Alternative 2

Impacts on visual resources from Alternative 2 would be the same as those described for Alternative1. Impacts would be temporary and not significant.

3.12.3.4 No Action Alternative

Under the No Action Alternative, the proposed low-altitude airspace would not be obtained and existing conditions would continue. This would have no effect on visual resources.

3.12.3.5 Reasonably Foreseeable Future Actions and Other Environmental Considerations

Impacts on visual resources from the Proposed Action would be temporary and not significant. Other reasonably foreseeable future actions listed in **Appendix B** would have the potential to temporary or permanently introduce visual elements that could result in short-term or long-term impacts on visual resources in the ROI. Such impacts on sensitive resources, such as historic properties and traditional cultural properties or Indian sacred sites, would be avoided or minimized through coordination with the Texas SHPO, relevant Native American tribes, and other relevant federal, state, and local agencies and organizations. Therefore, when considered with other reasonably foreseeable future actions, the Proposed Action would have no potential to contribute to cumulatively significant impacts on visual resources.

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CHAPTER 4 REFERENCES

502D Air Base Wing and Joint Base San Antonio. 2021. Bird/Wildlife Aircraft Strike Hazard (BASH) Plan. Joint Base San Antonio Plan 91-212. July.

ACAM. 2023. Air Conformity Applicability Model. Air Impact Modeling Software by Solutio Environmental, Inc. for U.S. Air Force Civil Engineering Center (AFCEC/CZTQ), Version 5.0.23a.

AETC. 2023. Air Education and Training Command. E-mail communication from USAF/AETC, Corey. L. Rotschafer, Maj, USAF on September 25, 2023.

AETC. 2024. USAF/AETC E-mail communication from USAF/AETC, David Wilson on July 12, 2024.

AFCEC. 2023. Air Force Civil Engineer Center. Compliance Technical Support Branch (CZTQ). DAF Greenhouse Gas (GHG) & Climate Change Assessment Guide. December. https://www.aqhelp.com/AQdocs.html. Accessed January 2024.

Air Force. 2020. Air Force Air Quality EIAP Guide, Volume II - Advanced Assessments. July. Air Force Safety Center. 2016. USAF Wildlife Strikes by Altitude (AGL) FY 1995-2016. https://www.safety.af.mil/Portals/71/documents/Aviation/BASH%20Statistics/USAF%20Wildlife%20Strikes%20by%20Altitude.pdf. Accessed 25 September 2023.

Air Force Safety Center. 2021a. T-38 Flight Mishap History, 28 December 2021, https://www.safety.af.mil/Portals/71/documents/Aviation/Aircraft%20Statistics/T-38.pdf. Accessed 9 May 2023.

Air Force Safety Center. 2021b. F-16 Flight Mishap History, 28 December 2021, https://www.safety.af.mil/Portals/71/documents/Aviation/Aircraft%20Statistics/F-16.pdf. Accessed 9 May 2023.

Bandera Corridor Conservation Bank, n.d. Bandera Corridor Conservation Bank. https://banderacorridor.com/. Accessed August 26, 2024.

BLM. 2012. Bureau of Land Management. Traditional Cultural Places and Indian Sacred Sites, Fundamentals for Managing the Cultural Heritage Program. https://www.ntc.blm.gov /krc/system/files?file=legacy/uploads/18293/GuidetoTCPs%26SacredSites.pdf. Accessed October 23, 2024.

Bowles, A. E. 1995. Responses of Wildlife to Noise. Pages 109-156 in R. L. Knight, and K. J. Gutzwiller, Eds. Wildlife and Recreationists: Coexistence through Management and Research. Island Press, Covelo, California.

Bureau of Economic Geology. 1996. Physiographic Map of Texas. The University of Texas at Austin, Austin, Texas.

Bureau of Indian Affairs. 2016. Indian Lands of Federally Recognized Tribes of the United States. Department of the Interior, Bureau of Indian Affairs, Office of Trust Services. https://www.bia.gov/sites/default/files/dup/assets/bia/ots/webteam/pdf/idc1-028635.pdf. Accessed August 2024.

Campbell, L. 2003. Endangered and Threatened Animals of Texas. Texas Parks and Wildlife, Resource Protection Division, Endangered Resources Branch, Austin. 127 pp.

Cleland, DT, JA Freeouf, JE Keys, GJ Nowacki, CA Carpenter, and WH McNab. 2007. Ecological Subregions: Sections and Subsections for the conterminous United States. USDA, Forest Service Gen. Tech Report WO-76D. https://www.fs.usda.gov/research/publications/misc/73326-wo-gtr-76d-cleland2007.pdf. Accessed January 6, 2024.

Czech, J.J., and K.J. Plotkin. 1998. NMAP 7.0 User’s Manual. Wyle Research Report WR 98-13. Wyle Laboratories, Inc. November.

DAF. 2020a. Department of the Air Force Manual 13-201, *Nuclear, Space, Missile, Command and Control – Airspace Management*, December. https://www.e-publishing.af.mil/Product-Index/#/?view=search&keyword=13-201&isObsolete=false&modID=449&tabID=131. Accessed February 9, 2023

DAF. 2020b. Air Force Instruction 91-202. 2015. Safety, The Department of the Air Force (DAF) Mishap Prevention Program, 24 June 2015, Incorporating Change 1, 12 March

DAF. 2020c. Guide for Environmental Justice (EJ) Analysis Under the Environmental Impact Analysis Process

DAF. 2022. JBSA T-7A Recapitalization Final Environmental Impact Statement. https://jbsa.t-7anepadocuments.com/documents. Accessed July 3, 2023.

DAF. 2023. Low-Altitude Flying Training. https://www.af.mil/About-Us/FactSheets/Display/Article/104591/low-altitude-flying-training/. Accessed May 25, 2023

DAF. 2024a. Final Report for Airspace Analysis in Support of the Environmental Impact Analysis Process for Randolph 2A Low MOA, Texas. June.

DAF. 2024b. Department of the Air Force Manual 91-224, *Ground Safety Investigations and Reports.*

DNWG. 2012. Department of Defense Noise Working Group. Technical Bulletin, Noise-Induced Hearing Impairment, Defense Noise Working Group. December.

DoD. 2019. Department of Defense. Report on Effects of a Changing Climate to the Department of Defense. DOD Office of the Under Secretary of Defense for Acquisition and Sustainment. Cleared for Open Publication Jaunary10, 2019.

DoD. 2024. Flight Information Publication AP/1A, Area Planning Special Use Airspace, North and South America. Published by National Geospatial-Intelligence Agency. July.

FAA. 2023a. Federal Aviation Administration. Order JO 7400.2P – Procedures for Handling Airspace Matters, April. https://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.current/documentNumber/7400.2. Accessed May 30, 2023.

FAA. 2023b. Chapter 15, “Airspace” in Pilot’s Handbook of Aeronautical Knowledge. https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak. Accessed May 25, 2023.

FAA. 2023c. FAA Aeronautical Information Manual. Official Guide to Basic Flight Information and ATC Procedures. April.

FAA. 2023d. 1050.1 Desk Reference, Version 3 (October 2023). https://www.faa.gov/about/office_org/headquarters_offices/apl/environ_policy_guidance/policy/faa_nepa_order/desk_ref. Accessed on October 30, 2024.

FAA. 2024a. FAA CDM International Online Workshop. https://tfmlearning.faa.gov/tfm-training/atfm-basics/cdm-t1-lesson5b.html. Accessed August 7, 2024.

FAA. 2024b. Aeronautical Information Services South Texas RGNL at Hondo. https://nfdc.faa.gov/nfdcApps/services/ajv5/airportDisplay.jsp?airportId=HDO. Accessed August 28, 2024.

Fidell et al. 1996. Effects of Military Aircraft Noise on Residential Property Values, BBN Systems and Technologies, BBN Report No. 8102.

Gladwin, D. N., D. A. Asherin, and K. M. Manci. 1988. Effects of Aircraft Noise and Sonic Booms on Domesticated Animals and Wildlife: Bibliographic Abstracts. NERC-88/32. USFWS, National Ecology Research Center, Fort Collins, Colorado.

Griffith, Glenn, Sandy Bryce, James Omernik, and Anne Rogers. 2007. Ecoregions of Texas. Pages 44-61. Texas Commission on Environmental Quality, Austin.

HQ AFSEC. 2023a. Headquarters Air Force Safety Center. Department of the Air Force. Aviation Class A Mishap Summary by Fiscal Year, 5 September.

HQ AFSEC. 2023b. Department of the Air Force. Aviation Class B Mishap Summary by Fiscal Year, 25 September.

Ikelheimer, B. and M. Downing. 2013. MR_NMap Noise Model Improvements. Blue Ridge Research and Consulting Technical Report. 26 August.

iNaturalist. 2024a. Balcones Canyonlands, TX EPA Level IV Ecoregion. https://www.inaturalist.org/places/balcones-canyonlands. Accessed January 9, 2024.

iNaturalist. 2024b. North Nueces Alluvial Plains Region. https://www.inaturalist.org/places/northern-nueces-alluvial-plains. Accessed January 9, 2024.

IPCC. 2021. Intergovernmental Panel on Climate Change. Summary for Policymakers. Climate Change 2021: The Physical Science Basis. Valerie Masson-Delmotte et al., eds.

Krausman, P. R., M. C. Wallace, D. W. DeYoung, M. E. Weisenberger, and C. L. Hayes. 1999. The Effects of Low-Altitude Jet Aircraft on Desert Ungulates. International Congress: Noise as a Public Health Problem 6:471-478.

Larkin, Ronald P. 1994. Effects of military noise on wildlife: a literature review. Center for Wildlife Ecology, Illinois Natural History Survey. https://www.leg.mn.gov/docs/2015/other/150681/PFEISref_1/Larkin%201994.pdf. Accessed January 10, 2024.

Lucas, Michael J., and Paul T. Calamia. 1997. Military Operating Area and Range Noise Model MR_NMAP User's Manual. Wyle Research Report WR 94-12-R. Wyle Laboratories, Inc. March.

Manci, KM., D. N. Gladwin, R. Villella, and M. G. Cavendish. 1988. Effects of aircraft noise and sonic booms on domestic animals and wildlife: a literature synthesis. USFWS. National Ecology Research Center, Feet. Collins, CO. NERC-88/29. 88 pp.

McNab, WH and PE Avers, Editors. 1994. Ecological Subregions of the United States: Section Descriptions. Chapter 37, Section 315C-Edwards Plateau. Administrative Publication WO-WSA-5. USDA, Forest Service, Washington, DC. 276 pp. https://www.fs.usda.gov/land/pubs/ecoregions/. Accessed January 6, 2024.

McNab, WH, D T Cleland, J A Freeouf, J E Keys, Jr., G J Nowacki, and C A Carpenter. 2007. Description of "Ecological Subregions: Sections of the Conterminous United States", First Approximation. Gen. Tech. Report WO-76B. USDA, Forest Service, Washington DC. 80 pp. https://www.fs.usda.gov/research/publications/misc/73327-wo-gtr-76b-mcnab2007.pdf. Accessed January 6, 2024.

NPS. 1995. National Park Service. Report on Effects of Aircraft Overflights on the National Park System. Report to Congress. https://archive.org/details/reportoneffectso00nati/page/n1/mode/2up. Accessed January 10, 2024.

NPS. 2024a. National Park Service. Native American Graves Protection and Repatriation Act. https://www.nps.gov/subjects/nagpra/index.htm. Accessed September 20, 2024.

NPS. 2024b. National Register of Historic Places (NRHP) Data Download. https://irma.nps.gov/DataStore/Reference/Profile/2210280. Accessed August 2024.

NPS. 2024c. El Camino Real de los Tejas, National Historic Trail TX, LA. https://www.nps.gov/elte/index.htm. Accessed August 2024.

NPS. n.d. National Park Service. Lost Maples State Natural Area. https://www.nps.gov/subjects/nnlandmarks/site.htm?Site=LOMA-TX. Accessed August 28, 2024.

Randolph AFB. 2023. Military Training Routes (MTRs) Underneath RAN2A Low MOA Proposal. 12th Operations Support Squadron, JBSA-Randolph, TX. 17 January.

Shoemaker, Jessica. 2007. "Siting a Wind Project." in Farmer's Guide to Wind Energy. Edited by Karen Krub, 4-1 - 4-46. St. Paul, Minnesota: Farmers' Legal Action Group, Inc.

Stusnick, E., K.A. Bradley, J.A. Molino, and G. DeMiranda. 1992. The Effect of Onset Rate on Aircraft Noise Annoyance, Volume 2: Rented Home Experiment. Wyle Laboratories Research Report WR 92-3, March.

TAMU. 2007a. Texas Agricultural and Mechanical University. The Texas Breeding Bird Atlas. Bald Eagle. https://txtbba.tamu.edu/species-accounts/bald-eagle/. Accessed January 9, 2024.

TAMU. 2007b. The Texas Breeding Bird Atlas. Golden Eagle. https://txtbba.tamu.edu/species-accounts/golden-eagle/. Accessed January 9, 2024.

Texas Comptroller. 2024. Valuing property. https://comptroller.texas.gov/taxes/property-tax/valuing-property.php. Accessed September 1, 2024

TNC. n.d. The Nature Conservancy. Love Creek Preserve. https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/love-creek-preserve/. Accessed August, 26, 2024.

TPWD. n.d.a. Texas Parks and Wildlife Department. Lost Maples State Natural Area. https://tpwd.texas.gov/state-parks/lost-maples. Accessed August 28, 2024.

TPWD. n.d.b. Hill Country State Natural Area. https://tpwd.texas.gov/state-parks/hill-country/. Accessed August 28, 2024.

TxDOT. 2018. Texas Department of Transportation. https://ftp.txdot.gov/pub/txdot-info/avn/tx-econ-summary.pdf

TxDOT. n.d. Texas Airport Directory Map. https://maps.dot.state.tx.us/TADSMap/. Accessed September 17, 2024.

TxDOT. 2023. Historic Resources Feature Layer. TxDOT Environmental Affairs Division. Electronic resource, ArcGIS Online. Accessed September 2023.

TXNRIS. 2023. Texas Natural Resources Information System. https://tnris.org/. Updated February 1, 2023. Accessed January 15, 2024.

U.S. Bureau of Labor Statistics. 2023. BLS Data Finder. Retrieved from https://beta.bls.gov/dataQuery/search. October.

U.S. Census Bureau. 2020. Census Demographic Profile.

U.S. Census Bureau. 2022.Current Population Survey, School Enrollment Supplement. United States of America. October.

U.S. Census Bureau. 2023. Quick Facts. Retrieved from Census: https://www.census.gov/quickfacts/fact/table/uvaldecountytexas,zavalacountytexas,realcountytexas,medinacountytexas,friocountytexas,banderacountytexas/PST045222. December.

U.S. Navy. 2018. U.S. Department of the Navy (Environmental Impact Statement for EA-18G “Growler” Airfield Operations at Naval Air Station Whidbey Island Complex, Appendix A1. https://media.defense.gov/2019/Feb/04/2002085746/-1/-1/1/APPENDIX%20A-1.PDF. Accessed October 2023.

USDA. 2017. U.S. Department of Agriculture. National Agricultural Statistics Service. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Texas/. Accessed January 9, 2024.

USDOE. n.d. U.S. Department of Energy. Wind Energy in Texas. https://windexchange.energy.gov/states/tx#maps. Accessed September 18, 2024.

USEIA. 2021. U.S. Energy Information Administration. Energy-Related CO_2 Emission Data Tables, Table 1, State energy-related carbon dioxide emissions by year 2000-2021. https://www.eia.gov/environment/emissions/state/. Accessed September 10, 2024.

USEIA. 2024. Wind Explained Where Wind Power is Harnessed. https://www.eia.gov/energyexplained/wind/where-wind-power-is-harnessed.php. Accessed September 18, 2024.

USEPA. 2016. U.S. Environmental Protection Agency. What Climate Change Means for Texas. https://www.epa.gov/sites/default/files/2016-09/documents/climate-change-tx.pdf. Accessed September 10, 2024.

USEPA. 2024. Environmental Justice. https://www.epa.gov/environmentaljustice. Accessed August 28, 2024.

USFS. U.S. Forest Service. 1992. Report to Congress: Potential Impacts of Aircraft Overflights of National Forest System Wilderness. U. S. Government Printing Office 1992-0-685-234/61004. Washington, D. C.

USFWS. 1987. U.S. Fish and Wildlife Service. Black Lace Cactus *(Echinocereus reichenbachii* var. *albertii*) Recovery Plan. https://ecos.fws.gov/docs/recovery_plan/870318b.pdf. Accessed January 7, 2024.

USFWS. 1996. San Marcos & Comal Springs & Associated Aquatic Ecosystems (Revised) Recovery Plan. February. https://ecos.fws.gov/docs/recovery_plan/960214.pdf. Accessed January 7, 2024.

USFWS. 2017a. ESA Basics, 40 Years of Conserving Endangered Species. Endangered Species Program. Arlington, VA. January. https://www.fws.gov/sites/default/files/documents/endangered-species-act-basics.pdf. Accessed January 6, 2024.

USFWS. 2017b. Species Status Assessment Report for Tobusch Fishhook Cactus (*Sclerocactus brevihamatus* ssp. *tobuschii*) (W. T. Marshall) N. P. Taylor. https://ecos.fws.gov/ServCat/DownloadFile/161581. Accessed January 7, 2024.

USFWS. 2023a - Recovery Outline *Streptanthus bracteatus* (Bracted Twistflower). https://ecos.fws.gov/docs/recovery_plan/Bracted%20Twistflower%20Recovery%20Outline_ARD%20Signed.pdf. Accessed January 7, 2024.

USFWS. 2023b. Species Status Assessment for Bracted Twistflower. Species Status Assessment Reports. Austin Ecological Services Field Office. https://ecos.fws.gov/ServCat/Reference/Profile/150386. Accessed January 7, 2024.

USFWS. 2024a. Information for Planning and Consultation (IPaC). https://ipac.ecosphere.fws.gov/. Accessed January 5, 2024.

USFWS. 2024b. Environmental Conservation Online System:
Tricolored bat (*Perimyotis subflavus*). https://ecos.fws.gov/ecp/species/10515
Golden-cheeked warbler (*Setophaga chrysoparia*). https://ecos.fws.gov/ecp/species/33
Piping Plover (*Charadrius melodus*). https://ecos.fws.gov/ecp/species/6039
rufa red knot (*Calidris canutus rufa*). https://ecos.fws.gov/ecp/species/1864
San Marcos salamander (*Eurycea nana*). https://ecos.fws.gov/ecp/species/6374
Texas blind salamander (*Eurycea rathbuni*). https://ecos.fws.gov/ecp/species/5130
Fountain darter (*Etheostoma fonticola*). https://ecos.fws.gov/ecp/species/5858
Comal Springs dryopid beetle (*Stygoparnus comalensis*). https://ecos.fws.gov/ecp/species/7175
Comal Springs riffle beetle (*Heterelmis comalensis*). https://ecos.fws.gov/ecp/species/3403
Monarch butterfly (*Danaus plexippus*). https://ecos.fws.gov/ecp/species/9743
Peck's cave amphipod (Stygobromus (= Stygonectes) pecki). https://ecos.fws.gov/ecp/

species/8575
Black lace cactus (*Echinocereus reichenbachii var. albertii*). https://ecos.fws.gov/ecp/species/5560
Bracted twistflower (*Streptanthus bracteatus*). https://ecos.fws.gov/ecp/species/2856
Texas wild-rice (*Zizania texana*). https://ecos.fws.gov/ecp/species/805
Tobusch fishhook cactus (*Sclerocactus brevihamatus* ssp. *tobuschii*). https://ecos.fws.gov/ecp/species/2221. Accessed January 6, 2024.

USFWS. 2024c. FWS Focus:
Comal Springs Dryopid Beetle. https://www.fws.gov/species/comal-springs-dryopid-beetle-stygoparnus-comalensis.

Comal Springs Riffle Beetle. https://www.fws.gov/species/comal-springs-riffle-beetle-heterelmis-comalensis.

Peck’s Cave Amphipod. https://www.fws.gov/species/pecks-cave-amphipod-stygobromus-pecki.

Texas wild-rice. https://www.fws.gov/species/texas-wild-rice-zizania-texana. Accessed January 7, 2024.

USGS. 2021. U.S. Geological Survey. National Land Cover Database. Earth Resources Observation and Science (EROS) Center. Updated 2021. https://www.usgs.gov/centers/eros/science/national-land-cover-database. Accessed January 15, 2024.

USGS. 2023. National Land Cover Database. Earth Resources Observation and Science (EROS) Center, Updated 2021. https://www.usgs.gov/centers/eros/science/national-land-cover-database. Accessed January 15, 2024.

Wasmer, F. and F. Maunsell. 2022a. BaseOps 7.369 User’s Guide. Wasmer Consulting.

Wasmer, F. and F. Maunsell. 2022b. NMPlot 4.974 User’s Guide. Wasmer Consulting.

Weatherbase. 2024. Hondo, Texas. https://www.weatherbase.com/weather/weather-summary.php3?s=335227&cityname=Hondo%2C+Texas%2C+United+States+of+America&units=. Accessed August 2024.

Weisenberger, ME., P. R. Krausman, M. C. Wallace, D. W. DeYoung, and O. E. Maughan. 1996. Effects of Simulated Jet Aircraft Noise on Heart Rate and Behavior of Desert Ungulates. Journal of Wildlife Management 60:52-61

West Texas Hunt Organization. 2024. https://www.westtexashunt.com/. Accessed January 7, 2024.

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APPENDICES

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APPENDIX A
INTERAGENCY AND INTERGOVERNMENTAL COORDINATION AND CONSULTATIONS

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APPENDIX A – INTERAGENCY AND INTERGOVERNMENTAL COORDINATION AND CONSULTATIONS

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 (E.O.) 12372, Intergovernmental Review of Federal Programs, as amended by E.O. 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.

The Intergovernmental Coordination Act and E.O. 12372 require federal agencies to cooperate with and consider state and local views in implementing a federal proposal. Through the coordination process, potentially interested and affected government agencies, government representatives, elected officials, and interested parties that could be affected by the Proposed Action and alternatives were notified during the development of this EA. The recipient mailing list and agency and intergovernmental coordination letters and responses are included in this appendix.

A.1.1 Agency Consultations

Implementation of the Proposed Action involves coordination with several organizations and agencies. Compliance with Section 7 of the Endangered Species Act and implementing regulations (50 Code of Federal Regulations [CFR] Part 402), requires communication with the U.S. Fish and Wildlife Service 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 identify such species that are known or have potential to occur in the project area. The Department of the Air Force (DAF) would then make a determination of potential adverse impacts on species known or having potential to be present.

The National Historic Preservation Act (NHPA) of 1966 (54 United States Code [U.S.C.] 300101 et seq.) established the National Register of Historic Places (NRHP) and outlines procedures for managing cultural resources on federal property. The NHPA requires federal agencies to consider the potential impacts of federal undertakings on historic properties that are listed, nominated to, or eligible for listing in the NRHP; designated as a National Historic Landmark; or valued by modern American Indians for maintaining their traditional culture. Section 106 of the NHPA requires federal agencies to consult with State Historic Preservation Officers, and others, if their undertakings have the potential to adversely affect historic properties and to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings.

A.1.2 Government-to-Government Consultation

Consistent with the NHPA's implementing regulations (36 CFR Part 800), DoD Instruction 4710.02, *DoD Interactions with Federally Recognized Tribes*, Department of the Air Force Instruction 90-2002, *Interactions with Federally Recognized Tribes*, and Air Force Manual 32-7003, *Environmental Conservation*, the DAF has a responsibility to consult in good faith with federally recognized tribes who have a documented interest in DAF lands and activities, even though the tribe may not be geographically located near the installation or its airspace, regarding a proposed action's potential to affect properties of cultural, historical, or religious significance to the tribes. The tribal coordination process is distinct from NEPA consultation and the intergovernmental coordination processes and requires separate notification of all relevant tribes. The timelines for tribal consultation are also distinct from those of intergovernmental consultations. The installation commander's role in tribal government-to-government consultation is similar to the commander's role with an ambassador. The installation commander may also designate a civilian government employee as the Installation Tribal Liaison Officer. The Installation Tribal Liaison Officer must be a high-level civilian who is able to interact directly with base leaders and is allowed access to the installation commander without multiple chain of command impediments.

Government-to-government consultation is included in this appendix.

A.2 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 *San Antonio Express-News*, Hondo *Anvil Herald*, *The Devine News,* the *Frio-Nueces Current*, and the *Uvalde Leader News* inviting the public to review and comment on the Draft EA during the 30-day review period.

The Draft EA and proposed FONSI were made available for review at the following locations and online at https://www.jbsa.mil/Resources/Environmental.

- Hondo Public Library, 2003 Avenue K, Hondo, Texas 78861
- Driscoll Public Library, 202 E. Hondo Avenue, Devine, Texas 78016
- Castroville Public Library, 802 London Street, Castroville, Texas 78009
- Medina Community Library, 13948 State Highway 16 North, Medina, Texas 78055
- El Progreso Memorial Library, 301 W Main Street, Uvalde, Texas 78801

Persons unable to access the Draft EA and proposed FONSI via the methods listed above were directed to contact Alex Galdencio at 210-671-3952 or 802ces.ceie.nepateam@us.af.mil to arrange alternate access.

A.3 INTERGOVERNMENTAL AND STAKEHOLDER COORDINATION

A.3.1 Representative General Scoping Letter

DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Mr. Brent D. Larson
Chief, Installation Management Flight
802d Civil Engineer Squadron
1555 Gott Street, Bldg 5595
JBSA-Lackland, TX 78236

Julie Wicker
Branch Chief
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, TX 78744

Dear Ms. Wicker

The Department of the Air Force (DAF) Air Education and Training Command is preparing an Environmental Assessment (EA) to evaluate potential environmental effects from the Proposed Action to establish new low-altitude training airspace near San Antonio, Texas. The Proposed Action would support current and anticipated future pilot training requirements of the 12th Flying Training Wing (12 FTW) at Randolph Air Force Base, Joint Base San Antonio (JBSA-Randolph) as well as other transient DAF users. The EA is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (40 Code of Federal Regulations [CFR] Parts 1500-1508) and the DAF Environmental Impact Analysis Process (32 CFR Part 989). The Federal Aviation Administration is serving as a cooperating agency during the NEPA process for the Proposed Action.

The proposed airspace would be established directly under the existing Randolph 2A Military Operations Area (RAN2A MOA). The RAN2A MOA is approximately 37 miles west of JBSA-Randolph and encompasses approximately 1,925 square miles of airspace (Figure 1). The RAN2A MOA has a floor of 9,000 feet above mean sea level (MSL) and a ceiling up to, but not including, 18,000 feet MSL. Military aircraft training operations below 9,000 feet MSL are not currently permitted in the RAN2A MOA.

The proposed airspace would have a floor of 500 feet above ground level and a ceiling of approximately 9,000 feet MSL (i.e., the floor of the existing RAN2A MOA) (Figure 2). The proposed airspace would have the same lateral boundaries of the existing RAN2A MOA and overlying RAN2A Air Traffic Control Assigned Airspace; no changes to the lateral or vertical extents of those existing airspaces are proposed. Once established, the proposed airspace would be operated and managed by the 12 FTW.

The Proposed Action does not include changes to the existing boundaries of, or the number and types of personnel and aircraft assigned to JBSA-Randolph or any other Department of Defense installation in the San Antonio area. No changes to the number of aircraft operations occurring at JBSA-Randolph are proposed. No construction, demolition, or other ground-

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disturbing activities would occur at JBSA-Randolph or on lands underlying the proposed airspace as part of the Proposed Action.

To support the NEPA process, we request your input on general or specific resources or conditions that you feel should be addressed in the EA. Your comments, questions, or requests for additional information about the Proposed Action should be sent to Ms. Maxie Tirella, 802d CES, 1555 Gott Street, JBSA-Lackland, Texas 78236. I encourage you to send your comments by email to 802CES.CEIE.NEPATeam@us.af.mil. For questions, please email or call Ms. Tirella at (210) 671-4037. We request your comments within 30 days of receiving this letter to ensure sufficient time to address them during preparation of the Draft EA. Thank you for your assistance.

Sincerely

LARSON.BRENT.DANIEL.1515771324
Digitally signed by LARSON.BRENT.DANIEL.1515771324
Date: 2024.08.19 15:50:18 -05'00'

BRENT D. LARSON, GS-14, DAF
Chief, Installation Management Flight

Attachments:
Figure 1 – Location of Existing Randolph 2A Military Operations Area
Figure 2 – Proposed Randolph 2A Low-Altitude Military Operations Area

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1

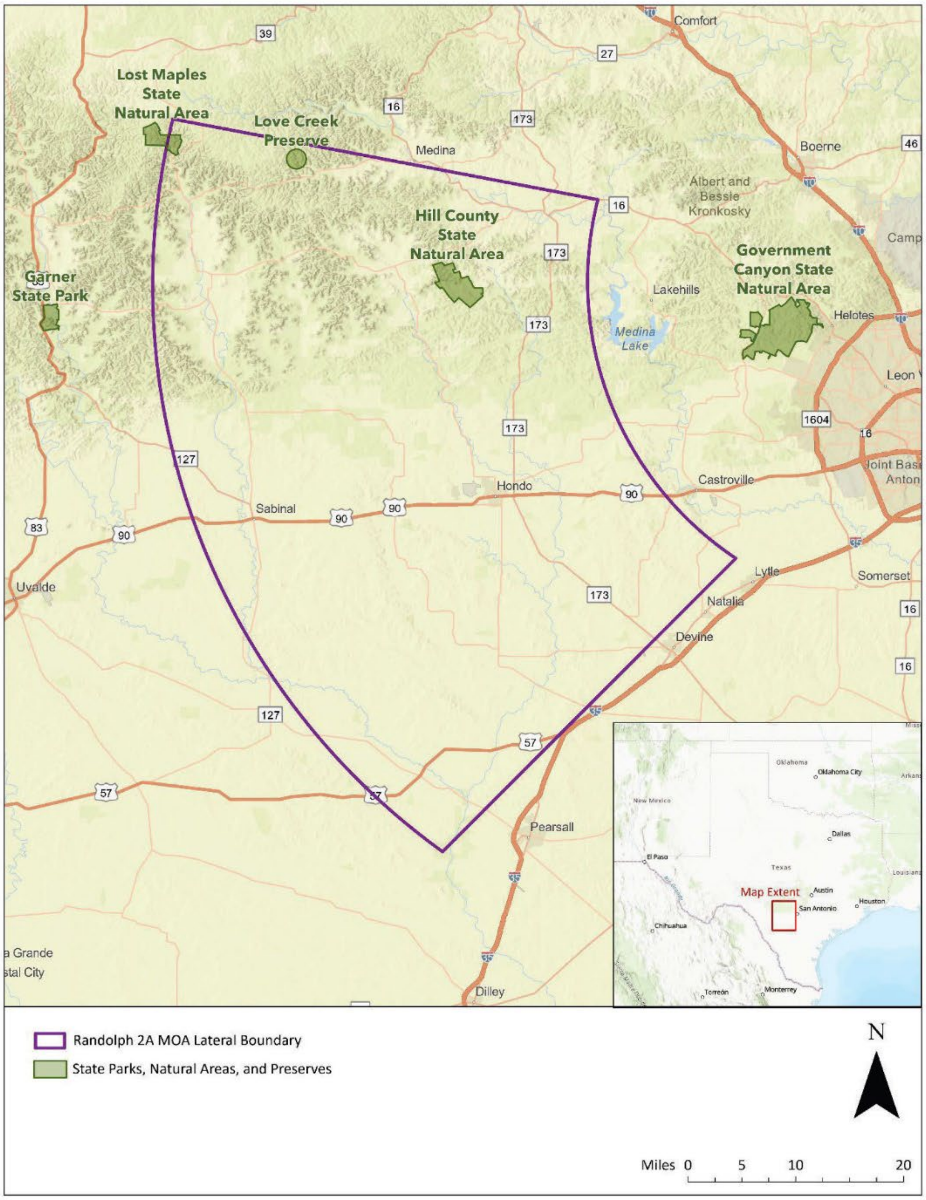

Figure 1 – Location of Existing Randolph 2A Military Operations Area

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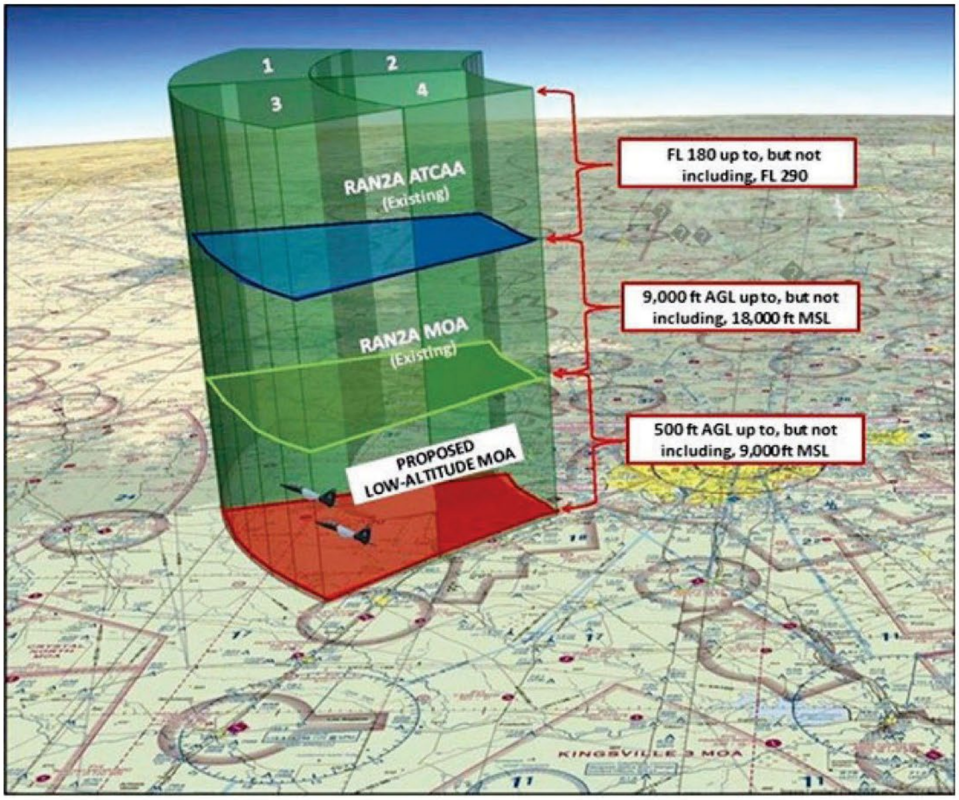

Figure 2 – Proposed Randolph 2A Low-Altitude Military Operations Area

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A.3.2 Representative Government-to-Government Scoping Letter

DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Mr. Brent D. Larson
Chief, Installation Management Flight
802d Civil Engineer Squadron
1555 Gott Street, Bldg 5595
JBSA-Lackland, TX 78236

Durell Cooper
Chairman
Apache Tribe of Oklahoma
PO Box 1330
Anadarko, OK 73005

Dear Chairman Cooper

The Department of the Air Force (DAF) Air Education and Training Command is preparing an Environmental Assessment (EA) to evaluate potential environmental effects from the Proposed Action to establish new low-altitude training airspace near San Antonio, Texas. The Proposed Action would support current and anticipated future pilot training requirements of the 12th Flying Training Wing (12 FTW) at Randolph Air Force Base, Joint Base San Antonio (JBSA-Randolph) as well as other transient DAF users. The EA is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (40 Code of Federal Regulations [CFR] Parts 1500-1508) and the DAF Environmental Impact Analysis Process (32 CFR Part 989). The Federal Aviation Administration is serving as a cooperating agency during the NEPA process for the Proposed Action.

The Proposed Action is considered an undertaking under Section 106 of the National Historic Preservation Act (NHPA). Therefore, the purpose of this letter is to initiate government-to-government consultation pursuant to Section 106 of the NHPA, implementing regulations at 36 CFR Part 800, and Department of Defense (DoD) Instruction 4710.02, *DoD Interactions with Federally Recognized Tribes*. The DAF also requests information on any properties of historic, religious, or cultural significance that could potentially be affected by the proposed undertaking.

The proposed airspace would be established directly under the existing Randolph 2A Military Operations Area (RAN2A MOA). The RAN2A MOA is approximately 37 miles west of JBSA-Randolph and encompasses approximately 1,925 square miles of airspace (Figure 1). The RAN2A MOA has a floor of 9,000 feet above mean sea level (MSL) and a ceiling up to, but not including, 18,000 feet MSL. Military aircraft training operations below 9,000 feet MSL are not currently permitted in the RAN2A MOA.

The proposed airspace would have a floor of 500 feet above ground level and a ceiling of approximately 9,000 feet MSL (i.e., the floor of the existing RAN2A MOA) (Figure 2). The proposed airspace would have the same lateral boundaries of the existing RAN2A MOA and overlying RAN2A Air Traffic Control Assigned Airspace; no changes to the lateral or vertical extents of those existing airspaces are proposed. Once established, the proposed airspace would be operated and managed by the 12 FTW.

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The proposed undertaking does not include changes to the existing boundaries of, or the number and types of personnel and aircraft assigned to, JBSA-Randolph or any other DoD installation in the San Antonio area. No changes to the number of aircraft operations occurring at JBSA-Randolph are proposed. No construction, demolition, or other ground-disturbing activities would occur at JBSA-Randolph or on lands underlying the proposed airspace as part of the proposed undertaking.

The inadvertent discovery of archaeological resources or human remains during the proposed undertaking is not anticipated because no ground-disturbing activities are proposed. However, in the event such a discovery occurs during the proposed undertaking you will be immediately informed by the DAF, regardless of whether you choose to participate in government-to-government consultation. In accordance with Section 106, the DAF is also consulting with other Native American tribes and the Texas State Historic Preservation Office with respect to the proposed undertaking.

As part of the government-to-government consultation process, the DAF requests comments or information on properties of historic, religious, or cultural significance that could potentially be affected by the proposed undertaking. Your comments, questions, or requests for additional information should be sent to my designated point of contact, Ms. Maxie Tirella, 802d CES, 1555 Gott Street, JBSA-Lackland, Texas 78236, by email to 802CES.CEIE.NEPATeam@us.af.mil, or by phone at (210) 671-4037. We request your comments at your earliest convenience to ensure sufficient time to address them during preparation of the Draft EA. Thank you for your assistance.

Sincerely

LARSON.BRENT.DANIEL.1515771324 Digitally signed by LARSON.BRENT.DANIEL.1515771324 Date: 2024.08.22 09:56:24 -05'00'

BRENT D. LARSON, GS-14, DAF
Chief, Installation Management Flight

Attachments:
Figure 1 – Location of Existing Randolph 2A Military Operations Area (Proposed Area of Potential Effect)
Figure 2 – Proposed Randolph 2A Low-Altitude Military Operations Area

cc:
Mark Wolfe, Texas State Historic Preservation Officer

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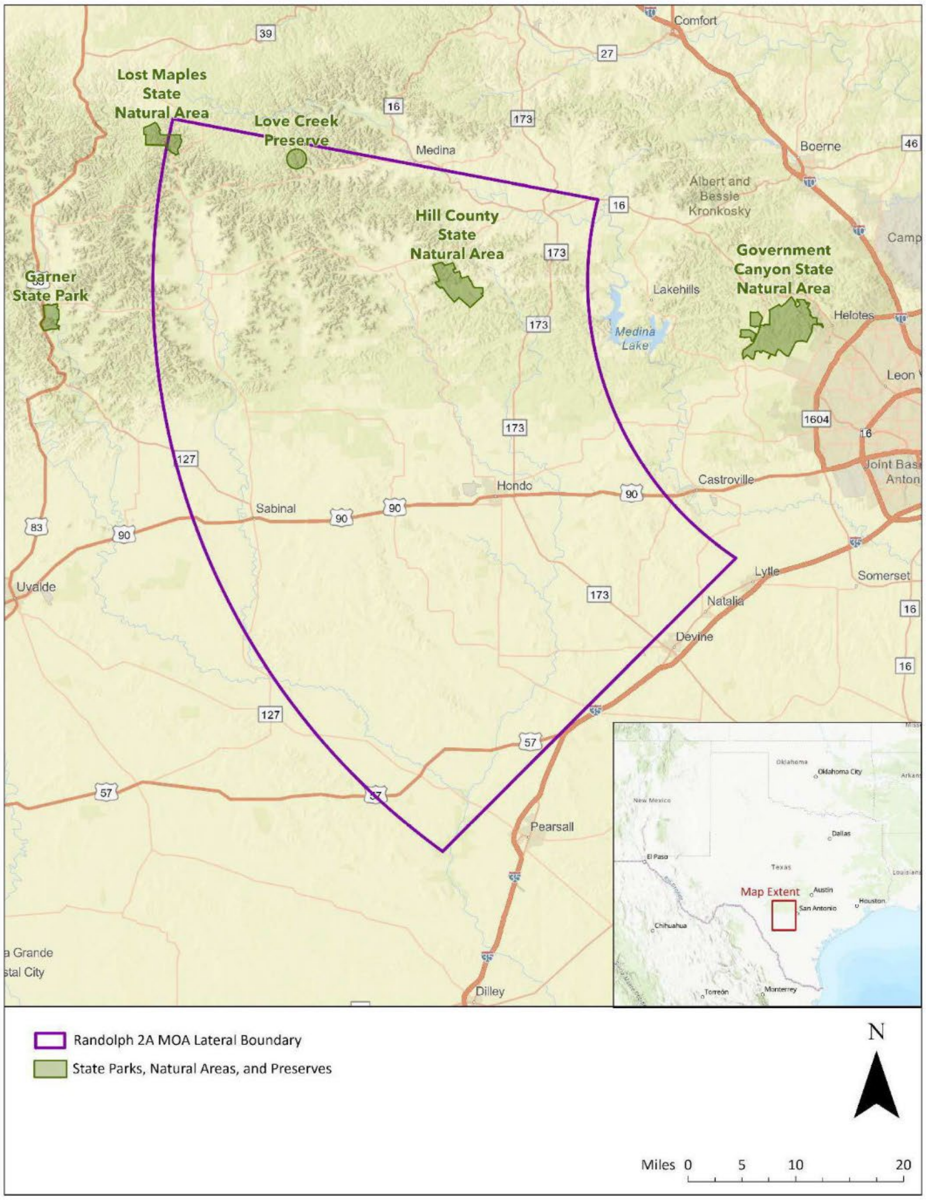

Figure 1 – Location of Existing Randolph 2A Military Operations Area (Proposed Area of Potential Effect)

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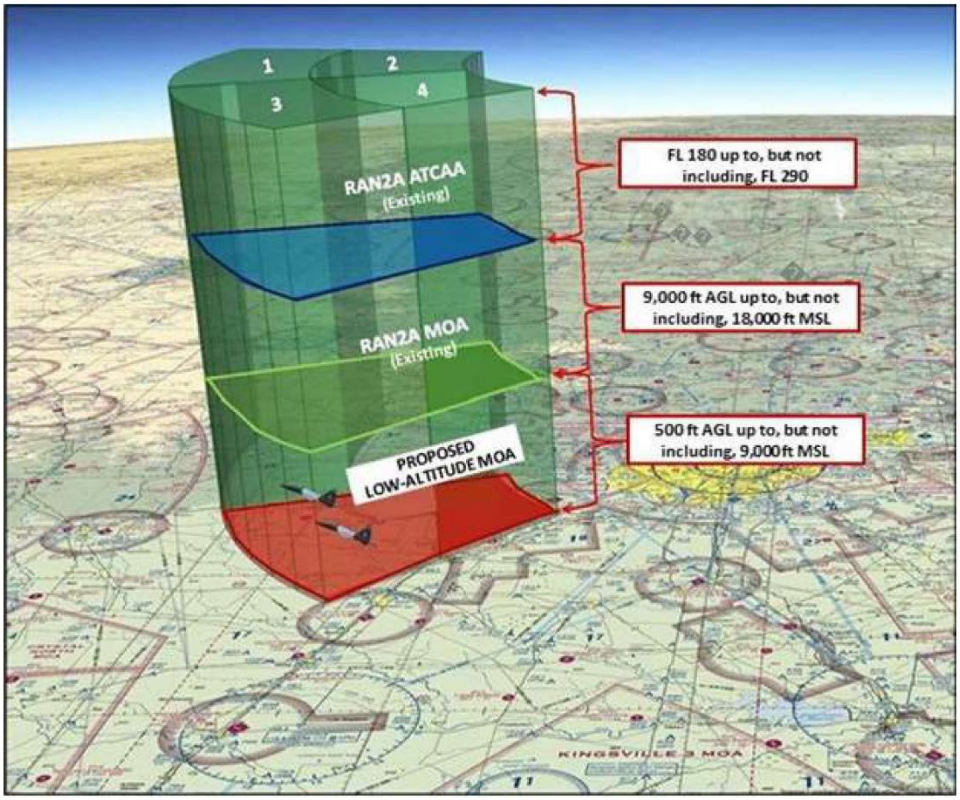

Figure 2 – Proposed Randolph 2A Low-Altitude Military Operations Area

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1 *A.3.4 USFWS Scoping Letter*

DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Mr. Brent D. Larson
Chief, Installation Management Flight
802d Civil Engineer Squadron
1555 Gott Street, Bldg 5595
JBSA-Lackland, TX 78236

Christina Williams
Austin Ecological Field Office
U.S. Fish and Wildlife Service
1505 Ferguson Lane
Austin, TX 78754

Dear Ms. Williams

The Department of the Air Force (DAF) Air Education and Training Command is preparing an Environmental Assessment (EA) to evaluate potential environmental effects from the Proposed Action to establish new low-altitude training airspace near San Antonio, Texas. The Proposed Action would support current and anticipated future pilot training requirements of the 12th Flying Training Wing (12 FTW) at Randolph Air Force Base, Joint Base San Antonio (JBSA-Randolph) as well as other transient DAF users. The EA is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (40 Code of Federal Regulations [CFR] Parts 1500-1508) and the DAF Environmental Impact Analysis Process (32 CFR Part 989). The Federal Aviation Administration is serving as a cooperating agency during the NEPA process for the Proposed Action.

The purpose of this letter is to initiate informal consultation between the DAF and U.S. Fish and Wildlife Service for the Proposed Action in accordance with Section 7 of the Endangered Species Act (ESA). The DAF also requests information on federally listed threatened and endangered species and/or critical habitat that could potentially be affected by the Proposed Action.

The proposed airspace would be established directly under the existing Randolph 2A Military Operations Area (RAN2A MOA). The RAN2A MOA is approximately 37 miles west of JBSA-Randolph and encompasses approximately 1,925 square miles of airspace (Figure 1). The RAN2A MOA has a floor of 9,000 feet above mean sea level (MSL) and a ceiling up to, but not including, 18,000 feet MSL. Military aircraft training operations below 9,000 feet MSL are not currently permitted in the RAN2A MOA.

The proposed airspace would have a floor of 500 feet above ground level (AGL) and a ceiling of approximately 9,000 feet MSL (i.e., the floor of the existing RAN2A MOA) (Figure 2). The proposed airspace would have the same lateral boundaries of the existing RAN2A MOA and overlying RAN2A Air Traffic Control Assigned Airspace; no changes to the lateral or vertical extents of those existing airspaces are proposed. Once established, the proposed airspace would be operated and managed by the 12 FTW.

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2

The Proposed Action does not include changes to the existing boundaries of, or the number and types of personnel and aircraft assigned to, JBSA-Randolph or any other Department of Defense installation in the San Antonio area. No changes to the number of aircraft operations occurring at JBSA-Randolph are proposed. No construction, demolition, or other ground-disturbing activities would occur at JBSA-Randolph or on lands underlying the proposed airspace as part of the Proposed Action.

To support the NEPA process and compliance with Section 7 of the ESA, we request your input on federally listed threatened and endangered species and/or critical habitat that could potentially be affected by the Proposed Action. The DAF will also obtain an official species list from the USFWS Information for Planning and Consultation website to identify federally listed species and critical habitat known or having potential to occur in the project area. Please send your comments, questions, or requests for additional information about the Proposed Action to Ms. Maxie Tirella, 802d CES, 1555 Gott Street, JBSA-Lackland, Texas 78236, by email to 802CES.CEIE.NEPATeam@us.af.mil, or by phone at (210) 671-4037. We request your comments within 30 days of receiving this letter to ensure sufficient time to address them during preparation of the Draft EA. When available, you will be provided with an opportunity to review the Draft EA and the DAF's determination of effects on federally listed species and critical habitat. Thank you for your assistance.

Sincerely

LARSON.BRENT.DANIEL.1515771324 Digitally signed by LARSON.BRENT.DANIEL.1515771324 Date: 2024.08.22 09:56:40 -05'00'

BRENT D. LARSON, GS-14, DAF
Chief, Installation Management Flight

Attachments:
Figure 1 – Location of Existing Randolph 2A Military Operations Area
Figure 2 – Proposed Randolph 2A Low-Altitude Military Operations Area

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1

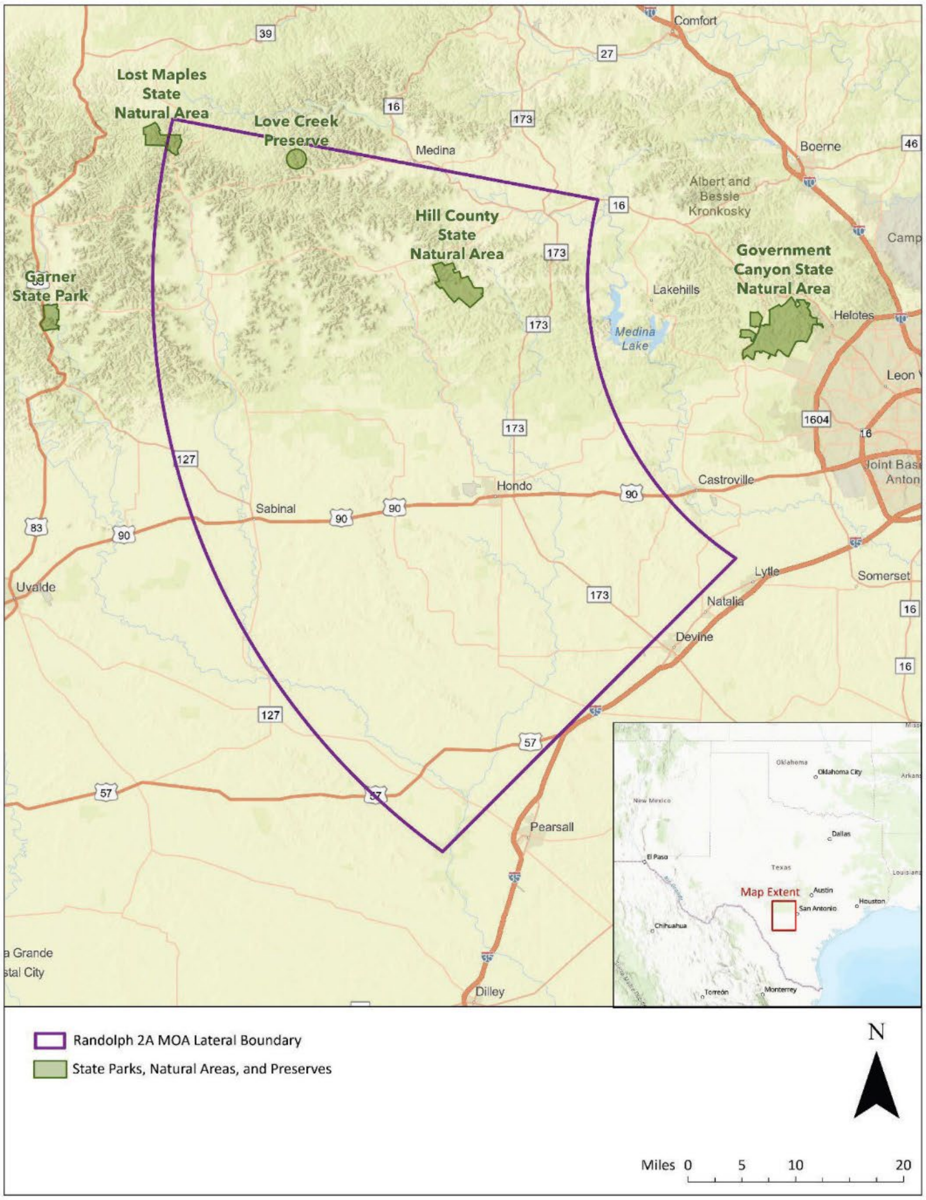

Figure 1 – Location of Existing Randolph 2A Military Operations Area

Mission ~ Wingman ~ Partners

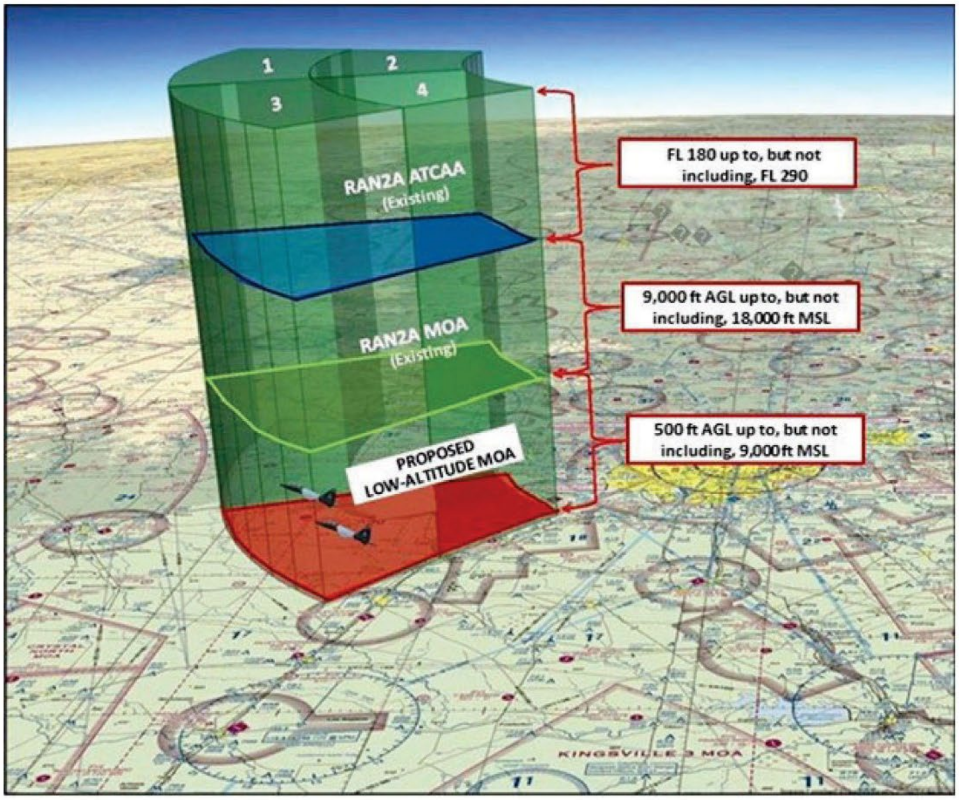

Figure 2 – Proposed Randolph 2A Low-Altitude Military Operations Area

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A.3.6 State Historic Preservation Officer Scoping Letter

DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Mr. Brent D. Larson
Chief, Installation Management Flight
802d Civil Engineer Squadron
1555 Gott Street, Bldg 5595
JBSA-Lackland, TX 78236

Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
PO Box 12276
Austin, TX 78711-2276
Submitted via eTRAC: https://xapps.thc.state.tx.us/106Review/

Dear Mr. Wolfe

The Department of the Air Force (DAF) Air Education and Training Command is preparing an Environmental Assessment (EA) to evaluate potential environmental effects from the Proposed Action to establish new low-altitude training airspace near San Antonio, Texas. The Proposed Action would support current and anticipated future pilot training requirements of the 12th Flying Training Wing (12 FTW) at Randolph Air Force Base, Joint Base San Antonio (JBSA-Randolph) as well as other transient DAF users. The EA is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (40 Code of Federal Regulations [CFR] Parts 1500-1508) and the DAF Environmental Impact Analysis Process (32 CFR Part 989). The Federal Aviation Administration is serving as a cooperating agency during the NEPA process for the Proposed Action.

The Proposed Action is considered an undertaking under Section 106 of the National Historic Preservation Act (NHPA). Therefore, the purpose of this letter is to initiate Section 106 consultation between the DAF and Texas State Historic Preservation Office (SHPO) and request information on historic properties that could potentially be affected by the proposed undertaking. The DAF also requests SHPO concurrence with the Area of Potential Effect (APE) for the proposed undertaking described below.

The proposed airspace would be established directly under the existing Randolph 2A Military Operations Area (RAN2A MOA). The RAN2A MOA is approximately 37 miles west of JBSA-Randolph and encompasses approximately 1,925 square miles of airspace (Figure 1). The RAN2A MOA has a floor of 9,000 feet above mean sea level (MSL) and a ceiling up to, but not including, 18,000 feet MSL. Military aircraft training operations below 9,000 feet MSL are not currently permitted in the RAN2A MOA.

The proposed airspace would have a floor of 500 feet above ground level and a ceiling of approximately 9,000 feet MSL (i.e., the floor of the existing RAN2A MOA) (Figure 2). The proposed airspace would have the same lateral boundaries of the existing RAN2A MOA and overlying RAN2A Air Traffic Control Assigned Airspace; no changes to the lateral or vertical extents of those existing airspaces are proposed. Once established, the proposed airspace would be operated and managed by the 12 FTW.

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The proposed undertaking does not include changes to the existing boundaries of, or the number and types of personnel and aircraft assigned to, JBSA-Randolph or any other Department of Defense (DoD) installation in the San Antonio area. No changes to the number of aircraft operations occurring at JBSA-Randolph are proposed. No construction, demolition, or other ground-disturbing activities would occur at JBSA-Randolph or on lands underlying the proposed airspace as part of the proposed undertaking.

The APE for the proposed undertaking is defined as lands underlying or intersected by the existing boundaries of the RAN2A MOA (see Figure 1). No changes to these boundaries are proposed and no ground-disturbing activities would occur within these boundaries under the proposed undertaking. In accordance with Section 106 of the NHPA, the DAF respectfully requests the Texas SHPO's concurrence with the proposed APE. Information is also requested for historic properties that could potentially be affected by the proposed undertaking. Historic properties underlying the proposed APE, and parties that the DAF intends to consult with or notify regarding the proposed undertaking, are included in the attached eTRAC Section 106 Consultation Request Form (Attachment 1).

The DAF has initiated government-to-government consultation with Native American tribes regarding the proposed undertaking in accordance with Section 106, implementing regulations at 36 CFR Part 800, and DoD Instruction 4710.02, *DoD Interactions with Federally Recognized Tribes* (see Attachment 1).

Please send your response and any comments, questions, or requests for additional information to Ms. Maxie Tirella, 802d CES, 1555 Gott Street, JBSA-Lackland, Texas 78236, by email to 802CES.CEIE.NEPATeam@us.af.mil, or by phone at (210) 671-4037. Your response is requested within 30 days of receiving this letter to ensure sufficient time for consideration of your comments during preparation of the Draft EA. When available, the Draft EA will be provided to your office for review and concurrence with the DAF's determination of effects on historic properties. Thank you for your assistance.

Sincerely

LARSON.BRENT.DANIEL.1515771324 Digitally signed by LARSON.BRENT.DANIEL.1515771324 Date: 2024.08.22 09:56:00 -05'00'

BRENT D. LARSON, GS-14, DAF
Chief, Installation Management Flight

Attachments:
Figure 1 – Location of Existing Randolph 2A Military Operations Area (Proposed Area of Potential Effect)
Figure 2 – Proposed Randolph 2A Low-Altitude Military Operations Area
Attachment 1 – eTRAC Section 106 Consultation Request Form

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1

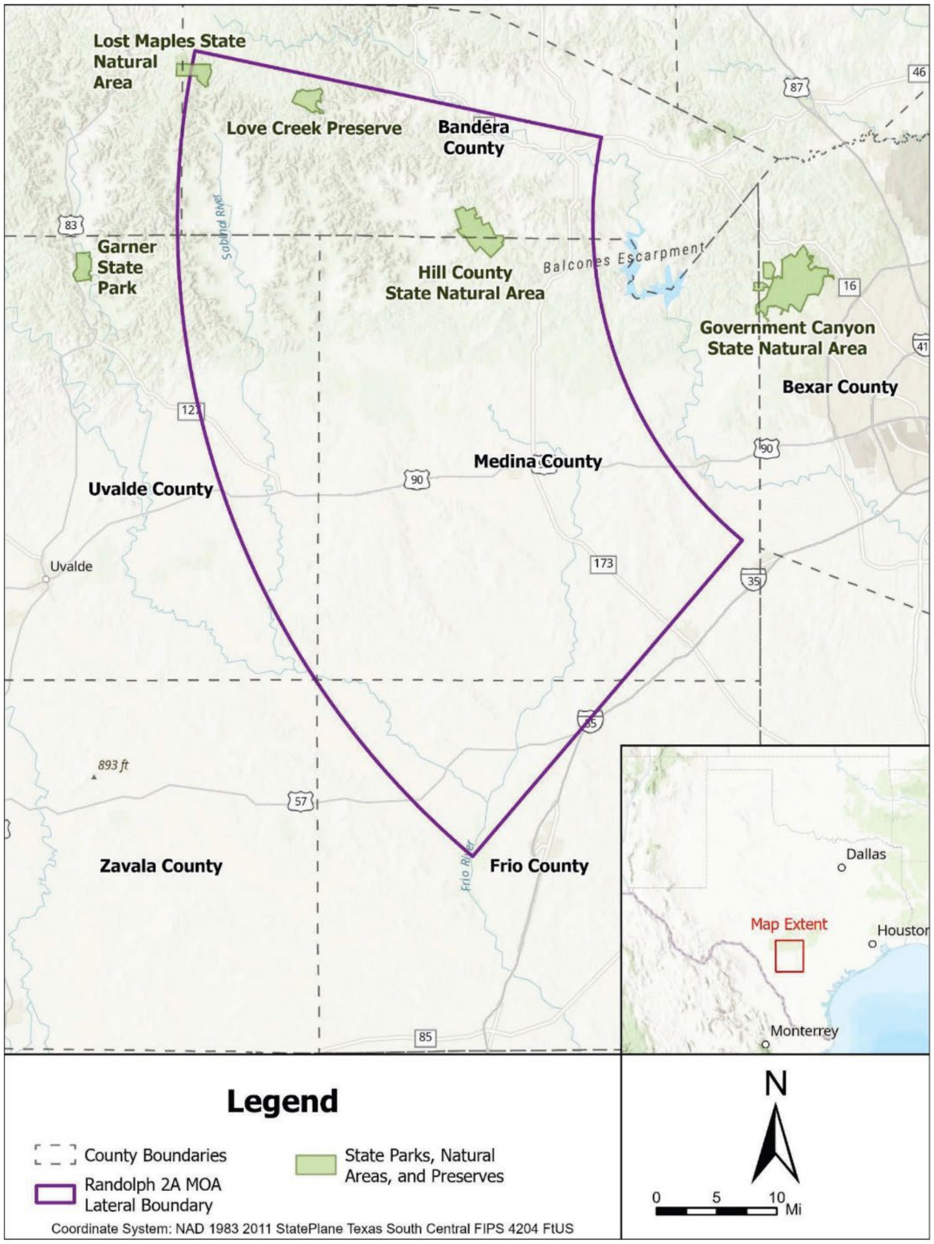

Figure 1 – Location of Existing Randolph 2A Military Operations Area (Proposed Area of Potential Effect)

Mission ~ Wingman ~ Partners

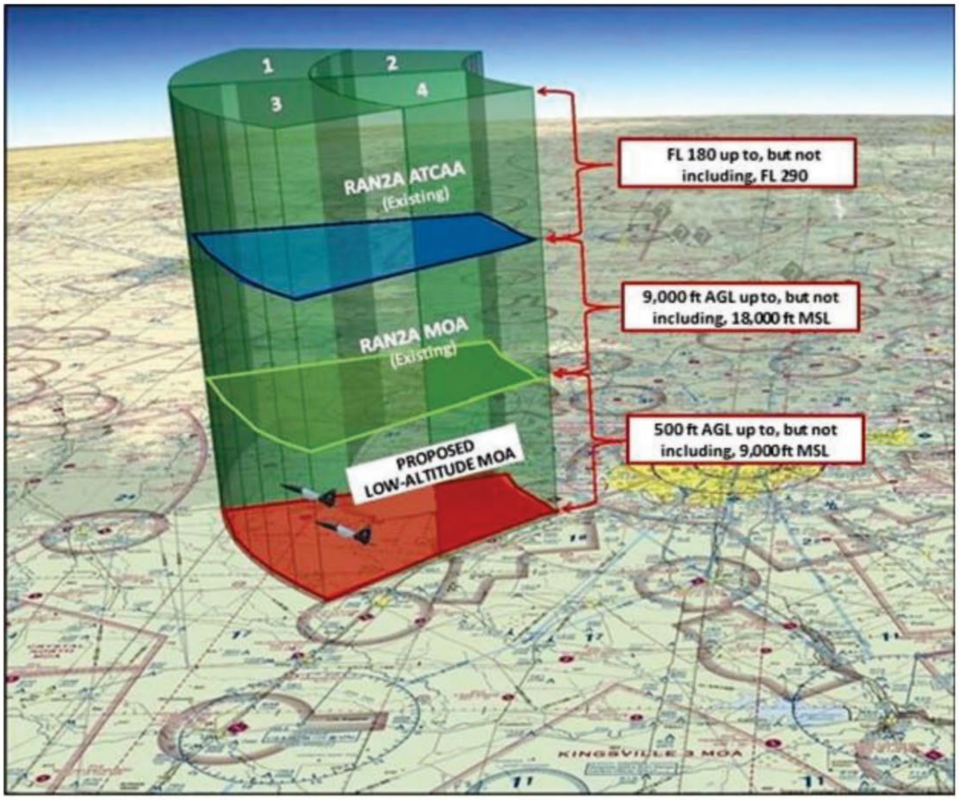

Figure 2 – Proposed Randolph 2A Low-Altitude Military Operations Area

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Attachment 1 – eTRAC Section 106 Consultation Request Form

TEXAS HISTORICAL COMMISSION

REQUEST FOR SHPO CONSULTATION:
Section 106 of the National Historic Preservation Act and/or the Antiquities Code of Texas

Please see instructions for completing this form and additional information on Section 106 and Antiquities Code consultation on the Texas Historical Commission website at http://www.thc.state.tx.us/crm/crmsend.shtml.

- [x] This is a new submission.
- [ ] This is additional information relating to THC tracking number(s): ____________

Project Information

PROJECT NAME
Environmental Assessment for Randolph AFB 2A Low Military Operations Area Special Use Airspace, San Antonio, Texas

PROJECT ADDRESS	PROJECT CITY	PROJECT ZIP CODE(S)

PROJECT COUNTY OR COUNTIES
Multiple (see Attachment)

PROJECT TYPE (Check all that apply)

- [ ] Road/Highway Construction or Improvement
- [ ] Site Excavation
- [ ] Utilities and Infrastructure
- [ ] New Construction
- [ ] Repair, Rehabilitation, or Renovation of Structure(s)
- [ ] Addition to Existing Structure(s)
- [ ] Demolition or Relocation of Existing Structure(s)
- [x] None of these

BRIEF PROJECT DESCRIPTION: Please explain the project in one or two sentences. More details should be included as an attachment to this form.
The Air Force is proposing to establish a new permanent low-altitude Military Operations Area near San Antonio, Texas to support routine low-altitude military student pilot training requirements. The proposed airspace would have a floor of 500' above ground level and ceiling of approx. 9,000 ' above mean sea level. All proposed activities would occur in airspace above the Earth's surface; no construction, demolition, or other ground-disturbing activities are proposed.

Project Contact Information

PROJECT CONTACT NAME	TITLE	ORGANIZATION	
Ms. Maxie Tirella	**NEPA Program Manager**	**AF Civil Engineer Center**	
ADDRESS	CITY	STATE	ZIP CODE
1555 Gott Street	**JBSA-Lackland**	**TX**	**78236**
PHONE	EMAIL		
254-458-1219	**802CES.CEIE.NEPATeam@us.af.mil**		

Federal Involvement (Section 106 of the National Historic Preservation Act)

Does this project involve approval, funding, permit, or license from a federal agency?

- [x] Yes (Please complete this section)
- [ ] No (Skip to next section)

FEDERAL AGENCY	FEDERAL PROGRAM, FUNDING, OR PERMIT TYPE
Department of the Air Force	**Air Force Air Education and Training Command**
CONTACT PERSON	PHONE
Nicolas Post	**(210) 925-3516**
ADDRESS	EMAIL

State Involvement (Antiquities Code of Texas)

Does this project occur on land or property owned by the State of Texas or a political subdivision of the state?

- [ ] Yes (Please complete this section)
- [x] No (Skip to next section)

CURRENT OR FUTURE OWNER OF THE PUBLIC LAND

CONTACT PERSON	PHONE
ADDRESS	EMAIL

VER 0811

1

REQUEST FOR SHPO CONSULTATION -- PROJECT NAME: **Environmental Assessment for Randolph AFB 2A Low Military O|**
Multiple (see Attachment)

Identification of Historic Properties: Archeology
Does this project involve ground-disturbing activity? ☐ Yes (Please complete this section) ☒ No (Skip to next section)
Describe the nature of the ground-disturbing activity, including but not limited to depth, width, and length.
Describe the previous and current land use, conditions, and disturbances.

Identification of Historic Properties: Structures		
Does the project area or area of potential effects include buildings, structures, or designed landscape features (such as parks or cemeteries) that are 45 years of age or older? ☒ Yes (Please complete this section) ☐ No (Skip to next section)		
Is the project area or area of potential effects within or adjacent to a property or district that is listed in or eligible for listing in the National Register of Historic Places? ☒ Yes, name of property or district: **multiple (see Attachment)** ☐ No ☐ Unknown		
In the space below or as an attachment, describe each building, structure, or landscape feature within the project area or area of potential effect that is 45 years of age or older.		
ADDRESS	DATE OF CONSTRUCTION	SOURCE FOR CONSTRUCTION DATE
ADDRESS	DATE OF CONSTRUCTION	SOURCE FOR CONSTRUCTION DATE
ADDRESS	DATE OF CONSTRUCTION	SOURCE FOR CONSTRUCTION DATE

Attachments

Please see detailed instructions regarding attachments.
Include the following with each submission:

- ☒ Project Work Description
- ☒ Maps
- ☒ Identification of Historic Properties
- ☐ Photographs

For Section 106 reviews only, also include:

- ☒ Consulting Parties/Public Notification
- ☒ Area of Potential Effects
- ☐ Determination of Eligibility
- ☐ Determination of Effect

Submit completed form and attachments to the address below. Faxes and email are not acceptable.

Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276, Austin, TX 78711-2276 (mail service)
108 W. 16th Street, Austin, TX 78701 (courier service)

For SHPO Use Only

PAGE 2 / VER 0811

1

Attachment to Texas Historical Commission eTRAC Section 106 Project Review Request Form

National Register of Historic Places-Listed Resources under the Randolph 2A MOA Area of Potential Effect.

Resource	Address	County	Reference No.	Latitude	Longitude
D'Hanis Historic District	7 miles west of Hondo, Texas	Medina	76002051	29.330	-99.260
Saathoff House	Quihi-Stormhill Road, Quihi, Texas	Medina	82004515	29.397	-99.008
Jureczki House	607 Cypress Street, Bandera, Texas	Bandera	80004075	29.720	-99.075
Bandera County Courthouse and Jail	Public Square, 12th and Maple Streets, Bandera, Texas	Bandera	79002911	29.726	-99.072
Langford, B.F., Jr. and Mary Hay House	415 Fourteenth Street, Bandera, Texas	Bandera	04000229	29.729	-99.071

List of Consulting Parties for Randolph 2A MOA Environmental Assessment and Section 106 Consultation.

Organization	
Alamo Area Council of Governments	Medina County
Apache Tribe of Oklahoma	Mescalero Apache Tribe of the Mescalero Reservation, New Mexico
Bandera County	Real County
City of Bandera	South Texas Regional Airport
City of Hondo	Texas Commission on Environmental Quality
City of Sabinal	Texas Parks and Wildlife Department
Comanche Nation, Oklahoma	Tonkawa Tribe of Indians of Oklahoma
Federal Aviation Administration	US Environmental Protection Agency, Region 6
Frio County	US Fish and Wildlife Service
Hill Country State Natural Area	Uvalde County
Lost Maples State Natural Area	Wichita and Affiliated Tribes (Wichita, Keechi, Waco & Tawakonie), Oklahoma
Love Creek Preserve	Zavala County

A.4 Stakeholder List

The following is the stakeholder list for correspondence associated with this Environmental Assessment.

General

Randy Gee
USEPA Region 6, Tribal Program Manager
1201 Elm Street
Dallas, TX 75270

Ms. Julie Wicker
Texas Parks & Wildlife Dept, Branch Chief
4200 Smith School Road
Austin, TX 78744

Ms. Laura Zebehazy
Texas Parks & Wildlife Dept, Program Leader
Wildlife Habitat Assessment Program
4200 Smith School Road
Austin, TX 78744

Ms. Kelly Keel
TCEQ - Office of Permits & Registrations, Executive Director
PO Box 13087
Austin, TX 78711-3087

Ms. Kristin Jacobsen
TCEQ - Air Quality Planning, Manager
PO Box 13087
Austin, TX 78711-3087

TCEQ
NEPA Coordinator
PO Box 13087
Austin, TX 78711-3087

Hill Country State Natural Area
10600 Bandera Creek Road
Bandera, TX 78003

Lost Maples State Natural Area
37221 FM 187
Vanderpool, TX 78885

Love Creek Preserve
2725 Elam Creek Road
Medina, TX 78055

Crystal Campos-Rosales
Alamo Area Council of Governments
Communications and Public Affairs
2700 NE Loop 410, Suite 101
San Antonio, TX 78217

Dieter Werner
Bandera County, County Engineer
PO Box 3275
Bandera, TX 78003

John McAnelly
City of Hondo, Mayor
1600 Avenue M
Hondo, TX 78861

Rebeca Gibson
City of Bandera, Mayor
511 Main Street
PO Box 896
Bandera, TX 78003

Rene Saenz
City of Hondo, Public Works Director
1000 Avenue Y
Hondo, TX 78861

Ryan Elder
South Texas Regional Airport
Director of Aviation
700 Vandenberg Road
Hondo, TX 78861

Stephen Henry
City of Sabinal, Mayor
501 N Center Street
Sabinal, TX 78881

The Honorable Bella A. Rubio
County Judge, Real County
PO Box 446
Leakey, TX 78873

The Honorable Richard Evans
County Judge, Bandera County
500 Main Street
PO Box 877
Bandera, TX 78003

The Honorable Rochelle Lozano Camacho
County Judge, Frio County
500 East San Antonio Street, Box 7
Pearsall, TX 78061

The Honorable William R. Mitchell
County Judge, Uvalde County
Courthouse Plaza, 100 N Getty Street, Ste 3
Uvalde, TX 78801

The Honorable Keith Lutz
County Judge, Medina County
1300 Avenue M, Room 250
Hondo, TX 78861

The Honorable Cindy Martinez-Rivera
County Judge, Zavala County
200 E Uvalde Street #9
Crystal City, TX 78839

Government-to-Government

Durell Cooper
Apache Tribe of Oklahoma, Chairman
PO Box 1330
Anadarko, OK 73005

Forrest Tahdooahnippah
Comanche Nation, Oklahoma, Chairman
PO Box 908
Lawton, OK 73502

Martina Minthorn
Comanche Nation, Oklahoma, THPO
PO Box 908
Lawton, OK 73502

Holly Houghten
Mescalero Apache Tribe of the Mescalero Reservation, New Mexico, THPO
PO Box 227
Mescalero, NM 88340

Thora Walsh Padilla
Mescalero Apache Tribe of the Mescalero Reservation, New Mexico, President
PO Box 227
Mescalero, NM 88340

Lauren Norman-Brown
Tonkawa Tribe of Indians of Oklahoma, THPO
1 Rush Buffalo Road
Tonkawa, OK 74653

Russell Martin
Tonkawa Tribe of Indians of Oklahoma, President
1 Rush Buffalo Road
Tonkawa, OK 74653-4449

Terri Parton
Wichita and Affiliated Tribes (Wichita, Keechi, Waco & Tawakonie), Oklahoma, President
PO Box 729
Anadarko, OK 73005

Gary McAdams
Wichita and Affiliated Tribes (Wichita, Keechi, Waco & Tawakonie), Oklahoma, THPO
PO Box 729
Anadarko, OK 73005

U.S. Fish and Wildlife Service

Christina Williams
U.S. Fish and Wildlife Service, Austin Ecological Field Office
1505 Ferguson Lane
Austin, TX 78754

State Historic Preservation Officer

Mark Wolfe
Texas Historical Commission, SHPO
PO Box 12276
Austin, TX 78711-2276

A.5 AGENCY AND TRIBAL COMMENT LETTERS

From: Williams, Christina [redacted]
Sent: Thursday, August 29, 2024 11:46 AM
To: 802 CES/CEIE NEPA Team [redacted]
Subject: [Non-DoD Source] 12 FTW at Randolph

Hello,

We're received your letter indicating the preparation of an EA and initiating informal consultation. Please note these are two separate things. Regarding the EA, please use our IPaC system to see what species are in the area and then determine if you think the project will have any impacts. If you believe there could be impacts, that is when you should initiate communications with us to see if a consultation is in order, not at the time of preparing an EA. Until such time, we will consider this to not be a formal request for initiating consultation.

Thank you,

Christina

Christina Williams
Supervisory Fish and Wildlife Biologist
Consultation and HCPs Branch
[redacted]
Austin, Texas 78754
[redacted]

Mission: work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

TEXAS PARKS & WILDLIFE

Life's better outside.®

September 13, 2024

Maxie Tirella
CES
[redacted]
JBSA-Lackland, TX 78236

RE: Preparation of an Environmental Assessment evaluating proposed airspace modifications to support current and anticipated future pilot training, Joint Base San Antonio-Randolph (JBSA-Randolph), Bexar County, Texas

Dear Ms. Maxie Tirella:

This letter is in response to your request for scoping comments regarding the proposed project referenced above. The Department of the Air Force (DAF) Air Education and Training Command is preparing a draft Environmental Assessment (EA) to evaluate potential environmental impacts associated with the proposed project.

Project Description

In order to support the mission of the 12th Flying Training Wing (12 FTW) at Randolph Air Force Base, JBSA-Randolph, as well as transient DAF users, the DAF is evaluating the establishment of low-altitude training airspace west of San Antonio, under the existing Randolph 2A Military Operations Area (RAN2A MOA). The current floor of the RAN2A MOA is 9,000 feet above mean sea level (MSL); the ceiling is up to, but not including 18,000 feet MSL. The proposed action would establish a training airspace with a floor of 500 feet above ground level (AGL) and a ceiling of approximately 9,000 feet MSL.

TPWD has reviewed the information provided and offers the following comments and recommendations.

State Regulations

Parks and Wildlife Code, Section 26 - Protection of Public Parks and Recreational Lands

Chapter 26 of the Parks and Wildlife Code requires that before a state agency can approve any project that will result in the use or taking of public land designated and used as a park, public recreation area, scientific area, wildlife refuge, or historic site, that state agency must provide certain notices to the public, conduct a hearing, and render a finding that there is no feasible and prudent alternative and that the project includes all reasonable planning to minimize harm to the property. Chapter 26 is modeled on a federal statute known as "section 4(f)" and codified at 49 U.S.C. §303. If a proposed project would affect a TPWD property, approval from the Parks and Wildlife Commission may be required.

[redacted]
AUSTIN, TEXAS 78744-3291
[redacted]
www.tpwd.texas.gov

Ms. Maxie Tirella
Page 2
September 13, 2024

TPWD maintains a statewide inventory of Land and Water Resources Conservation and Recreation Plan (LWRCRP) data depicting conservation and recreation lands in Texas, which can be found at http://tpwd.texas.gov/gis/. TPWD's Lost Maples State Natural Area (SNA), Hill Country SNA and The Nature Conservancy's Lost Creek Preserve are located within the study area. Impacts to TPWD's SNA's may be subject to Chapter 26.

Lost Maples SNA preserves a special stand of Uvalde bigtooth maples among a landscape of steep limestone canyons, wooded slopes, and clear streams that provide habitat for the federally listed Golden cheeked warbler. Hill Country SNA also consists of rocky canyons up to 2,000 feet high among a mosaic of oak mottes, grasslands, and creek bottoms. The property was conserved with the stipulation that it preserves intact its diverse natural resources. Both properties provide outdoor recreational opportunities for the public.

Exposure to disturbance, including aircraft overflights, has been demonstrated to cause physiological reactions, such as increased heart rate, in wildlife. Reacting to disturbance can also negatively affect foraging time which can lead to depleted energy reserves.

TPWD has concerns that lowering the floor of flight activities to 500 feet above ground level over SNAs could negatively affect the properties' mission to preserve natural resources. In addition to disturbing wildlife and domestic animals, extreme noise from low-altitude training could also negatively impact nature tourism and other outdoor recreational opportunities at the SNAs.

> **Recommendation:** TPWD recommends the proposed airspace modifications exclude lands owned or managed for conservation or recreation by the state, specifically Lost Maples SNA and Hill Country SNA.

General Comment

The text of the scoping notice identifies the floor and ceiling of the current airspace using "feet above mean sea level" as the standard. However, in Figure 2, both Mean Sea Level (MSL) and Above Ground Level (AGL) are used synonymously (e.g., both are used to describe the 9,000 feet level). As these terms have different meanings, TPWD recommends ensuring all units used to describe the floor and ceiling of the proposed airspace within the draft EA are appropriate and consistent. Understandably, AGL is the appropriate descriptor for the 500-foot floor of the proposed low-altitude training area as the elevation of the general area is already greater than 500 feet above mean sea level.

Ms. Maxie Tirella
Page 3
September 13, 2024

I appreciate the opportunity to review and provide comments on this project. Please contact me at [redacted] or [redacted] if you have any questions concerning our comments.

Sincerely,

Russell Hooten

Russell Hooten
Ecological and Environmental Planning Program
Wildlife Division

/rh 52844

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

September 17, 2024

Maxie Tirella
Chief, Government Relations
Department of the Air Force
[redacted]
JBSA-Lackland, TX 78236

Via: **E-mail**

Re: **TCEQ NEPA Request #2024-257. 32 CFR PART 989, 12TH FLYING TRAINING WING JBSA-RANDOLPH. Bexar County.**

Dear Ms. Tirella,

The Texas Commission on Environmental Quality (TCEQ) has reviewed the above-referenced project and offers the following comments:

The proposed action is located in Bexar County, which is designated nonattainment for the 2015 eight-hour ozone National Ambient Air Quality Standard (NAAQS) with a classification of serious; therefore, federal Clean Air Act, §176(c) general conformity requirements apply. Per federal general conformity regulations at 40 CFR §93.153, a conformity demonstration may be required when the total projected direct and indirect volatile organic compounds (VOC) and nitrogen oxides (NOX) emissions—precursor pollutants that lead to the formation of ozone—from an applicable federal action are equal to or exceed the de minimis emissions level of 50 tons per year for ozone NAAQS serious nonattainment areas.

For emissions analyses conducted to determine general conformity applicability, the TCEQ recommends using a methodology consistent with the requirements at 40 CFR §93.159. Air Quality staff looks forward to reviewing the draft environmental assessment in accordance with transportation and general conformity regulations codified in 40 Code of Federal Regulations Part 93.

We recommend the environmental assessment address actions that will be taken to prevent surface and groundwater contamination.

Any debris or waste disposal should be at an appropriately authorized disposal facility.

Thank you for the opportunity to review this project. If you have any questions, please contact the agency NEPA coordinator at ([redacted] or NEPA@tceq.texas.gov

Sincerely,

Ryan Vise,
Division Director
External Relations

[redacted] • Austin, Texas 78711-3087 • [redacted] • tceq.texas.gov

From: Ryan Elder [redacted]
Sent: Friday, August 30, 2024 11:56 AM
To: 802 CES/CEIE NEPA Team [redacted]
Cc: Mayor John McAnelly [redacted] John Naron [redacted]
Subject: [Non-DoD Source] RAND2A MOA Letter - KHDO Inquiry

Ms. Tirella,

I hope this email finds you well. I am writing you with regards to a letter we received concerning the proposed changes to the RAND2A MOA. As stated in the letter, and my understanding, is the proposed changes to the RAND2A MOA would change the current floor from 9,000'MSL to 500'AGL in the entire perimeter of the established MOA.

First I would like to say that we fully support all military operations in and around KHDO. We have a great relationship with several branches and outfits to support them in many different arenas, whether that be your flight training operations with T-6's or others who conduct military para-jump training on/around the field.

I believe our only question for clarity is concerning this significant floor change around KHDO, and how that will affect operations at KHDO. Will there be a perimeter around/within KHDO that is higher than 500' AGL? If so, can you share what that radius might be (e.g. 5NM, 10NM)? As I am sure you can imagine, 500' AGL off any approach/departure surface or over the field would pose significant safety concerns with local and transient aircraft, and the continued military para-jump training that occurs in the vicinity of KHDO. We typically NOTAM a 5NM radius around KHDO when these para-jump training operations occur, in addition to communicating these operations with Randolph's Ops desk.

We appreciate the notice and look forward to your reply.

Best Regards,

Ryan Elder
Director of Aviation
South Texas Regional Airport (KHDO)
City of Hondo
[redacted]

From: noreply@thc.state.tx.us <noreply@thc.state.tx.us>
Sent: Friday, September 20, 2024 5:18:46 PM
To: Bowen, Christopher [USA - EMP] <[redacted]>; reviews@thc.state.tx.us <reviews@thc.state.tx.us>
Subject: Environmental Assessment for Randolph AFB 2A Low Military Operations Area Special Use Airspace, San

TEXAS HISTORICAL COMMISSION
real places telling real stories

Re: Project Review under Section 106 of the National Historic Preservation Act
THC Tracking #202415607
Date: 09/20/2024
Environmental Assessment for Randolph AFB 2A Low Military Operations Area Special Use Airspace, San
Multiple (see attachments)
Hondo, TX 78861

Description: This EA concerns an Air Force proposal for a new permanent low-altitude airspace near San Antonio to support low-altitude military pilot training. No construction or ground disturbance proposed.

Dear Christopher Bowen:
Thank you for your submittal regarding the above-referenced project. This response represents the comments of the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission (THC), pursuant to review under Section 106 of the National Historic Preservation Act.

The review staff, led by Justin Kockritz, Patrick Bassett and Mary Galindo, has completed its review and has made the following determinations based on the information submitted for review:

Above-Ground Resources

- No adverse effects on historic properties.

Archeology Comments

- No historic properties affected. However, if cultural materials are encountered during construction or disturbance activities, work should cease in the immediate area; work can continue where no cultural materials are present. Please contact the THC's Archeology Division at 512-463-6096 to consult on further actions that may be necessary to protect the cultural remains.

We look forward to further consultation with your office and hope to maintain a partnership that will foster effective historic preservation. Thank you for your cooperation in this review process, and for your efforts to preserve the irreplaceable heritage of Texas. If the project changes, or if new historic properties are found, please contact the review staff. If you have any questions concerning our review or if we can be of further assistance, please email the following reviewers: [redacted], [redacted].

This response has been sent through the electronic THC review and compliance system (eTRAC). Submitting your project via eTRAC eliminates mailing delays and allows you to check the status of the review, receive an electronic response, and generate reports on your submissions. For more information, visit http://thc.texas.gov/etrac-system.

Sincerely,

Patrick Bassett

for Bradford Patterson
Chief Deputy State Historic Preservation Officer

Please do not respond to this email.

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APPENDIX B
REASONABLY FORESEEABLE FUTURE ACTIONS

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APPENDIX B – REASONABLY FORESEEABLE FUTURE ACTIONS

Table B-1 Reasonably Foreseeable Future Actions

Scheduled Project	Project Summary	Implementation Date	Relevance to Proposed Action
T-7A Recapitalization at JBSA-Randolph [1]	Beginning in 2027, the 12 FTW at JBSA-Randolph will begin transitioning to the DAF's newest flying trainer, the Boeing/Saab T-7A *Red Hawk* (T-7A). The T-7A is projected to begin operating at JBSA-Randolph in fiscal year (FY) 2027. The 12 FTW will initially fly a mix of T-38C and T-7A aircraft until full transition to the T-7A, currently projected by FY31, is completed. Potential impacts from this transition associated with the proposed establishment of the low-altitude MOA under the existing RAN2A MOA are assessed in this EA. The T-7A beddown at JBSA-Randolph would include 81 aircraft, 10 flight simulators, 200 permanent personnel, 60 temporary personnel over a 2-year period, demolition of some existing buildings, and new construction or modification of additional buildings. Potential environmental impacts from proposed operation of the T-7A at JBSA-Randolph were assessed in the JBSA T-7A Recapitalization Final Environmental Impact Statement (DAF, 2022).	Initial operations 2027, full operational capability by 2031	Project would utilize the same airspace.
Repair Airfield Aprons[2]	Replacement of approximately 45,175 square yards of deteriorated apron pavements; repair approximately 3,777 square yards of asphalt shoulder.	Unknown	Project could occur during implementation of the Proposed Action.

Table B-1 Reasonably Foreseeable Future Actions

Scheduled Project	Project Summary	Implementation Date	Relevance to Proposed Action
T-7A Recapitalization and Programmed Military Construction (MILCON) and Facilities Sustainment, Restoration, and Modernization (FSRM) Projects[1]	Transition of training aircraft from the T-38C Talon to the T-7A *Red Hawk*. Six MILCON and 13 FSRM projects are planned to support the new aircraft and associated operations. Approximately 300 additional staff would be stationed at JBSA-Randolph and up to 5,952 annual nighttime operations would be introduced. All T-38C Talon aircraft would eventually be removed from JBSA-Randolph.	2024-2031	Project could impact/be impacted by and would occur during implementation of the Proposed Action.
Programmed Dormitory and Child Development Center (CDC) Military Construction[2]	Planned construction of new CDCs at JBSA-Randolph, as well as construction and renovation of numerous residential facilities.	2023-2027	Project would overlap with implementation of the Proposed Action.
Various Road Projects, Texas Department of Transportation[3]	Implement various small- and large-scale construction projects to improve road safety and congestion. A large proportion of planned and underway projects involve seal coating new or existing roadways. Projects may also include widening or rehabilitation of roadways and installation of new or updated traffic controls.	Current – indefinite	Projects would overlap with implementation of the Proposed Action and could occur within the project area.
South Texas Regional Airport (HDO) – Routine Maintenance, Rehabilitation, and Development Projects[4]	Planning and implementation of numerous development and rehabilitation projects. Projects include the construction of new access roads, taxiways, and hangars as well as ongoing maintenance and rehabilitation of existing paved areas.	Current – indefinite	Projects would overlap with implementation of the Proposed Action and occur within the project area.
Sunray Solar Project[5]	Construction and operation of a new solar park with 200 megawatts (MW) of generational capacity. The new park will be approximately 1,865 acres of private land within Uvalde County.	2024-2026	Project would overlap with implementation of the Proposed Action and occur within the project area.

Table B-1 Reasonably Foreseeable Future Actions

Scheduled Project	Project Summary	Implementation Date	Relevance to Proposed Action
Rio Lago Solar[6]	Construction and operation of a new 123-MW solar farm. Project includes a wildlife fence and will produce little noise once operational.	2024-2025	Project would overlap with implementation of the Proposed Action and occur within the project area.
Proposed Rail Projects and Improvements – Texas Department of Transportation[7]	Proposed and current implementation of various rail system upgrades. These projects include extending rail lines, merging of rail systems, operational equipment upgrades, and adding additional trips and services to existing lines.	Current – indefinite	Projects would overlap with implementation of the Proposed Action and occur within the project area.
Ongoing Commercial and Private Development	Various commercial, residential, and private development projects are proposed or in progress within the project area. These projects include retail and residential development	Current – indefinite	Projects would overlap with implementation of the Proposed Action and occur within the project area.

Notes:

[1] Record of Decision, T-7A Recapitalization at JBSA-Randolph, TX. 2022. <https://jbsa.t-7anepadocuments.com/application/files/3216/5642/1374/Tab_1._220621_T-7A_at_JBSA-Randolph_Final_ROD_0_Signed_21_Jun_22.pdf>

[2] AFIMSC tackles dorm, child care center needs with $1.6 billion improvement plan. 2023. <https://www.jbsa.mil/News/News/Article/3501825/>

[3] TxDOT Project Tracker. 2024. <https://apps3.txdot.gov/apps-cq/project_tracker/>

[4] South Texas Regional Airport Draft Final Development Plan. 2017. <https://hondo-tx.org/DocumentCenter/View/102/Hon053-Draft-Final-Development-Plan-Report-PDF?bidId=>

[5] Sunray Solar Project, North American Development Bank. 2024. <https://www.nadb.org/our-projects/infrastructure-projects/sunray-solar-project-in-uvalde-county-texas>

[6] Rio Lago Project Overview. 2024. <https://pinegaterenewables.com/rio-lago/>

[7] TxDOT Texas Rail Plan. 2019. <https://www.txdot.gov/content/dam/docs/rail/texas-rail-plan-chapters.pdf>

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APPENDIX C
FURTHER DEFINITIONS OF RESOURCE AREAS ANALYZED, METHODOLOGIES, AND MODELING

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APPENDIX C – FURTHER DEFINITIONS OF RESOURCE AREAS ANALYZED, METHODOLOGIES, AND MODELING

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, United States Code § 40103, Sovereignty and use of airspace, and Public Law No. 103-272, the U.S. 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. The FAA created the National Airspace System which is made up of a network of air navigation facilities, air traffic control (ATC) facilities, airports, technology, and appropriate rules and regulations that are needed to operate the system and 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 civilian and military aircraft. The FAA has two categories of airspace or airspace areas: Regulatory (Class A, B, C, D, and E airspace areas, restricted and prohibited areas) and Nonregulatory (military operations areas [MOAs], warning areas, alert areas, controlled firing areas, and national security areas). These two categories are divided into four airspace types: Controlled, Uncontrolled, Special use, and Other airspace. These airspace categories and types are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and national and public interest in the airspace.

Class A. Generally, that airspace from 18,000 feet MSL up to and including flight level (FL) 600, including the airspace overlying the waters within 12 nautical miles (NM) off the coast of the 48 contiguous states and Alaska; and designated international airspace beyond 12 NM off the coast of the 48 contiguous states and Alaska within areas of domestic radio navigational signal or air traffic control radar coverage, and within which domestic procedures are applied. Unless otherwise authorized, all persons must operate their aircraft under Instrument Flight Rules (IFR).

Class B. Generally, that airspace from the surface to 10,000 feet mean sea level (MSL) surrounding the nation's busiest airports in terms of IFR operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers, and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are cleared receive separation services within the airspace. The cloud clearance requirement for visual flight rules (VFR) operations is "clear of clouds."

Class C. Generally, this is the airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually consists of a 5 NM radius core surface area that extends from the surface up to 4,000 feet above the airport elevation, and a 10 NM radius shelf area that extends no lower than 1,200 feet up to 4,000 feet above the airport elevation. 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 within the airspace.

Class D. Generally, Class D airspace extends upward from the surface to 2,500 feet 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. 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 Class D 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 feet 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 feet MSL. Unless designated at a lower altitude, Class E airspace begins at 14,500 feet 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 feet MSL, and the airspace above FL 600.

Class G. Uncontrolled airspace or Class G airspace is the portion of the airspace that has not been designated as Class A, B, C, D, or E. It is therefore designated uncontrolled airspace. Class G airspace extends from the surface to the base of the overlying Class E airspace. Although ATC has no authority or responsibility to control air traffic, pilots should remember there are VFR minimums that apply to Class G airspace.

Special use airspace (SUA) includes MOAs, Restricted Areas, Air Traffic Control Assigned Airspace (ATCAAs), and Warning Areas. 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 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 feet AGL to 18,000 feet above MSL, the floor may extend below 1,200 feet 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 exceeding 250 knots indicated airspeed (approximately 285 miles 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. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR 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 the 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 feet MSL and, in some cases, are contoured to the dimensions of the MOAs beneath them. A Warning Area is airspace of defined dimensions that extends from 3 NM outward from the coast of the United States and may be over U.S. waters, international waters, or both. The purpose of Warning Areas is to warn nonparticipating pilots of potentially hazardous activity. Warning areas may be used for other purposes if released to the FAA during periods when not required for their intended purpose and are within areas in which the FAA has ATC authority.

Other airspace refers to most of the remaining airspace including, but not limited to, military training routes, temporary flight restrictions, published VFR routes, national security areas, and flight restricted zones (FAA, 2023). Military training routes are established by joint venture between the FAA and the DoD for use by the military for the purpose of conducting low-altitude, high-speed (exceeding 250 knots) training. The routes above 1,500 feet AGL are developed to be flown, to the maximum extent possible, under IFR. Routes at 1,500 feet AGL and below are developed to be flown under VFR using see-and-avoid flying.

Each military organization responsible for SUA develops a daily use schedule. Although the FAA designates SUA for military use, other pilots may transit the airspace. Avoidance procedures are maintained for each SUA, and military aircrews build them into daily flight plans.

C.1.2 References

Federal Aviation Administration (FAA). 2023. Aeronautical Information Manual. *Official Guide to Basic Flight Information and ATC Procedures*. https://www.faa.gov/air_traffic/publications/atpubs/aim_html. Accessed March 2023.

C.2 NOISE

The following sections describe input data used in the noise modeling process.

C.2.1 Sound, Noise, and Potential Effects

C.2.1.1 Introduction

Section C.2.1 discusses sound and noise and their potential effects on the human and natural environment. **Section C.2.1.2** provides an overview of the basics of sound and noise. **Section C.2.1.3** defines and describes the different metrics used to describe noise. The largest section, **Section C.2.1.4**, reviews the potential effects of noise, focusing on effects on humans but also addressing effects on property values, terrain, structures, and animals. **Section C.2.6** contains the list of references cited. **Section C.2.2** 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.2.1.2 Basics of Sound

C.2.1.2.1 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.

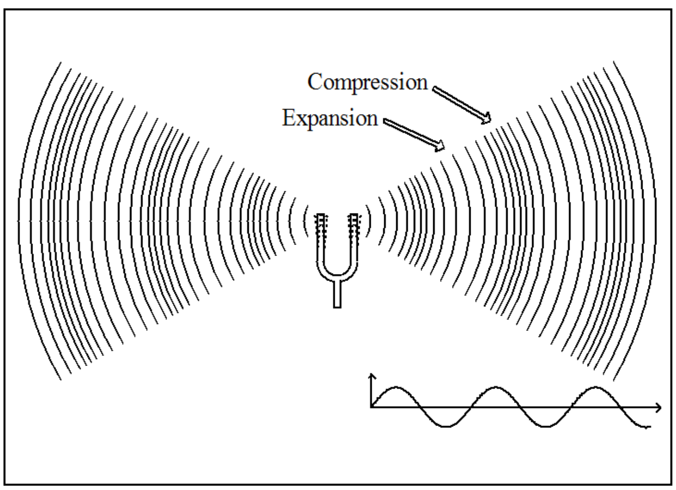


Figure C-1 Sound Waves from a Vibrating Tuning Fork

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.

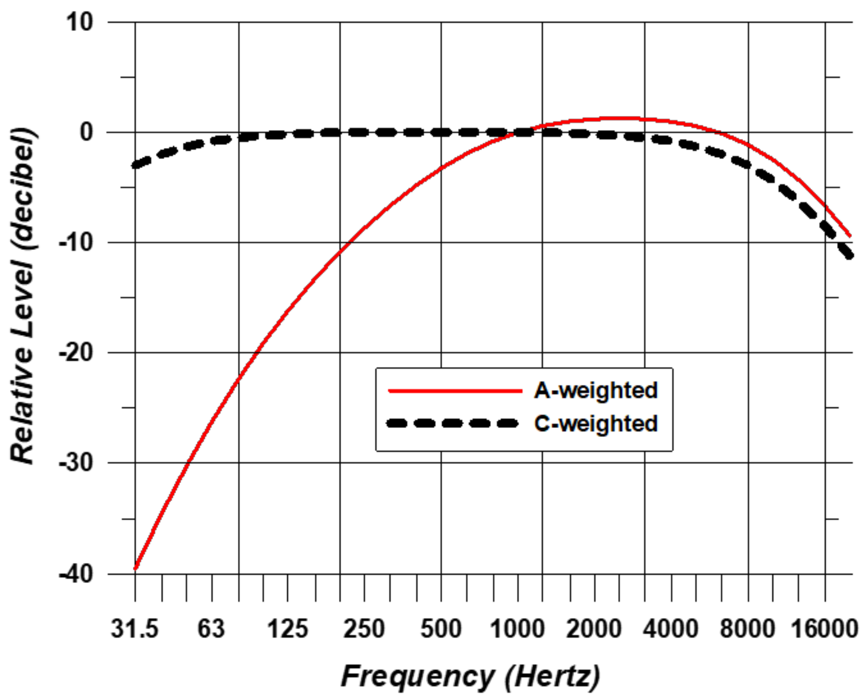
Because the addition of sound levels is different than that of ordinary numbers, this process is often referred to as "decibel addition."

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"

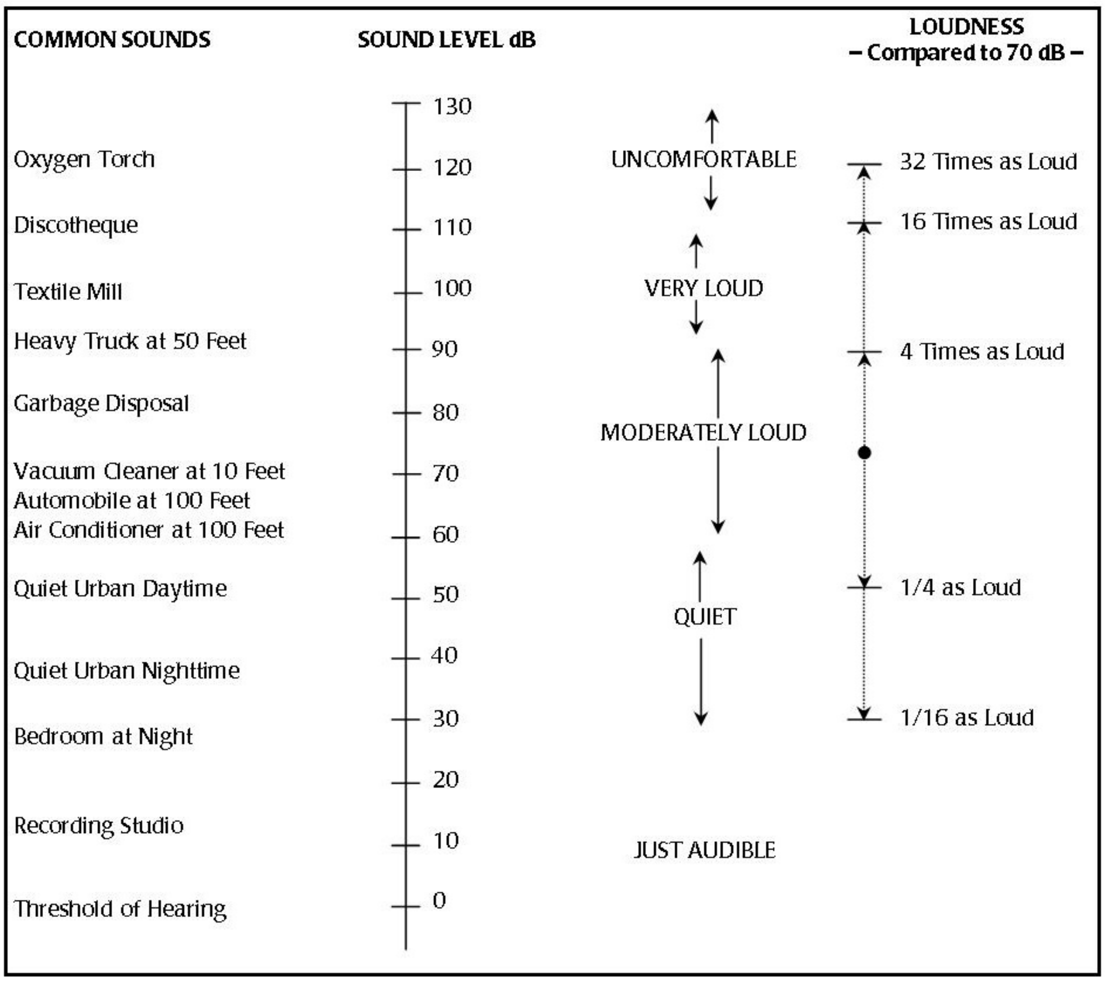
Figure C-2 Frequency Characteristics of A- and C-Weighting

C.2.1.2.2 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 (U.S. 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.2.1.3**.



Source: Harris, 1979

Figure C-3 Typical A-weighted Sound Levels of Common Sounds

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).

C.2.1.3 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.2.1.3.1 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 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.

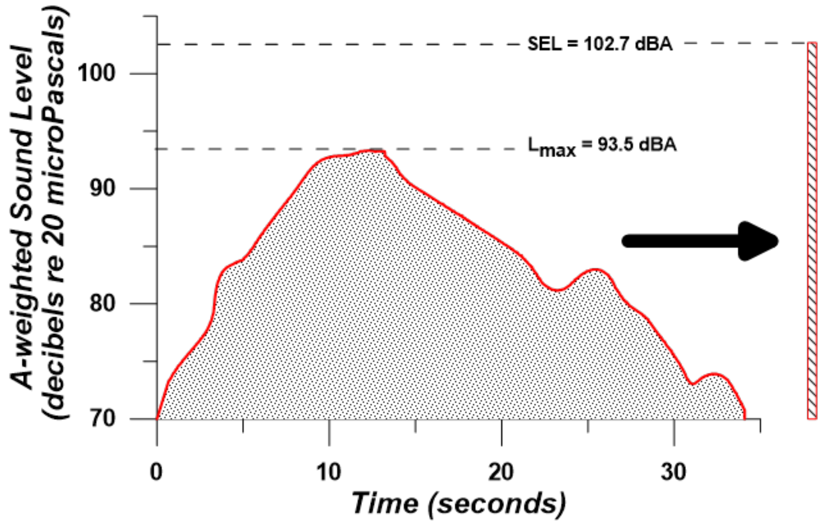


Figure C-4 Example Time History of Aircraft Noise Flyover

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.

<u>Overpressure</u>

The single event metrics commonly used to assess supersonic noise from sonic booms are overpressure in pound(s) per square foot (psf) 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 mile for each 1,000 feet 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).

<u>C-Weighted Sound Exposure Level</u>

CSEL is SEL computed with C frequency weighting, which is similar to A-Weighting (see **Section C.2.1.2.2**) except that C-weighting places more emphasis on low frequencies below 1,000 Hz.

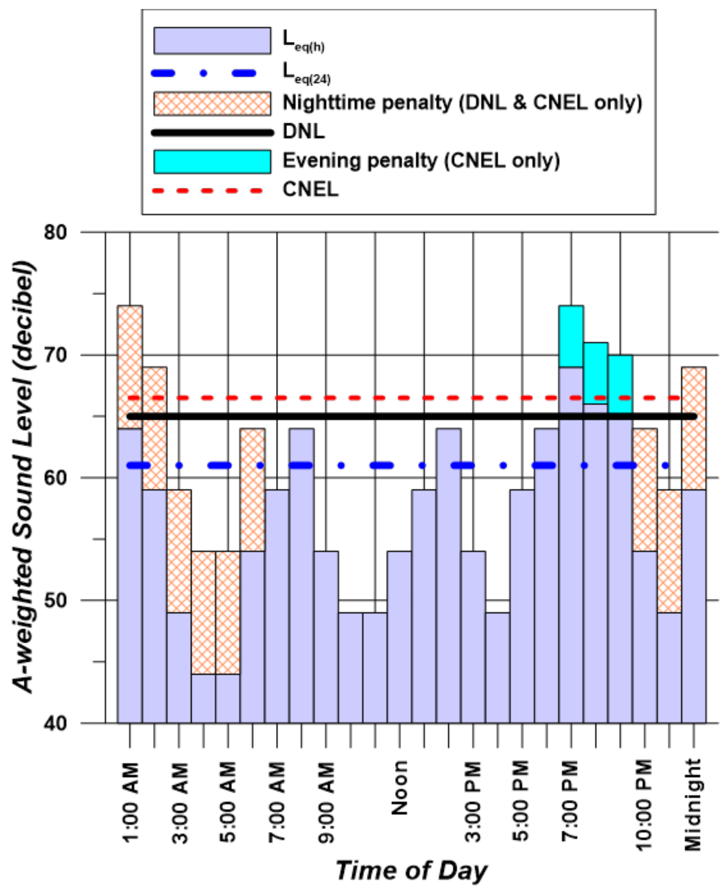
C.2.1.3.2 Cumulative Events

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.



Source: Wyle Laboratories

Figure C-5 Example of Equivalent Sound Level Over 24 Hours, DNL, and Community Noise Equivalent Level Computed from Hourly Equivalent Sound Levels

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.

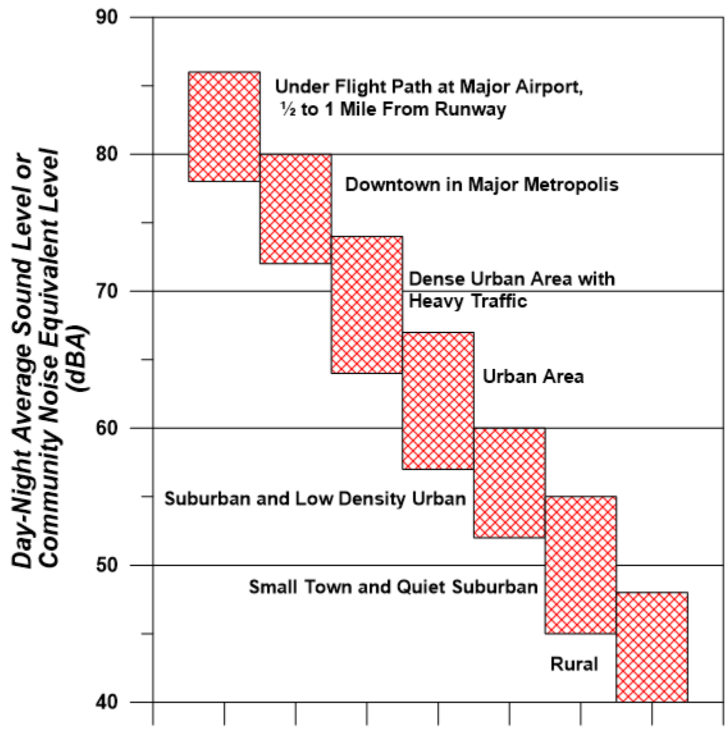
Figure C-6 shows the ranges of DNL or CNEL that occur in various types of communities. Under a flight path at a major airport, the DNL may exceed 80 dB while rural areas may experience DNL less than 45 dB. The decibel summation nature of these metrics causes the noise levels of the loudest events to 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).

Onset-Rate Adjusted Monthly Day-Night Average Sound Level and Onset-Rate Adjusted Monthly Community Noise Equivalent Level

Military aircraft utilizing SUA 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 SUA 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.



Source: DOD 1978.

Figure C-6 Typical Day-Night Average Sound Level or Community Noise Equivalent Level Ranges in Various Types of Communities

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 SUA 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.2.1.3.3 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.2.1.4 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.2.1.4.1 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.

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.

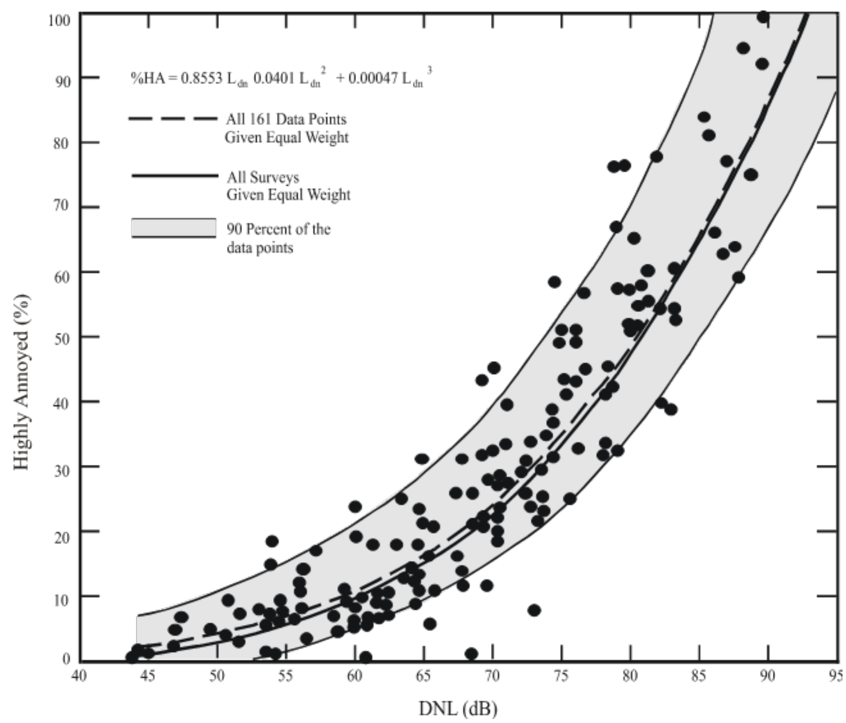


Figure C-7 Schultz Curve Relating Noise Annoyance to Day-Night Average Sound Level (Schultz, 1978)

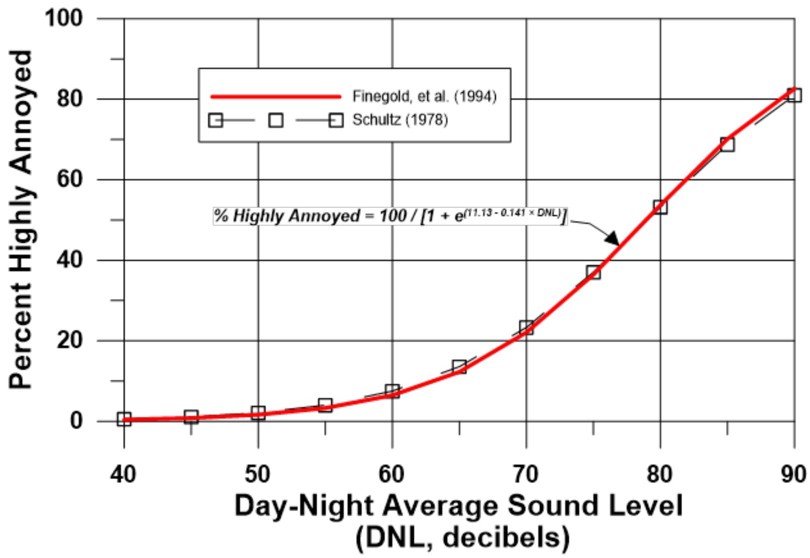


Figure C-8 Response of Communities to Noise; Comparison of Original Schultz (1978) with Finegold et al. (1994)

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 non-acoustical factors. Newman and Beattie (1985) divided the non-acoustic factors into the emotional and physical variables shown in **Table C-5**.

Table C-1 Nonacoustic Variables Influencing Aircraft Noise Annoyance

Emotional Variables
Feeling about the necessity or preventability of the noise
Judgment 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 non-acoustical 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-6** 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			
	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.

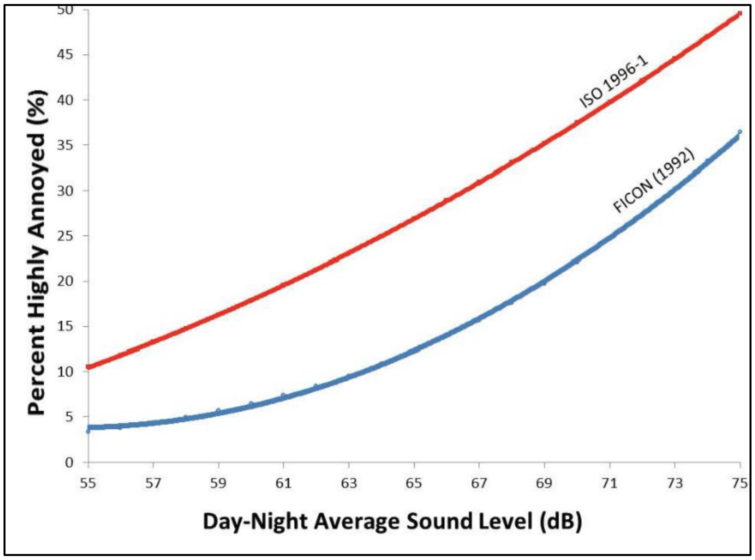


Figure C-9 Percent Highly Annoyed Comparison of International Standard 1996-1 to Federal Interagency Committee on Noise (1992)

C.2.1.4.2 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.

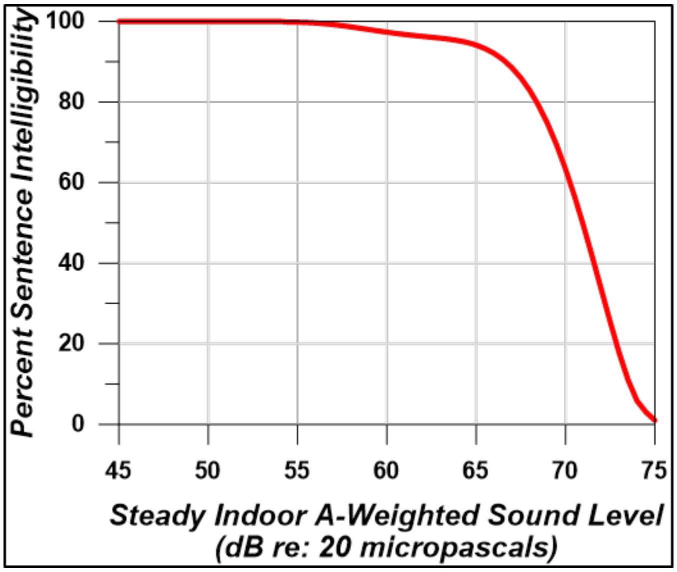


Figure C-10 Speech Intelligibility Curve

(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-7 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.

C.2.1.4.3 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.

Initial Studies

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 non-acoustic 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.

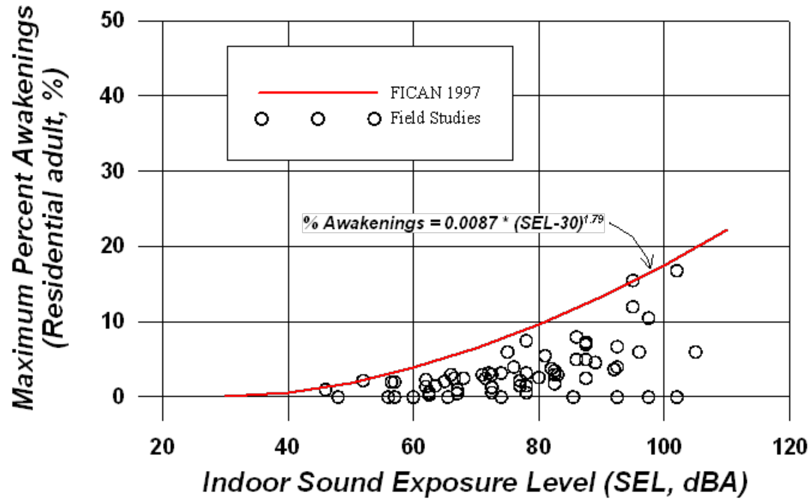
Recent Sleep Disturbance Research ‑ Field and Laboratory Studies

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 non-noise 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).



Source: FICAN 1997

Figure C-11 Federal Interagency Committee on Aviation Noise 1997 Recommended Sleep Disturbance Dose-Response Relationship

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.

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-8**.

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

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).

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.2.1.4.4 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.

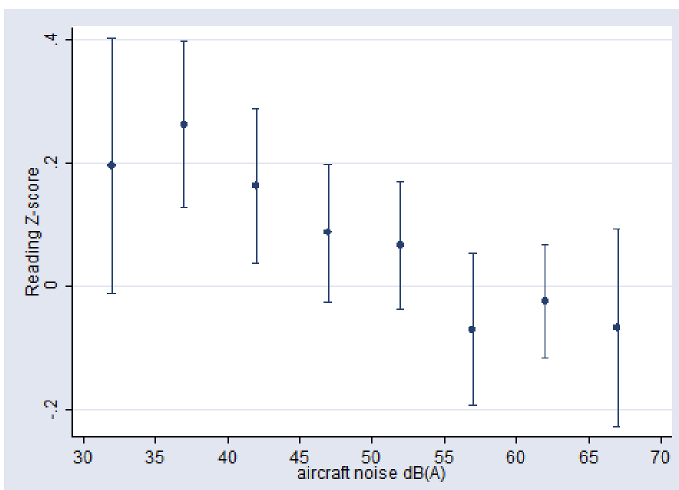
A longitudinal study reported by Evans et al. (1998), conducted prior to relocation of the old Munich airport in 1992, reported that high noise exposure was associated with deficits in long-term memory and reading comprehension in children with a mean age of 10.8 years. Two years after the closure of 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.

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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.2.1.4.5 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 ability 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.

Domestic Animals

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.

C.2.2 Noise Models

This section summarizes analysis tools used to calculate the noise levels, as applicable to the Proposed Action evaluated in the EA.

C.2.2.1 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, 2022a, 2022b). 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.

C.2.2.2 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, 1997). In this report, MR_NMAP Version 3.0 (Ikelheimer, 2013) was used to model subsonic aircraft noise in SUA. For airspace environments where noise levels are calculated to be less than 45 dB, noise levels are stated as "<45 dB."

C.2.2.3 Military Training Routes in the Study Area

MTRs and their route segments that cross the study area under the RAN2A MOA, which were modeled as part of the noise analysis, include: VR-1122 (Segment B-D)/VR-1123 (Segment D-F), VR-140 (Segment D-E), VR-168 (Segment D-E), and IR-149 (Segment A-B). Aircraft operations and flight conditions for these MTRs, representing Existing Conditions and the Proposed Action, are shown in **Tables C-5** through **Table C-8**, except for IR-149 which has no utilization. Corresponding aircraft altitude utilizations on these MTRs are as follows (note that the modeled reference elevation of the RAN2A MOA is 930 feet above MSL).

F-16C operations on VR-1122 (B-D) and VR-1123 (D-F) have the following altitude distribution:

- 100 to 500 feet AGL (0 percent)
- 500 feet AGL (100 percent)
- Above 500 feet AGL (0 percent)

T-38C operations on VR-140 (D-E) have the following altitude distribution:

- 0 to 500 feet AGL (0 percent)
- 500 to 1,000 feet AGL (40 percent)
- 1,000 to 2,000 feet AGL (20 percent)
- 2,000 to 3,000 feet MSL (20 percent)
- 3,000 to 4,000 feet MSL (20 percent)

T-44C and T-45 operations on VR-168 have the following altitude distribution:

- 0 to 300 feet AGL (0 percent)
- 300 to 500 feet AGL (15 percent)
- 500 to 1,000 feet AGL (25 percent)
- 1,000 to 2,000 feet AGL (25 percent)
- 2,000 to 3,000 feet AGL (25 percent)
- 3,000 to 4,000 feet AGL (10 percent)

These existing and proposed operations along with their associated average airspeeds, power settings, and altitude distributions were the inputs to the MTR noise models.

Table C-5 Existing and Proposed F-16C Annual Operations on VR-1122/VR-1123

VR-1122 (B-D) / VR-1123 (D-F)			F-16C			
Segment	Existing (feet AGL)		Annual Operations [1]		Average Speed (knots)	Average Power (percent NC)
	Floor	Ceiling	Day (7:00 a.m. to 10:00 p.m. local)	Night (10:00 p.m. to 7:00 a.m. local)		
B-D	100	1,500	16	0	500	90
D-F	100	1,500	16	0	500	90

Notes:
[1] One annual operation is one aircraft flying the route.

Table C-6 Existing and Proposed T-38C Annual Operations on VR-140

VR-140			T-38C			
Segment	Existing (feet)		Annual Operations [1]		Average Speed (knots)	Average Power (percent RPM)
	Floor (AGL)	Ceiling (MSL)	Day (7:00 a.m. to 10:00 p.m. local)	Night (10:00 p.m. to 7:00 a.m. local)		
D-E	500	4,000	197	0	350	95

Notes:
[1] One annual operation is one aircraft flying the route.

Table C-7 Existing and Proposed T-44C Annual Operations on VR-168

VR-168			T-44C			
Segment	Existing (feet MSL)		Annual Operations [1]		Average Speed (knots)	Average Power (percent RPM)
	Floor	Ceiling	Day (7:00 a.m. to 10:00 p.m. local)	Night (10:00 p.m. to 7:00 a.m. local)		
D-E	Surface	4,000	13	0	220	90

Notes:
[1] One annual operation is one aircraft flying the route.

Table C-8 Existing and Proposed T-45 Annual Operations on VR-168

VR-168			T-45			
Segment	Existing (feet MSL)		Annual Operations [1]		Average Speed (knots)	Average Power (percent RPM)
	Floor	Ceiling	Day (7:00 a.m. to 10:00 p.m. local)	Night (10:00 p.m. to 7:00 a.m. local)		
D-E	Surface	4,000	5	0	300	90

Notes:
[1] One annual operation is one aircraft flying the route.

C.2.3 References

American Speech-Language-Hearing Association. 2005. *Guidelines for Addressing Acoustics in Educational Settings*, *ASHA Working Group on Classroom Acoustics*.

ANSI. 1985. *Specification for Sound Level Meters, ANSI S1.4A-1985 Amendment to ANSI S1.4-1983*.

ANSI. 1988. *Quantities and Procedures for Description and Measurement of Environmental Sound: Part 1, ANSI S12.9-1988.*

ANSI. 1996. *Quantities and Procedures for Description and Measurement of Environmental Sound: Part 4, ANSI S12.9-1996.*

ANSI. 2002. *Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, ANSI S12.60-2002.*

ANSI. 2008. *Methods for Estimation of Awakenings with Outdoor Noise Events Heard in Homes, ANSI S12.9-2008/Part6.*

Basner, M., H. Buess, U. Miller, G. Platt, and A. Samuel. 2004. *Aircraft Noise Effects on Sleep: Final Results of DLR Laboratory and Field Studies of 2240 Polysomnographically Recorded Subject Nights.* Internoise 2004, The 33rd International Congress and Exposition on Noise Control Engineering, 22-25 August.

Basner M, U. Muller, and E.M. Elmenhorst. 2011. *Single and Combined Effects of Air, Road, and Rail Traffic Noise on Sleep and Recuperation*. Sleep 2011(34):11–23.

Berglund, B., and T. Lindvall, eds. 1995. *Community Noise*. Jannes Snabbtryck, Stockholm, Sweden.

Bowles, A.E. 1995. *Responses of Wildlife to Noise, In Wildlife and Recreationists: Coexistence through Management and Research*, R.L. Knight and K.J. Gutzwiller, eds. Island Press, Covelo, California, pp. 109-156.

Bradley J.S. 1985. *Uniform Derivation of Optimum Conditions for Speech in Rooms*. National Research Council, Building Research Note, BRN 239, Ottawa, Canada.

Bradley, J.S. 1993. *NRC-CNRC NEF Validation Study: Review of Aircraft Noise and its Effects*. National Research Council Canada and Transport Canada, Contract Report A-1505.5.

Bronzaft, A.L., and D.P. McCarthy. 1975. *The Effects of Elevated Train Noise on Reading Ability*. Journal Environment and Behavior 7:517-527.

Clark, C., R. Crombie, J. Head, I. van Kamp, E. van Kempen, and S.A. Stansfeld. 2012. *Does Traffic-Related Air Pollution Explain Associations of Aircraft and Road Traffic Noise Exposure on Children's Health and Cognition?* A Secondary Analysis of the United Kingdom Sample from the RANCH Project. American Journal of Epidemiology 176(4):327–337.

Clark, C., R. Martin, E. van Kempen, T. Alfred, J. Head, H.W. Davies, M.M. Haines, I.L. Barrio, M. Matheson, and S.A. Stansfeld. 2005. *Exposure-Effect Relations Between Aircraft and Road Traffic Noise Exposure at School and Reading Comprehension: the RANCH Project.* American Journal of Epidemiology 163:27-37.

Clark, C., S.A. Stansfeld, and J. Head. 2009. *The Long-Term Effects of Aircraft Noise Exposure on Children's Cognition: Findings from the UK RANCH Follow-Up Study*. In Proceedings of the Euronoise Conference. Edinburgh, Scotland. October.

Cohen, S., D.C. Glass, and J.E. Singer. 1973. *Apartment Noise, Auditory Discrimination, and Reading Ability in Children.* Journal of Experimental Social Psychology 9:407-422.

Cohen, S., G.W. Evans, D.S. Krantz. 1980. *Physiological, Motivational, and Cognitive Effects of Aircraft Noise on Children: Moving from Laboratory to Field*. American Psychologist 35:231-243.

Cohen, S., G.W. Evans, D.S. Krantz. 1981. *Aircraft Noise and Children: Longitudinal and Cross-sectional Evidence on Adaptation to Noise and the Effectiveness of Noise Abatement*. Journal of Personality and Social Psychology 40:331-345.

Cottereau, P. 1978. *The Effect of Sonic Boom from Aircraft on Wildlife and Animal Husbandry, In Effects of Noise on Wildlife*, Academic Press, New York, New York, pp. 63-79.

Czech, J.J., and K.J. Plotkin. 1998. NMAP 7.0 User's Manual. Wyle Research Report WR 98-13. Wyle Laboratories, Inc. November.

DoD. 2009a. *Improving Aviation Noise Planning, Analysis, and Public Communication with Supplemental Metrics*. Defense Noise Working Group Technical Bulletin, December.

DoD. 2009b. *Sleep Disturbance from Aviation Noise*. Defense Noise Working Group Technical Bulletin, December.

Eagan, M.E., G. Anderson, B. Nicholas, R. Horonjeff, and T. Tivnan. 2004. *Relation Between Aircraft Noise Reduction in Schools and Standardized Test Scores*. Washington, DC, FICAN.

Evans, G.W., M. Bullinger, and S. Hygge. 1998. *Chronic Noise Exposure and Physiological Response: A Prospective Study of Children Living under Environmental Stress*. Psychological Science 9:75-77.

FAA. 1985. *Airport Improvement Program (AIP) Handbook*. Order No. 100.38.

FICAN. 1997. *Effects of Aviation Noise on Awakenings from Sleep*. June.

FICAN. 2007. *Findings of the FICAN Pilot Study on the Relationship Between Aircraft Noise Reduction and Changes in Standardised Test Scores*. Washington, DC, FICAN.

FICAN. 2008. *FICAN Recommendation for use of ANSI Standard to Predict Awakenings from Aircraft Noise*. December.

FICON. 1992. *Federal Agency Review of Selected Airport Noise Analysis Issues*. August.

Fidell, S., and L. Silvati. 2004. *Parsimonious Alternatives to Regression Analysis for Characterizing Prevalence Rates of Aircraft Noise Annoyance.* Noise Control Engineering Journal 52:56–68.

Fidell, S., K. Pearsons, B. Tabachnick, R. Howe, L. Silvati, and D.S. Barber. 1995a. *Field Study of Noise-Induced Sleep Disturbance*. Journal of the Acoustical Society of America 98(2):1025-1033.

Fidell, S., K. Pearsons, R. Howe, B. Tabachnick, L. Silvati, and D.S. Barber. 1994. *Noise-Induced Sleep Disturbance in Residential Settings*. AL/OE-TR-1994-0131, Wright Patterson AFB, OH, Armstrong Laboratory, Occupational and Environmental Health Division.

Fidell, S., R. Howe, B. Tabachnick, K. Pearsons, and M. Sneddon. 1995b. *Noise-induced Sleep Disturbance in Residences near Two Civil Airports.* NASA Contractor Report 198252.

Finegold, L.S., C.S. Harris, and H.E. von Gierke. 1994. *Community Annoyance and Sleep Disturbance: Updated Criteria for Assessing the Impact of General Transportation Noise on People*. Noise Control Engineering Journal 42(1):25-30.

Green, K.B., B.S. Pasternack, and R.E. Shore. 1982. *Effects of Aircraft Noise on Reading Ability of School-Age Children.* Archives of Environmental Health 37(1):24-31.

Griefahn, B. 1978. *Research on Noise Disturbed Sleep Since 1973*. Proceedings of Third International Congress on Noise as a Public Health Problem, pp. 377-390 (as appears in NRC-CNRC NEF Validation Study: (2) Review of Aircraft Noise and Its Effects, A-1505.1, p. 31).

Haines, M.M., S.A. Stansfeld, J. Head, and R.F.S. Job. 2002. *Multilevel Modelling of Aircraft Noise on Performance Tests in Schools around Heathrow Airport London*. Journal of Epidemiology and Community Health 56:139-144.

Harris, C.M. 1979. *Handbook of Noise Control*. McGraw-Hill Book Co.

Horne, J.A., F.L. Pankhurst, L.A. Reyner, K. Hume, and I.D. Diamond. 1994. *A Field Study of Sleep Disturbance: Effects of Aircraft Noise and Other Factors on 5,742 Nights of Actimetrically Monitored Sleep in a Large Subject Sample*. American Sleep Disorders Association and Sleep Research Society: Sleep 17(2):146–195.

Ikelheimer, B. and M. Downing. 2013. MR_NMap Noise Model Improvements. Blue Ridge Research and Consulting Technical Report. 26 August.

Klatte M., K. Bergström, and T. Lachmann. 2013. *Does Noise Affect Learning? A Short Review on Noise Effects on Cognitive Performance in Children.* Frontiers in Psychology 4:578.

Lazarus, H. 1990. *New Methods for Describing and Assessing Direct Speech Communication Under Disturbing Conditions*. Environment International 16:373-392.

Lercher, P., G.W. Evans, and M. Meis. 2003. *Ambient Noise and Cognitive Processes Among Primary School Children.* Journal of Environment and Behavior 35:725-735.

Lind, S.J., K. Pearsons, and S. Fidell. 1998. *Sound Insulation Requirements for Mitigation of Aircraft Noise Impact on Highline School District Facilities*. Volume I, BBN Systems and Technologies, BBN Report No. 8240.

Lukas, J.S. 1978. *Noise and Sleep: A Literature Review and a Proposed Criterion for Assessing Effect*, In Daryl N. May, ed., *Handbook of Noise Assessment*, Van Nostrand Reinhold Company: New York, pp. 313-334.

Lucas, M.J., and P.T. Calamia. 1997. *Military Operating Area and Range Noise Model MR_NMAP User's Manual.* Wyle Research Report WR 94-12-R. Wyle Laboratories, Inc. March.

Manci, K.M., D.N. Gladwin, R. Villella, and M.G Cavendish. 1988. *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis*. US Fish and Wildlife Service National Ecology Research Center, Ft. Collins, CO, NERC-88/29. 88 pp.

Márki, F. 2013. *Outcomes of EU COSMA (Community Oriented Solutions to Minimise Aircraft Noise Annoyance) Project*. Budapest University of Technology and Economics, London, May.

Miedema, H.M., and C.G. Oudshoorn. 2001. *Annoyance from Transportation Noise: Relationships with Exposure Metrics DNL and DENL and Their Confidence Intervals*. Environmental Health Perspectives 109.4:409–416.

Miedema, H.M., and H. Vos. 1998. *Exposure-Response Relationships for Transportation Noise*. Journal of the Acoustical Society of America 104(6):3432–3445. December.

National Park Service. 1994. *Report to Congress: Report on Effects of Aircraft Overflights on the National Park System*. Prepared Pursuant to Public Law 100-91, The National Parks Overflights Act of 1987. 12 September.

NATO. 2000. *The Effects of Noise from Weapons and Sonic Booms, and the Impact on Humans, Wildlife, Domestic Animals and Structures*. Final Report of the Working Group Study Follow up Program to the Pilot Study on Aircraft Noise, Report No. 241, June.

Newman, J.S., and K.R. Beattie. 1985. *Aviation Noise Effects*. US Department of Transportation, Federal Aviation Administration Report No. FAA-EE-85-2.

Ollerhead, J.B., C.J. Jones, R.E. Cadoux, A. Woodley, B.J. Atkinson, J.A. Horne, F. Pankhurst, L. Reyner, K.I. Hume, F. Van, A. Watson, I.D. Diamond, P. Egger, D. Holmes, and J. McKean. 1992. *Report of a Field Study of Aircraft Noise and Sleep Disturbance*. Commissioned by the UK Department of Transport for the 36 UK Department of Safety, Environment and Engineering, London, England: Civil Aviation Authority, December.

Pearsons, K.S., D.S. Barber, and B.G. Tabachnick. 1989. *Analyses of the Predictability of Noise-Induced Sleep Disturbance*. US Air Force Report HSD-TR-89-029, October.

Plotkin, K.J., B.H. Sharp, T. Connor, R. Bassarab, I. Flindell, and D. Schreckenberg. 2011. *Updating and Supplementing the Day-Night Average Sound Level (DNL)*. Wyle Report 11-04, DOT/FAA/AEE/2011-03, June.

Rosenblith, W.A., K.N. Stevens, and Staff of Bolt, Beranek, and Newman. 1953. Handbook of Acoustic Noise Control, Vol. 2, Noise and Man. US Air Force Report WADC TR-52-204.

Schreckenberg, D. and R. Schuemer. 2010. *The Impact of Acoustical, Operational and Non-Auditory Factors on Short-Term Annoyance Due to Aircraft Noise*. Inter Noise 2010; Noise and Sustainability. 13 - 16 June 2010, Lisbon, Portugal.

Schultz, T.J. 1978. *Synthesis of Social Surveys on Noise Annoyance*. Journal of the Acoustical Society of America 64(2):377-405. August.

Sharp, B., T. Connor, D. McLaughlin, C. Clark, S. Stansfeld and J. Hervey. 2014. *Assessing Aircraft Noise Conditions Affecting Student Learning,* ACRP Web Document 16, http://www.trb.org/Aviation1/

Sharp, B.H., and K.J. Plotkin. 1984. *Selection of Noise Criteria for School Classrooms*. Wyle Research Technical Note TN 84-2 for the Port Authority of New York and New Jersey, October.

Smith, D.G., D.H. Ellis, and T.H. Johnston. 1988. *Raptors and Aircraft*, In R.L Glinski, B. Gron-Pendelton, M.B. Moss, M.N. LeFranc, Jr., B.A. Millsap, and S.W. Hoffman, eds., Proceedings of the Southwest Raptor Management Symposium, National Wildlife Federation, Washington, D.C., pp. 360-367.

Stansfeld, S.A. and C. Clark. 2015. *Health Effects of Noise Exposure in Children*. Current Environmental Health Reports 2(2):171-178.

Stansfeld, S.A., B. Berglund, and C. Clark, I. Lopez-Barrio, P. Fischer, E. Öhrström, M.M. Haines, J. Head, S. Hygge, and I. van Kamp, B.F. Berry, on Behalf of the RANCH Study Team. 2005. *Aircraft and Road Traffic Noise and Children's Cognition and Health: A Cross-National Study.* Lancet 365:1942-1949.

Stevens, K.N., W.A. Rosenblith, and R.H. Bolt. 1953. *Neighborhood Reaction to Noise: A Survey and Correlation of Case Histories (A)*. Journal of the Acoustical Society of America 25:833.

Stusnick, E., K.A. Bradley, J.A. Molino, and G. DeMiranda. 1992. *The Effect of Onset Rate on Aircraft Noise Annoyance, Volume 2: Rented Home Experiment.* Wyle Laboratories Research Report WR 92-3, March.

UKDfES. 2003. *Building Bulletin 93, Acoustic Design of Schools - A Design Guide*. London: The Stationary Office.

USEPA. 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. USEPA Report 550/9 74-004, March.

USEPA. 1978. *Protective Noise Levels*. Office of Noise Abatement and Control, Washington, DC. USEPA Report 550/9-79-100, November.

Wasmer, F. and F. Maunsell. 2022a. BaseOps 7.369 User’s Guide. Wasmer Consulting.

Wasmer, F. and F. Maunsell. 2022b. NMPlot 4.974 User's Guide. Wasmer Consulting.

Wesler, J.E. 1986. *Priority Selection of Schools for Soundproofing*. Wyle Research Technical Note TN 96 8 for the Port Authority of New York and New Jersey, October.

WHO. 1999. *Guidelines for Community Noise*. Berglund, B., T. Lindvall, and D. Schwela, eds.

Wyle Laboratories. 1971. *Supporting Information for the Adopted Noise Regulations for California Airports*. Wyle Report WCR 70-3(R)

C.3 AIR QUALITY

Air quality is an indicator of the suitability of the atmosphere to support human life and the environment, generally described in terms of the types and levels of air pollutants present in outdoor air. This appendix presents an overview of the Clean Air Act (CAA) and the relevant state of Texas air quality regulations or standards. It also presents emissions calculations and key assumptions used for the air quality analyses presented in the Air Quality sections of this EA.

C.3.1 Criteria Pollutants and National Ambient Air Quality Standards

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, National Ambient Air Quality 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 USEPA has divided the country into geographical regions known as Air Quality Control Regions (AQCRs) to evaluate compliance with the NAAQS. In accordance with CAA requirements, the air quality in the AQCR 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 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-9**.

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. Ammonia (NH_3), for example, is evaluated as a precursor of $PM_{2.5}$. 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 are identified for ultimate control.

Table C-9 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)			
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

Notes:

Source: USEPA, 2023a

[1] In February 2010, the USEPA established a new 1-hour standard for NO_2 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.

[2] 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.

[3] In November 2008, USEPA revised the primary Pb standard to 0.15 μg/m^3. USEPA revised the averaging time to a rolling 3-month average.

[4] In October 2006, USEPA revised the level of the 24-hour $PM_{2.5}$ standard to 35 μg/m^3 and retained the level of the annual $PM_{2.5}$ standard at 15 μg/m^3. In 2012, USEPA split standards for primary & secondary annual $PM_{2.5}$. 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 PM_{10}.

[5] 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 SO_2 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.

[6] Parenthetical value is an approximately equivalent concentration for NO_2, O_3, and SO_2.

μg/m^3 = microgram(s) per cubic meter; mg/m^3 = milligram(s) per cubic meter; ppm = part(s) per million; USEPA = United States Environmental Protection Agency

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. The Texas Commission on Environmental Quality oversees the state’s air pollution control program under the authority of the federal CAA and Amendments, federal regulations, and state laws. Texas has adopted the federal NAAQS (TAC Title 30 § 101.21). Each AQCR has regulatory areas that are designated as an attainment area or nonattainment area for each of the criteria pollutants depending on whether it meets or exceeds the NAAQS. Areas designated as "attainment" have demonstrated compliance with NAAQS. An area is designated as unclassified if there is insufficient information for a compliance determination. Maintenance areas are those that were previously designated nonattainment but are now in compliance with the NAAQS. 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 Region of Influence (ROI) for air quality includes the RAN2A MOA airspace that overlays portions of Bandera, Frio, Medina, Real, Uvalde, and Zavala Counties in Texas, all of which are in the Metropolitan San Antonio Intrastate AQCR (40 CFR § 81.40). The ROI also includes the airspace over portions of Uvalde and Zavala county that are crossed by certain segments of the Military Training Routes (MTRs) VR-140 and VR-1122. The AQCR comprising of these underlying counties in the ROI are in attainment (or is unclassifiable) for each of the criteria pollutants regulated under the NAAQS (40 CFR 81.344). As such these areas are anticipated to have relatively good air quality (currently not in near-nonattainment or maintenance for any criteria pollutants).

For determining potential air quality impacts, it is the volume of air extending up to the mixing height (3,000 feet AGL) and coinciding with the spatial distribution of the ROIs that is considered. Because the Proposed Action is intended entirely in airspaces, and not at airfields, this impact analysis does not include landing and takeoff (LTO) and touch and go (TGO) cycles. Also not considered in the air quality analysis are the ground support and fueling activities that take place at the airfield, or personnel commutes.

State Implementation Program

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. Maintenance areas are subject to a maintenance plan to ensure that compliance is maintained. To demonstrate progress toward attainment or maintenance status, 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. Air monitoring stations collect representative data that indicates how much of a pollutant is in the air. Texas has one of the most robust air monitoring networks in the country consisting of over 200 monitoring stations (Texas Commission on Environmental Quality [TCEQ], 2024).

Conformity Rules

The CAA required the USEPA draft general conformity regulations that are applicable in nonattainment areas, or in designated maintenance areas. 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. The General Conformity Rule would not apply to this Proposed Action because the ROI that includes the multiple counties underlying the proposed MOA is in attainment with the NAAQS for all criteria pollutants.

New Source Performance Standards

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. For stationary sources, the CAA establishes New Source Performance Standards for specific source categories. Standards and compliance requirements are listed in Title 40 CFR Parts 60 - 61. 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. The proposed operations within the airspace are classified as mobile source of emissions. As such, the requirements originating from Titles I and V are applicable only to stationary sources and would not apply for the proposed airspace operations.

Prevention of Significant Deterioration

Prevention of Significant Deterioration (PSD) applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is in attainment or unclassifiable with the NAAQS (USEPA, 2023b). The rule is to ensure that these sources are constructed or modified without causing significant adverse deterioration of the clean air in the area. Sources subject to PSD review are required to obtain a permit before commencing construction. The permit process requires an extensive air quality review of all other major sources within a 50-mile radius and all Class 1 areas within a 62-mile radius of the facility. Emissions from any new or modified source must be controlled using the maximum degree of control that can be achieved. The air quality, in combination with other PSD sources in the area, must not exceed the maximum allowable incremental increase as specified in the regulations. The rule also provides special protections for specific national parks or wilderness areas, known as Mandatory Federal Class 1 Areas (40 CFR Part 81), where any appreciable deterioration in air quality is considered significant. Class 1 areas are given special air quality and visibility protection under the CAA. 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 of any Class 1 area (wilderness area greater than 5,000 acres or national park greater than 6,000 acres). 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.

The proposed RAN2A MOA is not located within 100 kilometers (62 miles) of any USEPA-designated Class 1 areas protected by the Regional Haze Rule. No Class 1 areas would be affected by emissions associated with the Proposed Action. The two designated Class 1 areas in Texas, Big Bend National Park and Guadalupe Mountains National Park, are approximately 300 miles from the ROI and would not be affected by emissions associated with the Proposed Action.

There are no major sources associated with the Proposed Action, thus, PSD does not apply. Mobile sources, including those from aircraft emissions are generally not part of the PSD permit review process.

C.3.2 Greenhouse Gases and Climate Change Considerations

Greenhouse gases (GHGs) are gases, occurring from natural processes and human activities, that trap heat in the atmosphere. Natural sources of GHGs include land use, such as through deforestation, land clearing for agriculture, and degradation of soils. The largest source of GHGs from human activities in the United States is from burning fossil fuels for electricity, heat, and transportation. Combustion of fossil fuels (coal, oil, and natural gas) primarily generate three main GHGs: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). These three GHGs alone represent more than 97 percent of the United States' total GHG emissions (USEPA, 2024). GHGs are generally not a concern to human health at normal ambient levels and can potentially cause warming of the climatic system only at a cumulative global scale.

Emissions from GHG 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 on 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 CO_2. The larger the GWP, the more that a given gas warms the Earth compared with CO_2 over the same time period. Analysts cumulatively compare emission estimates of different gases using standardized GWPs.

Climate change is the variation in the Earth's climate (including temperature, precipitation, humidity, wind, and other meteorological variables) over time. Climate change is primarily driven by accumulation of GHGs in the atmosphere caused by the increased consumption of fossil fuels (e.g., coal, petroleum, and natural gas) since the early beginnings of the industrial age and accelerating in the mid- to late-20th century (IPCC, 2021). Human activities are altering the carbon cycle–both by adding more CO_2 to the atmosphere and by influencing the ability of natural sinks, like forests and soils, to remove and store CO_2 from the atmosphere (USEPA, 2024). Human-induced climate change is already affecting many weather and climate extremes in every region across the globe, resulting in observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones (IPCC, 2021).

C.3.3 Air Conformity Applicability Analysis

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-10)**, 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-10 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
CO, 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, 2022

C.3.4 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* (Air Force, 2020), 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 a Proposed Action 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 are below the corresponding *de minimis* threshold values, General Conformity Rule requirements would not be applicable. The net emissions from the Proposed Action Alternatives are assessed in the EA and compared with applicable insignificance indicators.

<u>GHG and Climate Change</u>

The Air Conformity Applicability Model (ACAM) (5.0.23a) was used to evaluate GHG emissions. The methodology in ACAM for assessing GHG emissions is based on recent CEQ guidance on the consideration of GHG emissions and Climate Change for proposed actions under NEPA (CEQ, 2023).

A GHG Emissions Evaluation establishes the quantity of speciated GHGs and CO_2e, determines if an action's emissions are insignificant, and provides a relative significance comparison. For the analysis, the PSD threshold for GHG of 75,000 tpy of CO_2e (or 68,039 metric tpy) was used as an indicator or "threshold of insignificance" for NEPA air quality impacts in all areas. This indicator does not define a significant impact; however, it provides a threshold to identify actions that are insignificant (*de minimis*, too trivial or minor to merit consideration). Actions with a net change in GHG (CO_2e) emissions below the insignificance indicator (threshold) are considered too insignificant on a global scale to warrant any further analysis. Note that actions with a net change in GHG (CO_2e) emissions above the insignificance indicator (threshold) are only considered potentially significant and require further assessment to determine if the action poses a significant impact. The action related GHGs have no significant impact to local air quality. However, from a global perspective, individual actions with GHG emissions each make a relatively small addition to global atmospheric GHG concentrations that collectively may have a large effect on climate change. If activities have *de minimis* (insignificant) GHG emissions, then on a global scale they are effectively zero and irrelevant (AFCEC, 2023).

C.3.5 Emissions Calculations and Assumptions

The following assumptions were used in the air quality analysis for the Proposed Action:

1. No construction would be associated with the Proposed Action. This includes no demolition, earth moving, hauling, or paving.
2. No installation of new air emission sources or modification of existing emission sources at JBSA Randolph would be associated with the Proposed Action.
3. For the purposes of ACAM, aircraft flight operations were assumed to start January 2028. Emissions were estimated for the Proposed Action in ACAM beginning in January 2028, with 2033 and beyond being considered “steady state”.
4. Air quality evaluation accounts for operations of T-38Cs and T-7As based on a transition schedule starting in 2028 when the use of T-7As would come into effect and ending in 2033 when T-38Cs would be completely phased out.
5. The projected timeline for delivery of T-7As and the transition of T-38Cs to T-7As were based on data collected through email correspondences with Air Education and Training Command (AETC) in 2023 and 2024 (AETC, 2023; AETC, 2024). Based on AETC data and information in the *JBSA T-7A Recapitalization Final EIS* (DAF, 2022), the projected number of aircraft and aircraft operations were estimated for use in ACAM. The ACAM input data, as shown in **Table C-11**, was used to estimate emissions for conducting air quality impact analysis.
6. Net change in annual operational emissions for the proposed alternatives were estimated in ACAM by adding or removing activities related to RAN2A Low MOA operations, as necessary. The total estimated net change in emissions calculated in ACAM is used for analyzing air quality impacts for the proposed alternatives.
7. Mixing height of 3,000 feet (this matches USEPA and DAF Guidance) was assumed. For consideration of potential air quality impacts, it is the volume of air extending up to the mixing height (3,000 feet 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 feet AGL is an acceptable default value (40 CFR § 93.153[c][2]).

8. Certain MTRs would be used by aircraft originating from various installations. Flights traveling to and from the RAN2A Low MOA airspace are assumed to operate at altitudes above mixing height of 3,000 feet AGL and are thus not considered in the analyses.

9. Aircraft emissions at or below 3,000 feet AGL do not appreciably differ by altitude. In other words, the emissions rate at 3,000 feet AGL is assumed to be the same as that at 500 feet AGL. Moreover, ACAM does not distinguish between aircraft operations at different altitudes.

10. ACAM does not have separate inputs for time spent within any given airspace. To represent the time spent at or below 3,000 feet, time spent in minutes for each airspace was assigned to Climb out/Intermediate power 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 TGOs; however, all inputs for these fields were set to zero for time spent within the SUA.

11. The noise data validation package includes flight operations data for existing operations in the RAN2A MOA and ATCAA, future operations proposed in the RAN2A MOA airspace, and certain segments of MTRs, VR-1122 / VR-1123, VR-140, VR-168, and IR-149 that exist under the RAN2A MOA. Air quality analysis for flight operations was based on noise data collected and compiled for RAN2A MOA airspace flight operations (for 0 to 3,000 feet AGL) air operations only.

12. Air quality analyses for flight operations was performed using operational data collected and compiled by the noise team for the airspace flight operations (0 to 3,000 feet AGL). Data were provided for annual operations by altitude band, engine power, airspeed, and time in minutes and percent time spent in airspace. Based on this information, ACAM input data for the total number of sorties and estimated total time spent at or below 3,000 feet AGL were estimated and are as shown in **Table C-12**.

13. Time-in-mode (TIM) estimates were calculated using the total distance traveled in each MTR and the average speed of the aircraft through the MTR segment.

Table C-11 Estimated Flight Operations and Number of Aircraft For RAN2A Low MOA

Aircraft	2028	2029	2030	2031	2032	2033
Cumulative Number of Aircraft that would be at JBSA-Randolph						
T-38C	97	96	85	78	62	0
T-7A	14	23	35	45	45	45
Total	**111**	**119**	**120**	**123**	**107**	**45**
Cumulative Annual Aircraft Operations at JBSA-Randolph						
T-38C	2,816	2,650	2,285	1,986	1,513	0
T-7A	104	270	635	934	1,407	2,920
Total	**2,920**	**2,920**	**2,920**	**2,920**	**2,920**	**2,920**

Source: T-7A delivery schedule and transition schedule based on e-mail correspondence with AETC (AETC 2023; AETC, 2024)

Table C-12 Air Conformity Applicability Model Data Inputs for RAN2A Low MOA

Airspace Type	Aircraft Type	Number of Sorties Per Year	Type of Operation	Estimated Time Spent at or Below 3,000 feet AGL Per Sortie (minutes)[5]
Existing Conditions: RAN2A MOA	T-38C	N/A[1]	All Sorties ≥3,000 feet AGL	N/A[1]
	F-16C	N/A[1]	All Sorties ≥3,000 feet AGL	
Alternative 1: RAN2A Low MOA	T-7A	2,920	Sorties at ≤3,000 feet AGL	18.8
	T-38C	Varies[2]	Sorties at ≤3,000 feet AGL	23.5
	F-16C	48	Sorties at ≤3,000 feet AGL	15
MTR (Segment)	**Aircraft Type**	**Number of Sorties Per Year**	**Type of Operation**	**Estimated Total Time Spent at or Below 3,000 feet AGL (minutes)[5]**
VR-1122 (B-D)	F-16C	16	Sorties at ≤3,000 feet AGL	6.5
VR-1123 (D-F)	F-16C	N/A[3]	Sorties at ≤3,000 feet AGL	N/A
VR-140 (D-E)	T-38C	197	Sorties at ≤3,000 feet AGL	4
VR-168 (D-E)	T-44C	13[4]	Sorties at ≤3,000 feet AGL	6.4
VR-168 (D-E)	T-45	N/A[4]	Sorties at ≤3,000 feet AGL	N/A
IR-149 (A-B)	T-38C	N/A[3]	Sorties at ≤3,000 feet AGL	N/A

Notes:
[1] Sorties occur above the atmospheric mixing height. Aircraft operations below 9,000 ft MSL are not currently permitted in the RAN2A MOA. No emissions are required to be calculated.
[2] Sorties are not shown in table as number of sorties will vary (decrease) by year due to phase-out of aircraft.
[3] No utilization (zero sorties), therefore no emissions are calculated.
[4] For T-44C, no change from baseline; emissions not estimated. For T-45, insufficient data to estimate time spent in airspace. No emissions were calculated.
[5] Time estimated per sortie is based on noise data provided.

C.3.6 References

Air Education and Training Command (AETC). 2023. *USAF/AETC e-mail correspondence and document*, *01_06_2023_T-7_Delivery_Schedule.pdf* from USAF/AETC, COREY L. ROTSCHAFER, Maj, USAF, Monday, September 25, 2023.

AETC. 2024. *USAF/AETC e-mail correspondence from USAF/AETC*, David Wilson, dated Friday, July 12, 2024.

Air Force Civil Engineer Center (AFCEC), Compliance Technical Support Branch (CZTQ). 2023. *DAF Greenhouse Gas (GHG) & Climate Change Assessment Guide*. December. <https://www.aqhelp.com/AQdocs.html. Accessed January 2024>.

Air Force. 2020. Air Force Air Quality EIAP Guide, Volume II - Advanced Assessments. July.

Council on Environmental Quality (CEQ). 2023. *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*.

<https://www.regulations.gov/document/CEQ-2022-0005-0001>. Accessed June 29, 2023.

DAF. 2022. *JBSA T-7A Recapitalization Final Environmental Impact Statement*. https://jbsa.t-7anepadocuments.com/documents. Accessed July 3, 2023.

Intergovernmental Panel on Climate Change (IPCC). 2021. *Intergovernmental Panel on Climate Change. Summary for Policymakers. Climate Change 2021: The Physical Science Basis*. Valerie Masson-Delmotte et al., eds

Texas Commission on Environmental Quality (TCEQ). 2024. *Air Quality and Monitoring, Ambient Air Monitoring*. <https://www.tceq.texas.gov/airquality/monops>. Website Last Modified 2023-08-22. Accessed September 2024.

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. 2022. *General Conformity: De Minimis Tables*. <https://www.epa.gov/general-conformity/de-minimis-tables>. July.

USEPA. 2023a. *NAAQS Table*. < https://www.epa.gov/criteria-air-pollutants/naaqs-table>. 15 March.

USEPA. 2023b. *Prevention of Significant Deterioration (PSD) Basic Information*. <https://www.epa.gov/nsr/prevention-significant-deterioration-basic-information> 23 January

USEPA. 2023c. USEPA's Annual *Inventory of U.S. Greenhouse Gas Emissions and Sinks* and the new *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2020.* https://cfpub.epa.gov/ghgdata/inventoryexplorer/#iallsectors/allsectors/allgas/inventsect/current. Accessed March 2023.

USEPA. 2024. *Overview of Greenhouse Gases*. https://www.epa.gov/ghgemissions/overview-greenhouse-gases. Accessed December 12, 2024.

DELIBERATIVE WORK PRODUCT – DO NOT DISTRIBUTE

C.3.7 Air Conformity Applicability Model (ACAM) Record of Air Analysis (ROAA), ACAM Social Cost GHG Report and ACAM Detail Report

C.3.7.1 Air Conformity Applicability Model Report (ACAM) - Record of Air Analysis (ROAA)

ALTERNATIVE 1 (SAME FOR ALTERNATIVE 2)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform a net change in emissions analysis to assess the potential air quality impact/s associated with the action. The analysis was performed in accordance with the Air Force Manual 32-7002, *Environmental Compliance and Pollution Prevention*; the *Environmental Impact Analysis Process* (EIAP, 32 CFR 989); the *General Conformity Rule* (GCR, 40 CFR 93 Subpart B); and the *USAF Air Quality Environmental Impact Analysis Process (EIAP) Guide*. This report provides a summary of the ACAM analysis.

Report generated with ACAM version: 5.0.23a

a. Action Location:
Base: RANDOLPH AFB
State: Texas
County(s): Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: RANDOLPH 2A LOW MILITARY OPERATIONS AREA SPECIAL USE AIRSPACE

c. Project Number/s (if applicable): N/A

d. Projected Action Start Date: 1 / 2028

e. Action Description:

Under the Proposed Action, the DAF would request the FAA to establish new, low-altitude training airspace under the existing RAN2A MOA. The proposed airspace would have a floor (i.e., minimum altitude) of 500 ft AGL to support low-altitude aircraft training operations.

Alternative 1 would implement the Proposed Action by establishing a new low-altitude airspace that would be designated as the RAN2A Low MOA. The proposed RAN2A Low MOA would be managed and operated separately from the existing RAN2A MOA and RAN2A ATCAA but could be combined with those airspaces, as needed, to support seamless flight operations from 500 ft AGL to FL 290. Training activities would occur in the new RAN2A Low MOA.

Alternative 2 would implement the Proposed Action by lowering the floor of the existing RAN2A MOA from 9,000 ft MSL to 500 ft AGL. The modified airspace would continue to be managed and operated as the RAN2A MOA. As needed, the modified airspace could be combined with the existing RAN2A ATCAA to support seamless flight operations from 500 ft AGL to FL 290. Training activities would occur within the modified RAN2A MOA.

Under the No Action Alternative, the proposed low-altitude MOA would not be established under the existing RAN2A MOA and existing conditions would continue. Pilots from JBSA-Randolph would continue to transit to the Brady MOA to conduct low-altitude training, resulting in operational inefficiencies and continuing to limit time spent in actual training. Low-altitude training in the Brady MOA would also continue to be susceptible to adverse weather conditions because no alternative low-altitude training MOA is available. Finally, pilots from JBSA-Randolph would continue to receive third-level priority for training time in the Brady MOA over other DoD units.

f. Point of Contact:

Name: Rahul Chettri
Title: AQ Specialist
Organization: Versar Global Services
Email: rchettri@versar.com
Phone Number: (757) 557-0810

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the GCR are:

_____ applicable
__X__ not applicable

Total reasonably foreseeable 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" (SS, no net gain/loss in emission stabilized and the action is fully implemented) emissions. The ACAM analysis uses 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 the proposed Action's potential impacts to local air quality. The insignificance indicators are trivial (de minimis) rate thresholds that have been demonstrated to have little to no impact to air quality. These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold and 25 ton/yr for lead for actions occurring in areas that are "Attainment" (attainment, not exceeding any National Ambient Air Quality Standard (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 pollutants is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQS. For further detail on insignificance indicators, refer to *Level II, Air Quality Quantitative Assessment, Insignificance Indicators*.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicators and are summarized below.

Analysis Summary:

2028

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	3.421	250	No
NOx	3.586	250	No
CO	74.118	250	No
SOx	1.375	250	No
PM 10	2.101	250	No
PM 2.5	1.889	250	No
Pb	0.000	25	No
NH3	0.000	250	No

2029

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	3.650	250	No
NOx	6.556	250	No

CO	70.056	250	No
SOx	1.499	250	No
PM 10	2.004	250	No
PM 2.5	1.800	250	No
Pb	0.000	25	No
NH3	0.000	250	No

2030

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	4.155	250	No
NOx	13.090	250	No
CO	61.121	250	No
SOx	1.773	250	No
PM 10	1.790	250	No
PM 2.5	1.605	250	No
Pb	0.000	25	No
NH3	0.000	250	No

2031

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	4.568	250	No
NOx	18.441	250	No
CO	53.804	250	No
SOx	1.997	250	No
PM 10	1.615	250	No
PM 2.5	1.445	250	No
Pb	0.000	25	No
NH3	0.000	250	No

2032

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	5.222	250	No
NOx	26.906	250	No
CO	42.227	250	No
SOx	2.352	250	No
PM 10	1.337	250	No
PM 2.5	1.192	250	No
Pb	0.000	25	No
NH3	0.000	250	No

2033

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	7.314	250	No
NOx	53.984	250	No
CO	5.195	250	No
SOx	3.486	250	No
PM 10	0.450	250	No

PM 2.5	0.383	250	No
Pb	0.000	25	No
NH3	0.000	250	No

2034 - (Steady State)

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	7.314	250	No
NOx	53.984	250	No
CO	5.195	250	No
SOx	3.486	250	No
PM 10	0.450	250	No
PM 2.5	0.383	250	No
Pb	0.000	25	No
NH3	0.000	250	No

None of the estimated annual net emissions associated with this action are above the insignificance indicators; therefore, the action will not cause or contribute to an exceedance of one or more NAAQSs and will have an insignificant impact on air quality. No further air assessment is needed.

Rahul Chettri, AQ Specialist — Aug 30 2024

Name, Title — **Date**

C.3.7.2 Air Conformity Applicability Model Report (ACAM) - Greenhouse Gas (GHG) Emissions and Social Cost (SC) GHG Analysis

ALTERNATIVE 1 (SAME FOR ALTERNAITVE 2)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to estimate GHG emissions and assess the theoretical Social Cost of Greenhouse Gases (SC GHG) associated with the action. The analysis was performed 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 USAF Air Quality Environmental Impact Analysis Process (EIAP) Guide. This report provides a summary of GHG emissions and SC GHG analysis.

Report generated with ACAM version: 5.0.23a

a. Action Location:
Base: RANDOLPH AFB
State: Texas
County(s): Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: RANDOLPH 2A LOW MILITARY OPERATIONS AREA SPECIAL USE AIRSPACE

c. Project Number/s (if applicable): N/A

d. Projected Action Start Date: 1 / 2028

e. Action Description:

Under the Proposed Action, the DAF would request the FAA to establish new, low-altitude training airspace under the existing RAN2A MOA. The proposed airspace would have a floor (i.e., minimum altitude) of 500 ft AGL to support low-altitude aircraft training operations.

Alternative 1 would implement the Proposed Action by establishing a new low-altitude airspace that would be designated as the RAN2A Low MOA. The proposed RAN2A Low MOA would be managed and operated separately from the existing RAN2A MOA and RAN2A ATCAA but could be combined with those airspaces, as needed, to support seamless flight operations from 500 ft AGL to FL 290. Training activities would occur in the new RAN2A Low MOA.

Alternative 2 would implement the Proposed Action by lowering the floor of the existing RAN2A MOA from 9,000 ft MSL to 500 ft AGL. The modified airspace would continue to be managed and operated as the RAN2A MOA. As needed, the modified airspace could be combined with the existing RAN2A ATCAA to support seamless flight operations from 500 ft AGL to FL 290. Training activities would occur within the modified RAN2A MOA.

Under the No Action Alternative, the proposed low-altitude MOA would not be established under the existing RAN2A MOA and existing conditions would continue. Pilots from JBSA-Randolph would continue to transit to the Brady MOA to conduct low-altitude training, resulting in operational inefficiencies and continuing to limit time spent in actual training. Low-altitude training in the Brady MOA would also continue to be susceptible to adverse weather conditions because no alternative low-altitude training MOA is available. Finally, pilots from JBSA-Randolph would continue to receive third-level priority for training time in the Brady MOA over other DoD units.

f. Point of Contact:
Name: Rahul Chettri

Title: AQ Specialist
Organization: Versar Global Services
Email: rchettri@versar.com
Phone Number: (757) 557-0810

2. Analysis: Total combined direct and indirect GHG emissions associated with the action were estimated through ACAM on a calendar-year basis from the action start through the expected life cycle of the action. The life cycle for Air Force actions with "steady state" emissions (SS, net gain/loss in emission stabilized and the action is fully implemented) is assumed to be 10 years beyond the SS emissions year or 20 years beyond SS emissions year for aircraft operations related actions.

GHG Emissions Analysis Summary:

GHGs produced by fossil-fuel combustion are primarily carbon dioxide (CO2), methane (CH4), and nitrous oxide (NO2). These three GHGs represent more than 97 percent of all U.S. GHG emissions. Emissions of GHGs are typically quantified and regulated in units of CO2 equivalents (CO2e). The CO2e takes into account the global warming potential (GWP) of each GHG. The GWP is the measure of a particular GHG's ability to absorb solar radiation as well as its residence time within the atmosphere. The GWP allows comparison of global warming impacts between different gases; the higher the GWP, the more that gas contributes to climate change in comparison to CO2. All GHG emissions estimates were derived from various emission sources using the methods, algorithms, emission factors, and GWPs from the most current Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and/or Air Emissions Guide for Air Force Transitory Sources.

The Air Force has adopted the Prevention of Significant Deterioration (PSD) threshold for GHG of 75,000 ton per year (ton/yr) of CO2e (or 68,039 metric ton per year, mton/yr) as an indicator or "threshold of insignificance" for NEPA air quality impacts in all areas. This indicator does not define a significant impact; however, it provides a threshold to identify actions that are insignificant (de minimis, too trivial or minor to merit consideration). Actions with a net change in GHG (CO2e) emissions below the insignificance indicator (threshold) are considered too insignificant on a global scale to warrant any further analysis. Note that actions with a net change in GHG (CO2e) emissions above the insignificance indicator (threshold) are only considered potentially significant and require further assessment to determine if the action poses a significant impact. For further detail on insignificance indicators see Level II, Air Quality Quantitative Assessment, Insignificance Indicators (April 2023).

The following table summarizes the action-related GHG emissions on a calendar-year basis through the projected life cycle of the action.

Action-Related Annual GHG Emissions (mton/yr)						
YEAR	CO2	CH4	N2O	CO2e	Threshold	Exceedance
2028	3,734	0.15699406	0.03062958	3,747	68,039	No
2029	4,072	0.17120461	0.03340206	4,086	68,039	No
2030	4,815	0.20246306	0.03950059	4,832	68,039	No
2031	5,424	0.22806202	0.04449495	5,443	68,039	No
2032	6,387	0.2685635	0.0523968	6,409	68,039	No
2033	9,468	0.39811143	0.07767163	9,501	68,039	No
2034 [SS Year]	9,468	0.39811143	0.07767163	9,501	68,039	No
2035	9,468	0.39811143	0.07767163	9,501	68,039	No
2036	9,468	0.39811143	0.07767163	9,501	68,039	No
2037	9,468	0.39811143	0.07767163	9,501	68,039	No
2038	9,468	0.39811143	0.07767163	9,501	68,039	No
2039	9,468	0.39811143	0.07767163	9,501	68,039	No
2040	9,468	0.39811143	0.07767163	9,501	68,039	No
2041	9,468	0.39811143	0.07767163	9,501	68,039	No
2042	9,468	0.39811143	0.07767163	9,501	68,039	No

2043	9,468	0.39811143	0.07767163	9,501	68,039	No
2044	9,468	0.39811143	0.07767163	9,501	68,039	No
2045	9,468	0.39811143	0.07767163	9,501	68,039	No
2046	9,468	0.39811143	0.07767163	9,501	68,039	No
2047	9,468	0.39811143	0.07767163	9,501	68,039	No
2048	9,468	0.39811143	0.07767163	9,501	68,039	No
2049	9,468	0.39811143	0.07767163	9,501	68,039	No
2050	9,468	0.39811143	0.07767163	9,501	68,039	No
2051	9,468	0.39811143	0.07767163	9,501	68,039	No
2052	9,468	0.39811143	0.07767163	9,501	68,039	No
2053	9,468	0.39811143	0.07767163	9,501	68,039	No
2054	9,468	0.39811143	0.07767163	9,501	68,039	No

The following U.S. and State’s GHG emissions estimates (next two tables) are based on a five-year average (2016 through 2020) of individual state-reported GHG emissions (Reference: State Climate Summaries 2022, NOAA National Centers for Environmental Information, National Oceanic and Atmospheric Administration. https://statesummaries.ncics.org/downloads/).

State’s Annual GHG Emissions (mton/yr)				
YEAR	CO2	CH4	N2O	CO2e
2028	700,652,689	3,554,625	135,896	704,343,210
2029	700,652,689	3,554,625	135,896	704,343,210
2030	700,652,689	3,554,625	135,896	704,343,210
2031	700,652,689	3,554,625	135,896	704,343,210
2032	700,652,689	3,554,625	135,896	704,343,210
2033	700,652,689	3,554,625	135,896	704,343,210
2034 [SS Year]	700,652,689	3,554,625	135,896	704,343,210
2035	700,652,689	3,554,625	135,896	704,343,210
2036	700,652,689	3,554,625	135,896	704,343,210
2037	700,652,689	3,554,625	135,896	704,343,210
2038	700,652,689	3,554,625	135,896	704,343,210
2039	700,652,689	3,554,625	135,896	704,343,210
2040	700,652,689	3,554,625	135,896	704,343,210
2041	700,652,689	3,554,625	135,896	704,343,210
2042	700,652,689	3,554,625	135,896	704,343,210
2043	700,652,689	3,554,625	135,896	704,343,210
2044	700,652,689	3,554,625	135,896	704,343,210
2045	700,652,689	3,554,625	135,896	704,343,210
2046	700,652,689	3,554,625	135,896	704,343,210
2047	700,652,689	3,554,625	135,896	704,343,210
2048	700,652,689	3,554,625	135,896	704,343,210
2049	700,652,689	3,554,625	135,896	704,343,210
2050	700,652,689	3,554,625	135,896	704,343,210
2051	700,652,689	3,554,625	135,896	704,343,210
2052	700,652,689	3,554,625	135,896	704,343,210
2053	700,652,689	3,554,625	135,896	704,343,210
2054	700,652,689	3,554,625	135,896	704,343,210

U.S. Annual GHG Emissions (mton/yr)				
YEAR	CO2	CH4	N2O	CO2e
2028	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2029	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2030	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2031	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2032	5,136,454,179	25,626,912	1,500,708	5,163,581,798

2033	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2034 [SS Year]	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2035	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2036	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2037	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2038	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2039	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2040	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2041	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2042	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2043	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2044	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2045	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2046	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2047	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2048	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2049	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2050	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2051	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2052	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2053	5,136,454,179	25,626,912	1,500,708	5,163,581,798
2054	5,136,454,179	25,626,912	1,500,708	5,163,581,798

GHG Relative Significance Assessment:

A Relative Significance Assessment uses the rule of reason and the concept of proportionality along with the consideration of the affected area (global, national, and regional) and the degree (intensity) of the proposed action's effects. The Relative Significance Assessment provides real-world context and allows for a reasoned choice against alternatives through a relative comparison analysis. The analysis weighs each alternative's annual net change in GHG emissions proportionally against (or relative to) global, national, and regional emissions.

The action's surroundings, circumstances, environment, and background (context associated with an action) provide the setting for evaluating the GHG intensity (impact significance). From an air quality perspective, context of an action is the local area's ambient air quality relative to meeting the NAAQSs, expressed as attainment, nonattainment, or maintenance areas (this designation is considered the attainment status). GHGs are non-hazardous to health at normal ambient concentrations and, at a cumulative global scale, action-related GHG emissions can only potentially cause warming of the climatic system. Therefore, the action-related GHGs generally have an insignificant impact to local air quality.

However, the affected area (context) of GHG/climate change is global. Therefore, the intensity or degree of the proposed action's GHG/climate change effects are gauged through the quantity of GHG associated with the action as compared to a baseline of the state, U.S., and global GHG inventories. Each action (or alternative) has significance, based on their annual net change in GHG emissions, in relation to or proportionally to the global, national, and regional annual GHG emissions.

To provide real-world context to the GHG and climate change effects on a global scale, an action's net change in GHG emissions is compared relative to the state (where action will occur) and U.S. annual emissions. The following table provides a relative comparison of an action's net change in GHG emissions vs. state and U.S. projected GHG emissions for the same time period.

Total GHG Relative Significance (mton)					
		CO2	CH4	N2O	CO2e
2028-2054	State Total	18,917,622,616	95,974,870	3,669,186	19,017,266,673
2028-2054	U.S. Total	138,684,262,833	691,926,615	40,519,106	139,416,708,555

2028-2054	Action	232,725	9.785739	1.9092	233,538
Percent of State Totals		0.00123020%	0.00001020%	0.00005203%	0.00122803%
Percent of U.S. Totals		0.00016781%	0.00000141%	0.00000471%	0.00016751%

From a global context, the action's total GHG percentage of total global GHG for the same time period is: 0.00002245%.*

* Global value based on the U.S. emits 13.4% of all global GHG annual emissions (2018 Emissions Data, Center for Climate and Energy Solutions, accessed 7-6-2023, https://www.c2es.org/content/international-emissions).

Climate Change Assessment (as SC GHG):

On a global scale, the potential climate change effects of an action are indirectly addressed and put into context through providing the theoretical SC GHG associated with an action. The SC GHG is an administrative and theoretical tool intended to provide additional context to a GHG's potential impacts through approximating the long-term monetary damage that may result from GHG emissions affect on climate change. It is important to note that the SC GHG is a monetary quantification, in 2020 U.S. dollars, of the theoretical economic damages that could result from emitting GHGs into the atmosphere.

The SC GHG estimates are derived using the methodology and discount factors in the "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990," released by the Interagency Working Group on Social Cost of Greenhouse Gases (IWG SC GHGs) in February 2021.

The speciated IWG Annual SC GHG Emission associated with an action (or alternative) are first estimated as annual unit cost (cost per metric ton, $/mton). Results of the annual IWG Annual SC GHG Emission Assessments are tabulated in the IWG Annual SC GHG Cost per Metric Ton Table below:

IWG SC GHG Discount Factor: 2.5%

IWG Annual SC GHG Cost per Metric Ton ($/mton [In 2020 $])			
YEAR	**CO2**	**CH4**	**N2O**
2028	$87.00	$2,400.00	$32,000.00
2029	$88.00	$2,500.00	$32,000.00
2030	$89.00	$2,500.00	$33,000.00
2031	$91.00	$2,600.00	$33,000.00
2032	$92.00	$2,600.00	$34,000.00
2033	$94.00	$2,700.00	$35,000.00
2034 [SS Year]	$95.00	$2,800.00	$35,000.00
2035	$96.00	$2,800.00	$36,000.00
2036	$98.00	$2,900.00	$36,000.00
2037	$99.00	$3,000.00	$37,000.00
2038	$100.00	$3,000.00	$38,000.00
2039	$102.00	$3,100.00	$38,000.00
2040	$103.00	$3,100.00	$39,000.00
2041	$104.00	$3,200.00	$39,000.00
2042	$106.00	$3,300.00	$40,000.00
2043	$107.00	$3,300.00	$41,000.00
2044	$108.00	$3,400.00	$41,000.00
2045	$110.00	$3,500.00	$42,000.00
2046	$111.00	$3,500.00	$43,000.00
2047	$112.00	$3,600.00	$43,000.00
2048	$114.00	$3,700.00	$44,000.00

2049	$115.00	$3,700.00	$45,000.00
2050	$116.00	$3,800.00	$45,000.00
2051	$118.00	$3,827.00	$45,817.00
2052	$119.00	$3,888.00	$46,423.00
2053	$120.00	$3,950.00	$47,028.00
2054	$122.00	$4,011.00	$47,634.00

Action-related SC GHG were estimated by calendar-year for the projected action's lifecycle. Annual estimates were found by multiplying the annual emission for a given year by the corresponding IWG Annual SC GHG Emission value (see table above).

Action-Related Annual SC GHG ($K/yr [In 2020 $])				
YEAR	**CO2**	**CH4**	**N2O**	**GHG**
2028	$324.83	$0.38	$0.98	$326.18
2029	$358.30	$0.43	$1.07	$359.80
2030	$428.53	$0.51	$1.30	$430.34
2031	$493.56	$0.59	$1.47	$495.63
2032	$587.60	$0.70	$1.78	$590.08
2033	$889.98	$1.07	$2.72	$893.78
2034 [SS Year]	$899.45	$1.11	$2.72	$903.28
2035	$908.92	$1.11	$2.80	$912.83
2036	$927.85	$1.15	$2.80	$931.80
2037	$937.32	$1.19	$2.87	$941.39
2038	$946.79	$1.19	$2.95	$950.94
2039	$965.73	$1.23	$2.95	$969.91
2040	$975.19	$1.23	$3.03	$979.46
2041	$984.66	$1.27	$3.03	$988.96
2042	$1,003.60	$1.31	$3.11	$1,008.02
2043	$1,013.07	$1.31	$3.18	$1,017.56
2044	$1,022.53	$1.35	$3.18	$1,027.07
2045	$1,041.47	$1.39	$3.26	$1,046.12
2046	$1,050.94	$1.39	$3.34	$1,055.67
2047	$1,060.40	$1.43	$3.34	$1,065.18
2048	$1,079.34	$1.47	$3.42	$1,084.23
2049	$1,088.81	$1.47	$3.50	$1,093.78
2050	$1,098.28	$1.51	$3.50	$1,103.28
2051	$1,117.21	$1.52	$3.56	$1,122.29
2052	$1,126.68	$1.55	$3.61	$1,131.83
2053	$1,136.15	$1.57	$3.65	$1,141.37
2054	$1,155.08	$1.60	$3.70	$1,160.38

The following two tables summarize the U.S. and State's Annual SC GHG by calendar-year. The U.S. and State's Annual SC GHG are in 2020 dollars and were estimated by each year for the projected action lifecycle. Annual SC GHG estimates were found by multiplying the U.S. and State's annual five-year average GHG emissions for a given year by the corresponding IWG Annual SC GHG Cost per Metric Ton value.

State's Annual SC GHG ($K/yr [In 2020 $])				
YEAR	**CO2**	**CH4**	**N2O**	**GHG**
2028	$60,956,783.99	$8,531,099.57	$4,348,665.05	$73,836,548.60
2029	$61,657,436.68	$8,886,562.05	$4,348,665.05	$74,892,663.77
2030	$62,358,089.37	$8,886,562.05	$4,484,560.83	$75,729,212.24
2031	$63,759,394.74	$9,242,024.53	$4,484,560.83	$77,485,980.10
2032	$64,460,047.43	$9,242,024.53	$4,620,456.61	$78,322,528.58
2033	$65,861,352.81	$9,597,487.01	$4,756,352.39	$80,215,192.22
2034 [SS Year]	$66,562,005.50	$9,952,949.49	$4,756,352.39	$81,271,307.39

2035	$67,262,658.19	$9,952,949.49	$4,892,248.18	$82,107,855.86
2036	$68,663,963.57	$10,308,411.98	$4,892,248.18	$83,864,623.72
2037	$69,364,616.26	$10,663,874.46	$5,028,143.96	$85,056,634.68
2038	$70,065,268.95	$10,663,874.46	$5,164,039.74	$85,893,183.15
2039	$71,466,574.33	$11,019,336.94	$5,164,039.74	$87,649,951.01
2040	$72,167,227.02	$11,019,336.94	$5,299,935.52	$88,486,499.48
2041	$72,867,879.71	$11,374,799.42	$5,299,935.52	$89,542,614.65
2042	$74,269,185.09	$11,730,261.90	$5,435,831.31	$91,435,278.30
2043	$74,969,837.78	$11,730,261.90	$5,571,727.09	$92,271,826.77
2044	$75,670,490.47	$12,085,724.39	$5,571,727.09	$93,327,941.94
2045	$77,071,795.84	$12,441,186.87	$5,707,622.87	$95,220,605.59
2046	$77,772,448.53	$12,441,186.87	$5,843,518.66	$96,057,154.06
2047	$78,473,101.22	$12,796,649.35	$5,843,518.66	$97,113,269.23
2048	$79,874,406.60	$13,152,111.83	$5,979,414.44	$99,005,932.87
2049	$80,575,059.29	$13,152,111.83	$6,115,310.22	$99,842,481.34
2050	$81,275,711.98	$13,507,574.31	$6,115,310.22	$100,898,596.52
2051	$82,677,017.36	$13,603,549.18	$6,226,337.08	$102,506,903.62
2052	$83,377,670.05	$13,820,381.30	$6,308,689.92	$103,506,741.27
2053	$84,078,322.74	$14,040,768.04	$6,390,906.87	$104,509,997.64
2054	$85,479,628.12	$14,257,600.15	$6,473,259.71	$106,210,487.98

U.S. Annual SC GHG ($K/yr [In 2020 $])				
YEAR	**CO2**	**CH4**	**N2O**	**GHG**
2028	$446,871,513.57	$61,504,588.03	$48,022,644.35	$556,398,745.96
2029	$452,007,967.75	$64,067,279.20	$48,022,644.35	$564,097,891.30
2030	$457,144,421.93	$64,067,279.20	$49,523,351.99	$570,735,053.12
2031	$467,417,330.29	$66,629,970.37	$49,523,351.99	$583,570,652.65
2032	$472,553,784.47	$66,629,970.37	$51,024,059.62	$590,207,814.46
2033	$482,826,692.83	$69,192,661.54	$52,524,767.26	$604,544,121.62
2034 [SS Year]	$487,963,147.01	$71,755,352.70	$52,524,767.26	$612,243,266.97
2035	$493,099,601.18	$71,755,352.70	$54,025,474.90	$618,880,428.78
2036	$503,372,509.54	$74,318,043.87	$54,025,474.90	$631,716,028.31
2037	$508,508,963.72	$76,880,735.04	$55,526,182.53	$640,915,881.29
2038	$513,645,417.90	$76,880,735.04	$57,026,890.17	$647,553,043.11
2039	$523,918,326.26	$79,443,426.21	$57,026,890.17	$660,388,642.63
2040	$529,054,780.44	$79,443,426.21	$58,527,597.80	$667,025,804.45
2041	$534,191,234.62	$82,006,117.38	$58,527,597.80	$674,724,949.80
2042	$544,464,142.97	$84,568,808.54	$60,028,305.44	$689,061,256.96
2043	$549,600,597.15	$84,568,808.54	$61,529,013.08	$695,698,418.77
2044	$554,737,051.33	$87,131,499.71	$61,529,013.08	$703,397,564.12
2045	$565,009,959.69	$89,694,190.88	$63,029,720.71	$717,733,871.28
2046	$570,146,413.87	$89,694,190.88	$64,530,428.35	$724,371,033.10
2047	$575,282,868.05	$92,256,882.05	$64,530,428.35	$732,070,178.44
2048	$585,555,776.41	$94,819,573.22	$66,031,135.98	$746,406,485.61
2049	$590,692,230.59	$94,819,573.22	$67,531,843.62	$753,043,647.42
2050	$595,828,684.76	$97,382,264.38	$67,531,843.62	$760,742,792.77
2051	$606,101,593.12	$98,074,191.00	$68,757,921.76	$772,933,705.88
2052	$611,238,047.30	$99,637,432.61	$69,667,350.59	$780,542,830.50
2053	$616,374,501.48	$101,226,301.14	$70,575,278.71	$788,176,081.32
2054	$626,647,409.84	$102,789,542.75	$71,484,707.53	$800,921,660.12

Relative Comparison of SC GHG:

To provide additional real-world context to the potential climate change impact associate with an action, a Relative Comparison of SC GHG Assessment is also performed. While the SC GHG estimates capture an indirect approximation of global climate damages, the Relative Comparison of SC GHG Assessment provides a better perspective from a regional and global scale.

The Relative Comparison of SC GHG Assessment uses the rule of reason and the concept of proportionality along with the consideration of the affected area (global, national, and regional) and the SC GHG as the degree (intensity) of the proposed action's effects. The Relative Comparison Assessment provides real-world context and allows for a reasoned choice among alternatives through a relative contrast analysis which weighs each alternative's SC GHG proportionally against (or relative to) existing global, national, and regional SC GHG. The below table provides a relative comparison between an action's SC GHG vs. state and U.S. projected SC GHG for the same time period:

Total SC-GHG ($K [In 2020 $])					
		CO2	**CH4**	**N2O**	**GHG**
2028-2054	State Total	$1,973,037,973.63	$308,100,660.83	$145,123,378.12	$2,426,262,012.59
2028-2054	U.S. Total	$14,464,254,968.06	$2,221,238,196.78	$1,602,608,685.90	$18,288,101,850.74
2028-2054	Action	$24,622.28	$32.09	$76.81	$24,731.18
Percent of State Totals		0.00124794%	0.00001042%	0.00005293%	0.00101931%
Percent of U.S. Totals		0.00017023%	0.00000144%	0.00000479%	0.00013523%

From a global context, the action's total SC GHG percentage of total global SC GHG for the same time period is: 0.00001812%.*

* Global value based on the U.S. emits 13.4% of all global GHG annual emissions (2018 Emissions Data, Center for Climate and Energy Solutions, accessed 7-6-2023, https://www.c2es.org/content/international-emissions).

Rahul Chettri, AQ Specialist — Aug 30 2024

Name, Title — **Date**

C.3.7.3 Air Conformity Applicability Model (ACAM) Detail Report – Alternative 1

ALTERNATIVE 1

1. General Information

- Action Location
Base: RANDOLPH AFB
State: Texas
County(s): Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: RANDOLPH 2A LOW MILITARY OPERATIONS AREA SPECIAL USE AIRSPACE

- Project Number/s (if applicable): N/A

- Projected Action Start Date: 1 / 2028

- Action Purpose and Need:

The purpose of the Proposed Action is to establish new low-altitude airspace, managed by the 12 FTW, to afford independent scheduling of nonhazardous, low-altitude flight training in proximity to JBSA-Randolph and meet tactical flight training requirements at altitudes at or above 500 ft AGL.

The need for the action is to minimize current 12 FTW aircraft commute times to access training airspace; maximize nonhazardous flying training syllabi execution; and produce pilots faster. This need is not tied to a basing or beddown proposal or support for a specific aircraft.

- Action Description:

Under the Proposed Action, the DAF would request the FAA to establish new, low-altitude training airspace under the existing RAN2A MOA. The proposed airspace would have a floor (i.e., minimum altitude) of 500 ft AGL to support low-altitude aircraft training operations.

Alternative 1 would implement the Proposed Action by establishing a new low-altitude airspace that would be designated as the RAN2A Low MOA. The proposed RAN2A Low MOA would be managed and operated separately from the existing RAN2A MOA and RAN2A ATCAA but could be combined with those airspaces, as needed, to support seamless flight operations from 500 ft AGL to FL 290. Training activities would occur in the new RAN2A Low MOA.

Alternative 2 would implement the Proposed Action by lowering the floor of the existing RAN2A MOA from 9,000 ft MSL to 500 ft AGL. The modified airspace would continue to be managed and operated as the RAN2A MOA. As needed, the modified airspace could be combined with the existing RAN2A ATCAA to support seamless flight operations from 500 ft AGL to FL 290. Training activities would occur within the modified RAN2A MOA.

Under the No Action Alternative, the proposed low-altitude MOA would not be established under the existing RAN2A MOA and existing conditions would continue. Pilots from JBSA-Randolph would continue to transit to the Brady MOA to conduct low-altitude training, resulting in operational inefficiencies and continuing to limit time spent in actual training. Low-altitude training in the Brady MOA would also continue to be susceptible to adverse weather conditions because no alternative low-altitude training MOA is available. Finally, pilots from JBSA-Randolph would continue to receive third-level priority for training time in the Brady MOA over other DoD units.

- Point of Contact

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Report generated with ACAM version: 5.0.23a

- Activity List:

Activity Type		Activity Title
2.	Aircraft	Alt 1: Add T-7A (2028) in RAN2A Low MOA only
3.	Aircraft	Alt 1: Add T-7A (2029) in RAN2A Low MOA only
4.	Aircraft	Alt 1: Add T-7A (2030) in RAN2A Low MOA only
5.	Aircraft	Alt 1: Add T-7A (2031) in RAN2A Low MOA only
6.	Aircraft	Alt 1: Add T-7A (2032) in RAN2A Low MOA only
7.	Aircraft	Alt 1: Add T-7A (2033 onwards) in RAN2A Low MOA only
8.	Aircraft	Alt 1: Add T-38C (2028) in RAN2A Low MOA only
9.	Aircraft	Alt 1: Add T-38C (2029) in RAN2A Low MOA only
10.	Aircraft	Alt 1: Add T-38C (2030) in RAN2A Low MOA only

11.	Aircraft	Alt 1: Add T-38C (2031) in RAN2A Low MOA only
12.	Aircraft	Alt 1: Add T-38C (2032) in RAN2A Low MOA only
13.	Aircraft	Alt 1: Add F-16C (2028 onwards) in RAN2A Low MOA only
14.	Aircraft	Alt 1: Add T-7A (2028) in MTR only
15.	Aircraft	Alt 1: Add T-7A (2029) in MTR only
16.	Aircraft	Alt 1: Add T-7A (2030) in MTR only
17.	Aircraft	Alt 1: Add T-7A (2031) in MTR only
18.	Aircraft	Alt 1: Add T-7A (2032) in MTR only
19.	Aircraft	Alt 1: Add T-7A (2033 onwards) in MTR only
20.	Aircraft	Alt 1: Remove T-38C (2028) in MTR only
21.	Aircraft	Alt 1: Remove T-38C (2029) in MTR only
22.	Aircraft	Alt 1: Remove T-38C (2030) in MTR only
23.	Aircraft	Alt 1: Remove T-38C (2031) in MTR only
24.	Aircraft	Alt 1: Remove T-38C (2032) in MTR only
25.	Aircraft	Alt 1: Remove T-38C (2033 onwards) in RAN2A Low MOA only

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: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2028) in RAN2A Low MOA only

- Activity Description:
In 2028, 14 T-7A aircraft will conduct 104 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2028

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2028

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	0.258679
SO_x	0.121932
NO_x	1.868871
CO	0.213097

Pollutant	Total Emissions (TONs)
PM 10	0.014814
PM 2.5	0.012535
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.015350

Pollutant	Total Emissions (TONs)
CO_2	365.049842

N_2O	0.002995	CO_2e	366.326144

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)
VOC	0.258679	PM 10	0.014814
SO_x	0.121932	PM 2.5	0.012535
NO_x	1.868871	Pb	0.000000
CO	0.213097	NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)
CH_4	0.015350	CO_2	365.049842
N_2O	0.002995	CO_2e	366.326144

2.2 Aircraft & Engines

2.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
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 Criteria Pollutant Emission Factors (lb/1000lb fuel)
Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

2.3 Flight Operations

2.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 14
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 104
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 18.8
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

2.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

3. Aircraft

3.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2029) in RAN2A Low MOA only

- Activity Description:
In 2029, 23 T-7A aircraft will conduct 270 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2029

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2029

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	0.671571
SO_x	0.316555
NO_x	4.851878
CO	0.553232

Pollutant	Total Emissions (TONs)
PM 10	0.038460
PM 2.5	0.032543
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.039850
N_2O	0.007775

Pollutant	Total Emissions (TONs)
CO_2	947.725551
CO_2e	951.039028

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	0.671571
SO_x	0.316555
NO_x	4.851878
CO	0.553232

Pollutant	Total Emissions (TONs)
PM 10	0.038460
PM 2.5	0.032543
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.039850
N_2O	0.007775

Pollutant	Total Emissions (TONs)
CO_2	947.725551
CO_2e	951.039028

3.2 Aircraft & Engines

3.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

3.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)
Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

3.3 Flight Operations

3.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 23
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 270
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 18.8
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

3.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

4. Aircraft

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2030) in RAN2A Low MOA only

- Activity Description:
In 2030, 35 T-7A aircraft will conduct 635 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2030

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2030

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	1.579435
SO_x	0.744491
NO_x	11.410898
CO	1.301121

Pollutant	Total Emissions (TONs)
PM 10	0.090452
PM 2.5	0.076537
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.093722
N_2O	0.018285

Pollutant	Total Emissions (TONs)
CO_2	2228.910092
CO_2e	2236.702900

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	1.579435
SO_x	0.744491
NO_x	11.410898
CO	1.301121

Pollutant	Total Emissions (TONs)
PM 10	0.090452
PM 2.5	0.076537
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.093722
N_2O	0.018285

Pollutant	Total Emissions (TONs)
CO_2	2228.910092
CO_2e	2236.702900

4.2 Aircraft & Engines

4.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

4.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

4.3 Flight Operations

4.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft:		35
Flight Operation Cycle Type:	LFP (Low Flight Pattern)	
Number of Annual Flight Operation Cycles for all Aircraft:		635
Number of Annual Trim Test(s) per Aircraft:		0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins):	0
Approach [Approach] (mins):	0
Climb Out [Intermediate] (mins):	18.8
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0

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):	0
Approach (mins):	0
Intermediate (mins):	0
Military (mins):	0
AfterBurn (mins):	0

4.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

5. Aircraft

5.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2031) in RAN2A Low MOA only

- Activity Description:
In 2031, 45 T-7A aircraft will conduct 934 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2031

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2031

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)

VOC	2.323138
SO_x	1.095047
NO_x	16.783903
CO	1.913774

PM 10	0.133043
PM 2.5	0.112575
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.137853
N_2O	0.026895

Pollutant	Total Emissions (TONs)
CO_2	3278.428387
CO_2e	3289.890565

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	2.323138
SO_x	1.095047
NO_x	16.783903
CO	1.913774

Pollutant	Total Emissions (TONs)
PM 10	0.133043
PM 2.5	0.112575
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.137853
N_2O	0.026895

Pollutant	Total Emissions (TONs)
CO_2	3278.428387
CO_2e	3289.890565

5.2 Aircraft & Engines

5.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

5.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

5.3 Flight Operations

5.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 45
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 934
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins):	0
Approach [Approach] (mins):	0
Climb Out [Intermediate] (mins):	18.8
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0

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):	0
Approach (mins):	0
Intermediate (mins):	0
Military (mins):	0
AfterBurn (mins):	0

5.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

6. Aircraft

6.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2032) in RAN2A Low MOA only

- Activity Description:
In 2032, 45 T-7A aircraft will conduct 1,407 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2032

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2032

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	3.499630
SO_x	1.649606
NO_x	25.283674
CO	2.882955

Pollutant	Total Emissions (TONs)
PM 10	0.200419
PM 2.5	0.169586
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.207665
N_2O	0.040516

Pollutant	Total Emissions (TONs)
CO_2	4938.703149
CO_2e	4955.970048

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	3.499630
SO_x	1.649606
NO_x	25.283674
CO	2.882955

Pollutant	Total Emissions (TONs)
PM 10	0.200419
PM 2.5	0.169586
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.207665
N_2O	0.040516

Pollutant	Total Emissions (TONs)
CO_2	4938.703149
CO_2e	4955.970048

6.2 Aircraft & Engines

6.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

6.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)
Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

6.3 Flight Operations

6.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 45
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 1407
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 18.8
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0

Military (mins): 0
AfterBurn (mins): 0

6.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

7. Aircraft

7.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2033 onwards) in RAN2A Low MOA only

- Activity Description:
From 2033 onwards, 45 T-7A aircraft will conduct 2,920 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2033

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions of Criteria Pollutants:

Pollutant	Emissions Per Year (TONs)
VOC	7.262915
SO_x	3.423488
NO_x	52.472159
CO	5.983106

Pollutant	Emissions Per Year (TONs)
PM 10	0.415938
PM 2.5	0.351947
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Emissions Per Year (TONs)
CH_4	0.430976
N_2O	0.084083

Pollutant	Emissions Per Year (TONs)
CO_2	10249.476329
CO_2e	10285.310973

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Emissions Per Year (TONs)
VOC	7.262915
SO_x	3.423488
NO_x	52.472159
CO	5.983106

Pollutant	Emissions Per Year (TONs)
PM 10	0.415938
PM 2.5	0.351947
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Emissions Per Year (TONs)
CH_4	0.430976
N_2O	0.084083

Pollutant	Emissions Per Year (TONs)
CO_2	10249.476329
CO_2e	10285.310973

7.2 Aircraft & Engines

7.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes

Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

7.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)
Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

7.3 Flight Operations

7.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 45
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 2920
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 18.8
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

7.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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

FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

8. Aircraft

8.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-38C (2028) in RAN2A Low MOA only

- Activity Description:
In 2028, 97 T-38C aircraft will conduct 2,816 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1

Start Year: 2028

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2028

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	3.158139
SO_x	1.215543
NO_x	0.795215
CO	73.920908

Pollutant	Total Emissions (TONs)
PM 10	2.033478
PM 2.5	1.828994
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.153022
N_2O	0.029855

Pollutant	Total Emissions (TONs)
CO_2	3639.176180
CO_2e	3651.899619

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	3.158139
SO_x	1.215543
NO_x	0.795215
CO	73.920908

Pollutant	Total Emissions (TONs)
PM 10	2.033478
PM 2.5	1.828994
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.153022
N_2O	0.029855

Pollutant	Total Emissions (TONs)
CO_2	3639.176180
CO_2e	3651.899619

8.2 Aircraft & Engines

8.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

8.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01

After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64
Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64
After Burn	7695.00	0.13	0.03	3203.44	3214.64

8.3 Flight Operations

8.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 97
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 2816
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 23.5
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

8.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

9. Aircraft

9.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-38C (2029) in RAN2A Low MOA only

- Activity Description:
In 2029, 96 T-38C aircraft will conduct 2,650 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2029

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2029

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	2.971971
SO_x	1.143888
NO_x	0.748338
CO	69.563355

Pollutant	Total Emissions (TONs)
PM 10	1.913607
PM 2.5	1.721177
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.144002
N_2O	0.028095

Pollutant	Total Emissions (TONs)
CO_2	3424.650880
CO_2e	3436.624286

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	2.971971
SO_x	1.143888
NO_x	0.748338
CO	69.563355

Pollutant	Total Emissions (TONs)
PM 10	1.913607
PM 2.5	1.721177
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.144002
N_2O	0.028095

Pollutant	Total Emissions (TONs)
CO_2	3424.650880
CO_2e	3436.624286

9.2 Aircraft & Engines

9.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

9.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01
After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64
Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64
After Burn	7695.00	0.13	0.03	3203.44	3214.64

9.3 Flight Operations

9.3.1 Flight Operations Assumptions

- Flight Operations
- **Number of Aircraft:** 96
- **Flight Operation Cycle Type:** LFP (Low Flight Pattern)
- **Number of Annual Flight Operation Cycles for all Aircraft:** 2650
- **Number of Annual Trim Test(s) per Aircraft:** 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
- **Taxi [Idle] (mins):** 0
- **Approach [Approach] (mins):** 0
- **Climb Out [Intermediate] (mins):** 23.5
- **Takeoff [Military] (mins):** 0
- **Takeoff [After Burn] (mins):** 0

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):** 0
- **Approach (mins):** 0
- **Intermediate (mins):** 0
- **Military (mins):** 0
- **AfterBurn (mins):** 0

9.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

10. Aircraft

10.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-38C (2030) in RAN2A Low MOA only

- Activity Description:
In 2030, 85 T-38C aircraft will conduct 2,285 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2030

- Activity End Date
Indefinite: No
End Month: 12

End Year: 2030

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	2.562624
SO_x	0.986334
NO_x	0.645265
CO	59.981987

Pollutant	Total Emissions (TONs)
PM 10	1.650035
PM 2.5	1.484109
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.124167
N_2O	0.024225

Pollutant	Total Emissions (TONs)
CO_2	2952.953683
CO_2e	2963.277922

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	2.562624
SO_x	0.986334
NO_x	0.645265
CO	59.981987

Pollutant	Total Emissions (TONs)
PM 10	1.650035
PM 2.5	1.484109
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.124167
N_2O	0.024225

Pollutant	Total Emissions (TONs)
CO_2	2952.953683
CO_2e	2963.277922

10.2 Aircraft & Engines

10.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

10.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01
After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64

Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64
After Burn	7695.00	0.13	0.03	3203.44	3214.64

10.3 Flight Operations

10.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 85
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 2285
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 23.5
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

10.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year
$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

11. Aircraft

11.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-38C (2031) in RAN2A Low MOA only

- Activity Description:
In 2031, 78 T-38C aircraft will conduct 1,986 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2031

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2031

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	2.227296
SO_x	0.857268
NO_x	0.560830
CO	52.133140

Pollutant	Total Emissions (TONs)
PM 10	1.434122
PM 2.5	1.289909
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.107920
N_2O	0.021055

Pollutant	Total Emissions (TONs)
CO_2	2566.549678
CO_2e	2575.522956

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	2.227296
SO_x	0.857268
NO_x	0.560830
CO	52.133140

Pollutant	Total Emissions (TONs)
PM 10	1.434122
PM 2.5	1.289909
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.107920
N_2O	0.021055

Pollutant	Total Emissions (TONs)
CO_2	2566.549678
CO_2e	2575.522956

11.2 Aircraft & Engines

11.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

11.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01
After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64
Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64

After Burn	7695.00	0.13	0.03	3203.44	3214.64

11.3 Flight Operations

11.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 78
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 1986
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 23.5
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

11.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

12. Aircraft

12.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-38C (2032) in RAN2A Low MOA only

- Activity Description:
In 2032, 62 T-38C aircraft will conduct 1,513 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2032

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2032

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	1.696827
SO_x	0.653095
NO_x	0.427259

Pollutant	Total Emissions (TONs)
PM 10	1.092561
PM 2.5	0.982695
Pb	0.000000

CO	39.716738		NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)		Pollutant	Total Emissions (TONs)
CH_4	0.082217		CO_2	1955.281804
N_2O	0.016041		CO_2e	1962.117942

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)		Pollutant	Total Emissions (TONs)
VOC	1.696827		PM 10	1.092561
SO_x	0.653095		PM 2.5	0.982695
NO_x	0.427259		Pb	0.000000
CO	39.716738		NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)		Pollutant	Total Emissions (TONs)
CH_4	0.082217		CO_2	1955.281804
N_2O	0.016041		CO_2e	1962.117942

12.2 Aircraft & Engines

12.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

12.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01
After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64
Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64
After Burn	7695.00	0.13	0.03	3203.44	3214.64

12.3 Flight Operations

12.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 62
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 1513
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 23.5
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

12.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

13. Aircraft

13.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Frio; Medina; Real; Uvalde; Zavala
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add F-16C (2028 onwards) in RAN2A Low MOA only

- Activity Description:
From 2028 onwards, F-16C aircraft will conduct 48 sorties in RAN2A Low MOA

- Activity Start Date
Start Month: 1
Start Year: 2028

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions of Criteria Pollutants:

Pollutant	Emissions Per Year (TONs)
VOC	0.002373
SO_x	0.036279
NO_x	0.900204
CO	0.012884

Pollutant	Emissions Per Year (TONs)
PM 10	0.053571
PM 2.5	0.048147
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Emissions Per Year (TONs)

Pollutant	Emissions Per Year (TONs)

CH_4	0.004567		CO_2	108.615837
N_2O	0.000891		CO_2e	108.995584

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Emissions Per Year (TONs)		Pollutant	Emissions Per Year (TONs)
VOC	0.002373		PM 10	0.053571
SO_x	0.036279		PM 2.5	0.048147
NO_x	0.900204		Pb	0.000000
CO	0.012884		NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Emissions Per Year (TONs)		Pollutant	Emissions Per Year (TONs)
CH_4	0.004567		CO_2	108.615837
N_2O	0.000891		CO_2e	108.995584

13.2 Aircraft & Engines

13.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: F-16C
Engine Model: F100-PW-200
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:

13.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	1006.00	2.05	1.07	6.21	24.06	2.47	2.22
Approach	3251.00	0.05	1.07	17.93	1.22	2.37	2.13
Intermediate	5651.00	0.07	1.07	26.55	0.38	1.58	1.42
Military	8888.00	0.11	1.07	34.32	0.56	1.66	1.49
After Burn	40123.00	0.69	1.07	6.63	10.42	3.07	2.76

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	1006.00	0.13	0.03	3203.44	3214.64
Approach	3251.00	0.13	0.03	3203.44	3214.64
Intermediate	5651.00	0.13	0.03	3203.44	3214.64
Military	8888.00	0.13	0.03	3203.44	3214.64
After Burn	40123.00	0.13	0.03	3203.44	3214.64

13.3 Flight Operations

13.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 1

Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 48
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 15
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

13.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year
$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

14. Aircraft

14.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2028) in MTR only

- Activity Description:
In 2028, 14 T-7A aircraft will conduct 7 sorties in the MTR

- Activity Start Date
Start Month: 1
Start Year: 2028

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2028

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	0.003056
SO_x	0.001441
NO_x	0.022080
CO	0.002518

Pollutant	Total Emissions (TONs)
PM 10	0.000175
PM 2.5	0.000148
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.000181
N_2O	0.000035

Pollutant	Total Emissions (TONs)
CO_2	4.312935
CO_2e	4.328014

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	0.003056
SO_x	0.001441
NO_x	0.022080
CO	0.002518

Pollutant	Total Emissions (TONs)
PM 10	0.000175
PM 2.5	0.000148
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.000181
N_2O	0.000035

Pollutant	Total Emissions (TONs)
CO_2	4.312935
CO_2e	4.328014

14.2 Aircraft & Engines

14.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

14.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)
Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

14.3 Flight Operations

14.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 14
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 7
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 3.3
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

14.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

15. Aircraft

15.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2029) in MTR only

- Activity Description:
In 2029, 23 T-7A aircraft will conduct 18 sorties in the MTR

- Activity Start Date
Start Month: 1
Start Year: 2029

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2029

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	0.007859
SO_x	0.003704
NO_x	0.056777
CO	0.006474

Pollutant	Total Emissions (TONs)
PM 10	0.000450
PM 2.5	0.000381
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.000466
N_2O	0.000091

Pollutant	Total Emissions (TONs)
CO_2	11.090405
CO_2e	11.129180

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	0.007859
SO_x	0.003704
NO_x	0.056777
CO	0.006474

Pollutant	Total Emissions (TONs)
PM 10	0.000450
PM 2.5	0.000381
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.000466
N_2O	0.000091

Pollutant	Total Emissions (TONs)
CO_2	11.090405
CO_2e	11.129180

15.2 Aircraft & Engines

15.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

15.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)
Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

15.3 Flight Operations

15.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 23
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 18
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 3.3
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

15.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

16. Aircraft

16.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2030) in MTR only

- Activity Description:

In 2030, 35 T-7A aircraft will conduct 43 sorties in the MTR

- Activity Start Date
Start Month: 1
Start Year: 2030

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2030

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)
VOC	0.018774	PM 10	0.001075
SO_x	0.008849	PM 2.5	0.000910
NO_x	0.135635	Pb	0.000000
CO	0.015466	NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)
CH_4	0.001114	CO_2	26.493746
N_2O	0.000217	CO_2e	26.586375

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)
VOC	0.018774	PM 10	0.001075
SO_x	0.008849	PM 2.5	0.000910
NO_x	0.135635	Pb	0.000000
CO	0.015466	NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)
CH_4	0.001114	CO_2	26.493746
N_2O	0.000217	CO_2e	26.586375

16.2 Aircraft & Engines

16.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

16.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

16.3 Flight Operations

16.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 35
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 43
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 3.3
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

16.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

17. Aircraft

17.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2031) in MTR only

- Activity Description:
In 2031, 45 T-7A aircraft will conduct 63 sorties in the MTR

- Activity Start Date
Start Month: 1
Start Year: 2031

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2031

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	0.027506
SO_x	0.012965

Pollutant	Total Emissions (TONs)
PM 10	0.001575
PM 2.5	0.001333

NO_x	0.198721		Pb	0.000000
CO	0.022659		NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)		Pollutant	Total Emissions (TONs)
CH_4	0.001632		CO_2	38.816419
N_2O	0.000318		CO_2e	38.952130

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)		Pollutant	Total Emissions (TONs)
VOC	0.027506		PM 10	0.001575
SO_x	0.012965		PM 2.5	0.001333
NO_x	0.198721		Pb	0.000000
CO	0.022659		NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)		Pollutant	Total Emissions (TONs)
CH_4	0.001632		CO_2	38.816419
N_2O	0.000318		CO_2e	38.952130

17.2 Aircraft & Engines

17.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

17.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

17.3 Flight Operations

17.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 45
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 63
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins):	0
Approach [Approach] (mins):	0
Climb Out [Intermediate] (mins):	3.3
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0

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):	0
Approach (mins):	0
Intermediate (mins):	0
Military (mins):	0
AfterBurn (mins):	0

17.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

18. Aircraft

18.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2032) in MTR only

- Activity Description:
In 2032, 45 T-7A aircraft will conduct 95 sorties in the MTR

- Activity Start Date
Start Month: 1
Start Year: 2032

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2032

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	0.041477
SO_x	0.019551
NO_x	0.299658
CO	0.034168

Pollutant	Total Emissions (TONs)
PM 10	0.002375
PM 2.5	0.002010
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	0.002461
N_2O	0.000480

Pollutant	Total Emissions (TONs)
CO_2	58.532695
CO_2e	58.737340

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	0.041477
SO_x	0.019551
NO_x	0.299658
CO	0.034168

Pollutant	Total Emissions (TONs)
PM 10	0.002375
PM 2.5	0.002010
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	0.002461
N_2O	0.000480

Pollutant	Total Emissions (TONs)
CO_2	58.532695
CO_2e	58.737340

18.2 Aircraft & Engines

18.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

18.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

18.3 Flight Operations

18.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 45
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 95
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 3.3
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

18.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

19. Aircraft

19.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Add T-7A (2033 onwards) in MTR only

- Activity Description:
From 2033 onwards, 45 T-7A aircraft will conduct 197 sorties in the MTR

- Activity Start Date
Start Month: 1
Start Year: 2033

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions of Criteria Pollutants:

Pollutant	Emissions Per Year (TONs)	Pollutant	Emissions Per Year (TONs)
VOC	0.086010	PM 10	0.004926
SO_x	0.040542	PM 2.5	0.004168
NO_x	0.621396	Pb	0.000000
CO	0.070854	NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Emissions Per Year (TONs)	Pollutant	Emissions Per Year (TONs)
CH_4	0.005104	CO_2	121.378326
N_2O	0.000996	CO_2e	121.802694

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Emissions Per Year (TONs)	Pollutant	Emissions Per Year (TONs)
VOC	0.086010	PM 10	0.004926
SO_x	0.040542	PM 2.5	0.004168
NO_x	0.621396	Pb	0.000000
CO	0.070854	NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Emissions Per Year (TONs)	Pollutant	Emissions Per Year (TONs)
CH_4	0.005104	CO_2	121.378326
N_2O	0.000996	CO_2e	121.802694

19.2 Aircraft & Engines

19.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-7A
Engine Model: F404-GE-102
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

19.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)
Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors.

19.3 Flight Operations

19.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 45
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 197
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 3.3
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

19.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

20. Aircraft

20.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Remove

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Remove T-38C (2028) in MTR only

- Activity Description:
In 2028, 7 T-38C sorties will be removed

- Activity Start Date
Start Month: 1
Start Year: 2028

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2028

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	-0.001323
SO_x	-0.000509
NO_x	-0.000333
CO	-0.030964

Pollutant	Total Emissions (TONs)
PM 10	-0.000852
PM 2.5	-0.000766
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	-0.000064
N_2O	-0.000013

Pollutant	Total Emissions (TONs)
CO_2	-1.524389
CO_2e	-1.529719

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	-0.001323
SO_x	-0.000509
NO_x	-0.000333
CO	-0.030964

Pollutant	Total Emissions (TONs)
PM 10	-0.000852
PM 2.5	-0.000766
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	-0.000064
N_2O	-0.000013

Pollutant	Total Emissions (TONs)
CO_2	-1.524389
CO_2e	-1.529719

20.2 Aircraft & Engines

20.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

20.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01
After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64
Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64
After Burn	7695.00	0.13	0.03	3203.44	3214.64

20.3 Flight Operations

20.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 97
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 7
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 3.96
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

20.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

21. Aircraft

21.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Remove

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Remove T-38C (2029) in MTR only

- Activity Description:
In 2029, 18 T-38C sorties will be removed

- Activity Start Date
Start Month: 1
Start Year: 2029

- Activity End Date
Indefinite: No
End Month: 12

End Year: 2029

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	-0.003402
SO_x	-0.001309
NO_x	-0.000857
CO	-0.079622

Pollutant	Total Emissions (TONs)
PM 10	-0.002190
PM 2.5	-0.001970
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	-0.000165
N_2O	-0.000032

Pollutant	Total Emissions (TONs)
CO_2	-3.919857
CO_2e	-3.933562

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	-0.003402
SO_x	-0.001309
NO_x	-0.000857
CO	-0.079622

Pollutant	Total Emissions (TONs)
PM 10	-0.002190
PM 2.5	-0.001970
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	-0.000165
N_2O	-0.000032

Pollutant	Total Emissions (TONs)
CO_2	-3.919857
CO_2e	-3.933562

21.2 Aircraft & Engines

21.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

21.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01
After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64

Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64
After Burn	7695.00	0.13	0.03	3203.44	3214.64

21.3 Flight Operations

21.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 96
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 18
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 3.96
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

21.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year
$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

22. Aircraft

22.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Remove

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Remove T-38C (2030) in MTR only

- Activity Description:
In 2030, 43 T-38C sorties will be removed

- Activity Start Date
Start Month: 1
Start Year: 2030

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2030

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	-0.008126
SO_x	-0.003128
NO_x	-0.002046
CO	-0.190209

Pollutant	Total Emissions (TONs)
PM 10	-0.005232
PM 2.5	-0.004706
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	-0.000394
N_2O	-0.000077

Pollutant	Total Emissions (TONs)
CO_2	-9.364104
CO_2e	-9.396843

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	-0.008126
SO_x	-0.003128
NO_x	-0.002046
CO	-0.190209

Pollutant	Total Emissions (TONs)
PM 10	-0.005232
PM 2.5	-0.004706
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	-0.000394
N_2O	-0.000077

Pollutant	Total Emissions (TONs)
CO_2	-9.364104
CO_2e	-9.396843

22.2 Aircraft & Engines

22.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

22.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01
After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64
Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64

After Burn	7695.00	0.13	0.03	3203.44	3214.64

22.3 Flight Operations

22.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 85
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 43
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 3.96
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

22.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year
$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

23. Aircraft

23.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Remove

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Remove T-38C (2031) in MTR only

- Activity Description:
In 2031, 63 T-38C sorties will be removed

- Activity Start Date
Start Month: 1
Start Year: 2031

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2031

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)
VOC	-0.011906
SO_x	-0.004583
NO_x	-0.002998

Pollutant	Total Emissions (TONs)
PM 10	-0.007666
PM 2.5	-0.006895
Pb	0.000000

CO	-0.278678

NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)
CH_4	-0.000577
N_2O	-0.000113

Pollutant	Total Emissions (TONs)
CO_2	-13.719501
CO_2e	-13.767467

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
VOC	-0.011906
SO_x	-0.004583
NO_x	-0.002998
CO	-0.278678

Pollutant	Total Emissions (TONs)
PM 10	-0.007666
PM 2.5	-0.006895
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)
CH_4	-0.000577
N_2O	-0.000113

Pollutant	Total Emissions (TONs)
CO_2	-13.719501
CO_2e	-13.767467

23.2 Aircraft & Engines

23.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

23.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01
After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64
Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64
After Burn	7695.00	0.13	0.03	3203.44	3214.64

23.3 Flight Operations

23.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft:	78
Flight Operation Cycle Type:	LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft:	63
Number of Annual Trim Test(s) per Aircraft:	0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins):	0
Approach [Approach] (mins):	0
Climb Out [Intermediate] (mins):	3.96
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0

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):	0
Approach (mins):	0
Intermediate (mins):	0
Military (mins):	0
AfterBurn (mins):	0

23.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

24. Aircraft

24.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Remove

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Remove T-38C (2032) in MTR only

- Activity Description:
In 2032, 95 T-38C sorties will be removed

- Activity Start Date
Start Month: 1
Start Year: 2032

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2032

- Activity Emissions of Criteria Pollutants:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)
VOC	-0.017954	PM 10	-0.011560
SO_x	-0.006910	PM 2.5	-0.010398
NO_x	-0.004521	Pb	0.000000
CO	-0.420229	NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)

CH_4	-0.000870	CO_2	-20.688136
N_2O	-0.000170	CO_2e	-20.760467

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)
VOC	-0.017954	PM 10	-0.011560
SO_x	-0.006910	PM 2.5	-0.010398
NO_x	-0.004521	Pb	0.000000
CO	-0.420229	NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Total Emissions (TONs)	Pollutant	Total Emissions (TONs)
CH_4	-0.000870	CO_2	-20.688136
N_2O	-0.000170	CO_2e	-20.760467

24.2 Aircraft & Engines

24.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

24.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01
After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64
Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64
After Burn	7695.00	0.13	0.03	3203.44	3214.64

24.3 Flight Operations

24.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 62

Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 95
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi [Idle] (mins): 0
Approach [Approach] (mins): 0
Climb Out [Intermediate] (mins): 3.96
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0

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): 0
Approach (mins): 0
Intermediate (mins): 0
Military (mins): 0
AfterBurn (mins): 0

24.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000$

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
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year
$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

25. Aircraft

25.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Remove

- Activity Location
County: Bandera; Uvalde
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Alt 1: Remove T-38C (2033 onwards) in RAN2A Low MOA only

- Activity Description:
From 2033 onwards, all 197 T-38C sorties will be removed

- Activity Start Date
Start Month: 1
Start Year: 2033

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions of Criteria Pollutants:

Pollutant	Emissions Per Year (TONs)
VOC	-0.037230
SO_x	-0.014330
NO_x	-0.009374
CO	-0.871421

Pollutant	Emissions Per Year (TONs)
PM 10	-0.023972
PM 2.5	-0.021561
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses:

Pollutant	Emissions Per Year (TONs)
CH_4	-0.001804
N_2O	-0.000352

Pollutant	Emissions Per Year (TONs)
CO_2	-42.900661
CO_2e	-43.050652

- Activity Emissions of Criteria Pollutants [LFP Flight Operations part]:

Pollutant	Emissions Per Year (TONs)
VOC	-0.037230
SO_x	-0.014330
NO_x	-0.009374
CO	-0.871421

Pollutant	Emissions Per Year (TONs)
PM 10	-0.023972
PM 2.5	-0.021561
Pb	0.000000
NH_3	0.000000

- Global Scale Activity Emissions of Greenhouse Gasses [LFP Flight Operations part]:

Pollutant	Emissions Per Year (TONs)
CH_4	-0.001804
N_2O	-0.000352

Pollutant	Emissions Per Year (TONs)
CO_2	-42.900661
CO_2e	-43.050652

25.2 Aircraft & Engines

25.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: T-38C
Engine Model: J85-GE-5R
Primary Function: Trainer
Aircraft has After burn: Yes
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

25.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Criteria Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5
Idle	520.00	16.80	1.07	1.08	177.45	4.70	4.23
Approach	689.00	7.96	1.07	0.84	119.23	2.42	2.17
Intermediate	1030.00	2.78	1.07	0.70	65.07	1.79	1.61
Military	2220.00	0.75	1.07	1.92	30.99	1.13	1.01
After Burn	7695.00	6.97	1.07	6.23	53.43	0.25	0.23

- Aircraft & Engine Greenhouse Gasses Pollutant Emission Factors (lb/1000lb fuel)

	Fuel Flow	CH_4	N_2O	CO_2	CO_2e
Idle	520.00	0.13	0.03	3203.44	3214.64
Approach	689.00	0.13	0.03	3203.44	3214.64
Intermediate	1030.00	0.13	0.03	3203.44	3214.64
Military	2220.00	0.13	0.03	3203.44	3214.64
After Burn	7695.00	0.13	0.03	3203.44	3214.64

25.3 Flight Operations

25.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 0
Flight Operation Cycle Type: LFP (Low Flight Pattern)
Number of Annual Flight Operation Cycles for all Aircraft: 197
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi [Idle] (mins):	0
Approach [Approach] (mins):	0
Climb Out [Intermediate] (mins):	3.96
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0

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):	0
Approach (mins):	0
Intermediate (mins):	0
Military (mins):	0
AfterBurn (mins):	0

25.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for Flight Operation Cycles per Year

AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * FOC / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
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1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
FOC: Number of Flight Operation Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Flight Operation Cycles per Year

$AE_{FOC} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{FOC}: 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 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)

APPENDIX D
LIST OF PREPARERS AND CONTRIBUTORS

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APPENDIX E
GLOSSARY OF TERMS

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APPENDIX E – 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.

Air Traffic Control Assigned Airspace (ATCAA): Assigned to Air Traffic Control to segregate air traffic between specified activities being conducted within the assigned airspace and other Instrument Flight Rules traffic. ATCAA is the equivalent of a Military Operations Area at 18,000 feet MSL and above. This airspace is not depicted on any chart but is often an extension of a Military Operations Area to higher altitudes and usually referred to by the same name. This airspace remains in control of the Federal Aviation Administration when not in use to support general aviation activities.

Bald and Golden Eagle Protection Act (BGEPA): Prohibits anyone, without a permit issued by the Secretary of the Interior, from taking eagles, including their parts, nests, or eggs.

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. Class A Airspace is generally from 18,000 feet MSL up to and including 60,000 feet MSL and includes airspace overlying waters within 12 nautical miles of the coast of the 48 contiguous United States and Alaska.

Closed patterns: Consist of two operations, one departure and one arrival (e.g., two closed pattern circuits consist of four total operations).

Council on Environmental Quality (CEQ): Established by NEPA within the Executive Office of the President to ensure that federal agencies meet their obligations under NEPA.

Day-Night Average Sound Level (DNL or L_{dn}): A cumulative metric that accounts for all noise events in a 24-hour period. A 10-dB penalty is applied to events during the nighttime period (defined as 10:00 p.m. to 7:00 a.m.) to account for the increased sensitivity of humans to noise occurring at night.

Environmental Impact Analysis Process (EIAP): Department of the Air Force procedures to ensure compliance with the requirements of NEPA.

Environmental justice (EJ): 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.

Flight level (FL): Flight level is vertical altitude expressed in hundreds of feet.

Low-altitude air-to-air training: This type of training supports air-to-air combat against simulated enemy aircraft and occurs between 500 feet AGL and 5,000 feet MSL.

Low-altitude air-to-ground training: This type of training simulates attacks by training aircraft against simulated ground-based targets and occurs between 500 feet AGL and 3,000 feet MSL.

Low-level operations: This type of training allows pilots to gain familiarity with aircraft handling characteristics when operating at low altitudes and focuses on elements such as fuel consumption, maneuvering, terrain avoidance, task management, low-altitude tactical navigation, and low-altitude tactical formation. These operations primarily occur between 500 feet AGL and 1,000 feet MSL.

Maximum Sound Level (L_{max}): The highest A-weighted sound level measured during a single event in which the sound changes with time.

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 feet 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.

Migratory Bird Treaty Act (MBTA): The MBTA makes it illegal for anyone, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, [or] possess migratory birds or their nests or eggs at any time, unless permitted by regulation. Most bird species are protected under the MBTA.

National Ambient Air Quality Standards (NAAQS): Thresholds established by the U.S. Environmental Protection Agency under the Clean Air Act to regulate emissions of six criteria pollutants (ozone [O_3], carbon monoxide [CO], nitrogen dioxide [NO_2], sulfur dioxide [SO_2], respirable particulate matter 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]).

National Environmental Policy Act (NEPA) of 1969: Law requiring federal agencies to assess the environmental effects of proposed major federal actions prior to making decisions.

Operation: Defined as a single aircraft takeoff or landing.

Region of Influence (ROI): Geographic area where potential impacts from a proposed action would be anticipated to occur or be experienced.

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 consist of Military Operations Areas, warning areas, restricted areas, and alert areas. SUA descriptions are contained in FAA Order Joint Order 7400.10F, Special Use Airspace.