ENVIRONMENTAL ASSESSMENT (EA)

FOR

CONTINUED USE OF EDWARDS RESTRICTED AIRSPACE IN SOUTHEASTERN CALIFORNIA

State Clearinghouse (SCH) # 2021080461

PREPARED BY:

Department of the Air Force
412th Civil Engineer Group
Edwards Air Force Base, California

November 2021

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FINDING OF NO SIGNIFICANT IMPACT (FONSI)

CONTINUED USE OF EDWARDS RESTRICTED AIRSPACE IN SOUTHEASTERN CALIFORNIA EDWARDS AFB, CALIFORNIA

INTRODUCTION

Pursuant to provisions of the National Environmental Policy Act (NEPA), Title 42 United States Code (USC) Sections 4321 to 4347, implemented by Council on Environmental Quality (CEQ) Regulations, Title 40, Code of Federal Regulations (CFR) §1500-1508, and 32 CFR §989, Environmental Impact Analysis Process, the U.S. Air Force (Air Force) assessed the potential environmental consequences associated with the continued use of the airspace that comprises Restricted Area R-2515 and the test ranges located within the airspace. The Edwards Air Force Base (AFB) 412th Operational Support Squadron Airspace Management Office (412 OSS/OSSA) proposes this continued use. R-2515 is one of several types of Special Use Airspace contained within a larger restricted airspace area known as the R-2508 Complex located in the western Mojave Desert of Southern California. The 412th Test Wing (412 TW) at Edwards AFB, California is the primary user of R-2515.

PURPOSE AND NEED

The Proposed Action is for the Air Force to continue to conduct flight test and training operations in R-2515 (also referred to in this document as the Edwards Restricted Airspace) in essentially the same manner as it has for the last 70 years. The purpose of the Proposed Action is to ensure that the Air Force continues to have combat-ready aircraft to provide for the national defense. The 412 TW conducts and analyzes test missions and reports on flight and ground testing of aircraft, weapons systems, software, components, modeling, and simulation for the Air Force. The Air Force must continually test aircraft to evaluate technology improvements and to provide advanced training. The 412 TW needs the Proposed Action to accomplish its mission. The mission of the 412 TW is to "conduct developmental test and evaluation of air, space, and cyber systems to provide timely, objective, and accurate information to decision makers."

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This Environmental Assessment (EA), incorporated by reference into this finding, analyzes the potential environmental consequences of activities associated with Continued Use of Restricted Airspace R-2515. The EA considers potential impacts of three alternatives:

- **ALTERNATIVE 1 – NO ACTION ALTERNATIVE** includes the continued use of the Edwards Restricted Airspace (R-2515) for flight testing and training operations at current levels.

- **ALTERNATIVE 2 – PROPOSED ACTION ALTERNATIVE** includes the continued use of R-2515 with the addition of three reasonably foreseeable activities: (1) a nominal amount of testing operations for the B-21, (2) the one-to-one replacement of the T-38 operations with the T-7, and (3) testing of the KC-46A.
- **ALTERNATIVE 3 – ADDITIONAL OPERATIONS (SURGE)** includes all components outlined under Alternative 2 (i.e., the continued use of R-2515, a nominal amount of testing operations for the B-21, the replacement of the T-38 operations with T-7, and testing of the KC-46A) with the addition of a 100 percent increase in all types of airspace operations in R-2515 with a similar mix of uses.

The EA also considers cumulative environmental impacts with other projects in the Region of Influence.

ENVIRONMENTAL CONSEQUENCES

The following components of the natural and manmade environment were analyzed for potentially significant impacts: airspace use and management, air quality, cultural resources, land use, natural resources, noise, and safety. No potentially significant impacts were identified for any of these areas. The components with potentially the greatest impact are air quality and noise. Emissions for the No Action Alternative would not change from current conditions. Emissions for Alternatives 2 and 3 would be below *de minimis* threshold values under the General Conformity Applicability Analysis and, therefore, would not have significant impacts to air quality. The No Action Alternative would result in no effect on the noise environment. Both Alternatives 2 and 3 would result in long-term minor adverse impacts on the noise environment, due to incremental changes in aircraft mix and tempo of operations. In addition, no adverse cumulative impacts or unavoidable impacts were identified for any of the three alternatives.

SUMMARY OF FINDINGS

The analyses of the affected environment and environmental consequences of implementing any of the three alternatives presented in the EA concluded that by implementing standing environmental protection measures and operational planning, the Air Force would be in compliance with all terms and conditions and reporting requirements. No additional mitigations or environmental protection measures would be required.

PUBLIC REVIEW

This EA was circulated for public review from 25 August 2021 through 24 September 2021 on the California State Clearinghouse website (SCH #2021080461), and was mailed to potentially interested federal, state, and local agencies including the U.S. Army Corps of Engineers, U.S. Department of Interior Bureau of Land Management, National Training Center Fort Irwin, China Lake Naval Weapons Station, U.S. Fish and Wildlfie Service, Federal Aviation Administration, Antelope Valley Air Quality Management District, Eastern Kern Air Pollution Control District, Mojave Desert Air Quality

Management District, California Department of Fish and Wildlife, California Department of Transportation, California State Office of Historic Preservation, Native American Heritage Commission, the cities of Lancaster and Palmdale, and the counties of Kern, Los Angeles, and San Bernardino. In addition, copies of the EA were mailed to local libraries in the communities of Rosamond, California City, Mojave, Quartz Hill, Barstow, Lancaster, and Palmdale. No comments were received on the document through the SCH or at the 412th Test Wing Public Affairs office at Edwards AFB.

FONSI

Based on my review of the facts and analyses contained in the attached EA, conducted under the provisions of NEPA, CEQ Regulations, and 32 CFR §989, I conclude that implementation of the Proposed Action or any of the alternatives would not have a significant environmental impact, either by itself or cumulatively with other known projects. Accordingly, an Environmental Impact Statement is not required. The signing of this FONSI completes the environmental impact analysis process.

Background information that supports the research and development of this FONSI and the EA are on file at Edwards AFB and may be obtained by contacting:

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(661) 277-8707, e-mail 412tw.pae@us.af.mil

JUDKINS.JAMES.E.1133772983 Digitally signed by JUDKINS.JAMES.E.1133772983
Date: 2021.12.15 18:35:56 -08'00'

JAMES JUDKINS, NH-IV
Base Civil Engineer

Date

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TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF APPENDICES

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ACAM	Air Conformity Applicability Model
ACEC	Area of Critical Environmental Concern
AF	Air Force
AFB	Air Force Base
AFI	Air Force Instruction
AFMC	Air Force Materiel Command
AFOTEC	Air Force Operational Test and Evaluation Center
AFRC	(NASA) Armstrong Flight Research Center
AFRL	Air Force Research Laboratory
AFTC	Air Force Test Center
AGL	above ground level
AHO	above highest object
AICUZ	Air Installation Compatible Use Zone
AOPA	Aircraft Owners and Pilots Association
AQCR	air quality control region
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCAA	air traffic control assigned airspace
AVAQMD	Antelope Valley Air Quality Management District
BASH	bird aircraft strike hazard
BLM	Bureau of Land Management
BMP	best management practices
°C	degrees Celsius
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CCF	Central Coordinating Facility
CFA	Controlled fire area
CFR	Code of Federal Regulations
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CO	carbon monoxide

CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
dB	decibels
dBA	A-weighted decibels
de minimis	of minimal importance
DOD	Department of Defense
DZ	Drop Zone
EA	Environmental Assessment
EAFBI	Edwards AFB Instruction
EDW	Edwards Tower
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EO	executive order
EOD	Explosive Ordnance Demolition
ESA	Endangered Species Act
ET-CTF	Emerging Technologies-Combined Test Force
°F	degrees Fahrenheit
FAA	Federal Aviation Administration
FL	flight level
FONSI	Finding of No Significant Impact
ft	feet
GHG	greenhouse gas
GPS	global positioning system
ICRMP	Installation Cultural Resources Management Plan
IFR	instrument flight rule
INRMP	Installation Natural Resources Management Plan
IR	instrument route
ISA	International Standard Atmosphere
JBBP	Joint Planning and Policy Board
JCF	Joshua Control Facility
JO	(FAA) Job Order
JTAC	Joint Tactical Attack Control
KCAPCD	Kern County Air Pollution Control District

L_{eq}	equivalent continuous sound level
L_{max}	maximum sound level
LOA	letter of agreement
MBTA	Migratory Bird Treaty Act
MDAB	Mojave Desert Air Basin
MDAQMD	Mojave Desert Air Quality Management District
MOA	Military Operations Area
MSL	mean sea level
MTR	military training route
NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NAWS	Naval Air Weapons Station
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NM	nautical miles
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
NOTAM	notice to airmen
NRHP	National Register of Historic Places
NTC	National Training Center
O_3	ozone
OHV	off-highway vehicle
OSHA	Occupational Safety & Health Administration
OSS/OSSA	Operation Support Squadron Airspace Management Office
PAA	Permanently Assigned Aircraft
PIRA	Precision Impact Range Area
PM_{10}	particulate matter 10 microns or less
$PM_{2.5}$	particulate matter 2.5 microns or less
PMD	Palmdale Plant 42 Airport
ppb	parts per billion
ppm	parts per million
psf	pounds per square foot

RA	Restricted Area/Restricted Airspace
RDT&E	research, development, test and evaluation
RNAV	area navigation
ROI	region of influence
SEL	sound exposure level
SEA	(Los Angeles County) Significant Ecological Area
SIP	state implementation plan
SO2	sulfur dioxide
SOx	oxides of sulfur
SR	slow route
SUA	special use airspace
TFR	Terrain Following Route
TPS	Test Pilot School
tpy	tons per year
TW	test wing
μ/m^3	micrograms per cubic meter
UAS	unmanned aerial systems
USAF	United States Air Force/U.S. Air Force
USC	United States Code
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service/U.S. Forest Service
USFWS	United States Fish and Wildlife Service
VFR	visual flight rules
VMC	VFR Meteorological Conditions
VR	visual route

1.0 PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

Edwards Air Force Base (AFB) is part of Air Force Materiel Command (AFMC) and supports the mission of the United States Air Force (USAF or Air Force) to protect the United States in its global interests through the use of superior defense systems in air, space, and cyberspace. Edwards AFB is home to the 412th Test Wing (412 TW), the USAF Test Pilot School, the Air Force Research Laboratory (AFRL), and National Aeronautics and Space Administration (NASA) Armstrong Flight Research Center. Almost every United States military aircraft since the 1950s has been at least partially tested at Edwards AFB, and it has been the site of many aviation breakthroughs. Edwards AFB currently operates as the integral unit for the testing and evaluation of military aircraft. Edwards AFB uses the R-2515 Restricted Airspace and the larger R-2508 Complex for these purposes.

Edwards Restricted Airspace (R-2515) covers approximately 1,812 square miles and supports developmental and follow-on flight test and evaluation of current and next generation aircraft and aerospace systems. These tests ensure capabilities of numerous platforms, from concept to deployment, under the direction of the 412 TW Commander at Edwards AFB, California. Activities within this airspace are managed and coordinated by the Central Coordinating Facility (CCF). The R-2508 Complex, of which R-2515 is a subset, is managed by the Joint Policy and Planning Board (JPPB) led by the Commanders of the Air Force Test Center (AFTC) at Edwards AFB, Naval Air Weapons Station (NAWS) China Lake, and the National Training Center (NTC) Fort Irwin.

Edwards Restricted Airspace is one of several types of Special Use Airspace (SUA) contained within a larger restricted airspace area known as the R-2508 Complex located in the western Mojave Desert region of inland central and Southern California (Figure 1-1). The R-2508 Complex is a three-dimensional resource which includes all the airspace and associated land presently used and managed by the three principal military installations in the region: Edwards AFB, NAWS China Lake, and NTC, Fort Irwin. The R-2508 Complex is one of the largest military SUAs in the United States (19,600 square miles) and is a major range and test facility where the military, NASA, and other federal and commercial testing entities conduct large-scale training and testing activities for aircraft and advanced weapon systems. The controlling agency is the Federal Aviation Administration (FAA), which designates special use airspace for military use. This airspace, including Edwards Restricted Airspace, has been used successfully for over 70 years and will continue to be used in a similar manner with current, updated, and new airframes.

This Environmental Assessment (EA) evaluates the potential environmental impacts associated with the continued use of the airspace that comprises Edwards Restricted Airspace and the test ranges located within Edwards Restricted Airspace. Edwards Restricted Airspace is used primarily by 412 TW at Edwards AFB and is referred to in this document as Edwards Restricted Airspace or R-2515. The Edwards AFB 412th Operational Support Squadron Airspace Management Office (412 OSS/OSSA) proposes this continued use.

This EA provides the following information:

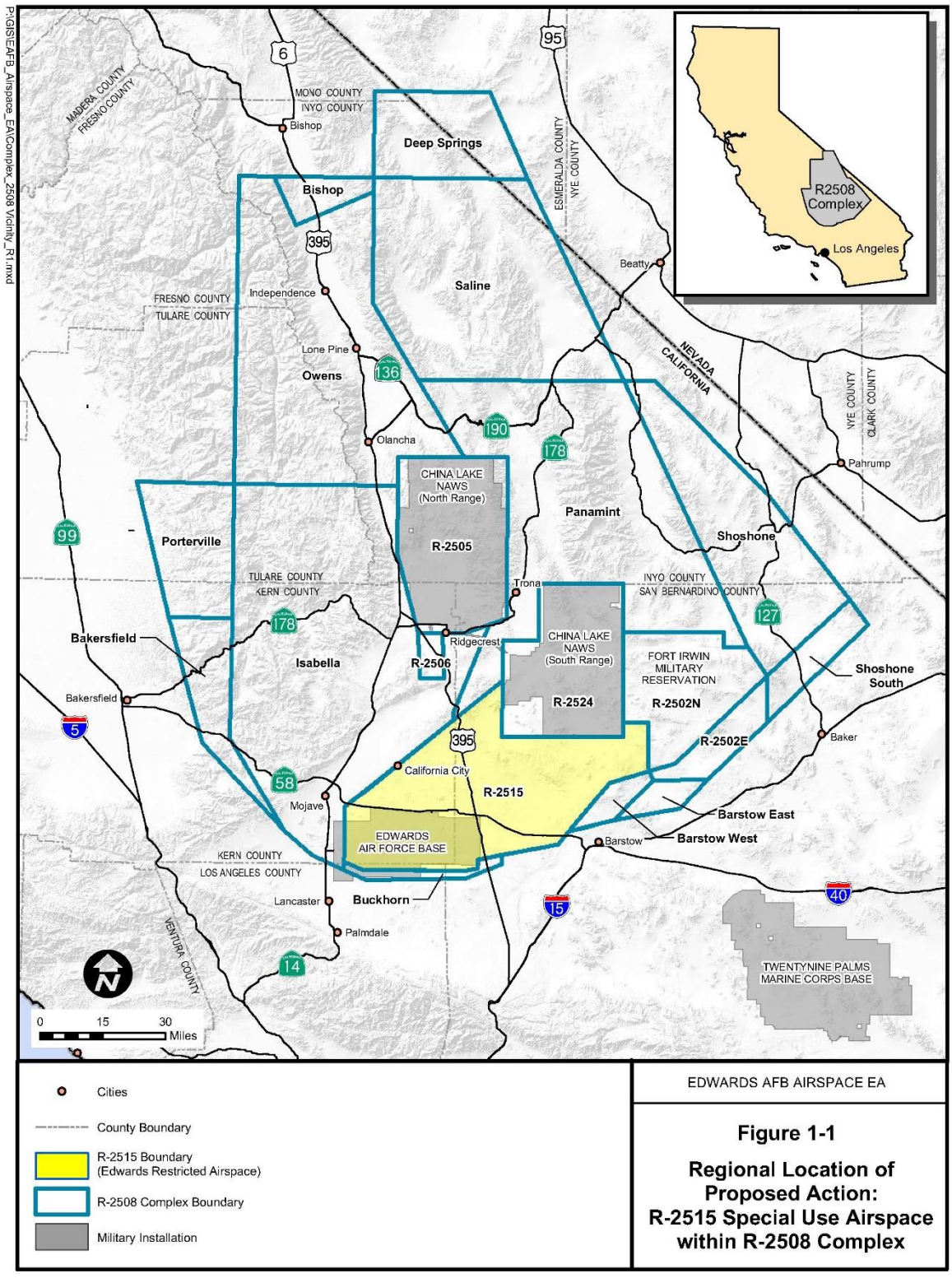
- Description of the existing environment in Edwards Restricted Airspace;
- Discussion of guidance and regulations pertaining to use of Edwards Restricted Airspace;
- Identification of six alternatives considered, with three dismissed for technical or mission reasons;
- Analysis of three alternatives;
- Identification of sensitive resources, values and opportunities, and potential impacts to and from aircraft operations; and
- List of environmental protection measures.

This EA also provides a technical memorandum regarding the continued use of the Sidewinder Low-Level Route and JEDI Transition Corridor, which are not in Edwards Restricted Airspace but are used by the Air Force and other Edwards Restricted Airspace users and had not been established at the time previous environmental documents were prepared for this airspace. The technical memorandum is provided in Appendix A.

1.2 LOCATION OF PROPOSED ACTION

The Proposed Action would occur on Edwards AFB (the installation) and areas to the north and east of the installation that make up the Edwards Restricted Airspace which extends northeast to the southern and western boundaries of the restricted areas for NAWS China Lake (R-2425) and the U.S. Army's NTC Fort Irwin (R-2502N), respectively (Figure 1-1). Vertical dimensions of these restricted areas extend from the surface to an unlimited altitude. Edwards AFB is located in the Antelope Valley region of the western edge of the Mojave Desert in Southern California, about 60 miles northeast of Los Angeles, California, 90 miles northwest of the City of San Bernardino, and 80 miles southeast of the City of Bakersfield. Most of Edwards AFB lies within Kern County, with smaller portions in Los Angeles and San Bernardino counties. The installation occupies an area of 307,517 acres or 480 square miles and consists of largely undeveloped or semi-improved land that is used predominantly for aircraft test ranges and maintained and unmaintained landing sites (i.e., dry lake beds). Edwards AFB is bounded by State Highways 14 to the west and 58 to the north; and U.S. Route 395 to the east; with county road Avenue E near the southern boundary.

Approximately 35% of the Edwards Restricted Airspace lies in Kern County, approximately 63% in San Bernardino County, and a small portion (less than 2%), lies in Los Angeles County (U.S. Air Force 1998). The communities of Boron (population 2,253), California City (population 14,120), Hinkley (population 75), Kramer Junction (population 45), Randsburg (population 69), North Edwards (population 1,058), Rosamond (population 18,150), and City of Barstow, California (population 22,639) are under or near the Edwards Restricted Airspace (U.S. Census 2000, 2010).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R2508 Complex
Los Angeles
MADERA COUNTY
FRESNO COUNTY
MONO COUNTY
INYO COUNTY
Bishop
Deep Springs
Saline
ESMERALDA COUNTY
NYE COUNTY
Beatty
Independence
FRESNO COUNTY
TULARE COUNTY
Lone Pine
Owens
NEVADA
CALIFORNIA
NYE COUNTY
CLARK COUNTY
Pahrump
Olancha
CHINA LAKE NAWS (North Range)
R-2505
Panamint
Shoshone
Porterville
TULARE COUNTY
KERN COUNTY
Trona
INYO COUNTY
SAN BERNARDINO COUNTY
Bakersfield
Ridgecrest
CHINA LAKE NAWS (South Range)
FORT IRWIN MILITARY RESERVATION
Isabella
R-2506
R-2524
R-2502N
Shoshone South
Bakersfield
R-2502E
Baker
California City
R-2515
Mojave
Barstow East
EDWARDS AIR FORCE BASE
Barstow
Barstow West
KERN COUNTY
LOS ANGELES COUNTY
Lancaster
Buckhorn
Palmdale
VENTURA COUNTY
TWENTYNINE PALMS MARINE CORPS BASE
0 15 30 Miles
Cities
County Boundary
R-2515 Boundary (Edwards Restricted Airspace)
R-2508 Complex Boundary
Military Installation
EDWARDS AFB AIRSPACE EA
Figure 1-1
Regional Location of Proposed Action: R-2515 Special Use Airspace within R-2508 Complex

1.3 PURPOSE OF AND NEED FOR PROPOSED ACTION

The Proposed Action is for the Air Force to continue to conduct flight test and training operations in the Edwards AFB Restricted Airspace in essentially the same manner as it has for the last 70 years.

The purpose of the Proposed Action is to ensure that the Air Force continues to have combat-ready aircraft to provide for the national defense. Congress has designated the purpose of the Edwards Restricted Airspace to test aircraft technologies and training military personnel in the use of advanced aircraft technologies.

The 412 TW conducts and analyzes test missions and reports on flight and ground testing of aircraft, weapons systems, software, components, modeling, and simulation for the Air Force. The Air Force must continually test aircraft to evaluate technology improvements and to provide advanced training.

The 412 TW needs the Proposed Action to accomplish its mission. The mission of the 412 TW is to "conduct developmental test and evaluation of air, space, and cyber systems to provide timely, objective, and accurate information to decision makers." This includes the following activities that support the mission:

- Conduct and support the tests of manned and unmanned aerospace vehicles;
- Conduct flight evaluation and recovery of aerospace research vehicles and development testing of aerodynamic decelerators;
- Support space and missile tests;
- Operate a fleet of test bed aircraft for early development and testing of new avionics;
- Operate the USAF Test Pilot School (TPS);
- Manage and operate the Edwards AFB Flight Test Range; and
- Support and participate in USAF, U.S. Department of Defense (DoD), and other governmental agency, foreign, and contractor test and evaluation programs.

A broad array of activities is conducted at Edwards AFB, including testing aircraft flight characteristics, new software for various uses, new radar functions, towed objects (e.g., targets, sensor arrays), engine performance, drop cargo methods and procedures, new fuels, refueling activities equipment, aircraft modifications, new avionics, and concealment and countermeasures, as well as conducting pilot training and jump training. The 412 TW's customers need to know that the 412 TW can continue current operations and can meet their testing and evaluation needs in a timely and environmentally responsible manner.

The test activities can be categorized as shown in the Table 1-1.

Table 1-1 Typical Test Activities in Edwards Restricted Airspace

Aerospace • Weapons Integration • Navigation • Mission Data Systems • Propulsion • Flying Quality • Flight Control • Aircraft Performance • Aircraft Structural Integrity **Electrical/Electronic** • Telemetry • Instrumentation and Measurement • Electro-Optical Sensors • Communication/Navigation/Identification (CNI) • Network Centric Operations (NCO) • Collision Avoidance Systems • Radar • Terrain Following Systems • Weapons Integration • Low Observable (LO) Systems • Battle Management Systems • Electronic Warfare • Defensive Management Systems	**Mechanical** • Weapons Integration (Gravity, Guided/GPS, Air-to-Ground, Air-to-Air) • Telemetry, Instrumentation and Measurement • Mission Data Systems • Aircraft Subsystems • Flight Test Evaluation **Computer/Software** • Communication Technologies • Tactical Data Links • Network Centric Warfare • Joint Tactical Radio Systems (JTRS) • Mission Data Systems **Miscellaneous** • Benefield Anechoic Facility (BAF) • Digital Integrated Air Defense System (DIADS) • Avionics Systems • Electronic Warfare Systems (EW) • Electronic Counter Measurement (ECM) Jamming Systems • Radar Target Generators (RTGs)

1.4 ISSUES AND CONCERNS CONSIDERED

The following issues and concerns were identified as requiring assessment when considering the potential environmental impacts of the alternatives.

- Airspace;
- Air Quality;
- Cultural Resources;
- Land Use;
- Natural Resources;
- Noise; and
- Safety.

This EA assesses only aircraft flight operations and not any ground-based activities. As such, aircraft flight operations are expected to have little or no potential impact on geology and soils, hazardous materials and waste, hydrology and water quality, infrastructure, socioeconomics, and environmental justice and are not, therefore, addressed in this EA. Even though cultural

and natural resources are ground-based resources, they are included in the analysis because the noise and vibration of low-level flights may affect sensitive cultural or natural resources.

1.5 REGULATORY REQUIREMENTS AND PERMITS

Under the National Environmental Policy Act (NEPA), federal agencies are required to consider the environmental consequences of proposed actions using a systematic, interdisciplinary approach to ensure well-informed federal decisions. The President's Council on Environmental Quality (CEQ) was established under NEPA to implement and oversee federal policy in this process. To this end, CEQ issued regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, which are found in Title 40 of the Code of Federal Regulations (CFR), Parts 1500-1508 (40 CFR 1500-1508). The Air Force Environmental Impact Analysis Process (EIAP) is provided in 32 CFR 989, with additional Air Force instructions provided in Air Force Instruction (AFI) 32-7061.

This documentation is prepared in compliance with NEPA and the CEQ regulations for an EA. The regulations require that the EA identify and consider all the environmental regulations, requirements, and permits for the Proposed Action and alternatives. Per the CEQ regulations, the EA will list any new federal permits, licenses, or other entitlements that must be obtained as a result of the Proposed Action or alternatives. None of the three alternatives analyzed in this EA, including the continued use of Edwards Restricted Airspace (continue current operations or No Action Alternative) as Alternative 1, the addition of three reasonably foreseeable activities as Alternative 2, and an increase in operational tempo as Alternative 3, will require new permits, licenses, or entitlements.

1.6 RELATED ENVIRONMENTAL DOCUMENTS

This EA draws on a library of environmental documentation and other references prepared or obtained by Edwards AFB on the Edwards Restricted Airspace. In particular, a few EAs have addressed aircraft operations within R-2515, including the *Environmental Assessment for Continued Use of Restricted Area R-2515* (U.S. Air Force 1998). Since that EA is 20 years old and the environmental analysis needs updating to reflect the most recent environmental guidance and legislation, and there have been some changes in the use of the Edwards Restricted Airspace, this EA provides that update in the form of a comprehensive analysis of the impacts of current flight operations. Other EAs have focused on continuing supersonic operations, including in the Alpha Corridor/ Precision Impact Range Area (PIRA) and Black Mountain Supersonic Corridor EAs (U.S. Air Force 1995 and 2001, respectively), and low-level flight testing, evaluation, and training (U.S. Air Force 2005).

Incorporation by reference was used to provide efficiency when preparing this EA. The CEQ regulations direct agencies to incorporate relevant material by reference into an Environmental Impact Statement (EIS) or EA to reduce the size of the document and avoid duplicative effort (40 CFR § 1502.21). For all materials incorporated by reference into this EA, the Air Force has (1) provided a citation that clearly identifies the material incorporated in this EA; (2) briefly described the content (40 CFR § 1502.21); (3) informed the reader of the purpose and value of

the incorporated materials; and (4) synopsized the basis provided in the incorporated materials that support any conclusions being incorporated.

This EA incorporates by reference the following documents, which are reasonably available for inspection as required under 40 CFR § 1502.21:

- *Final Environmental Assessment for the Continued Use of Restricted Area R-2515*, April 1998. Alternatives considered were the Proposed Action, which was to maintain flight training and testing operations in R-2515 at current levels. The Proposed Action and No Action were one and the same alternative. The second alternative was to add a test program similar to the F-22. Primary issues of concern were noise and air quality (U.S. Air Force 1998).
- *Final Environmental Assessment for Continued Supersonic Operations in the Black Mountain Supersonic Corridor and the Alpha Corridor/ Precision Impact Range Area*, August 1995. The Preferred Alternative was to continue use of the existing Edwards AFB supersonic corridors. The No Action Alternative was to discontinue low altitude supersonic activity in the corridors. Alternatives considered (but rejected) included: using other existing supersonic areas, establishing new operational areas, relocating operational units, and flying over water. Primary issues of concern were noise, air quality, and natural resources (U.S. Air Force 1995).
- *Revised Final Environmental Assessment to Extend the Supersonic Speed Waiver for Continued Operations in the Black Mountain Supersonic Corridor and Alpha Corridor/ Precision Impact Range Area*, April 2001. The proposed and Preferred Action was to authorize continuing supersonic operations at the current levels. The No Action Alternative was to discontinue the waiver, thereby eliminating low altitude supersonic activity in the corridors. Numerous alternatives were considered and rejected. Primary issues of concern were noise and air quality (U.S. Air Force 2001).
- *Final Environmental Assessment for Low-Level Flight Testing, Evaluation, and Training,* May 2005. The Proposed Action was to continue flying on 30 previously established low-level routes (Colored Routes, Terrain Following Routes, and Military Training Routes) using a new mix of aircraft at a tempo about 7 percent lower than current conditions. The No Action was to continue operations at a status quo level of aircraft type and operational tempo. Main issues of concern were airspace management, land use, noise, air quality, and natural and cultural resources (U.S. Air Force 2005).
- *Final Environmental Assessment for Routine and Recurring Small Transient and New Test Missions,* April 2008. This EA evaluated the potential effects of the proposed action and three alternatives that would include major and minor construction that could be needed to support the proposed action and alternatives. Alternative A included adding the complete contingent of aircraft, personnel, and major construction activities. Alternative B would be similar to Alternative A, except only minor construction would occur. Alternative C would use existing facilities, and Alternative D is the No-Action Alternative. Primary issues of concern were air quality, noise, airspace management and safety, hazardous waste/ solid waste, infrastructure, and natural resources (U.S. Air Force 2008).

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2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action and Alternatives. The criteria established for selecting a reasonable range of alternatives are identified, as are the alternatives that were considered but dismissed from further discussion. The potential environmental impacts for each alternative are summarized in table form at the end of this chapter, as are the minimization measures proposed to ensure that all impacts are kept to a level that is not significant.

2.1 PROPOSED ACTION

The Proposed Action is for the Air Force to continue to conduct flight test and training operations in the Edwards AFB Restricted Airspace in essentially the same manner as it has for the last 70 years.

2.2 CRITERIA FOR SELECTION OF A REASONABLE RANGE OF ALTERNATIVES

NEPA and the CEQ regulations mandate the consideration of reasonable alternatives for the proposed action. “Reasonable alternatives” are those that also could be utilized to meet the purpose of and need for the proposed action. Per the requirements of 32 CFR §989, the Air Force EIAP regulations, selection criteria are used to identify alternatives for meeting the purpose and need for the Air Force action.

The criteria established here set the minimum requirements that must be met for an alternative to be considered viable. Those alternatives not meeting one or more of the selection criteria have been eliminated from further discussion. Explanation of eliminated alternatives is provided in Section 2.3. Descriptions of three alternatives considered are provided in Sections 2.4, 2.5, and 2.6. Alternatives meeting all selection criteria were retained and are analyzed in Chapter 4 (Environmental Consequences) of this EA.

The criteria used to select the alternatives discussed in this document are described below. Selection criteria have been separated into four categories:

- **Sustainable/Mission Support Criteria.** To meet the criteria which address sustainability and supportability of the 412 TW mission at Edwards AFB, the alternative must (1) retain the ability to support the 412 TW Mission at Edwards AFB; and (2) include continuing access to Edwards Restricted Airspace as a critical component of the 412 TW Mission at Edwards AFB.
- **Environmental Criteria.** To meet the criteria which address environmental considerations at Edwards AFB, the alternative must (1) verify compliance with applicable environmental regulations and Air Force policy; (2) minimize impacts to sensitive natural resources; and (3) continue to minimize the extent of environmental impacts.
- **Technical Criteria.** To meet the criteria which address technical and regulatory compliance requirements, the alternative must be (1) technically sound and regulatory compliant; and (2) compatible with existing Edwards AFB infrastructure.

- **Economic Criteria.** In addition to the above criteria, the alternative must be economically viable.

2.3 ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER CONSIDERATION

Alternatives that were either beyond the scope of this EA or did not meet all of the selection criteria were eliminated from further discussion. The dismissed alternatives and the reasons for their dismissal are:

- **Change in analysis of impact areas or land-based targets.** This EA is focused on the continued use of the Edwards Restricted Airspace, which is a primary mission component for Edwards AFB. A change in impact areas or land-based targets is beyond the scope of this EA and by themselves would not meet the mission criteria. The continued use of Edwards Restricted Airspace in its current form would not alter or directly affect impact areas or land-based targets. If new flight test programs or new missions at Edwards AFB require changes to impact areas or land-based targets, then those programs would require their own NEPA compliance documents.
- **Shifting operations and testing locations away from Edwards AFB.** This alternative may require realignment of Edwards AFB and its flight and test mission. Shifting the flight and test capabilities from Edwards AFB to another installation would not meet the mission support or economic viability criteria for Edwards AFB.
- **Reduction in operations and testing at Edwards AFB.** This alternative would not meet the mission support criteria in that it would not provide the flexibility needed to accommodate changes in the demand for use of Edwards AFB and its restricted airspace resource. The capability of Edwards AFB to support the overall Air Force mission would be severely affected.

2.4 ALTERNATIVE 1 – NO ACTION ALTERNATIVE

Alternative 1 includes the continued use of the Edwards Restricted Airspace (R-2515) for flight testing and training operations at current levels (Figure 2-1). This would be in keeping with the mission requirements of its many users, but primarily as used by 412 TW. The best available information on the number and type of airspace operations within Edwards Restricted Airspace, including its sub-areas and functions, has been collected specifically for this EA and used as a comparative baseline under NEPA. The 2016 Air Installation Compatible Use Zone (AICUZ) Plan and the 2018 mobile air emissions inventory has been used to supplement this information, as appropriate. Components other than the continued use of Edwards Restricted Airspace and the recently-established training route and associated transition will not be carried forward for detailed analysis in this EA.

2.5 ALTERNATIVE 2 – PROPOSED ACTION ALTERNATIVE

The Proposed Action includes the continued use of R-2515 with the addition of three reasonably foreseeable activities, including (1) a nominal amount of testing operations for the B-21, (2) the one-to-one replacement of the T-38 operations with the T-7, and (3) testing of the KC-46A. The

Proposed Action does not include any other changes to testing and training activities or air operations. The Proposed Action does not include any construction or infrastructure components.

2.6 ALTERNATIVE 3 – ADDITIONAL OPERATIONS (SURGE) ALTERNATIVE

Alternative 3 includes all components outlined under Alternative 2 (i.e., the continued use of Edwards Restricted Airspace, a nominal amount of testing operations for the B-21, the replacement of the T-38 operations with T-7, and testing of the KC-46A) with the addition of a 100 percent increase in all types of airspace operations in Edwards Restricted Airspace with a similar mix of uses. This would provide for an expanded operational envelope to account for moderate changes in funding, deployment, and testing and training requirements within the airspace. As with Alternatives 1 and 2, no other changes to testing and training activities or construction or infrastructure components are included in the Proposed Action. If distinct or large changes in operations Edwards AFB or within Edwards Restricted Airspace are proposed, additional NEPA documentation may be required.

2.7 SUMMARY OF ENVIRONMENTAL IMPACTS

Table 2-1 presents a summary of anticipated environmental impacts for all alternatives.

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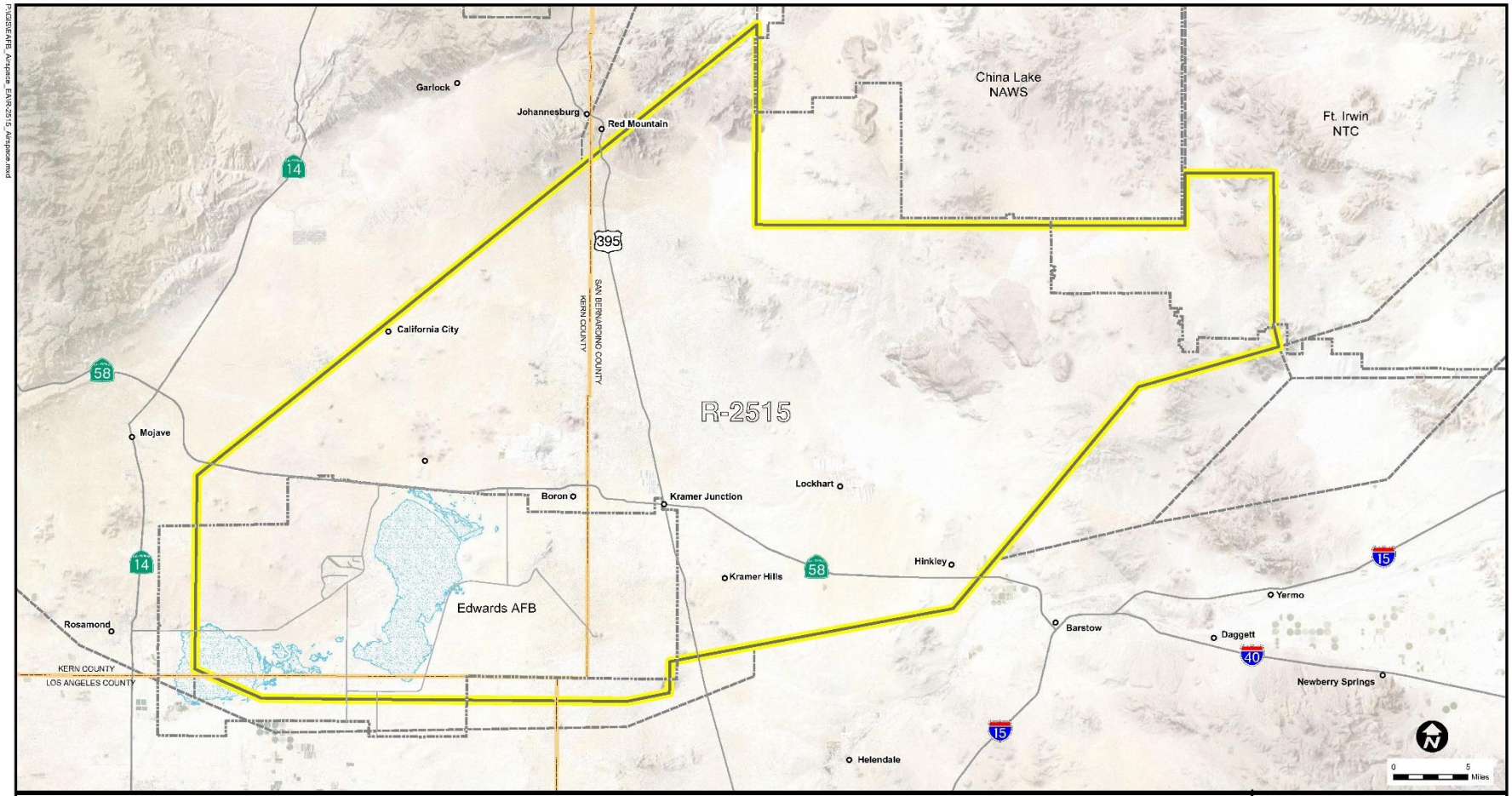
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Garlock
Johannesburg
Red Mountain
China Lake
NAWS
Ft. Irwin
NTC
14
395
KERN COUNTY
SAN BERNARDINO COUNTY
California City
58
R-2515
Mojave
Boron
Kramer Junction
Lockhart
Hinkley
Kramer Hills
58
15
Yermo
Barstow
Daggett
40
Newberry Springs
14
Edwards AFB
Rosamond
KERN COUNTY
LOS ANGELES COUNTY
15
Helendale
N
0
5
Miles
R-2515 Boundary
(Edwards Restricted Airspace)
R-2508 Boundary
Military Installation
County Boundary
EDWARDS AFB AIRSPACE EA
Figure 2-1
R-2515 Special Use Airspace

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Table 2-1 Summary of Potential Environmental Impacts

Resource	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Additional Operations (Surge)
Airspace Use and Management	No change from current conditions. No additional impacts, and no mitigation required.	The three additional actions do not represent any significant change to on-going operations within the Edwards Restricted Airspace (R-2515). Therefore, implementation of Alternative 2 would have less than significant impacts to airspace use and management. No mitigation would be required.	Implementation of Alternative 3, a doubling of Proposed Action operations, would have less than significant impacts to airspace use and management. Following current procedures for managing the airspace would keep impacts less than significant. No mitigation would be required.
Air Quality	No change from current conditions. No additional impacts, and no mitigation required.	Long-term minor adverse impacts on air quality would occur from incremental increases in emissions from changes in aircraft mix when compared to existing training and testing within the Edwards Restricted Airspace. Emissions would be below the *de minimis* thresholds and would not contribute to a violation of any federal, state, or local air regulations. No mitigation would be required.	Long-term minor adverse impacts on air quality would occur from incremental increases in emissions below the mixing height from changes in aircraft fleet mix and additional air operations when compared to existing training and testing within the Edwards Restricted Airspace. Both the overall and county-specific changes in emissions would be less than the *de minimis* thresholds for all pollutants. No mitigation would be required.
Cultural Resources	No change from current conditions. Impacts would be less than significant, and no mitigation would be required.	Potential increase in noise impacts to cultural resources, but this increase would be trivial relative to the total amount of current air operations. Therefore, impacts would be less than significant, and no mitigation would be required.	Potential increase in noise impacts to cultural resources, but operations would avoid known cultural sites that are susceptible to noise effects from overflight to the maximum extent practicable. Since only random, occasional overflight may occur, the potential to impact cultural resources

Resource	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Additional Operations (Surge)
			would be less than significant, and no mitigation would be required.
Land Use	No change from current conditions. Following current procedures and restrictions should be adequate for the continued protection of city, county, and private lands within the Edwards Restricted Airspace. No significant land use impacts are anticipated, and no mitigation would be required.	Activities would be similar to other testing activities that have occurred over the past 20 years within the Edwards Restricted Area and would not result in new or appreciably greater impacts to the land uses described for the No Action Alternative. Following current procedures and restrictions would be adequate for the continued protection of city, county, and private lands within the Edwards Restricted Airspace. No significant land use impacts are anticipated, and no mitigation would be required.	This alternative would likely result in a noticeable change in airspace activities and tempo to residents and users of the land underlying the Edwards Restricted Airspace. However, the area is sparsely populated and most of the flying activities take place on weekdays and during daylight hours, thereby limiting adverse impacts to residents and recreational users of the lands. Following current procedures and restrictions would be adequate for the continued protection of city, county, and private lands within the Edwards Restricted Airspace. No significant land use impacts are anticipated, and no mitigation would be required.
Natural Resources	No change from current conditions. No additional impacts, and no mitigation required.	Potential impacts to wildlife, sensitive species, migratory birds, or sensitive habitats would be incrementally greater but unnoticeable than under the No Action Alternative due to changes in the fleet mix of aircraft conducting testing and training activities in the Edwards Restricted Airspace. No mitigation would be required.	Potential impacts to wildlife would be greater than under the No Action Alternative due to small changes in the fleet mix, and a doubling of testing and training activities. However, noise levels would not be increased by more than 3 A-weighted decibel (dBA) Community Noise Equivalent Level (CNEL) in a noise sensitive area that is exposed to noise above 65 dBA CNEL, or generate individual acoustic events

Resource	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Additional Operations (Surge)
			loud enough to damage hearing or structures. As a result, the same types of natural resources impacts would occur as discussed for the Proposed Action Alternative and would not, therefore, result in significant impacts to wildlife, sensitive species, migratory birds, or sensitive habitats in the Edwards Restricted Airspace. No mitigation would be required.
Noise	No change from current conditions. No additional impacts, and no mitigation required.	Long-term negligible adverse impacts on the noise environment would occur due to incremental, yet unnoticeable, changes in the fleet mix of aircraft conducting testing and training activities in the Edwards Restricted Airspace. Noise levels would not be increased by more than 1.5 dBA CNEL in a noise sensitive area that is exposed to noise above 65 dBA CNEL, or generate individual acoustic events loud enough to damage hearing or structures. No significant impacts are anticipated, and no mitigation would be required.	Long-term minor adverse impacts on the noise environment due to incremental, yet unnoticeable, changes in the fleet mix of aircraft conducting testing and training activities in the Edwards Restricted Airspace. Noise levels would not be increase by more than 3 dBA CNEL in a noise sensitive area that is exposed to noise above 65 dBA CNEL, or generate individual acoustic events loud enough to damage hearing or structures. No significant impacts are anticipated, and no mitigation would be required.
Safety	No change from current conditions. No additional impacts, and no mitigation required.	Safety procedures within the Edwards Restricted Airspace with respect to areas of concentrated air traffic, bird aircraft strike hazards (BASH), or other potential safety concerns would continue to be in place under this	Doubling operations in the Edwards Restricted Airspace could result in an increased potential for public health and safety impacts. However, safety procedures within the Edwards Restricted Airspace with respect to

Resource	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Additional Operations (Surge)
		alternative. Therefore, implementation of the Proposed Action Alternative would have a less than significant public health and safety impact. No mitigation would be required.	areas of concentrated air traffic, BASH hazards, or other potential safety concerns would continue to be in place under this alternative. In addition, over the last 70 years of flight operations at Edwards AFB, the types and numbers of aircraft have increased and evolved, and procedures have been established to refine use of the airspace to accomplish the missions and keep operations safe. Since the airspace is restricted, few aircraft may operate there without permission of the controlling entities or the users. Overall, no significant impacts are anticipated, and no mitigation would be required.

3.0 AFFECTED ENVIRONMENT

This chapter describes existing environmental conditions likely to be affected by implementing the Proposed Action and Alternatives. It provides the baseline information that was used to identify and evaluate potential environmental changes resulting from the implementation of the Proposed Alternatives. Resources identified that may be affected by the project include airspace use and management, air quality, cultural resources, land use, natural resources, noise, and safety. In accordance with CEQ regulations, AFI 32-7061, and FAA Order 1050.1, the EA focuses on only resource areas subject to environmental impacts that could result from continued use of the Edwards Restricted Airspace (R-2515). Resource areas that would experience negligible environmental impacts from implementation of the Proposed Action and are not covered in this EA are identified in Section 1.4, Issues and Concerns Considered.

3.1 AIRSPACE USE AND MANAGEMENT

3.1.1 Overview

Airspace is the four-dimensional area (space and time) that overlies a nation and falls under its jurisdiction. Airspace consists of both controlled and uncontrolled areas. Controlled airspace and the constructs that manage it are known as the National Airspace System (NAS). This system is "…a common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures; technical information; and manpower and material" (Federal Aviation Administration, 2015a). Navigable airspace is airspace above the minimum altitudes of flight prescribed by Title 49, Subtitle VII, Part A, *Air Commerce and Safety*, and includes airspace needed to ensure the safety of aircraft launch, recovery, and transit of the NAS (49 United States Code [USC] 40102).

Congress has charged the FAA with the responsibility of developing plans and policies for the use of navigable airspace and assigning, by regulation or order, the use of the airspace necessary to ensure efficient use and the safety of aircraft (49 USC 40103(b)). The FAA also regulates military operations in the NAS through the implementation of FAA Order JO (Job Order) 7400.2M, *Procedures for Handling Airspace Matters* and FAA Order JO 7610.4U, *Special Operations*. FAA Order JO 7610.4U was jointly developed by the DOD and FAA to establish policy, criteria, and specific procedures for air traffic control (ATC) planning, coordination, and services during defense activities and special military operations. The use and management of airspace by Air Force organizations is defined in AFI 13-201 *Air Force Airspace Management* and AFI 11-214 *Air Operations and Procedures*.

Different classifications of airspace are defined by different types of altitude measurements. The classifications commonly referred to throughout this section are:

- Above Ground Level (AGL) - This measurement is the distance above the earth and is typically used at lower elevations in Class G airspace (defined in Appendix B), approach/ departure situations, or any condition that typically resides in the area between surface and 1,200 feet (ft) AGL.

- Mean Sea Level (MSL) - This measurement is defined as the altitude of the aircraft above MSL as defined by altimeter instrumentation.
- Flight Level (FL) - FL is for airspace higher than 18,000 ft above MSL up to and including 60,000 ft above MSL. To obtain FL, the altimeter is set at the International Standard Atmosphere (ISA) and described by dropping the last two digits. For example, FL600 is comparable to 60,000 ft above MSL at the ISA setting.

Controlled airspace is defined as a limited section of airspace of established dimensions within which, ATC is provided to instrument flight rules (IFR) and to visual flight rules (VFR) traffic. Controlled airspace also has a set of classifications indicated on Sectional Maps to include Classes A through E, and Class G (there is no Class F). There are also Special Use Airspaces (SUAs) that are designed to ensure the separation of non-participating (non-military) aircraft from potentially hazardous operations or conflict with military operations. SUAs typically include Restricted Areas (RAs and referred to in this EA as Restricted Airspace), Military Operations Areas (MOAs) and Air Traffic Control Assigned Airspace (ATCAAs). Airspace components are summarized in Section 3.1.2, and all of these terms are defined in detail in Appendix B, Supporting Airspace Information.

3.1.2 Airspace Components

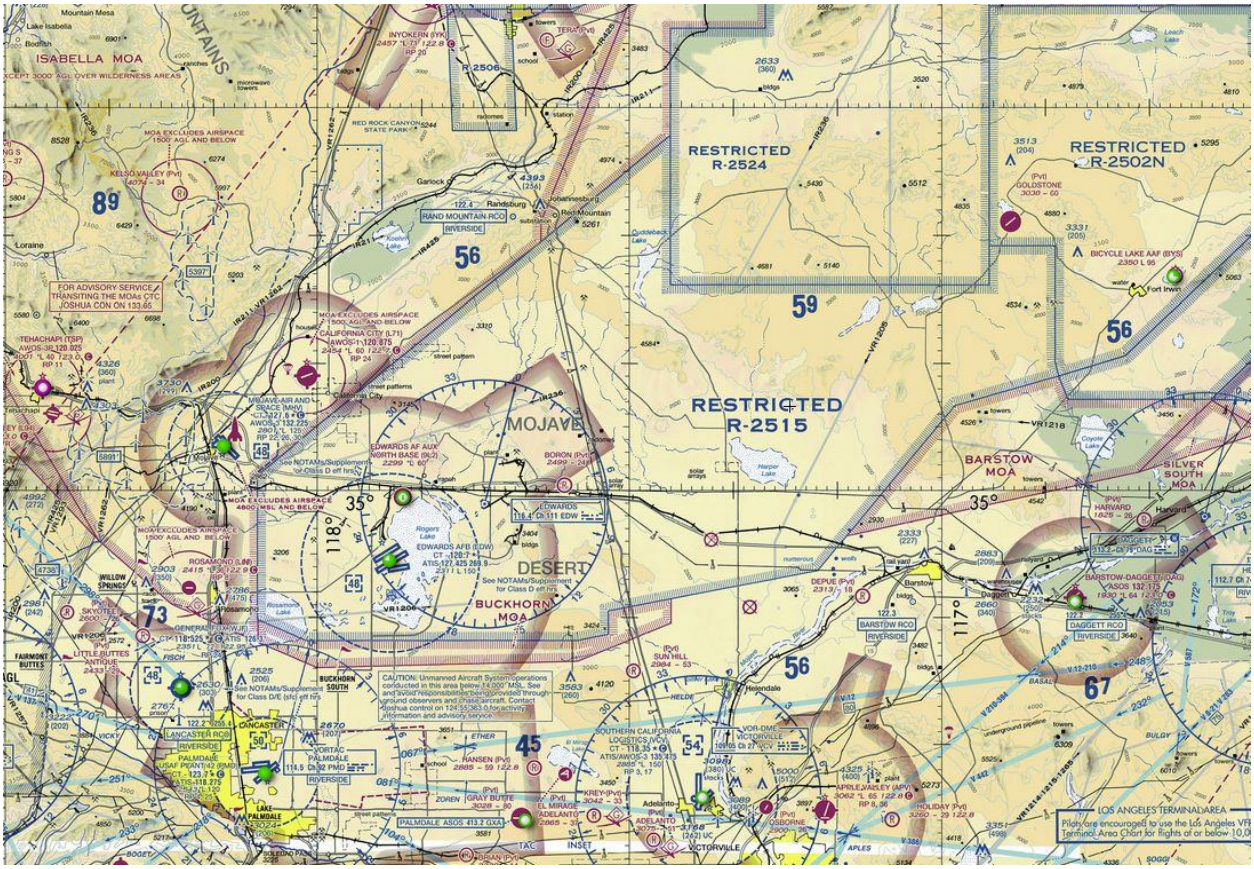
The region of influence (ROI) is considered to be an area extending approximately ten nautical miles (NM) beyond the boundary of the Edwards Restricted Airspace (R-2515) and includes all major airports and activities that interact with or are affected by the presence of the Edwards Restricted Airspace (R-2515). Airspace components within the ROI include various SUA such as RA, MOA, ATCAA, Controlled Fire Areas (CFAs), military traffic routes (MTRs), civilian air routes (V-Routes, Q-Routes and Jet-routes), as well as other military, civilian and private airports. Figure 3-1 depicts the ROI on a typical airspace Sectional Map. These airspace components are summarized here and described in more detail in Appendix B:

- **Restricted Airspace.** RA airspace defines areas where operations are hazardous to non-participating aircraft which are not permitted between the designated altitudes and during the time of designation without advanced permission of the using agency or the controlling agency.
- **Military Operations Areas.** MOAs are SUA with defined vertical and lateral limits established for the purpose of separating certain military training activities from IFR traffic. MOAs often support the activities of RAs by providing additional protected airspace surrounding the activity to act as a safety buffer and extended operations airspace. MOAs cannot extend higher than 18,000 ft above MSL. When not in use, these airspaces are returned to the FAA for use by non-participating aircraft.
- **Air Traffic Control Assigned Airspace.** ATCAAs are another type of SUA above 18,000 ft above MSL designed to accommodate non-hazardous high-altitude military flight training; this airspace remains under the control of the FAA, and when not in use by the military, may be used to support civil aviation activities. ATCAAs permit military aircraft to conduct high-altitude combat training, perform aerial refueling, and initiate or

egress from attacks on targets within a range. ATC routes IFR traffic around this airspace when activated.

- **Controlled Firing Areas.** A CFA exists north of the Edwards Restricted Airspace between two RAs associated with NAWS China Lake, including R-2505 and R-2524. The area between these RA is known as the Trona Corridor, which is the site of heavy military and civilian traffic transiting north-south through the R-2508 Complex. The Trona CFA allows for free flight weapons systems transiting from launch areas to target areas on the two NAWS China Lake ranges.
- **Military Training Routes.** MTRs are designated by three categories including visual routes (VR), instrument routes (IR) and slow routes (SR). VRs are for VFR type traffic at altitudes below 1,500 ft AGL. IRs are designated for IFR military traffic that is flown between 1,500 and 18,000 feet above MSL. SRs are similar to VRs, but are reserved for slow speed VFR traffic such as helicopters and smaller fixed wing aircraft.
- **Federal Airways.** Federal airways are designated linear routes that extend between navigational beacons that broadcast directional information used by pilots to maintain course along the route. Federal airways include low-altitude Victor Routes and high-altitude jet routes. Victor Routes extend from 1,200 ft AGL up to but not including 18,000 ft above MSL. High-altitude jet routes extend from FL180 to FL450. Traffic on jet routes is controlled by the FAA at all times. There are no Victor Routes or high-altitude jet routes that traverse the Edwards Restricted Airspace, but several exist around its perimeter.
- **Airports.** There are numerous airports and airfields within the ROI, including three within the Edwards Restrict Airspace (R-2515): Boron Airstrip, Edwards AFB, and Edwards AF Auxiliary North Base. The Boron Airstrip is the only registered and active non-military airfield within the Edwards Restricted Airspace. The busiest airport in the ROI is General William J Fox Airport at nearly 82,000 operations per year, located southwest of the Edwards Restricted Airspace and northwest of Plant 42 at Lancaster, California. Edwards AFB is a close second at just over 78,000 operations per year although many of those are short-duration training flights, touch-and-go, or otherwise restricted to their on-base airspace only.

Figure 3-1 Region of Influence



3.1.3 Airspace Control Agencies

The primary authority over Edwards Restricted Airspace is the FAA and the Los Angeles Air Route Traffic Control Center (ARTCC), located near Palmdale Plant 42 Airport (PMD). Daily IFR activities requiring ATC are managed by Joshua Control Facility (JCF) otherwise known by their callsign Joshua Approach. Joshua Approach manages activity throughout the R-2508 Complex as well as approach / departure services for airports outside of RA but within their transitional airspace including California City, Mojave Air and Space Port, General William J Fox Airfield, and Palmdale Plant 42 Airport.

SPORT provides non-ATC advisory services to VFR aircraft operating within the Edwards Restricted Airspace and throughout the R-2508 Complex. The vast majority of flight in the Edwards Restricted Airspace is conducted VFR. When VFR meteorological conditions (VMC) are not present, those portions of the airspace will revert to Joshua Approach for IFR guidance.

The Edwards Control Tower manages all flight activity within their Class D circle (on Edwards AFB) from surface up to 4,800 ft above MSL with a few exceptions. When the PIRA supersonic corridor is activated, aircraft fly VFR under SPORT advisory through the Edwards Tower Class

D airspace. Edwards Tower will divert all other flight to avoid that area. Similarly, in the same general area, the Alpha corridor can become activated, following the same flight protocols. The unmanned aerial system (UAS) Work Area and the North UAS Extension Area over the northern half of Roger's Dry Lake is also exempted from Class D airspace when activated and transferred to SPORT. The UAS corridor connects the UAS work area to the PIRA at elevations above 5,000 ft above MSL, which is above the Edwards Class D airspace and therefore does not affect tower operations.

PIRA Range Operations Center, callsign Downfall, provides ATC for flight and range activities when aircraft enter that airspace. SPORT will coordinate handoffs of aircraft entering the PIRA, to Downfall and vice versa.

3.1.4 Components and Activities of the R-2515

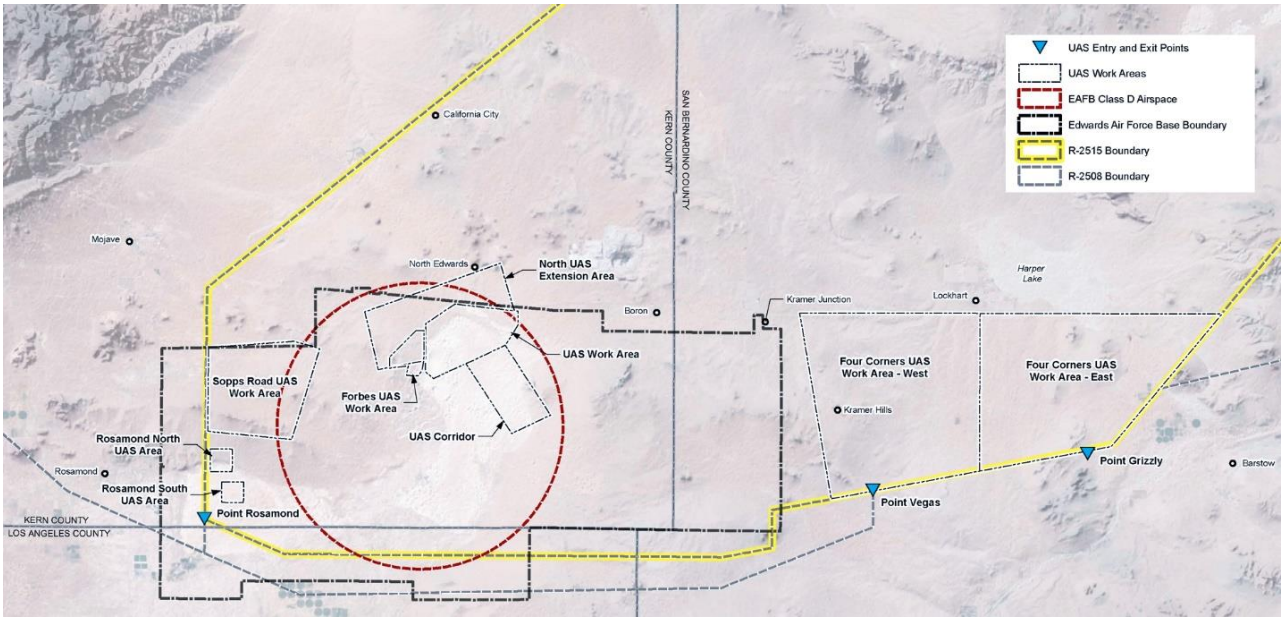
The Edwards Restricted Airspace supports a variety of integrated and overlapping test and training activities, all of which must be carefully managed to avoid conflict and promote maximum benefit to all users. That restricted airspace is also connected to other RA, MOA and ATCAA airspaces that function together as a contiguous SUA complex serving a multitude of military, other governmental, and contract agencies with aerospace activities.

Activities and work areas are scheduled for use with the Central Coordinating Facility (CCF). SPORT provides work separation and conflict advisory and has the responsibility to ensure deconfliction of airspace use following the CCF schedule and real-time activities. This is provided throughout the entire R-2508 Complex, which includes the Edwards Restricted Airspace. Edwards AFB Instruction (EAFBI) 13-204 describes these areas and provides rules and instruction as to use, control, and scheduling.

Work areas for specific types of test and training activities within the Edwards Restricted Airspace include: UAS work areas, drop zones (DZs), spin areas, supersonic operations, military training routes (MTRs), terrain following routes (TFRs), range operations, aerial refueling, tow operations, tower fly-bys and calibration, as well as specially designed 'X'-model aircraft flight characteristics testing.

Unmanned Aerial Systems Work Areas. While UAS are authorized for flight anywhere in the Edwards Restricted Airspace, there are designated work areas to provide some containment of those activities to allow simultaneous operations in other areas of the airspace. There are nine identified UAS work areas and a UAS corridor (Figure 3-2). All exist in and around the Edwards AFB installation and five are at least partially within the Edwards Tower Class D airspace. SPORT provides advisory services for large UAS with transponders but has no way to monitor flight activities of small UAS. Table 3-1 describes each UAS Work area with its altitude designation.

Figure 3-2 UAS Work Areas



Source: EAFBI 13-204, R-2515 Users Handbook, Airspace and Flying Procedures, July 2019.

Table 3-1 UAS Work Areas

UAS Work Area Designation	Altitudes
UAS Work Area	Surface – 10,000’ MSL (~7,500’ AGL)
North UAS Extension Area	Surface – 4,800’ MSL (~2,300’ AGL)
Rosamond North UAS Area	Surface – 500’ AGL (~3,000’ MSL)
Rosamond South UAS Area	Surface – 3,000’ AGL (~5,500’ MSL)
North Exhibit Area	Surface – 400’ AGL (2,900’ MSL)
Forbes UAS Work Area	Surface – 500’ AGL (3,100’ MSL)
SOPP Road UAS Work Area	Surface – 500’ AGL (3,100’ MSL)
Four Corners (East & West) UAS Work Area	8,000’ MSL (~10,500’AGL) - Unlimited
ET-CTF UAS Area	Surface – 200’ AGL (~2,700’ AGL)
UAS Corridor	5,000’ MSL (~7,500’ AGL) – 10,000’ MSL (~12,500’ AGL)

Source: EAFBI 13-204, R-2515 Users Handbook, Airspace and Flying Procedures, July 2019.
ET-CTF: Emerging Technologies – Combined Test Force

The town of North Edwards, population 1,058 (2010, city-data.com), partially lies within the North Extension UAS Work Area, a circumstance of a Restricted Area having been established over private property. UAS have no restrictions from operating within the established airspace over this town from surface to approximately 2,300 ft AGL.

The lost-link hold pattern area is located over PIRA West Range centered on PB-8. There are five UAS ingress/egress points for the Edwards Restricted Airspace. Ingress altitude is at 8,500 ft above MSL and egress is conducted at 7,500 ft above MSL.

The UAS Work Area, located near Edwards North Base, is the primary test and training site for UASs at Edwards AFB. This provides adequate airfield surfaces and support infrastructure for those activities. The Four Corners East and West UAS Work Area is used most often by larger RQ-4 Global Hawk UAS conducting post production test flights before delivery to customers. These airframes originate from Plant 42 near Palmdale. SPORT retains the ability to release airspace within 1,000 ft above or below UAS when in stable flight conditions, in that airspace. There are considerable private land holdings in this area but no population centers. The Emerging Technologies – Combined Test Force (ET-CFT) operates out of the South Base airstrip. They typically utilize small Group 1 (less than 20 pounds) and Group 2 (20-55 pounds) UAS for development and testing of new technologies. Use of the PIRA as an extension to those activities is not uncommon.

Drop Zones. There are seven DZs within the Edwards Restricted Airspace, all of which are located within the Edwards Tower Class D control circle (Figure 3-3). All DZs have a relatively small landing zone but are protected by a larger buffer area surrounding it. SPORT maintains these areas clear of all other traffic when DZs are scheduled. Table 3-2 identifies each of the DZs with their altitudes, uses, and buffer zone distances.

Table 3-2 Drop Zones

Drop Zone	Use	User	Altitude	Buffer Radius
Erickson DZ	Cargo & Personnel	DOD Aircraft	Unlimited	2 NM
Enad DZ	Cargo & Personnel	DOD Aircraft	Unlimited	2 NM
PB-8 DZ	Cargo & Personnel	412 TW Aircraft	Unlimited	PIRA
Survival School DZ	Test Parachute Program		Unlimited	1.5 NM, or 2.5 NM if HAHO
Housing DZ	Test Parachute Program		13,000' MSL	1.5 NM, or 2.5 NM if HAHO
Gainz DZ	Test Parachute			1 NM
Wings DZ	Test Parachute			1 NM

Source: EAFBI 13-204, R-2515 Users Handbook, Airspace and Flying Procedures, July 2019.

HAHO: High Altitude High Open

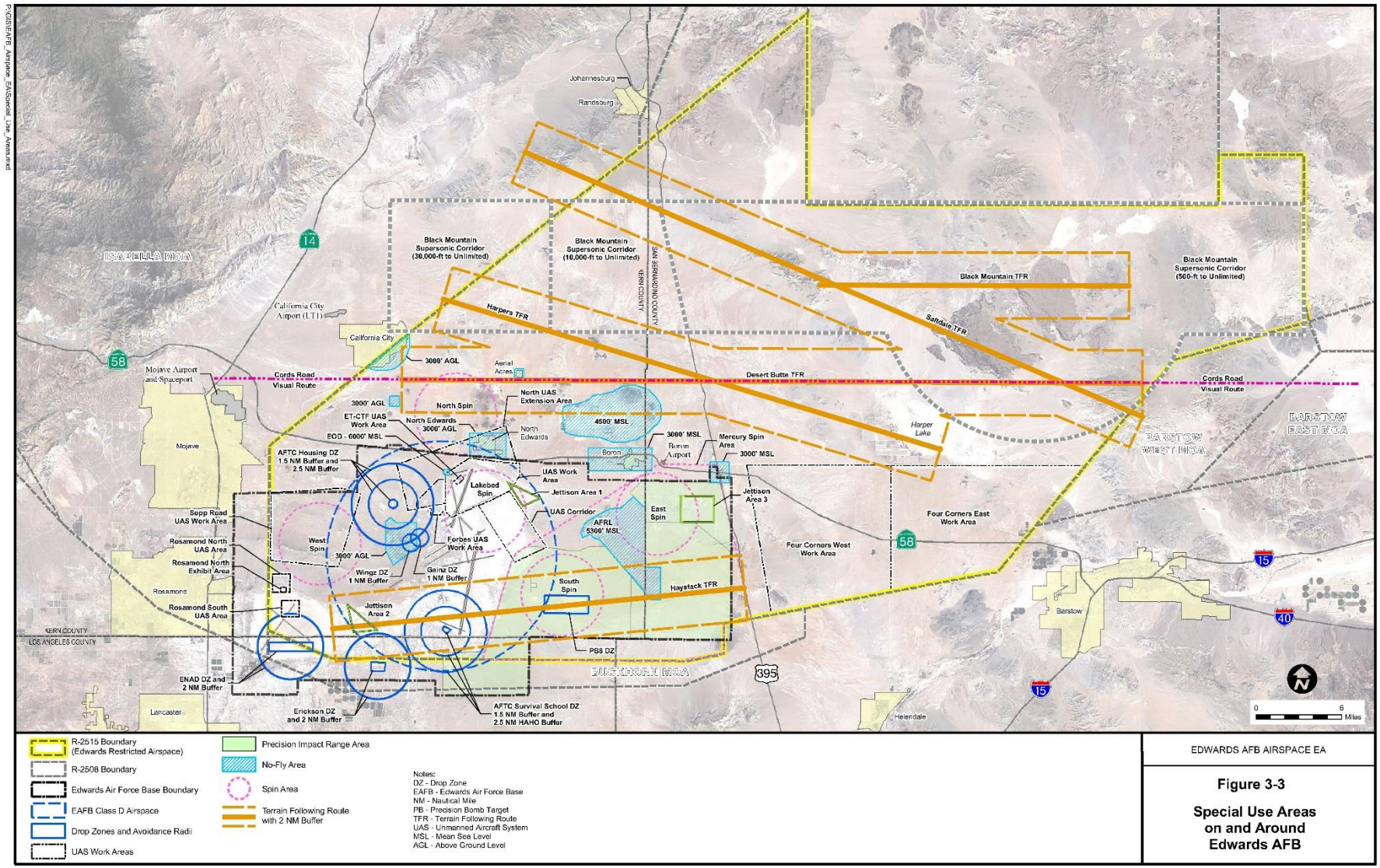
Each of the DZs have overlapping use areas with other functionality of the Edwards Restricted Airspace (R-2515) or other potential safety issues identified in the following:

- **Erickson DZ** landing zone resides outside of the Edwards Restricted Airspace, but remains within the Buckhorn MOA. The air traffic avoidance area extends into the Edwards RA (R-2515), the Alpha Corridor and PIRA Supersonic Corridor, and intersects the Edwards Tower Class D airspace. Flight pattern is east/west.
- **Enad DZ** is inside the Alpha Corridor and PIRA Supersonic Corridor. It has a long rectangular landing zone that extends well outside of the Edwards Restricted Airspace, but remains within the Buckhorn MOA. Flight pattern is east/west.
- **PB-8 DZ** is over the PIRA including PB-8 bombing target and the dual aerial gunnery range and RAGDAG tower. It is in the same area as the South Spin area. The Haystack TFR traverses directly through the DZ center on an east/west track. It is also the location of the UAS lost-link return and hold location.
- **Survival School DZ** resides within the Edwards Tower Class D airspace and is inside the Alpha Corridor and PIRA Supersonic Corridor. The Haystack TFR traverses through the DZ buffer zone on an east/west track.
- **Housing DZ** resides fully within the Edwards Tower Class D airspace. The air traffic avoidance areas intersect with the North UAS Extension Area, the Forbes UAS Work Area and the SOPP Road UAS Work Area. This safety buffer also extends over the family housing community of Edwards AFB.
- **Gainz DZ** and **Wings DZ** reside fully within the Edwards Tower Class D airspace. The air traffic avoidance areas intersect with that of the Housing DZ.

Spin Areas. Spin areas are used to test spin recovery characteristics of aircraft and to train pilots on spin recovery techniques. There are five circular spin areas and one rectilinear area. Spin areas overlap other potentially conflicting activities including other spin areas. Circular spin areas are five NM diameter and extend from 11,000 ft above MSL up to FL450, except for Lakebed Spin, which has a floor of 6,000 ft above MSL. Those five include West Spin, North Spin, Lakebed Spin, South Spin, and East Spin. The Mercury Spin area is a large rectilinear area that overlies the PIRA and AFRL. It extends from 11,000 ft above MSL up to FL450.

Although the activity involves putting an aircraft into non-aerodynamic flight situations, installation personnel state that there is no danger of inability to recover controlled flight. No ground or flight activities below the floor are affected. All Spin areas reside at least partially above the Edwards Class D circle with one exception; the East Spin Area. Lakebed Spin and South Spin areas are the primary spin areas and see the majority of operations.

1
2
3


P:\GIS\EAFB_Airspace_EA\Special_Use_Areas.mxd
Johannesburg
Randsburg
ISABELLA MOA
Black Mountain Supersonic Corridor (30,000-ft to Unlimited)
Black Mountain Supersonic Corridor (10,000-ft to Unlimited)
SAN BERNARDINO COUNTY
KERN COUNTY
Black Mountain TFR
Black Mountain Supersonic Corridor (500-ft to Unlimited)
California City Airport (LTI)
Harpers TFR
Saltdale TFR
California City
3000' AGL
Aerial Acres
Mojave Airport and Spaceport
Cords Road Visual Route
Desert Butte TFR
North UAS Extension Area
North Spin
ET-CTF UAS Work Area
North Edwards 3000' AGL
EOD - 6000' MSL
4500' MSL
3000' MSL
Mercury Spin Area
Boron
Boron Airport
Harper Lake
BARSTOW WEST MOA
BARSTOW EAST MOA
Mojave
AFTC Housing DZ 1.5 NM Buffer and 2.5 NM Buffer
UAS Work Area
Lakebed Spin
Jettison Area 1
Jettison Area 3
Sopp Road UAS Work Area
UAS Corridor
East Spin
AFRL 5300' MSL
Four Corners East Work Area
Four Corners West Work Area
Rosamond North UAS Area
Rosamond North Exhibit Area
West Spin
Forbes UAS Work Area
Wingz DZ 1 NM Buffer
Gainz DZ 1 NM Buffer
South Spin
Haystack TFR
Rosamond
Rosamond South UAS Area
Jettison Area 2
Barstow
KERN COUNTY
LOS ANGELES COUNTY
PB8 DZ
EDWARDS MOA
ENAD DZ and 2 NM Buffer
Lancaster
Erickson DZ and 2 NM Buffer
AFTC Survival School DZ 1.5 NM Buffer and 2.5 NM HAHO Buffer
Helendale
0 6 Miles
R-2515 Boundary (Edwards Restricted Airspace)
R-2508 Boundary
Edwards Air Force Base Boundary
EAFB Class D Airspace
Drop Zones and Avoidance Radii
UAS Work Areas
Precision Impact Range Area
No-Fly Area
Spin Area
Terrain Following Route with 2 NM Buffer
Notes:
DZ - Drop Zone
EAFB - Edwards Air Force Base
NM - Nautical Mile
PB - Precision Bomb Target
TFR - Terrain Following Route
UAS - Unmanned Aircraft System
MSL - Mean Sea Level
AGL - Above Ground Level
EDWARDS AFB AIRSPACE EA
Figure 3-3
Special Use Areas on and Around Edwards AFB

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Supersonic Flight. There are three designated supersonic flight areas within the Edwards Restricted Airspace, each with different characteristics fulfilling a variety of test and training requirements for the installation (Figure 3-3). These are identified in Table 3-3 including altitudes, corridor width, and restrictions. Both Black Mountain and PIRA Supersonic Corridors are in airspace that also supports other potentially conflicting activities. Black Mountain Supersonic Corridor overlies a considerable amount of private property but no population centers. The corridor extends down to 500 ft AGL over this area.

Table 3-3 Supersonic Corridors

Airspace Designation	Width	Altitudes
Black Mountain Supersonic	8 NM	*1) FL300-Unlmtd, 2) 10,000' MSL-Unlimited, 3) 500'
High Altitude Supersonic	15 NM	FL300-Unlimited
PIRA Supersonic Corridor	N/A	500' AGL-Unlimited
PIRA Supersonic Corridor	N/A	500' AGL-Unlimited

Source: EAFBI 13-204, R-2515 Users Handbook, Airspace and Flying Procedures, July 2019.
**: Black Mountain SS Corridor is vertically stepped down from west to east.*

Terrain Following Routes. Terrain following routes are used for low-altitude flight, as the name implies, hugging the terrain or nap of the earth flight. Altitudes for standard flight are 200 ft AGL to 1,500 ft AGL unless special permission is granted for lower flight. Supersonic operations are held to a floor of 500 ft AGL. There are many non-terrain obstacles that exist along these routes, requiring avoidance by 500 ft above highest obstacle (AHO). TFR route widths are typically two NM either side of centerline unless otherwise specified. There are six TFRs within the Edwards Restricted Airspace (Figure 3-3 and Table 3.4).

Table 3-4 Terrain Following Routes

Airspace Designation	Width	Altitudes
Haystack Range TFR	4 NM	200' AGL-1500' AGL
Desert Butte TFR (Cords Road)	4 NM	200' AGL-1500' AGL
Harpers TFR	4 NM	200' AGL-1500' AGL
Saltdale TFR	4 NM	200' AGL-1500' AGL
Black Mountain TFR	4 NM	200' AGL-1500' AGL
Rough One TFR	4 NM	200' AGL-1500' AGL

Source: EAFBI 13-204, R-2515 Users Handbook, Airspace and Flying Procedures, July 2019.

All TFRs are flown VFR at subsonic speeds except for the Haystack TFR and the Black Mountain TFR, which are authorized to fly supersonic because they reside within the PIRA supersonic corridor and the Black Mountain supersonic corridor respectively. Desert Butte TFR

(Cords Road) overlies the community of Aerial Acres (estimated population approximately 160). Criteria requires avoiding populated areas by 3,000 ft AGL, which is above the established ceiling of the route. Cords Road is also used for test and training flights other than terrain following and is a civilian route that accommodates Highway Patrol aircraft, helicopters, pipeline and powerline patrol aircraft paralleling Highway 58.

The Haystack TFR crosses through a variety of potentially conflicting activities including the PIRA and associated activities, the South Spin area, Mercury Spin area, Survival School DZ, Erickson DZ, and the ET-CTF UAS Work Area. SPORT provides deconfliction advisory services.

Precision Impact Range Area Operations. The PIRA is a large area of the installation, approximately 75 square miles, located east of the airfield at the intersection of Highways 58 and 395 (Figure 3-3). The range is subdivided into two areas, east and west, separated by an extension of the AFRL. It hosts a variety of test and training activities including aerial gunnery, photo and infrared resolution, spin testing, aerial decelerator testing, tests requiring precision instrumentation, precision bombing, laser targeting, UAS testing, supersonic flight, drop zone testing, and other types of aerial test activity. There are no ground fire munitions used at PIRA. Air and ground activities are controlled by the range ATC tower, callsign Downfall, from surface to an unlimited altitude. Outside of the PIRA, flight activities are provided advisory services by SPORT.

All range activities are deconflicted by Downfall, while SPORT deconflicts activities outside of the PIRA. Lazing operations (operations with lasers) occasionally emanate from outside the PIRA to targets within, which is managed by both organizations working together. There is one dudded impact area for live munitions drops: PB-13 in East Range, which has a 500-pound maximum capacity. Most bomb drops are inert and intended to test the navigational and release mechanism. The aerial gunnery range is Class A certified using Joint Technical Attack Controls (JTACs) to control strafing runs below 300 ft AGL.

Weapons may not be armed until beyond Mercury Boulevard when approaching from the west, Highway 395 when approaching from the east and highway 58 when approaching from the north. Mercury Boulevard and Mars Boulevard are typically closed and vacated during bombing or aerial gunnery operations. Aircraft must remain above 3,000 ft AGL when crossing Mercury Boulevard or Highways 58 and 395. All air traffic must remain above 5,300 ft above MSL. That is equivalent to approximately 2,400 ft AGL along Mars Boulevard, 2,000 ft AGL on Haystack Butte, and 1,895 ft AGL on Leuhman Ridge. Rocket testing along the shoehorn area of AFRL (Sites 1-32, 1-42, 1-46, and 1-52) requires cessation of PIRA activities. Conversely, PIRA activities that require the closure of Mars Boulevard require cessation of AFRL activities and evacuation of the shoehorn area.

Viper Range. Viper Range is a small, unimproved aerial gunnery range located on private property within the Edwards Restricted Airspace. It is owned and operated by the Mojave Test Pilot School to teach students how to make strafing approaches. They do not actually fire on the range or otherwise use live ordnance. They only use low-speed single engine aircraft such as a Cessna 182 to teach students ingress and egress attitude alignments. Installation

personnel report that the facility has not been used in many years. Given these facts and its location, it does not present a conflict to R-2515 air operations.

3.1.5 Airspace Use and Management of the R-2515

The Edwards Restricted Airspace (R-2515) is one of the oldest, continuous use airspaces in the United States. Its mission has essentially remained unchanged for the past eight decades, that being test and evaluation of aerospace vehicles and their essential components. Those activities generate a continual flow of new aircraft and equipment through the installation. Test and evaluation of a new airframe can be extensive, requiring 30 or 40 aircraft stationed at the installation for one to two years. Other airframes are permanently stationed at Edwards AFB in support of component equipment testing and test pilot training. Agencies on-base that generate continual, non-intermittent use of the Edwards Restricted Airspace include:

- 412th Test Wing / 412th Operations Group and seven Flight Test Squadrons
- U.S. Air Force Test Pilot School
- NASA Armstrong Flight Research Center
- Air Force Operational Test and Evaluation Center (AFOTEC)-Detachment 1
- Air Force Research Laboratory (AFRL)
- 31st Test and Evaluation Squadron
- Air Test and Evaluation Squadron Nine Det Edwards (VX-9)

Agencies located off-base in the region that generate consistent use of the Edwards Restricted Airspace include:

- NAWS China Lake
- Fort Irwin
- U.S. Air Force Plant 42
    - Boeing
    - Lockheed Martin Skunk Works
    - Northrup Grumman
    - NASA Armstrong Flight Research Center
- El Mirage
    - General Atomics Aeronautical Systems
- Gray Butte Airfield
    - General Atomics Aeronautical Systems
- Mojave Air and Space Port
    - ASB Avionics
    - BAE Systems
    - Flight Research, Inc.
    - Flight Test Aerospace
    - Flight Test Associates
    - Interorbital Systems
    - Masten Space Systems
    - Mercy Air

- National Test Pilot School
- Northrup Grumman-Orbital ATK
- Scaled Composites
- Stratolaunch Manufacturing Facility
- The Spaceship Company
- Virgin Galactic

The R-2515 Airspace Management Office collects annual usage data for the Edwards Restricted Airspace. Table 3-5 provides airspace statistics for each fiscal year from FY10 to FY18 as well as one older historical record (U.S. Air Force 1998) for comparison.

Table 3-5 R-2515 Airspace Usage

Data Fields	FY18	FY17	FY116	FY15	FY14	FY13	FY12	FY11	FY10	FY96
Total Sorties	13,233	14,002	13,421	12,355	12,175	10,863	13,674	-	13,534	21,175
Days Scheduled	365	365	365	365	365	365	365	-	365	N/A
Days Activated	365	365	365	365	365	365	365	-	365	N/A
Days Utilized	365	365	365	365	365	365	365	-	365	N/A
Hours Scheduled	8,760	8,760	8,760	8,760	8,760	8,760	8,760	-	8,760	N/A
Hours Activated	8,760	8,760	8,760	8,760	8,760	8,760	8,760	-	8,760	N/A
Hours Utilized	8,760	8,760	8,760	8,760	8,760	8,760	8,760	-	8,760	N/A
Hours Returned to FAA	0	0	0	0	0	0	0	-	0	N/A
Types of Airframes	307	95	91	90	71	88	71	-	55	28
Hours NP Allowed Use	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	8,760	

Source: R-1515 Airspace Management Office.
Environmental Assessment of R-2515, Edwards AFB, CA, 1996
No data provided for FY11
NP: Non-Participating aircraft

This data reveals a slight operational increase over the past five years, which is lower (38% reduction on five-year average) than 22 years ago. It also indicates that the airspace has been scheduled, activated and utilized continuously, for every hour of every day for the past eight years. At no time over the past eight years was the entire Edwards Restricted Airspace released for use to the FAA for non-participating aircraft access. That being said, FY10 shows

partial access granted for fly-throughs of active RA for non-participating aircraft. The data indicates that a vertical segment was opened up at some point for every hour of every day of the year. Vertical segmentations included: 1) 6,000 ft above MSL and above, 2) FL260 and above, 3) FL370 and above. FY10 is the only year where that data is stated. It is unclear if that practice ceased to exist or if the data was just not collected.

3.2 AIR QUALITY

Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. By comparing a pollutant concentration in the atmosphere to federal and/or state ambient air quality standards, the significance of its presence can be determined. Air quality as a resource incorporates several components that describe the levels of overall air pollution within a region, sources of air emissions, and regulations governing air emissions. The following sections include a regulatory overview, a discussion of the existing conditions, and a summary of greenhouse gases and climate.

3.2.1 National Ambient Air Quality Standards

The Clean Air Act (42 USC 7401-7671q), as amended, assigns the United States Environmental Protection Agency (USEPA) responsibility to establish the primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) that specify acceptable concentration levels of six criteria pollutants: particulate matter (measured as both particulate matter less than 10 microns in diameter [PM_{10}] and particulate matter less than 2.5 microns in diameter [$PM_{2.5}$]), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), and lead. Short-term NAAQS (1-, 8-, and 24-hour periods) have been established for pollutants contributing to acute health effects, while long-term NAAQS (annual averages) have been established for pollutants contributing to chronic health effects. Table 3-6 outlines the NAAQS for each criteria pollutant. California has slightly stricter air quality standards when compared to the NAAQS.

3.2.2 Existing Conditions

The Edwards Restricted Area extends into portions of Kern, Los Angeles, and San Bernardino Counties and is within the Mojave Desert Air Basin (MDAB). Three local air districts maintain jurisdiction over the area: the Kern County Air Pollution Control District (KCAPCD), the Antelope Valley Air Quality Management District (AVAQMD), and the Mojave Desert Air Quality Management District (MDAQMD).

Federal regulations designate air quality control regions (AQCRs) in violation of the NAAQS as nonattainment areas, and AQCRs with levels below the NAAQS as attainment areas. USEPA has designated areas of Kern and San Bernardino Counties beneath Edwards Restricted Airspace as a serious nonattainment area for the 8-hour O_3 NAAQS, areas of Los Angeles County beneath Edwards Restricted Airspace as a severe nonattainment area for the 8-hour O_3 NAAQS, and areas of San Bernardino County beneath Edwards Restricted Airspace as a moderate nonattainment area for the PM_{10} NAAQS. The area is in attainment or unclassified for the remaining criteria pollutants, including CO, NO_2, and SO_2.

Table 3-6 National Ambient Air Quality Standards

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead (Pb)		Primary and Secondary	Rolling 3-month average	0.15 µ/m^3	Not to be exceeded
Nitrogen Dioxide (NO_2)		Primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and Secondary	Annual	53 ppb	Annual mean
Ozone (O_3)		Primary and Secondary	8-hour	0.070 ppm	Annual fourth highest daily maximum 8-hour concentration, averaged over 3 years
Particulate Matter	($PM_{2.5}$)	Primary	Annual	12 µ/ m^3	Annual mean, averaged over 3 years
		Secondary	Annual	15 µ/m^3	Annual mean, averaged over 3 years
		Primary and Secondary	24-hour	35 µ/ m^3	98th percentile, averaged over 3 years
	(PM_{10})	Primary and Secondary	24-hour	150 µ/ m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Source: USEPA 2020a.

Notes: ppm = parts per million; ppb = parts per billion; µ/m^3 = micrograms per cubic meter

The Air Conformity Applicability Model (ACAM) was used to provide emissions estimates for aircraft flight operations in the Edwards Restricted Airspace. ACAM was developed by the Air Force; it provides estimated air emissions from proposed federal actions for each specific criteria and precursor pollutant as defined in the NAAQS. ACAM uses the procedures established by the Air Force as provided in Air Emissions Guide for Air Force Mobile Sources.

ACAM was used to estimate the existing air emissions from testing and training activities within the Edwards Restricted Airspace, which were then used as a comparative baseline to determine the level of impacts under NEPA (Table 3-7). All aircraft operations associated with testing and training in the Edwards Restricted Airspace below the mixing height of 3,000 feet AGL were accounted for in the assessment. Emissions from operations above the mixing height of 3,000 ft AGL have little or no effect on ambient air quality and, therefore, they have not been included (40 CFR 93.153 (c) (xxii)). Detailed emission calculations are in Appendix C.

Table 3-7 Existing Air Emissions from Testing and Training Operations in R-2515

Pollutant	Emissions in Tons per Year (tpy)
VOC	0.2
NO_x	11.5
CO	4.3
SO_x	0.7
PM_{10}	0.9
$PM_{2.5}$	0.7
CO_2e	2,034

Source: Air Force 2020

3.2.3 Climate and Greenhouse Gases

The average high temperature under R-2515 is 97.7 degrees Fahrenheit (°F) in the hottest month of July, and an average low temperature of 34.4 °F in the coldest month of January. The area has average annual precipitation of 6.9 inches per year. The wettest month of the year is February with an average rainfall of 1.6 inches (Idcide 2020).

Greenhouse gases (GHGs) are components of the atmosphere that trap heat relatively near the surface of the earth, and therefore, contribute to the greenhouse effect and climate change. Most GHGs occur naturally in the atmosphere, but increases in their concentration result from human activities such as the burning of fossil fuels. Global temperatures are expected to continue to rise as human activities continue to add carbon dioxide (CO_2), methane, nitrous oxide, and other greenhouse (or heat-trapping) gases to the atmosphere. Whether or not rainfall will increase or decrease remains difficult to project for specific regions (USEPA 2019 and IPCC 2014).

Executive Order (EO) 13834: *Efficient Federal Operations* outlines policies intended to ensure that federal agencies meet such statutory requirements in a manner that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the environment. The EO specifically requires agencies within the DOD to measure, report, and reduce their GHG emissions from both their direct and indirect activities.

3.3 CULTURAL RESOURCES

Cultural resources are tangible remains of past human activity and include prehistoric and historic districts, sites, structures, and objects. The specific locations of these resources are generally not available to the public and are only released on a need-to-know basis. Information for cultural resources in the Edwards Restricted Airspace was obtained from the Edwards AFB *Integrated Cultural Resources Management Plan* (ICRMP) (Edwards AFB 2017) and the Bureau of Land Management (BLM) West Mojave Route Network Project (BLM 2019). Approximately 66% of Edwards AFB has been surveyed for archaeological resources, but only a very small portion of the total ground area of the Edwards Restricted Airspace has been surveyed. Therefore, the numbers of cultural sites presented below represent only a small percentage of the total number of sites anticipated in the Edwards Restricted Airspace.

3.3.1 Prehistoric Resources

Previous archaeological surveys identified 4,657 archaeological sites throughout Edwards AFB; of these, 3,439 are considered eligible for the National Register of Historic Places (NRHP) or not yet evaluated. There are 11 sacred sites identified by Native American Tribes (Edwards AFB 2017).

Many prehistoric sites also occur in the remainder of the Edwards Restricted Airspace. The following BLM Areas of Critical Environmental Concern (ACECs) in the Edwards Restricted Airspace are identified as having important prehistoric sites: Steam Well ACEC, Red Mountain Spring ACEC (previously named Squaw Spring), Black Mountain ACEC, and the Rainbow Basin/Owl Canyon ACEC. The Red Mountain Spring Archaeological District, Black Mountain Rock Art District, and Steam Well Petroglyph Archaeological District are listed on the NRHP (BLM 2019).

Prehistoric sites in the Edwards Restricted Airspace include villages, camps, rock shelters, milling stations, lithic or ceramic deposits, quarries, burial sites, cremation sites, rock alignments or features, rock art, trails, hearths, and bone deposits. Above-surface sites such as rock art on geological outcrops and rock shelters are most sensitive to airspace operations. All four of the ACECs listed above contain rock art, and the Red Mountain Spring ACEC also contains rock shelters and alignments (BLM 2019).

3.3.2 Historic Resources

Of the 3,234 facilities and structures listed in Edwards AFB Real Property (included in the Automated Civil Engineering System) that are tracked by Cultural Resources, 368 have been evaluated and concurred upon. One (1) has been determined Individually Listed National Historic Landmark (NHLI); 12 have been determined Individually Eligible for the NRHP and

NREI; 139 have been determined Contributing to a District Eligible for the NRHP (NREC) and 216 have been Determined Not Eligible (DNE) (Edwards AFB 2017). Rogers Dry Lake is the only cultural resource on Edwards AFB that is listed on the NRHP and is recognized as a National Historic Landmark.

Many historic sites also occur in the remainder of the Edwards Restricted Airspace. Although the Red Mountain Spring ACEC was designated for prehistoric resources, there are also historic materials within the ACEC. Historic mining remnants have also been located on the Rainbow Basin/Owl Canyon ACEC (BLM 2019). The Kramer historic mining district and Randsburg historic mining district both occur in the Edwards Restricted Airspace, where wooden structures and crumbling building foundations remain (U.S. Air Force 1998).

Historic sites in the Edwards Restricted Airspace include refuse deposits, townsites, homesteads, ranching features, agricultural features, mines and mining camps, rock features, railroads, roads and trails, recreation sites, and military features. In addition, a total of 18 historic facilities on Edwards AFB have been determined individually NRHP-eligible, 96 are eligible as contributing elements to proposed historic districts, and 1,209 have not been assessed (Edwards AFB 2012). Most of the historic facilities on Edwards AFB also occur in the Edwards Restricted Airspace. Sites such as homesteads, mines, and historic buildings are most sensitive to airspace operations. Table 3-8 lists the NRHP sites and BLM ACECs for cultural resources in the Edwards Restricted Airspace.

Table 3-8 NRHP Sites and BLM ACECs in R-2515

Cultural Resource	Type			Status	
	Prehistoric	Historic	Native American	NRHP (Listed)	NHL
Rogers Dry Lake		X		X	X
Red Mountain Spring Archaeological District	X	X		X	
Black Mountain Rock Art District	X		X	X	
Steam Well Petroglyph Archaeological District	X			X	
Rainbow Basin/Owl Canyon ACEC	X	X			
Red Mountain Spring ACEC	X	X			
Steam Well ACEC	X				
Black Mountain ACEC	X		X		

Notes: NHL = National Historic Landmark; NRHP = National Register of Historic Places

3.3.3 Native American Values

Native American groups consider many prehistoric sites sacred. Examples of Native American sites include burial or cremation sites, rock art, and rock features. There are 11 sacred sites identified by Native American Tribes (Edwards AFB 2017). The Black Mountain ACEC contains one of the most extensive assemblages of prehistoric petroglyphs within California, as well as cairns and trail shrines (BLM 2019).

3.4 LAND USE

The 1,812-square mile Edwards Restricted Airspace is generally sparsely populated, with California City in the west being the most developed area, and other small unincorporated communities such as Boron, North Edwards, Kramer Junction, and Hinkley scattered throughout (Figure 2-1). There are no National Parks or National Forests under the Edwards Restricted Airspace. In general, land use in this area can be broken into the following categories: military installation, BLM lands, City/County lands, and private lands.

3.4.1 Military Installations

Edwards AFB is the primary military installation under the Edwards Restricted Airspace, with most of the installation underlying this airspace. The installation consists of 470 square miles, or approximately 25% of the entire land area under the Edwards Restricted Airspace. The far eastern portion of the airspace overlies the southwest edge of Fort Irwin.

Edwards AFB is organized into eight major and seven special use planning districts: Main Base, Flightline, North Base, South Base, Edwards 93523, Radar Hill, Special Use, and the AFRL.. The most dominant features on Edwards AFB are the large airfield and dry lakebeds, with their associated runways, taxiways, and aprons covering a majority of the main cantonment area. Parking aprons for test aircraft are bordered to the west and northwest by airfield operations and maintenance land uses, including large hangars, parked aircraft, and maintenance units (U.S. Air Force 2017b). The Special Use District is largely undeveloped, but serves essential functions such as military ranges or research, development, test, and evaluation (RDT&E) of aircraft.

The central area of the installation includes administrative facilities that support ongoing test missions, which are primarily located on Wolfe Avenue. Other wing facilities are located along the main road, Rosamond Boulevard, which leads from the community of Rosamond through the West Gate (the main gate) to the Main Base, exiting onto Highway 58 through the North Gate. Industrial facilities are distributed throughout the Main Base area and include warehouses, fuel storage facilities, and the civil engineer complex. The NASA Armstrong Flight Research Center (AFRC) is located to the north of the Flightline District and includes its own administrative, hangar, and test facilities (U.S. Air Force 2017b).

Fitz-Gerald Boulevard is the “Main Street” of the residential area of the installation and connects the industrial and airfield-related land uses of the Main Base flightline area to the community-focused residential area. The Edwards 93523 community area includes privatized housing, public schools, lodging, medical facilities, retail and service facilities, outdoor recreational facilities, and open space (U.S. Air Force 2017b).

North Base, which includes a ramp and landing strip, is the smallest of the three airfield areas. It has recently been used as a transient site for several test missions of shorter duration. The larger South Base complex has its own ramp and hangar area with associated administrative and maintenance facilities. South Base is currently transitioning to a new test mission (U.S. Air Force 2017b).

The AFRL complex is several miles east of Main Base. Its mission is to test liquid and solid rocket fuels and requires a remote location. The complex is accessed via Rocket Site Road or Mercury Boulevard and has its own entrance gate. It includes administrative facilities, laboratories, maintenance facilities, and test facilities (U.S. Air Force 2017b).

Beyond these developed areas, the Special Use District and its sub districts include several thousand acres of RDT&E land. Although this land may appear to be open space, it supports an essential function by enabling safe testing of numerous aircraft. Most land in this classification is part of ranges, such as the PIRA to the east or the small arms training range south of Rosamond Boulevard. In some areas, when there is no active testing, portions of the land are used for outdoor recreational activities (U.S. Air Force 2017b).

3.4.2 Bureau of Land Management Lands

Outside Edwards AFB, over half of the lands under the Edwards Restricted Airspace are managed by BLM. The BLM lands are used for recreation, rangeland (grazing), mining, and resource conservation/ preservation. Preservation uses include designated wilderness. There are no National Monuments recreation areas, wild and scenic rivers, or designated national trails underlying the airspace.

ACECs are BLM-designated lands where special management attention is needed to protect important historical, cultural, and scenic values, or fish and wildlife or other natural resources. There are 11 BLM-designated ACECs which cover most of the area under Edwards Restricted Airspace (except for the installation itself), which cover BLM and non-BLM land, as shown on Figure 3-4. Four of these ACECs contain cultural resources, as described in Section 3.3, Cultural Resources. The remaining seven of these ACECs contain natural resources, and are discussed in Section 3.5, Natural Resources. The Red Mountain Spring ACEC contains both cultural and natural resources.

Wilderness areas are federal lands that have been designated by Congress as part of the National Wilderness Preservation System. Land use in these areas is undeveloped open space and primitive recreational uses. There are three BLM-designated wilderness areas under the Edwards Restricted Airspace: a portion of the Golden Valley and Grass Valley Wilderness Areas and the Black Mountain Wilderness Area (Figure 3-4).

3.4.3 City/County and Private Lands

Edwards AFB and the Edwards Restricted Airspace lie in portions of Kern, San Bernardino, and Los Angeles counties. Residential areas under this Airspace are North Edwards, Boron, Hinkley, Kramer Junction, and a portion of California City. There is a patchwork of private land throughout the area, with most in Kern County.

3.4.4 Airports

There is one private airfield located beneath the Edwards Restricted Area and reports of several unregistered private airstrips. Boron Airstrip is the only registered and active non-military airfield within the Edwards Restricted Area. It was established before the installation came to

importance for aviation and before the Edwards Restricted Area was established. There are numerous other airstrips and airfields extending approximately 10 NM beyond the boundary of the Edwards Restricted Airspace. These are discussed in Section 3.1.1, Airspace Components and in Appendix B, Supporting Airspace Information.

3.5 NATURAL RESOURCES

Natural (biological) resources are defined as terrestrial and aquatic ecosystems along with the native plants and animals that occur throughout these ecosystems. Sensitive biological resources are defined as those plant and wildlife species listed or proposed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS), and species having equivalent status at the California state level. The USFWS identifies primary physical and biological constituent elements of an area designated as critical habitat that are essential to the conservation of the species (50 CFR 424.12).

Under Section 7 of the federal Endangered Species Act (ESA), consultation with the USFWS is required for federal projects if impacts may affect listed species or critical habitat. As required by the Air Force, Edwards AFB prepared an *Integrated Natural Resources Management Plan* (INRMP) (Edwards AFB 2015) which provides guidance for protecting sensitive species, sensitive communities, and habitats recognized by state and local agencies when evaluating impacts of a project.

This section provides general information and a brief summary of the vegetation and wildlife communities occurring in the Edwards Restricted Airspace, followed by more information for sensitive species potentially affected by the Proposed Action. The Edwards Restricted Airspace overlies a large part of the western Mojave Desert, and consists mainly of arid plains with intermittent low mountain ranges. Rogers, Rosamond, and Harper Dry Lakes are the three large dry lake basins under the airspace.

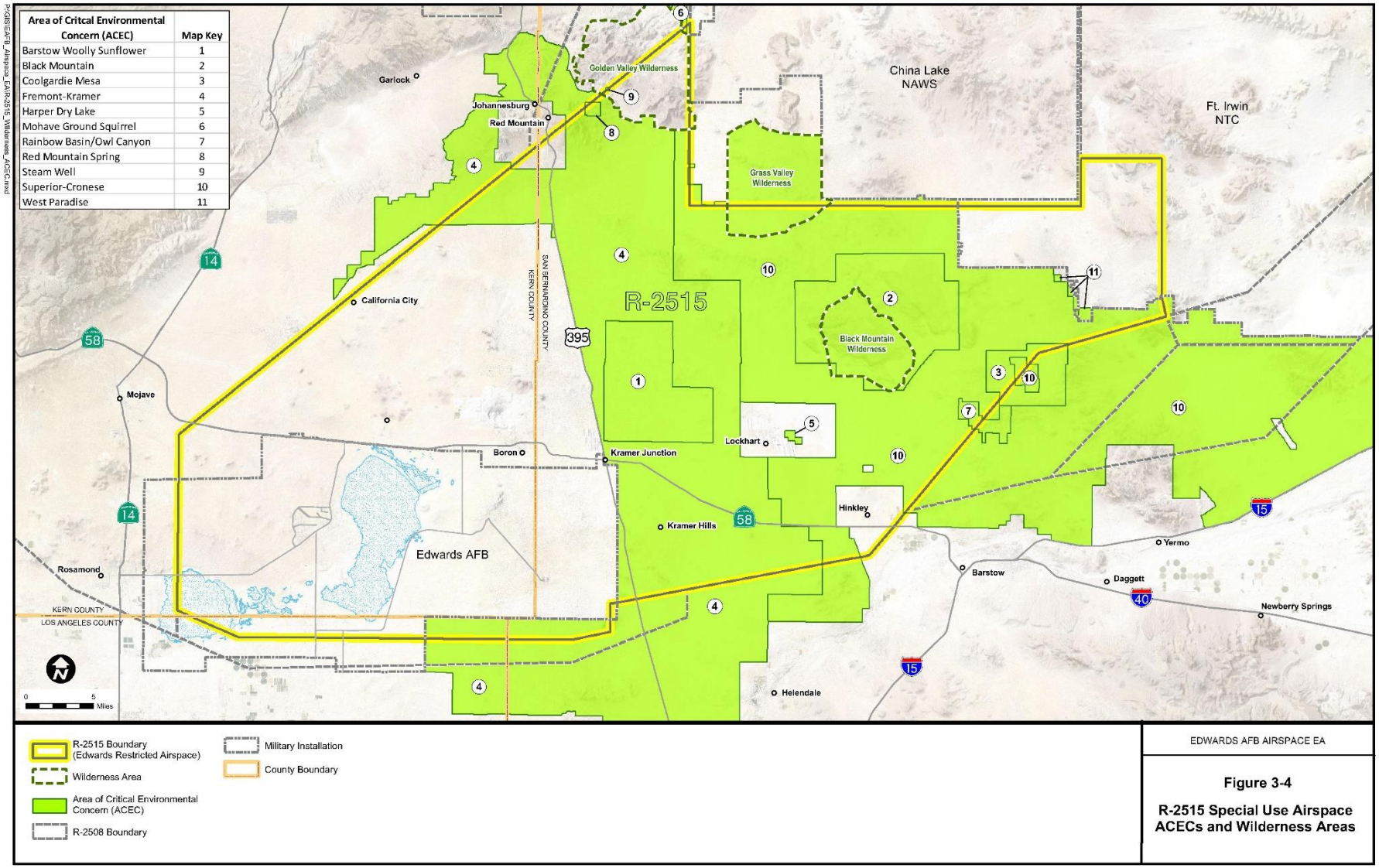
3.5.1 Vegetation

There are several plant communities under the Edwards Restricted Airspace, with two vegetation types predominating the area. Mojave creosote bush scrub covers approximately 60% of the area, while desert saltbush scrub covers approximately 25% of the area. Mojave creosote bush scrub typically has shrubs that are widely spaced, usually with bare ground in between. Joshua tree woodlands also occur in the area, but they occur in relatively small patches and are sometimes classified according to their understory, such as creosote bush scrub, desert saltbush scrub, or Mojave mixed woody scrub.

3.5.2 Wildlife

A wide variety of wildlife have adapted to the Mojave Desert's arid climate. The area under the Edwards Restricted Airspace supports a diverse assemblage of invertebrates and vertebrates.

Invertebrates include insects and arthropods. Commonly observed insect groups include wasps, ants, bees, flies, grasshoppers, moths, butterflies, and beetles. Arthropods are not insects and typically include spiders, scorpions, and fairy shrimp (Edwards AFB 2015).


Area of Critcal Environmental Concern (ACEC) | Map Key
Barstow Woolly Sunflower | 1
Black Mountain | 2
Coolgardie Mesa | 3
Fremont-Kramer | 4
Harper Dry Lake | 5
Mohave Ground Squirrel | 6
Rainbow Basin/Owl Canyon | 7
Red Mountain Spring | 8
Steam Well | 9
Superior-Cronese | 10
West Paradise | 11
Garlock
Golden Valley Wilderness
China Lake NAWS
Ft. Irwin NTC
Johannesburg
Red Mountain
Grass Valley Wilderness
California City
KERN COUNTY
SAN BERNARDINO COUNTY
R-2515
Black Mountain Wilderness
Mojave
Lockhart
Boron
Kramer Junction
Hinkley
Kramer Hills
Edwards AFB
Yermo
Barstow
Daggett
Rosamond
KERN COUNTY
LOS ANGELES COUNTY
Newberry Springs
Helendale
0 5 Miles
R-2515 Boundary (Edwards Restricted Airspace)
Wilderness Area
Area of Critical Environmental Concern (ACEC)
R-2508 Boundary
Military Installation
County Boundary
EDWARDS AFB AIRSPACE EA
Figure 3-4
R-2515 Special Use Airspace ACECs and Wilderness Areas

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Fish and amphibians in this desert area are sparse due to the lack of perennial water sources. The only native fish in the area is the Mohave tui chub (*Gila bicolor Mohavensis*). Reptiles are much more common and include snakes, lizards, and the federally threatened desert tortoise (*Gopherus agassizii*).

The area supports many mammals, including a variety of rabbits, squirrels, and bats, as well as coyote (*Canis latrans*), desert kit fox (*Vulpes macrotis arsipis*), bobcat (*Lynx rufus*), and American badger (*Taxidea taxus*).

The area supports a diverse bird population, including resident, migratory, wintering, and transient species (e.g., common raven, numerous types of sparrows, mourning doves, quail, thrashers, and many types of raptors). Perennial water sources, such as the sewage treatment ponds and Piute Ponds at Edwards AFB and the marsh at Harper Dry Lake, are important stopover areas for migratory and resident waterfowl and shorebirds.

The Migratory Bird Treaty Act (MBTA) and EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, identify requirements for the protection of migratory birds, including raptors. The MBTA protects more than 1,500 migratory bird species in the U.S. and its territories. This Act and EO 13186 protect migratory bird species, including their nests and eggs. Migratory birds use the airspace within the Edwards Restricted Area. Large birds and bird flocks are known to present hazards to aircraft, typically below 5,000 feet AGL, depending on local terrain (U.S. Air Force 2008).

3.5.3 Sensitive Species

The USFWS is responsible for the listing of federally sensitive species. Listed species are reported in the California Natural Diversity Database (CNDDB). There are two federally-listed threatened wildlife species, two federally-listed endangered wildlife species, and one federally-listed endangered plant in the area that makes up the Edwards Restricted Airspace. The threatened wildlife species are the desert tortoise (*Gopherus agassizii*) and the western snowy plover (*Charadrius alexandrinus nivosus*). The desert tortoise is also listed as threatened by the State of California. One federally endangered wildlife species is the Yuma Ridgway's rail (*Rallus obsoletus yumanensis*) (formerly known as the Yuma clapper rail), which is also listed as threatened by the State. The second endangered wildlife species is the Mohave tui chub (*Siphateles bicolor mohavensis*). This fish is also listed as endangered by the State. The federally-listed endangered plant is the Lane mountain milkvetch (*Astragalus jaegerianus*).

There are also two state-listed threatened species in the area: the Mohave ground squirrel (*Xerospermophilus mohavensis*) and the tricolored blackbird (*Agelaius tricolor*). Two insects are candidate endangered species in the area: the Crotch bumblebee (*Bombus crotchii*) and the western bumblebee (*Bombus occidentalis*).

A brief description of each sensitive species is provided here.

The **desert tortoise** is an herbivore that lives in several desert habitats. Desert tortoise habitat is highly fragmented and degraded as a result of human activities such as livestock grazing, energy and mineral development, off-highway vehicle use, road and trail construction, urban

development, and tortoise collection. In addition, disease and predation by ravens have contributed to substantial population losses.

The **western snowy plover** is a small shorebird that normally populates the beaches along the open coast of California, with human use of their nesting beaches contributing to their decline. They also inhabit the sandy shores of other salt-influenced habitats such as transitory and perennial waters in the desert. This bird has been recorded at Rosamond Dry Lake and Harper Dry Lake. However, only the coastal population of the snowy plover is considered threatened.

Yuma Ridgway's rail lives in shallow, freshwater marshes containing dense stands of cattails and bulrushes, and has been recorded at Rosamond Dry Lake, although not in several decades.

Mohave tui chub is a fish native to the Mojave River that only occurs now in highly modified refuge sites in San Bernardino County. It was once found in deep pools and slough-like areas throughout the Mojave River drainage, and declined through habitat alteration, water diversion, pollution, and hybridization with the non-native arroyo chub (*Gila orcutti*).

Lane mountain milkvetch is an herbaceous perennial species that is restricted in distribution to a small portion of the central Mojave Desert north of Barstow in San Bernardino County. Major threats are from surface mining, rack and mineral collecting, off-highway vehicle (OHV) activity, military training activities, and unplanned destructive human activities because of its limited distribution (USFWS 2014).

The **Mohave ground squirrel** is a small rodent found only in the Mojave Desert. Optimal habitats are open desert scrub, alkali desert scrub, Joshua tree, and annual grasslands. This diurnal ground squirrel is active above ground in the spring and early summer, but spends much of the rest of the year in underground burrows to avoid the harsh conditions of its desert environment.

The **tricolored blackbird** is native to California, occurring mainly in the lowlands of California west of the Sierra Nevada. Small populations can also be found south into Baja. These birds breed and nest near fresh water, preferably in emergent wetland with tall, dense cattails or tules. Major threats include loss of habitat, destruction of breeding colonies, and predation. This bird has been recorded nesting in the cattails at the edge of Branch Park Pond on Edwards AFB (CNDDB 2020).

The **Crotch bumblebee** was historically common in the southern two-thirds of California, but now appears to be absent from most of it, especially in the center of its historic range. It has been mapped in the CNDDB in the vicinity of the former mining town of Kramer Hills, east of Edwards AFB.

The **western bumblebee** historically ranged from the Pacific Coast to the Rocky Mountains but since 1998 it has experienced severe population declines throughout some areas of its former range, including in California. As with the Crotch bumblebee, it has been mapped in the CNDDB in the vicinity of the former mining town of Kramer Hills, east of Edwards AFB.

3.5.4 Sensitive Habitats

A sensitive habitat is one that is considered rare, supports unique associations, or supports sensitive plants or wildlife. Two plant communities, mesquite woodlands and Transmontane alkali marsh, are considered sensitive and occur within the area. Mesquite woodlands are generally limited to desert washes in the south-central part of the area. Transmontane alkali marshes within the Edwards Restricted Airspace area are limited to the northwestern edge of Harper Dry Lake. Harper Dry Lake ACEC was designated by the BLM because of its substantial Transmontane alkali marsh that provides habitat for a variety of waterfowl and other water-associated species.

The south-central portion of Edwards AFB has been designated by Los Angeles County as a Significant Ecological Area (SEA) (Area 47). In addition to the desert tortoise, Mohave ground squirrel and several sensitive plants, the area supports the County's only extensive, healthy mesquite woodlands. Rosamond Dry Lake has also been designated a SEA (Area 50) because it represents the best example of alkali playa and shadscale scrub in the County.

Approximately half of the land area under the Edwards Restricted Airspace is listed as desert tortoise critical habitat. Critical habitat is a habitat area that contains features essential to the conservation of a threatened or endangered species. Critical habitat is designated by the USFWS under the federal Endangered Species Act.

There are 11 BLM-designated ACECs under the Edwards Restricted Airspace (Figure 3-4). As discussed in Section 3.3, Cultural Resources, four of them (Black Mountain, Rainbow Basin/Owl Canyon, Red Mountain Spring, and Steam Well) were designated as ACECs primarily for cultural resources, although the Red Mountain Spring ACEC also provides high quality desert tortoise habitat. Brief descriptions of the remainder are as follows:

- **Barstow Woolly Sunflower ACEC.** This ACEC is 4 miles northeast of Kramer Junction and provides important habitat for the extremely rare and highly localized plant, the Barstow woolly sunflower (*Eriophyllum mohavense*).
- **Coolgardie Mesa ACEC.** This ACEC is approximately 9 miles north of Barstow and was established to protect the extremely narrowly endemic Lane Mountain milkvetch and Barstow woolly sunflower.
- **Fremont-Kramer ACEC.** This ACEC cuts through the middle of the Edwards Restricted Area and contains desert tortoise critical habitat considered essential to the recovery of the desert tortoise.
- **Harper Dry Lake ACEC.** Harper Dry Lake is a year-round marsh and wetland used by a variety of resident and migratory bird species, located approximately 20 miles northwest of Barstow.
- **Mohave Ground Squirrel ACEC.** This is a large area, most of which is north of the Edwards Restricted Airspace area, containing habitat for the Mohave ground squirrel. It was established to protect the long-term survival of this species.
- **Superior-Cronese ACEC.** This ACEC is south of Fort Irwin, north of Interstate 15 and provides high-quality desert tortoise habitat and provides critical tortoise habitat linkage.

Part of the area has been the subject of long-term population monitoring studies for the desert tortoise.

- **West Paradise ACEC**. This ACEC lies adjacent to the Superior-Cronese ACEC and adjoins military lands of Fort Irwin near Lane Mountain. It was established to protect the extremely narrowly endemic Lane Mountain milkvetch and the Barstow woolly sunflower.

3.6 NOISE

Sound is a physical phenomenon consisting of vibrations that travel through a medium, such as air, and are sensed by the human ear. Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies depending on the type and characteristics of the noise, distance between the noise source and the receptor, receptor sensitivity, and time of day. Noise is often generated by activities essential to a community's quality of life, such as aircraft operations, construction, or vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure level, described in decibels (dB), is used to quantify sound intensity. The dB is a logarithmic unit that expresses the ratio of a sound pressure level to a standard reference level. Hertz are used to quantify sound frequency. The human ear responds differently to different frequencies. "A-weighing", measured in A-weighted decibels (dBA), approximates a frequency response expressing the perception of sound by humans. Sounds encountered in daily life and associated sound levels are provided in Table 3-9.

Table 3-9 Common Sound Levels

Outdoor	Sound Level (dBA)	Indoor
Jet flyover at 1,000 feet	100	Rock band
Gas lawnmower at 3 feet	90	Food blender at 3 feet
Downtown (large city)	80	Garbage disposal
Heavy traffic at 150 feet	70	Vacuum cleaner at 10 feet
Normal conversation	60	Normal speech at 3 feet
Quiet urban daytime	50	Dishwasher in next room
Quiet urban nighttime	40	Theater, large conference room

Source: Harris 1998

The sound pressure level noise metric describes steady noise levels, although few noises are, in fact, constant; therefore, additional noise metrics have been developed to describe noise, including:

- **Maximum Sound Level (L_{max}).** L_{max} is the maximum sound level of an acoustic event in decibels (e.g. when an aircraft is directly overhead).
- **Equivalent Sound Level (L_{eq}).** L_{eq} is the average sound level in decibels.

- **Sound Exposure Level (SEL).** SEL is a measure of the total energy of an acoustic event. It represents the level of a one-second long constant sound that would generate the same energy as the actual time-varying noise event such as an aircraft overflight. SEL provides a measure of the net effect of a single acoustic event, but it does not directly represent the sound level at any given time.
- **Community Noise Equivalent Level (CNEL).** CNEL is the average sound energy in a 24-hour period with a penalty added to evening and nighttime levels. Because of the potential to be particularly intrusive, noise events occurring between 7:00 p.m. and 7:00 a.m. are assessed a 5 to 10 dB penalty when calculating CNEL. CNEL is a useful descriptor for aircraft noise because: (1) it averages ongoing yet intermittent noise, and (2) it measures total sound energy over a 24-hour period. CNEL provides a measure of the overall acoustical environment, but as with SEL, it does not directly represent the sound level at any given time.

3.6.1 Regulatory Review and Land Use Planning

The Noise Control Act of 1972 directs federal agencies to comply with applicable federal, state, and local noise control regulations. The Noise Control Act specifically exempts both aircraft operations and military training activities from state and local noise ordinances. There are no federal, state, or local noise regulations directly applicable to the Proposed Action. The Air Force's land use guidelines for noise exposure are outlined in AFI 32-7084, AICUZ Program Managers Guide. Table 3-10 provides a general overview of recommended noise limits from aircraft operations for land use planning purposes. Detailed guidelines for the compatibility of various land uses with noise exposure levels are included in Appendix D.

Table 3-10 Recommended Noise Limits for Land Use Planning

General Level of Noise	Percent Highly Annoyed	Aircraft Noise (CNEL)	General Recommended Uses
Low	<15%	< 65 dBA	Noise-sensitive land uses acceptable
Moderate	15%-39%	65–75 dBA	Noise-sensitive land uses normally not recommended
High	>39%	> 75 dBA	Noise-sensitive land uses not recommended

Source: U.S. Air Force 2017

3.6.2 Background Noise Levels

Background sound levels (L_{eq} and CNEL) were estimated for the areas below the Edwards Restricted Airspace using the techniques specified in the *American National Standard Institute - Quantities and Procedures for Description and Measurement of Environmental Sound Part 3: Short-term measurements* with an observer present (ANSI 2013). Table 3-11 outlines the overall sound levels beneath Edwards Restricted Airspace without any aircraft activities. Most of the land beneath Edwards Restricted Airspace is rural or remote; however, there are a few

small towns and villages. These towns would be relatively quiet, and background sound levels without aircraft would not normally exceed 45 dBA L_{eq} in the daytime, or 39 dBA L_{eq} at night. Background levels would be less than this in rural areas, and appreciably less in remote areas.

Table 3-11 Estimated Background Sound Levels

Land Use Category	CNEL [dBA]	L_{eq}[dBA]	
		Daytime	Nighttime
Quiet suburban residential	47	45	39
Rural residential	42	40	34
Rural/Remote	<42	<40	<34

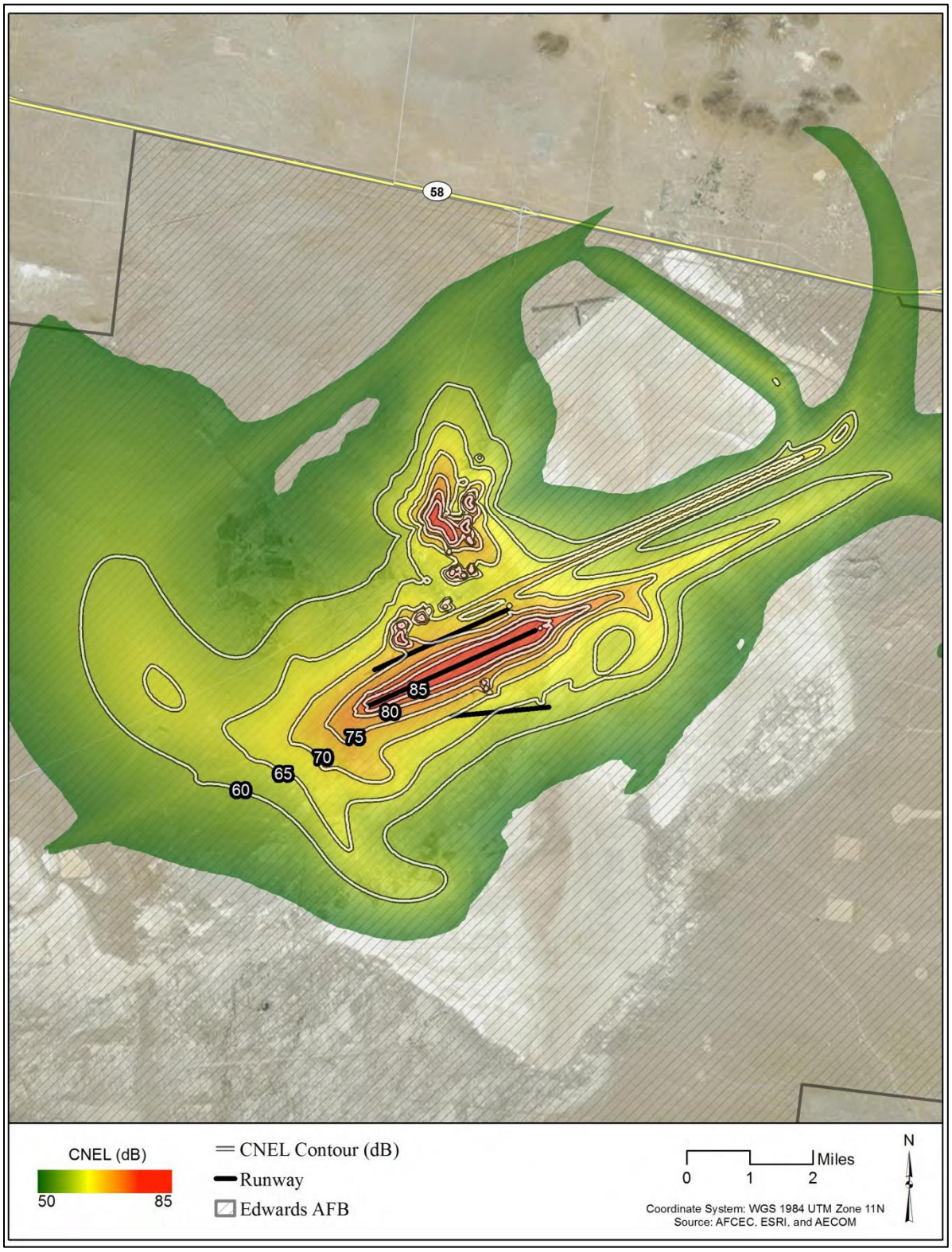
Source: ANSI 2013.
Note: Background CNEL estimated to be approximately equal to day-night sound level for areas below R-2515.

3.6.3 Existing Overall Aircraft Noise

NOISEMAP Version 7.3 was used to calculate the existing CNEL noise contours at Edwards AFB and under R-2515 (U.S. Air Force 2016a; 2016c). CNEL is the average sound energy in a 24-hour period with a penalty added to the evening and nighttime levels. Figure 3-5 shows the existing 65-dBA CNEL noise contour extends approximately two miles from the western end and four miles from the eastern end of the Edwards AFB main runway, and in the areas immediately surrounding the Edwards Air Force Auxiliary North Base Airfield. The noise contours, as shown, depict operational conditions as outlined in the 2016 Edwards AFB AICUZ Plan. These contours are provided for comparison purposes, as there would be no changes in air operations at Edwards AFB from the Proposed Action or any of the alternatives.

The estimated CNEL from testing and training activities within the Edwards Restricted Airspace is 54.8 dBA in areas beneath the airspace. In areas outside the immediate vicinity of Edwards AFB and Edwards Air Force Auxiliary North Base Airfield, the overall average noise from aircraft operations from testing and training activities in the Edwards Restricted Airspace is substantially higher than background noise levels. In general, the aircraft operations are spread throughout the 1,812 square miles beneath Edwards Restricted Airspace. Outside of noise from runway operations at Edwards AFB and the Edwards Air Force Auxiliary North Base Airfield, noise from aircraft operations under Edwards Restricted Airspace do not exceed 65 dBA CNEL, and would be compatible with all land uses (U.S. Air Force 2017a). This includes being compatible with all residential areas, churches, schools, and recreational areas underneath Edwards Restricted Airspace. Detailed guidelines for the compatibility of various land uses with noise exposure levels are included in Appendix D.

Figure 3-5 Edwards AFB CNEL Noise Contours



Source: U.S. Air Force 2016c

3.6.4 Existing Individual Overflight Noise

Although operational noise levels are too low to result in incompatibility with existing land uses, noise from individual overflights generate distinct acoustical events. Table 3-12 provides the L_{max} and SEL for individual aircraft overflights for the primary users of the Edwards Restricted Airspace. L_{max} and SEL are completely different from CNEL. L_{max} is the maximum sound level of an acoustic event (e.g. when an aircraft is directly overhead). SEL is a measure of the total energy of an acoustic event. It represents the level of a one-second long constant sound that would generate the same energy as the actual time-varying noise event, such as an aircraft overflight.

Areas beneath Edwards Restricted Airspace would intermittently experience aircraft overflights that range from loud to very loud on the ground. Effects from these overflights are distributed throughout areas below and adjacent to Edwards Restricted Airspace. These overflights are brief, intermittent, distributed throughout the area, and are neither loud enough nor frequent enough to generate areas of incompatible land-use underneath the airspace. Although completely compatible with all land uses, the Air Force has established no-fly-zones above many of the nearby communities, including Boron, Desert Lake, North Edwards, Kramer Junction, parts of California City, and the Edward AFB cantonment area.

Table 3-12 Estimated Sound Levels for Individual Overflights

Aircraft	F-35	T-38	F-16	KC-135	C-12	F-22
Altitude	**L_{max} (dBA)**					
500	**120**	**89**	**103**	**92**	**79**	**106**
1,000	**115**	**81**	**96**	**85**	73	**99**
5,000	**87**	60	**76**	67	57	**79**
10,000	**90**	48	65	56	49	68
20,000	**78**	34	53	44	39	56
Altitude	**SEL (dBA)**					
500	**120**	**96**	**109**	**97**	83	**109**
1,000	**115**	90	**104**	**92**	78	**104**
5,000	**99**	72	88	77	66	88
10,000	**90**	62	80	69	60	79
20,000	78	50	70	58	52	68

Source: Air Force 2016a and DNWG 2009.

Notes: L_{max} of 75 dBA is the threshold for speech interference.
SEL of 90 dBA is the threshold for sleep interference.
Bold text indicates exceedance of 75 dBA

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 give rise to frustration and irritation. The threshold at which aircraft noise may begin to interfere with speech and communication is 75 dBA (DNWG 2009). This level is consistent with, and more conservative than, the thresholds outlined in the American National Standards Institute's *Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools* (ANSI 2010). As shown in Table 3-12, sound levels for several of the aircraft operating in Edwards Restricted Airspace are greater than 75 dBA L_{max}, the threshold for speech interference (DNWG 2009). There are approximately 13,000 individual aircraft operations per year conducting testing and training activities spread throughout Edwards Restricted Airspace. Individuals directly beneath, and adjacent to the flight paths of louder and lower-flying aircraft, pause there speech briefly, particularly when the aircraft is directly overhead.

Sleep Interference. Some testing and training activities in Edwards Restricted Airspace (less than 1%) are conducted between 10:00 p.m. and 7:00 a.m.; therefore, an assessment of their potential to interfere with sleep is provided. 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 how loud, 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. As shown in Table 3-12, sound levels for several of the aircraft operating close to the ground in Edwards Restricted Airspace are greater than 90 dBA SEL, the threshold for sleep interference within houses (DNWG 2009). Aircraft that are loud enough to interfere with sleep, tend to operate at much higher altitudes, especially at night. However, on rare occasion, it is possible that individuals directly under a flight path are awakened by an aircraft conducting testing or training activities in Edwards Restricted Airspace.

Damage to Hearing. Noise-related hearing loss due to long-term exposure (many years) to continuous noise in the workplace has been studied extensively, but there has been little research on the potential for noise induced hearing loss on members of the community from exposure to aircraft noise. Unlike workplace noise, community exposure to aircraft overflights is not continuous, but consists of individual events where the sound level exceeds the background level for a limited time. An individual would need to be exposed to average sound levels of 75 dBA, 8 hours per day, for 40 years to experience hearing loss (CHABA 1977), as such Occupational Safety & Health Administration (OSHA) and the Air Force have adopted an exposure of 80 dBA for 8 hours per day as the threshold for hearing protection (U.S. Air Force 2016b).

As aircraft overflights are intermittent and not continuous, no individuals are exposed to sound levels exceeding 80 dBA for 8 hours per day beneath Edwards Restricted Airspace. In addition, OSHA and the Air Force have adopted a threshold of 140 dB instantaneous noise level as a threshold for short-term exposure that may induce hearing loss. Some individual aircraft

overflights within Edwards Restricted Airspace are supersonic, and generate sonic booms; however, there are no reported sound levels exceeding 140 dB from sonic booms under the supersonic corridors, and no noise-related hearing loss is expected.

Damage to Structures. Noise from low-level aircraft overflights can cause buildings under their flight path to vibrate, which the occupants experience as shaking of the structure and rattling of the windows. However, based on experimental data and models, noise and vibrations from subsonic aircraft overflights do not cause structural damage to buildings. An impact noise (i.e., blast noise or sonic boom) above 140 dB is required to generate sufficient energy to damage structures (Siskind 1989, and Bureau of Mines 1980). Some individual aircraft overflights within Edwards Restricted Airspace are supersonic, and generate sonic booms; however, there are no reported sound levels exceeding 140 dB; therefore, there is no potential to damage to structures.

3.7 SAFETY

Public health and safety in the Edwards Restricted Airspace is primarily related to the potential for midair collisions and aircraft crashes that then affect the underlying lands. Other safety issues include bird aircraft strike hazards (BASH), wind hazards and associated dust hazards, and blasting (such as at the Borax mine in Boron).

Flight safety in the area is greatly enhanced because the flight activity is occurring in a Restricted Airspace, which is strictly controlled to deconflict incompatible flight activities and aircrews flying within the Restricted Airspace are also segregated and informed of flight risks and areas to avoid to help ensure safe operations within the airspace. Accidents are more likely to occur during high performance and high stress missions flown for training purposes.

3.7.1 Areas of Concentrated Air Traffic

Concentrated air traffic, other than around Edwards AFB, occurs close to Mojave Airport (located outside of the Edwards Restricted Area), and along State Highway 58 and U.S. Highway 395. Civilian light aircraft are permitted to fly along State Highway 58 enroute to the Boron Airstrip and Kramer Junction (intersection of State Highway 58 and U.S. Highway 395). Law enforcement and utility companies are permitted to fly along highways or utility lines. In general, these flights are at a low altitude (1,000 feet above ground level or less) to avoid conflict with military operations, although conflicts are rare.

3.7.2 Bird Airstrike Hazard

The Air Force has an active BASH program to assist pilots in preventing bird strikes on aircraft. The program calls for modifications to operations according to birdwatch threat conditions. During low threat conditions, normal operations prevail. During moderate threat conditions, some restrictions will apply. During severe bird strike conditions, all flying activity is either stopped or greatly curtailed until the threat is reduced.

In general, there is a period of moderate bird activity and moderate threat of bird strike one hour before sunrise and one hour after sunset, from October through March. In addition, during the

wet season, Rosamond, Rogers, and Cuddeback Dry Lakes can be areas of bird strike activity. Harper Dry Lake is an important stop-over point for migrant water fowl and is a potential bird strike area year round. Large numbers of birds also congregate in the Piute Ponds area, at the southwest corner of Edwards AFB.

3.7.3 Other Potential Safety Concerns

Edwards AFB has established procedures to reduce potential for accidents and to promote pilot safety. These procedures include:

- Maximum crosswind limits for formation takeoffs and practice landings on the lakebed runways;
- Residential communities will not be overflown lower than 3,000 feet above ground level at any time except in an emergency;
- Minimum altitude over the AFRL is 5,300 feet MSL; and
- Minimum altitude over the Borax mine is 4,500 feet MSL.

In addition, vertical obstructions such as power poles, within the Edwards Restricted Airspace could pose a hazard to low flying aircraft, although most flight operations occur above the nominal 100 to 150 foot height of these towers and pole lines. Other potential hazards within the Edwards Restricted Airspace include reduced visibility from blowing dust and sand originating from the dry lakebeds and projectiles from blasting at mines.

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4.0 ENVIRONMENTAL CONSEQUENCES

This chapter presents the potential environmental consequences that could result from implementation of the various airspace use alternatives. Possible changes to the natural and human environment that could result from the project alternatives were evaluated relative to existing environmental conditions described within Chapter 3.0. For all resources, impacts would not be significant, and no new mitigation would be required. Use of the Edwards Restricted Airspace (R-2515) is dictated by numerous established procedures and a well-organized control system which limits impacts to local communities and other sensitive resources. This chapter also provides a discussion of cumulative impacts,

4.1 AIRSPACE USE AND MANAGEMENT

4.1.1 Methodology and Significance Criteria

This section provides a discussion of the possible environmental impacts to airspace that could result from the No Action and Proposed Action Alternatives (described in Chapter 2.0). Impacts to airspace use and management would be less than significant unless the Proposed Action would:

- Result in violation of FAA or DOD criteria or any state or federal law; or
- Undermine the safety of military, commercial or civil aviation; or
- Cause substantial adverse effects or present a danger to persons or personal assets not associated with the activity; or
- Cause unacceptable conflicts, congestion, delays or economic hardship for non-participating aircraft that would otherwise freely utilize that airspace.

4.1.2 Alternative 1 – No Action Alternative

The No Action Alternative is consistent with continued use of the Edwards Restricted Airspace at current levels. In FY18 there were more than 13,000 sorties flown by more than 300 different airframes from more than 30 military, other governmental, and civilian agencies. Total flight hours are not known because the vast majority of flights are flown VFR, but the airspace was reportedly utilized 24 hours a day for 365 days of the year. Other ground-based activities contributed to airspace utilization including explosive ordnance demolitions (EOD), rocket test firing operations by AFRL, and small UAS flights that otherwise cannot be individually tracked. Additionally, classified ground and air operations are often conducted during non-daylight hours and on weekends that are not tracked but require RA activation and contribute to airspace utilization.

Airfield operations identified in FY15 (U.S. Air Force 2016c) indicate that operations emanating from Edwards AFB were conducted 95% during the day (7:00 am to 7:00 pm), 4.5% during the evening (7:00 pm to 10:00 pm), and 0.5% during the night (10:00 pm to 7:00 am). Usage of the Edwards Restricted Airspace can be assumed to be similarly consistent to these time divisions although additionally impacted by other off-base users and ground activities. For the recorded

number of sorties in FY18 applied to the flight time ratios of the FY15 result in 12,571 sorties during the day, 596 sorties in the evening and 66 sorties at night, throughout the year.

Private Property Overflight

The Edwards Restricted Airspace had originally been established over some properties not owned or controlled by the using or controlling agency. While this does not violate any regulation for restricted areas (14 CFR, Part 73, Subpart B), it is currently a common requirement for FAA charting of new or modified Restricted Airspace. This is due to the inherent risk of dangerous flight activity, that typically occurs in RAs, to persons and property below those activities. This inherent risk is exacerbated at Edwards AFB by the potentially hazardous flight testing of vehicles and equipment still in development and the training of test pilots for those activities.

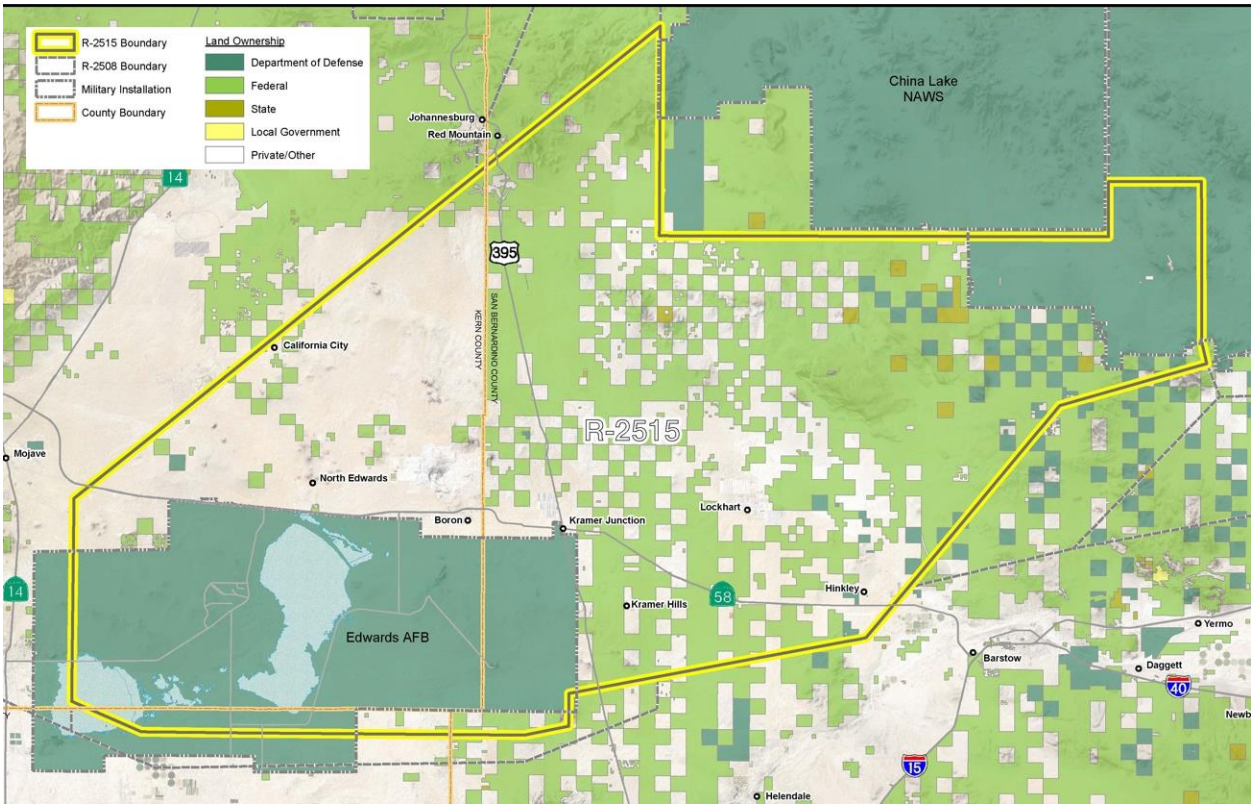
The Edwards Restricted Airspace resides over property owned by the installation, BLM, State and Federal Government, as well as privately owned property (Figure 4-1). Of the total 1,159,064 acres of land within the boundaries of the Edwards Restricted Airspace, 392,406 acres are privately owned, which equates to approximately 34%, or roughly one third of the total land holdings. The vast majority of that privately owned property is vacant desert, devoid of persons, residences or other personal property. However, there are several homes and small towns scattered throughout the area. The *R-2515 Users Handbook, Airspace and Flying Procedures* (30 July 2019) defines a flight restriction of 3,000 ft AGL over populated areas, which provides protection from disturbance but does not necessarily protect against accidental impact by manned or unmanned aircraft or aircraft components or parts that may come from airspace above 3,000 ft AGL. Installation personnel state that the likelihood of such an occurrence is extremely low rendering this issue no more than a potentially minor impact.

Airport and General Aviation Access

There is one private airfield located beneath the Edwards Restricted Airspace and reports of several unregistered private airstrips. The Boron Airstrip (57CL) was established before the installation came to importance for aviation and before the RA was established. This was also at a time before the FAA made special accommodations for existing assets in SUA, and therefore no accommodations have been provided. Protocols for flight operations from Boron Airstrip puts burdens on users as to free and unfettered use due to on-going military operations in the Edwards Restricted Airspace. Boron Airstrip experiences approximately 50 operations each month, primarily conducted on weekends.

Current protocols for operations at the airstrip require notification to Joshua Approach and SPORT of intent to fly a minimum of two weeks prior. There must also be a current letter of agreement (LOA) for use of the airspace with conditions to that use. This can present an undue burden to free and fair use of this private asset and the NAS. Additionally, once airborne, flight within the RA consists of egress and ingress only along the Highway 58 corridor with protections provided by transponder activation and separation advisory calls from SPORT during regular hours of operation. Outside of those hours, Joshua Approach will monitor operations but will not provide ATC.

Figure 4-1 Property Ownership Beneath R-2515



Other civilian and local governmental agency (non-military) use of restricted area airspace, consists primarily of activity along Highways 58 and 395, which traverse the land beneath the RA. These consist of law enforcement, utility observation, Forest or Park Service, and the occasional air ambulance. Users must have a LOA and provide notice two weeks prior to flight. Flight is restricted to 1,000 ft AGL within a corridor one quarter mile north of the highway. SPORT provides separation advisory calls during regular hours of operation. It should be noted that this path crosses the North UAS Extension Work Area. Because of the low-volume of this type of air traffic, these factors present a moderate impact to airspace use and management.

Airspace Management and Control

Management and control of the R-2508 Complex, including the Edwards Restricted Airspace, is very well organized and consistently documented. This system allows a very complex airspace to function without incident while providing numerous functional capabilities to a wide variety of users. Although the Edwards Restricted Airspace is quite large in lateral area, the majority of test and training activities are consolidated to within the boundaries of installation property. Given those spatial limitations of RA over installation property, many functions overlap requiring proactive scheduling and real-time management. Some conflict situations are described in the following paragraphs.

The Desert Butte TFR has a corridor width of four NMs and follows Cords Road. Being a terrain-following route, the intent is for low-altitude flight. The floor of the route extends down to 200 ft AGL, which is where the majority of traffic would operate. This route, however, runs directly over or near several features that have no-fly zone restrictions that would prevent use at low altitudes for significant portions of the route (*R-2515 Users Handbook, p.4 Section 2.6, 30 July 2019*). These operational obstructions include:

- California City at the far westerly point of the route has a 3,000 ft AGL no-fly zone.
- Aerial Acres approximately ten NM from the westerly point has a 3,000 ft AGL no-fly zone.
- Boron Mine approximately 17 NM from the westerly point has a 4,500 ft above MSL no-fly zone. The high point of the mine is 2,600 ft above MSL making this 1,900 ft AGL and the low point is at 2,400 ft above MSL making this 2,100 ft AGL.
- At the easterly edge a portion of the route overlaps the lower elevations of the Black Mountain Supersonic Corridor. This would require schedule deconfliction only.

The southern one half of the installation contains many unrelated work areas and airspace assets that require proactive management in order to maintain a safe work environment while providing maximum benefit of the RA. These include:

- The Haystack TFR
- The Alpha Corridor
- The PIRA Supersonic Corridor
- PIRA East and West Ranges, which include a myriad of uses at all altitudes from surface to FL600
- Three DZs including ENAD DZ, Erickson DZ, and Survival School DZ
- Three UAS work areas including Rosamond North & South, and ET-CTF
- Two overlapping Spin Areas including South Spin and Mercury Spin
- The Edwards Tower Class D airspace
- The AFRL Rocket Testing area

The northern half of the installation area is even more condensed including all airfield operations. The installation area covers approximately one fourth the entire area of the Edwards Restricted Airspace but holds the vast majority of airspace activities. An easing of this congestion by relocating some work areas to other parts of the RA might improve airspace use and management as well as operational capabilities. Despite this congestion and complexity, there are no impacts to airspace use and management.

Summary of Alternative 1 Impacts to Airspace Use and Management

Implementation of the No Action Alternative, the continued use of the Edwards Restricted Airspace at current levels, would have less than significant impacts to airspace use and management in that it would not (1) result in violation of FAA or DOD criteria or any state or federal law; or (2) undermine the safety of military, commercial or civil aviation; or (3) cause adverse effects or present an untenable level of danger to persons or personal assets not associated with the activity; or (4) cause unacceptable conflicts, congestion, delays or economic

hardship for non-participating aircraft that would otherwise freely utilize that airspace. No mitigation is required.

4.1.3 Alternative 2 – Proposed Action Alternative

The Proposed Action includes all aspects identified in the No Action Alternative along with consideration of three additional factors:

- On-going and/or increased testing of the B-21
- On-going and/or increased testing of the KC-46A
- A one-for-one replacement of T-38 permanently assigned aircraft (PAA) for the new T-7

The environmental consequences and associated environmental impacts identified in Alternative 1 will remain unchanged under this alternative in addition to the environmental consequences and impacts identified regarding the three additional factors.

(U) The B-21 Raider will be a future test program. Projected usage for the Edwards Restricted Airspace, assuming a regular schedule, is 16-sorties for a total of 79-hours per month.

The KC-46A is in year one of an estimated five-year test program. Projected usage of the Edwards Restricted Airspace for the remaining test requirements includes 600 sorties for a total of 3,600 flight hours over the remaining 60 months. Assuming a regular schedule, that would calculate out to ten sorties for a total of 60 hours per month.

Replacement of the total number of T-38 PAA with the new T-7 is to be a one-for-one swap with no increase or decrease in PAA. Similarly, the flight usage and flight characteristics are equivalent between these two aircraft. Therefore, there would be no perceivable difference to airspace use and management due to this action.

The type of flight characteristics and systems testing that would occur with these additional activities is consistent with the primary mission of Edwards AFB and therefore is consistent with its capabilities and capacity. The Edwards Restricted Airspace is consistently capable of supporting this level of activity. Historic data shows that average flight activity within the Edwards Restricted Airspace has held relatively consistent at around 13,000 sorties per year for the past several years with no issues identified in lack of capability. In FY96, there were more than 21,000 sorties. Even at this level, there were no reported issues of congestion or scheduling conflicts.

Summary of Alternative 2 Impacts to Airspace Use and Management

These three additional actions do not represent any significant change to on-going operations within the Edwards Restricted Airspace. Therefore, implementation of Alternative 2, Proposed Action Alternative, or continued use along with completion of testing activities for the B-21 and KC-46A as well as replacement of the T-38 for an equal number of the new T-7 ,would have less than significant impacts to airspace use and management in that it would not (1) result in violation of FAA or DOD criteria or any state or federal law; or (2) undermine the safety of military, commercial or civil aviation; or (3) cause adverse effects or present an untenable level of danger to persons or personal assets not associated with the activity; or (4) cause

unacceptable conflicts, congestion, delays or economic hardship for non-participating aircraft that would otherwise freely utilize that airspace. No mitigation is required.

4.1.4 Alternative 3 – Additional Operations (Surge)

This alternative includes all aspects identified in the No Action Alternative and the Preferred Action Alternative along with a projected doubling of all airspace activities. Alternative 2 identified an annual usage of approximately 13,000 sorties. This alternative then would consider an annual usage of 26,000 sorties within the Edwards Restricted Airspace. Those activities should include all mission sets and activities previously identified in Section 1.3.

Private Property Overflight

The condition of test and training air activities over private property as described in Section 4.1.2, would be exacerbated under this alternative. A doubling of test and training sorties as well as other aerospace activities would increase resulting in a commensurately heightened danger for private property owners as previously described. If protocols are followed for established no-fly zones over populated areas to a floor of 3,000 ft AGL, there remains only a minor probability for impact to private property, persons and possessions.

Airport and General Aviation Access

Increased test and training activity would serve to commensurately reduce the capabilities of non-participating flight activities within the RA as previously described in Section 4.1.2. This legacy conflict would realize a reduced ability for timely arrival and departure to Boron Airstrip as well as other unregistered airfields, and non-participating air traffic that need to traverse the airspace.

Airspace Management and Control

Since the Edwards Restricted Airspace is fully operational (activated) every hour of every day of the year, the only change is operational tempo and the resulting congestion of the airspace. A doubling of airspace use under the current model, whereby the vast majority of activity is conducted in airspace immediately over the installation proper, would create even greater congestion than if those activities were more evenly distributed across the entire Edwards Restricted Airspace. Live fire activities must be conducted over range land, but all other activity could be conducted elsewhere within the Edwards Restricted Airspace. Land ownership issues may restrict certain types of training as previously discussed. Additional infrastructure may also be needed closer to those activities such as airstrips and maintenance / operations facilities, to make them operationally efficient.

Less congested airspace segments of the Edwards Restricted Airspace can be utilized as a flexible buffer for surge activities described in this alternative. That would, however, require the fore-work of establishing the parameters of drop zones, spin areas, UAS work zones, etc. and including those descriptions in airspace management documentation and protocols. Security of classified operations could limit the types of activities due to the lack of control over ground access because the property is not part of the installation.

Summary of Alternative 3 Impacts to Airspace Use and Management

Implementation of Alternative 3 – Additional Operations (Surge) Alternative, including both Alternative 1 and Alternative 2 impacts as well as an additional 100 percent of those combined activities, would have less than significant impacts to airspace use and management in that it would not (1) result in violation of FAA or DOD criteria or any state or federal law; or (2) undermine the safety of military, commercial or civil aviation; or (3) cause adverse effects or present an untenable level of danger to persons or personal assets not associated with the activity; or (4) cause unacceptable conflicts, congestion, delays or economic hardship for non-participating aircraft that would otherwise freely utilize that airspace. Following current procedures for managing the airspace would keep impacts less than significant. No mitigation is required.

4.2 AIR QUALITY

4.2.1 Methodology and Significance Criteria

Impacts on air quality were determined based on the net change in emissions of regulated pollutants when compared to existing conditions. ACAM was used to estimate the total direct and indirect emission from the Proposed Action, which have been compare to the *de minimis* (of minimal importance) thresholds to determine if the general conformity rules apply, and the level of impacts under NEPA (U.S. Air Force 2020). The Proposed Action would have a significant adverse impact on air quality if it would:

- Produce emissions that exceed the general conformity rule *de minimis* threshold values, or
- Contribute to a violation of any federal, state, or local air regulation.

4.2.2 Alternative 1 – No Action Alternative

The No Action Alternative would result in no effect on air quality. There would be no long-term changes in emissions due to the Proposed Action. Ambient air quality would remain unchanged when compared to existing conditions.

4.2.3 Alternative 2 – Proposed Action Alternative

Alternative 2 would have long-term minor adverse impacts on air quality. Impacts would occur from incremental increases in emissions from changes in aircraft mix when compared to existing training and testing within the Edwards Restricted Airspace. Table 4-1 outlines the change in annual air emissions from Alternative 2 compared to the *de minimis* threshold values. The emissions from Alternative 2 would be below the *de minimis* thresholds and would not contribute to a violation of any federal, state, or local air regulations. The general conformity rule was established with NEPA in mind, and it is understood that actions of this size within a USEPA-designated nonattainment area would have less than significant impacts to air quality. Detailed emission calculations are in Appendix C.

Table 4-1 Annual Air Emissions Compared to *De Minimis* Thresholds – Alternative 2

Pollutant	Emissions (tpy)			*De Minimis* Thresholds	Exceeds *De Minimis* Threshold?
	Existing Conditions	Alternative 2 Proposed Action	Net Change		
VOC	0.2	0.5	0.3	25	No
NO_x	11.5	14.9	3.3	25	No
CO	4.3	0.8	(3.5)	100[a]	No
SO_x	0.7	0.8	0.2	100[a]	No
PM_{10}	0.9	0.8	(0.1)	100	No
$PM_{2.5}$	0.7	0.7	(0.0)	100[a]	No
Pb	0.0	0.0	0.0	25[a]	No
CO_2e	2,035	2,507	472	-	-

Source: USEPA 2020b and U.S. Air Force 2020.

[a] The least restrictive de minimis thresholds were used for attainment pollutants to determine the level of impacts under NEPA.

For analysis purposes, it was assumed that all aircraft operations and associated emissions would be totally within each nonattainment area. However, aircraft operations and subsequent emissions would actually be distributed throughout the Edwards Restricted Airspace, and would be less than those shown in Table 4-1 within individual nonattainment areas. Therefore, regardless of where the operations took place within the Edwards Restricted Airspace, overall emissions within individual nonattainment areas would not exceed *de minimis* thresholds.

There would be no new stationary sources of air emissions and no changes in ground-based operations at Edwards AFB. No changes to the existing air permits would be required. There would be no heavy construction or associated sources of air emissions, and no best management practices (BMPs) associated with these types of activities would be required.

Climate Change and Greenhouse Gases (GHGs). At this time, climate change presents a global problem caused by increasing global atmospheric concentrations of GHG emissions and the current state of the science surrounding it does not support determining the global significance of local or regional emissions of GHGs from a particular action. Therefore, the quantitative analysis of carbon dioxide equivalent (CO_2e) emissions in this EA is for disclosing the local net effects (increase or decrease) of the proposed action and alternatives, and for its potential usefulness in making reasoned choices among alternatives. Under Alternative 2, there would be an incremental increase in GHG emissions of 472 tons per year of CO_2e (U.S. Air Force 2020).

California is in the southwest climate region of the United States, an area that climate change leaves exceptionally vulnerable to extreme heat events and decreased water availability. Parts of the Southwest reach the hottest temperatures on Earth, with the world record high of 134°F (57°C) recorded in Death Valley National Park, and daily maximum temperatures across much

of the region regularly exceeding 98°F during summer. The average annual temperature of the Southwest increased 1.6°F between 1901 and 2016. Moreover, the region recorded more warm nights and fewer cold nights between 1990 and 2016, including an increase of 4.1°F (2.3°C) for the coldest day of the year (NCA 2019). Table 4-2 lists climate stressors and their potential impacts on the air operations in the Edwards Restricted Airspace. At this time, no future climate scenario or potential climate stressor would have appreciable impacts on any element of the Proposed Action. The longer fire seasons and more severe wildfires in the southwest would introduce a minor additional risk to the air operations at Edwards AFB and within the Edwards Restricted Airspace.

Table 4-2 Effects of Potential Climate Stressors on Aircraft Operations

Climate Stressor	Potential Effect on Aircraft Operations
More frequent and intense heat waves	Negligible
Longer fire seasons and more severe wildfires	Minor
Changes in precipitation patterns	Negligible
Increased drought	Negligible
Harm to water resources, agriculture, wildlife, ecosystems	Negligible

Source: NCA 2019

4.2.4 Alternative 3 – Additional Operations (Surge)

As with Alternative 2 and for similar reasons, Alternative 3 would have long-term minor adverse impacts on air quality. Impacts would occur from incremental increases in emissions below the mixing height from changes in aircraft fleet mix and additional air operations when compared to existing training and testing within the Edwards Restricted Airspace (U.S. Air Force 2020). Table 4-3 outlines the change in annual air emissions from Alternative 3 compared to the de minimis threshold values. Both the overall and county-specific changes in emissions would be less than the de minimis thresholds for all pollutants; therefore, the general conformity rules would not apply, and the level of impacts would be less than significant. No mitigation would be required.

Table 4-3 Annual Air Emissions Compared to *De Minimis* Thresholds – Alternative 3

Pollutant	Emissions in Tons per Year (tpy)			De Minimis Thresholds	Exceeds De Minimis Threshold?
	Existing Conditions	Alternative 3 Surge	Net Change		
VOC	0.2	1.0	0.8	25	No
NO_X	11.5	29.7	18.2	25	No
CO	4.3	1.5	(2.8)	100[a]	No
SO_X	0.7	1.7	1.0	100[a]	No
PM_{10}	0.9	1.6	0.7	100	No
$PM_{2.5}$	0.7	1.5	0.7	100[a]	No
Pb	0.0	0.0	0.0	25[a]	No
CO_2e	2,035	5,013	2,979	-	-

Source: USEPA 2020b and U.S. Air Force 2020.

[a] The least restrictive *de minimis* thresholds were used for attainment pollutants to determine the level of impacts under NEPA.

As with Alternative 2, and for similar reasons, regardless of where the operations took place within the Edwards Restricted Airspace, overall emissions within individual nonattainment areas would not exceed *de minimis* thresholds. As with Alternative 2, there would be no new stationary sources of air emissions and no changes in ground-based operations at Edwards AFB; no changes to the existing air permits would be required. There would be no heavy construction or associated sources of air emissions, and no BMPs associated with these types of activities would be required.

Climate Change and GHGs. Under Alternative 3, there would be an increase in GHG emissions of 2,979 tons per year of CO_2e (U. S. Air Force 2020). Table 4-2 lists climate stressors and their potential impacts on the air operations in the Edwards Restricted Airspace. As with Alternative 2 and for similar reasons, no future climate scenario or potential climate stressor would have appreciable impacts on any element of the Proposed Action, and no mitigation would be required.

4.3 CULTURAL RESOURCES

4.3.1 Methodology and Significance Criteria

Noise and vibration of low-level aircraft flights is evaluated for potential impacts to cultural resources in this EA. Subsonic and supersonic overflights at or below 2,500 feet AGL have the potential to impact cultural resources (U. S. Air Force 1998). Impacts would be considered significant if noise (and sonic booms) results in measurable damage to or permanent loss of prehistoric or historic sites or prevents the use of Native American sites.

4.3.2 Alternative 1 – No Action Alternative

Flight testing and training operations in the Edwards Restricted Airspace would continue at current levels under Alternative 1. With the high number of cultural sites in the Edwards Restricted Airspace, some of the sites could be exposed to subsonic and supersonic noise.

The United States Forest Service (USFS) prepared a report on the potential impacts of aircraft overflights and concluded that resonant vibrations of building elements may occur during overflight (USFS 1992). These findings are most applicable to above-ground cultural sites such as buildings, structures, or artifacts. This may cause visible motion, permanent displacement, vibration that can be felt, or audible sound (USFS 1992). There is minimal potential for damage to structures due to overflight of subsonic aircraft and light helicopters at 50 feet AGL, but heavy bombers at 200 feet AGL or heavy helicopters at 50 feet AGL could have a risk of damage (USFS 1992). Visual Route (VR)-1205 does not overfly areas where known prehistoric, historic, or Native American sites occur, and helicopters would not normally use the visual route due to the high speed required. Therefore, other than the chance of random, occasional overflight, there would be no effect from the use of VR-1205 on cultural resources.

The probability of damage to a structure from a sonic boom, ranging from 1 to 128 pounds per square foot (psf), is shown in Table 4-4. For example, at 8 psf the probability of damage to a window is 4 in 10, or 40%. A value of greater than one indicates that damage to the structure is certain. Supersonic aircraft used in the Edwards Restricted Airspace can range in sonic boom pressure from approximately 11 to 50 psf, depending on the size of the aircraft (U.S. Air Force 1998). At these pressures, a direct flyover could cause damage to structures such as those made of brick or wood-frame with plaster walls but is unlikely to damage petroglyphs or caves.

Table 4-4 Probability of Sonic Boom Damage to Structures

Type of Structure	Free Field Pressure (pounds per square foot)							
	1	2	4	8	16	32	64	128
Window	5.9E-03	3.5E-02	1.6E-01	4.0E-01	7.6E-01	>1	>1	>1
Masonry-stone	1.2E-06	6.4E-05	1.7E-03	1.6E-02	1.3E-01	3.9E-01	8.1E-01	>1
Brick	8.6E-02	2.9E-01	6.2E-01	>1	>1	>1	>1	>1
Adobe walls	2.1E-04	4.2E-03	3.7E-02	2.0E-01	5.2E-01	>1	>1	>1
Wood-frame, plaster walls	1.7E-02	1.6E-01	4.9E-01	>1	>1	>1	>1	>1
Wood-frame, wood walls	6.1E-04	7.9E-03	5.3E-02	2.2E-01	5.2E-01	9.5E-01	>1	>1
Wood-frame, open (bridge)	4.2E-04	5.9E-03	4.1E-02	1.9E-01	4.7E-01	8.9E-01	>1	>1
Masonry/stone-roof	3.9E-02	1.6E-01	3.8E-01	7.1E-01	>1	>1	>1	>1
Masonry/stone-no roof	9.9E-04	8.7E-03	4.6E-02	1.8E-01	4.1E-01	7.4E-01	>1	>1
Adobe-roof	1.3E-04	7.8E-02	2.7E-01	5.8E-01	>1	>1	>1	>1
Adobe-no roof	5.5E-04	6.8E-03	4.4E-02	1.9E-01	4.6E-01	8.6E-01	>1	>1
Petroglyphs/caves	1.8E-03	1.1E-02	4.3E-02	1.5E-01	3.2E-01	5.8E-01	9.0E-01	>1

Potential impacts to cultural resources in the Edwards Restricted Airspace are not anticipated, except from subsonic overflights of large bombers (200 feet AGL) or heavy helicopters (50 feet AGL), or supersonic corridor operations that directly overfly cultural resources at or below 2,500 feet AGL. However, these operations would avoid known cultural sites that are susceptible to this type of noise effect (e.g., aboveground sites) to the maximum extent practicable. While noise due to overflight of a Native American site could disrupt a ceremony, no noise complaints of this type have been registered. If this occurs, flight operations would attempt to avoid sites where ceremonies have been disrupted by aircraft noise in the past. Since only random, occasional overflight may occur, the potential to impact cultural resources would be low. In addition, Alternative 1 would create no new effects on cultural resources because operations would continue at current levels. No significant damage to cultural resources in the Edwards Restricted Airspace from current flight operations has been documented to date. Therefore, Alternative 1 would have less than significant impacts to cultural resources, and no mitigation would be required.

4.3.3 Alternative 2 – Proposed Action Alternative

Alternative 2 includes the continued use of the Edwards Restricted Airspace with the addition of a nominal amount of testing operations for the B-21, the one-to-one replacement of the T-38 operations with the T-7, and testing of the KC-46A. The continued use of the Edwards Restricted Airspace would have less than significant impacts to cultural resources, as described for Alternative 1. While testing of the B-21 and KC-46A would increase the potential for noise impacts to cultural resources, this increase would be trivial relative to the total amount of current air operations. Therefore, Alternative 2 would have less than significant impacts to cultural resources, and no mitigation would be required.

4.3.4 Alternative 3 – Additional Operations (Surge)

Alternative 3 includes all components of Alternative 2 with the addition of a 100 percent increase in all types of airspace operations in the Edwards Restricted Airspace with a similar mix of uses. While the increase in airspace operations would increase the potential for noise impacts to cultural resources, these operations would avoid known cultural sites that are susceptible to noise effects from overflight (e.g., aboveground sites) to the maximum extent practicable. No noise complaints have been registered due to overflight of a Native American site, and if this occurs, flight operations would attempt to avoid sites where ceremonies have been disrupted by aircraft noise in the past. Since only random, occasional overflight may occur, the potential to impact cultural resources would be low. Therefore, Alternative 3 would have less than significant impacts to cultural resources, and no mitigation would be required.

4.4 LAND USE

4.4.1 Methodology and Significance Criteria

Land use impacts are determined by consistency with federal plans and policies and local land use plans (such as general plans, zoning ordinances, master plans, and other specific land use policies).

An alternative would be considered to result in a significant adverse impact related to land use if it would:

- Conflict with established recreational, educational, or scientific uses;
- Be inconsistent with relevant federal or local plans and policies; or,
- Be associated with the incompatibility of physical development to adjacent existing and planned uses.

4.4.2 Alternative 1 – No Action Alternative

The No Action Alternative is the continued use of the Edwards Restricted Airspace at current levels, which affects the various land uses within its boundaries.

Military Installations

Most of the flight activity within the Edwards Restricted Airspace originates from Edwards AFB and is required by its mission. Mission-related operations are tailored to avoid areas on the installation that may be incompatible with military operations, such as the Community Area near the Main Base. The R-2515 Handbook defines “no fly areas” at Edwards AFB. This includes no overflying the AFRL below 5,300 feet, not overflying the EOD area below 6,000 feet, and not overflying base housing or the medical facility. As such, the continued use of the Edwards Restricted Airspace is consistent with the land use at the installation. No significant land use impacts to Edwards AFB are anticipated.

Bureau of Land Management Lands

On-going flight operations in the Edwards Restricted Airspace have the potential to adversely affect some of the recreational activities that occur on BLM lands, including hiking, camping, hunting. However, the impacts from the No Action Alternative would not change from current conditions. In addition, approximately 95% of flight operations occur during the day and are largely intermittent and temporary in nature.

Of the three designated wilderness areas under the Edwards Restricted Airspace, the Black Mountain Wilderness Area has the most potential to be adversely impacted by continued operations in the area, as it lies under the High Altitude and Black Mountain Supersonic Corridors, and VR-1205. In addition, the Black Mountain and Saltdale TFRs traverse the edge of this wilderness area. Both Golden Valley and Grass Valley Wilderness Areas are located on the border of the Edwards Restricted Airspace, further away from supersonic and low-level activity. However, flights on these corridors are intermittent and temporary.

No significant land use impacts to BLM land are anticipated from the No Action Alternative.

City/County and Private Lands

Most of the area under the Edwards Restricted Area is sparsely populated. A few communities, such as Boron, North Edwards, Kramer Junction, and a part of California City, would be impacted by noise from flights, but at the same level as current conditions. The *R-2508 Complex Users Handbook* (24 April 2020) defines all communities as “noise sensitive areas” and must be avoided by 3,000 feet MSL, with the only exception is while operating on an

approved test plan. The *R-2515 Users Handbook* (30 July 2020) also flying below 4,500 feet MSL over the Boron Mine (near Boron).

The continued use of the Edwards Restricted Airspace would not change or adversely affect public or private land uses in the area. No significant land use impacts are anticipated.

Airports

The Boron Airstrip experiences approximately 50 operations each month, primarily on weekends. The *R-2508 Complex Users Handbook* (24 April 2020) requires the avoidance of airports by 1,500 feet AGL and 3 NM. In addition, most operations in the Edwards Restricted Airspace occur during the week. As a result, no significant land use impacts to the Boron Airstrip are anticipated.

Summary

The Edwards Restricted Airspace is sparsely populated and most of the flying activities take place on weekdays and during daylight hours, thereby limiting adverse impacts to residents and recreational users of the lands. Following current procedures and restrictions should be adequate for the continued protection of city, county, and private lands, as well as users of the Boron Airstrip. No significant land use impacts are anticipated, and no mitigation would be required.

4.4.3 Alternative 2 – Proposed Action Alternative

The Proposed Action would include the continued use of the Edwards Restricted Airspace with the addition of three activities, that may affect land uses in the area. The one-to-one replacement of the T-38 operations with the T-7 would not appreciably change the use of the Airspace and, therefore, would have no additional impacts. Testing of the B-21 and KC-46A would add operations to the Edwards Restricted Airspace Airspace over several years, as described in Section 4.1.3. However, these activities are similar to other testing activities that have occurred over the past 20 years within the Edwards Restricted Area and would not result in new or appreciably greater impacts to the land uses described in Section 4.4.2 for the No Action Alternative.

However, as noted for the No Action Alternative, the area is sparsely populated and most of the flying activities take place on weekdays and during daylight hours, thereby limiting adverse impacts to residents and recreational users of the lands. Following current procedures and restrictions should be adequate for the protection of city, county, and private lands, as well as users of the Boron Airstrip. No significant land use impacts are anticipated, and no mitigation would be required.

4.4.4 Alternative 3 – Additional Operations (Surge)

This alternative includes all aspects identified in the No Action Alternative and the Proposed Action Alternative along with a projected doubling of all airspace activities. This would likely result in a noticeable change in airspace activities to residents and users of the land underlying the Edwards Restricted Airspace. However, as noted for the other alternatives, the area is

sparsely populated and most of the flying activities take place on weekdays and during daylight hours, thereby limiting adverse impacts to residents and recreational users of the lands on weekends. Following current procedures and restrictions should be adequate for the protection of city, county, and private lands, as well as users of the Boron Airstrip. In addition, this increase in use of the airspace is consistent with historic usage of the airspace, even as the mix of activities in the airspace has changed. No significant land use impacts are anticipated, and no mitigation would be required.

4.5 NATURAL RESOURCES

4.5.1 Methodology and Significance Criteria

Since all alternatives involve flight within the Edwards Restricted Airspace and do not include new construction or land disturbance, noise is the primary factor that is evaluated for potential impacts to natural resources. A wide range of impacts to wildlife due to aircraft overflights has been reported in the literature. Reports of behavioral responses in animals are highly variable depending on study methodology, the species in questions, spatial and temporal parameters, and other broad characteristics. However, despite studies on the effects of noise on natural resources, findings are inconclusive. The limited information neither support nor disproves the contention that noise generated by aircraft harms natural resources.

One particular study, the *Ecological Risk Assessment Framework for Low-Altitude Overflights by Fixed-Wing and Rotary-Wing Military Aircraft* report (Oak Ridge National Laboratory 2000), provided a summary of various research studies and identified the key stressor for low-altitude, military aircraft overflights as sound, although the visual and physical (collision) stressors can also be a factor. The analysis concluded that the studies of effects of aircraft overflights have not been associated with a quantitative assessment framework; therefore, no consistent relationships between exposure and population-level response have been developed. In general, there is a moderate amount of information on behavioral effects associated with overflights, but little on abundance and reproduction. For some species, responses are dependent on activities that animals were previously engaged in, as well as previous exposures to overflights. Such potential impacts are identified in the discussion of impacts by alternative.

This same report (Oak Ridge National Laboratory 2000) provides some information which indicates that aircraft overflights may not substantially affect certain natural resources for the purposes of this analysis. For example, impacts on plant communities may be caused by air movement associated with aircraft takeoffs and landings. This project is the continued use of the airspace, not looking at takeoffs and landings. In addition, none of the alternatives include ground-level activities in areas with sensitive plants populations. Therefore, impacts to vegetation would not occur as a result of the Proposed Action or alternatives, and are not discussed further.

The following criteria were used to determine the severity and intensity of impacts:

- The degree to which the action may adversely affect an endangered or threatened species or designated critical habitat;

- Whether an action significantly affects unique characteristics of the geographic area such as proximity to critical habitats, sensitive habitats, or other ecologically critical areas; or
- Have a substantial adverse effect on birds protected by the MBTA.

For all alternatives, overflights, while regular, are sporadic and of short duration, and therefore do not provide a consistent level of increased noise. In most cases, the wildlife in the area seem to habituate to the noise and, therefore, are not significantly affected by it.

4.5.2 Alternative 1 – No Action Alternative

Under the No Action Alternative, there would be no long-term changes in aircraft mix or operations. The noise environment would remain unchanged when compared to existing conditions and, therefore, no additional impacts to wildlife in the Edwards Restricted Airspace would occur, and no mitigation would be required.

4.5.3 Alternative 2 – Proposed Action Alternative

Under this alternative, potential impacts to wildlife would be incrementally greater (but unnoticeable) compared to the No Action Alternative due to changes in the fleet mix of aircraft conducting testing and training activities in the Edwards Restricted Airspace. Potential impacts to wildlife species and sensitive habitats in the area are discussed, although impacts would not be appreciably different than for the No Action Alternative. No mitigation would be required.

Wildlife

The startle response to noise is the most readily observed and best documented response of animals to aircraft, but the long-range impact of the startle effect on populations has not been thoroughly investigated. Of more significant concern than an immediate startle response is the potential for modification of behavior patterns in animals as a result of human intervention. There is a concern that noise may alter the ability to detect and escape predators, disrupt feeding patterns, or lower reproductive potential. A brief overview of potential impacts to general categories of wildlife is provided here.

Invertebrates. A USFS study, *Report to Congress: Potential Impacts of Aircraft Overflights of National Forest System Wildernesses* (U.S. Forest Service 1992), concluded that although invertebrate response to aircraft overflights have rarely been studied, general observations do not suggest that further studies are necessary and no significant impacts are expected to invertebrate populations from activities in the Edwards Restricted Airspace.

Fish and Amphibians. As discussed in Section 3.5.2, fish and amphibians in this desert area are sparse due to the lack of perennial water sources. Although startle responses to aircraft noise are possible, no adverse effects were reported in the short-term studies reviewed (USFS 1992), and there was evidence that fish habituated. No significant impacts are expected.

Reptiles. Reptiles in general show little startle response and may not depend greatly on hearing and, therefore, their behavior should not be greatly impacted by aircraft noise. No significant impacts are expected.

Mammals. Most documentation of startle responses of mammals has been of that demonstrated by grazing or browsing herds of elk or deer, which are not found in this area, but until further studies are conducted, it is assumed that smaller herbivores also exhibit startle response and similar tendency to habituate. Both avian and mammalian species frequently show rapid habituation to aircraft presence and exhibit minimal response after a short time (U.S. Forest Service 1992). No significant impacts are expected.

Birds. Behavioral responses that are potentially the most significant to population survival are those that affect reproductive success. Birds would appear to be most vulnerable to noise because the startle response could result in broken eggs, nestlings ejected from the nest, or abandonment of the nest after repeated disturbances. Therefore, nesting areas are especially sensitive to environmental stress. Although human intrusion can cause a decline of as much as one-third in the number of waterfowl eggs laid, aircraft noise seems to be less detrimental than other human interventions because it is perceived to be of nonspecific origin (USFS 1992). For raptors, most accounts suggest that aircraft passes do not modify raptor behavior in more than a short-term manner, and that severe reactions occurred when aircraft passed with 500 to 1,500 feet of the nest at altitudes below 1,000 feet AGL (U.S. Air Force 1998). Impacts would be less than significant.

Sensitive Species and Migratory Birds

Based on the previous discussion, of the sensitive species discussed in Section 3.5.3, it is likely that only the bird species (western snowy plover, tri-colored blackbird, and Yuma Ridgway's rail) could be adversely affected by an increase in military overflights as a result of Proposed Action Alternative. This is true for migratory birds in the area as well, although aircraft strike hazards are also a hazard to migratory birds, especially from low-altitude flights. However, Edwards AFB has limited incidents of bird strikes, partly because of the lack of water in the area, and an incremental increase in flights associated with the Proposed Action would not be expected to significantly increase the impact on bird species in the Edwards Restricted Airspace.

Therefore, the change in overflights due to the Proposed Action Alternative would not be appreciably different than under the No Action Alternative. No significant adverse impacts to sensitive species or migratory birds would occur.

Sensitive Habitats

As discussed in Section 3.5.4, a sensitive habitat is one that is considered rare, supports unique associations, or supports sensitive plants or wildlife. The two sensitive plant communities in the area, mesquite woodlands and Transmontane alkali marsh, would not be affected by an increase in military overflights. The two Los Angeles County SEAs support sensitive plant associations, desert tortoise, and Mohave ground squirrel, none of which would be affected by an increase in overflights. Of the BLM ACECs under the Edwards Restricted Airspace, only the Harper Dry Lake ACEC could be affected by the Proposed Project. Harper Dry Lake is a year-round marsh and wetland used by a variety of resident and migratory bird species. Since birds are especially vulnerable to disturbance during nesting season, an increase in overflights could potentially affect these birds. However, the increase associated with the Proposed Project

would be incrementally greater, but essentially unnoticeable. Therefore, impacts would not be appreciably different than for the No Action Alternative. No significant impacts would occur.

4.5.4 Alternative 3 – Additional Operations (Surge)

As discussed in Section 4.6.3, Noise, Alternative 3 would have long-term minor adverse impacts on the noise environment. Impacts would be due to small changes in the fleet mix, and a doubling of testing and training activities in Edwards Restricted Airspace. However, Alternative 3 would not increase noise levels by more than 3 dBA CNEL when compared to existing conditions from 54.8 to 57.8 dBA CNEL. This would be a barely perceptible change in the overall noise environment. As a result, the same types of natural resources impacts would occur as discussed for the Proposed Action Alternative and would not, therefore, result in significant impacts to wildlife, sensitive species, migratory birds, or sensitive habitats in the Edwards Restricted Airspace. No mitigation would be required.

4.6 NOISE

4.6.1 Methodology and Significance Criteria

This noise analysis uses the MR_NMAP (v3.0) as part of the Air Force's NoiseMAP computer suite to predict noise levels associated with aircraft operations beneath Edwards Restricted Airspace (U.S. Air Force 2016a). The parameters considered in the modeling included aircraft type, airspeed, power settings, aircraft operations, vertical training profiles, and the time spent within each airspace block. MR_NMAP was used to model the overall sound levels with CNEL based on annual air operations without rapid onset penalty. The number and type of airspace operations within Edwards Restricted Airspace, including its sub-areas and functions is not tracked, and is not available. Therefore, the annual usage report for Edwards Restricted Airspace, the 2016 AICUZ Plan for Edwards AFB, and the 2018 mobile air emissions inventory were used to estimate the number and types of operations in the airspace as a whole, and to develop a comparative baseline under NEPA.

The Air Force encourages the inclusion of supplemental noise metrics in the assessment of noise from airspace actions. It is understood that the sole use of CNEL and land-use compatibility cannot accurately describe the nature and effects from aircraft noise. This is particularly true for airspace actions which have effects of low- to medium- intensity over large geographical areas, as opposed to high-intensity effects over a smaller area (e.g., noise near an airport or air installation). MR_NMAP was also used to calculate L_{max} and SEL for individual overflights within Edwards Restricted Airspace. These metrics were used to assess the potential for disturbance to both speech and sleep, to determine if individual acoustic events would be loud enough to damage hearing or structures, and to provide the public with a better understanding of the specific effects.

The Proposed Action would have a significant adverse impact on noise if it would:

- Increase noise levels by more than 1.5 dBA CNEL in a noise sensitive area exposed to noise above 65 dBA CNEL; or
- Generate individual acoustic events loud enough to damage hearing or structures.

4.6.2 Alternative 1 – No Action Alternative

The No Action Alternative would result in no effect on the noise environment. There would be no long-term changes in aircraft mix or operations due to the Proposed Action. The noise environment would remain unchanged when compared to existing conditions. No mitigation would be required.

4.6.3 Alternative 2 – Proposed Action Alternative

Alternative 2 would have long-term negligible adverse impacts on the noise environment. Impacts would be due to incremental, yet unnoticeable, changes in the fleet mix of aircraft conducting testing and training activities in Edwards Restricted Airspace. Alternative 2 would not increase noise levels by more than 1.5 dBA CNEL in a noise sensitive area that is exposed to noise above 65 dBA CNEL, or generate individual acoustic events loud enough to damage hearing or structures. No significant impacts are anticipated, and no mitigation would be required.

Overall Aircraft Noise and Land Use Compatibility

CNEL is the average sound energy in a 24-hour period with a penalty added to the evening and nighttime levels. The estimated CNEL would remain 54.8 dBA, and would not change with the implementation of Alternative 2. The noise environment would be similar to existing conditions, with a slightly different aircraft mix. Beyond the noise from runway operations at Edwards AFB, noise from aircraft operations under Edwards Restricted Airspace would continue to not exceed 65 dBA CNEL, and would be compatible with all land uses (U.S. Air Force 2017). This includes being compatible with all residential areas, churches, schools, and recreational areas underneath Edwards Restricted Airspace.

Individual Overflight Noise

Noise levels for individual overflights would be comparable to existing conditions for areas beneath Edwards Restricted Airspace. L_{max} and SEL are completely different from CNEL. L_{max} is the maximum sound level of an acoustic event (e.g. when an aircraft is directly overhead). SEL is a measure of the total energy of an acoustic event. It represents the level of a one-second long constant sound that would generate the same energy as the actual time-varying noise event such as an aircraft overflight.

Speech and Sleep Interference. There would continue to be approximately 13,000 individual aircraft conducting testing and training activities throughout Edwards Restricted Airspace, with a small number operating between 10:00 p.m. and 7:00 a.m. As shown in Table 4-5, additional aircraft types would be similar in loudness to those currently operating throughout the airspace.

Areas beneath Edwards Restricted Airspace would continue to intermittently experience aircraft overflights that would range from loud to very loud, exceeding 75 dBA L_{max} and 90 dBA SEL at any given point on the ground. Individuals directly beneath, and adjacent to the flight paths of louder and lower-flying aircraft, would continue to need to pause there speech briefly, particularly when aircraft fly directly overhead. As with existing conditions, it is possible that on rare occasion, individuals directly under a flight path would be awakened by an aircraft

conducting testing or training activities in Edwards Restricted Airspace at night. Levels of sleep and speech interference from noise from testing and training activities in Edwards Restricted Airspace under Alternative 2 would be indistinguishable when compare to existing conditions. Although completely compatible with all land uses, the Air Force would continue to maintain no-fly-zones above many of the nearby communities, including Boron, Desert Lake, North Edwards, Kramer Junction, parts of California City, and the Edward AFB cantonment area.

Table 4-5 Estimated Sound Levels for Individual Overflights

Aircraft	F-35	T-38	F-16	KC-135	C-12	F-22	B-21	KC-46
Altitude	**L_{max} (dBA)**							
500	**120**	**89**	**103**	**92**	**79**	**106**	**110**	**95**
1,000	**115**	**81**	**96**	**85**	73	**99**	**102**	**87**
5,000	**87**	60	**76**	67	57	**79**	**82**	64
10,000	**90**	48	65	56	49	68	71	53
20,000	**78**	34	53	44	39	56	59	42
Altitude	**SEL (dBA)**							
500	**120**	**96**	**109**	**97**	83	**109**	**114**	**101**
1,000	**115**	90	**104**	**92**	78	**104**	**108**	**95**
5,000	**99**	72	88	77	66	88	**92**	76
10,000	90	62	80	69	60	79	83	67
20,000	78	50	70	58	52	68	73	57

Source: U.S. Air Force 2016a and DNWG 2009.
Notes: L_{max} of 75 dBA is the threshold for speech interference.
SEL of 90 dBA is the threshold for sleep interference.
Bold text indicates exceedance of 75 dBA

***Damage to Hearing or Structures*.** As with existing conditions, and for similar reasons, aircraft overflights would not generate individual acoustic events loud enough to damage hearing or structures. Although aircraft overflights would not be loud enough to damage hearing or structures, individual low-level overflights would be loud and abrupt enough to startle individuals and cause readily perceptible vibrations in homes and buildings directly under their flight paths. These impacts would be less than significant.

4.6.4 Alternative 3 – Additional Operations (Surge)

Alternative 3 would have long-term minor adverse impacts on the noise environment. Impacts would be due to small changes in the fleet mix, and a doubling of testing and training activities in Edwards Restricted Airspace. Alternative 3 would not increase noise levels by more than 1.5 dBA CNEL in a noise sensitive area that is exposed to noise above 65 dBA CNEL, or generate individual acoustic events loud enough to damage hearing or structures. No significant impacts are anticipated, and no mitigation would be required.

Overall Aircraft Noise and Land Use Compatibility

With the implementation of Alternative 3, the estimated CNEL would increase 3 dBA CNEL when compared to existing conditions from 54.8 to 57.8 dBA CNEL. This would be a barely perceptible change in the overall noise environment. As with Alternative 2, beyond the noise from runway operations at Edwards AFB, noise from aircraft operations under Edwards Restricted Airspace would continue to not exceed 65 dBA CNEL, and would be compatible with all land uses (U.S. Air Force 2017).

Individual Overflight Noise

Noise levels from individual overflights would be comparable to existing aircraft for areas beneath Edwards Restricted Airspace; however, the number of overflights would double during the surge.

Speech and Sleep Interference. There would be approximately 26,000 individual aircraft sorties per year conducting testing and training activities throughout Edwards Restricted Airspace, with a small number operating between 10:00 p.m. and 7:00 a.m. As shown in Table 4-5, additional aircraft types would be similar in loudness to those currently operating throughout the airspace. Areas beneath Edwards Restricted Airspace would continue to intermittently experience aircraft overflights that would range from loud to very loud, exceeding 75 dBA L_{max} and 90 dBA SEL at any given point on the ground. Individuals directly beneath, and adjacent to the flight paths of louder and lower-flying aircraft, would continue to need to pause there speech briefly, particularly when aircraft fly directly overhead. As with existing conditions, it is possible that on rare occasion, individuals directly under a flight path would be awakened by an aircraft conducting testing or training activities in Edwards Restricted Airspace at night.

Although the number of individual overflights that would be loud enough to interfere with speech or sleep would double, they would be neither loud enough, nor frequent enough, to create areas of incompatible land use under Edwards Restricted Airspace. Operations in Edwards Restricted Airspace during a surge would continue to be compatible with all land uses (U.S. Air Force 2017). Although completely compatible with all land uses, the Air Force would continue to maintain no-fly-zones above many of the nearby communities, including Boron, Desert Lake, North Edwards, Kramer Junction, parts of California City, and the Edward AFB cantonment area. These effects would be less than significant.

Damage to Hearing or Structures. As with existing conditions, and for similar reasons, aircraft overflights would not generate individual acoustic events loud enough to damage hearing or structures. Although aircraft overflights would not be loud enough to damage hearing or structures, individual low-level overflights, and sonic booms, would be loud and abrupt enough to startle individuals and cause readily perceptible vibrations in homes and buildings directly under their flight paths. These impacts would be less than significant.

4.7 SAFETY

4.7.1 Methodology and Significance Criteria

Potential safety impacts from a particular alternative are determined by looking at established procedures for ensuring safety within the airspace, and how a change in the operations within that airspace may affect overall safety and if new safety procedures would need to be implemented.

4.7.2 Alternative 1 – No Action Alternative

Under the No Action Alternative, there would be no change in public health and safety risks from current conditions within the Edwards Restricted Airspace. No new impacts would occur, and no mitigation would be required.

4.7.3 Alternative 2 – Proposed Action Alternative

Under the Proposed Action Alternative, additional flight operations would occur as a result of the B-21 and KC-46A program. However, the addition of these programs would not change safety procedures within the Edwards Restricted Airspace with respect to areas of concentrated air traffic, BASH hazards, or other potential safety concerns. Therefore, implementation of the Proposed Action Alternative would have a less than significant public health and safety impact. No mitigation would be required.

4.7.4 Alternative 3 – Additional Operations (Surge)

Under this alternative, there would be a doubling of airspace activity within the Edwards Restricted Airspace. This could result in an increased potential for public health and safety impacts. However, over the last 70 years of flight operations at Edwards AFB, the types and numbers of aircraft have increased and evolved, and procedures have been established to refine use of the airspace to accomplish the missions and keep operations safe. Since the airspace is restricted, few aircraft may operate there without permission of the controlling entities or the users, as described in Sections 3.1 and 4.1 (Airspace Use and Management). This allows the Airspace Manager, in coordination with other relevant organizations, to evaluate the safety and potential mission impact of the requested activity, as well as dictate procedures that pilots must follow. Overall, as described in the following paragraphs, no significant impacts are anticipated, and no mitigation would be required.

Areas of Concentrated Air Traffic

Under this alternative, areas of concentrated air traffic would continue to occur along the highways, with civilian and law enforcement aircraft using those corridors. Continued adherence to established operating procedures should continue to promote safe flying, and impacts to public health and safety from these areas of concentrated air traffic would be less than significant.

Bird Airstrike Hazard

Under this alternative, bird strike avoidance procedures would remain in effect and, therefore, impacts to public health and safety from bird strike hazards would be less than significant.

Other Potential Safety Concerns

Edwards AFB has in place extensive procedures to eliminate other potential safety concerns, including adhering to minimum altitudes to avoid impacts to sensitive land uses, adhering to procedures for windy or dusty flying conditions, and avoiding obstructions within the Edwards Restricted Airspace. These procedures would remain in effect and, therefore, impacts to public health and safety from other potential safety concerns would be less than significant.

4.8 CUMULATIVE IMPACTS

This EA also considers the effects of cumulative impacts as required in 40 CFR 1508.7 and concurrent actions as required in 40 CFR 1508.25[1]. A cumulative impact, as defined by the CEQ (40 CFR 1508.7) is the "…impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

4.8.1 Methodology

As discussed in Section 3.4, Land Use, the 1,812-square mile Edwards Restricted Airspace is generally sparsely populated, with California City in the west being the most developed area, and other small unincorporated communities such as Boron, North Edwards, Kramer Junction, and Hinkley scattered throughout. In general, land use in this area can be broken into the following categories: military installation, BLM lands, City/County lands, and private lands. Population growth in the area has been slow and, outside Edwards AFB, over half of the lands under the Edwards Restricted Airspace are managed by BLM. The BLM lands are used for recreation, rangeland (grazing), mining, and resource conservation/ preservation, all of which are compatible with military overflights as discussed in Sections 4.4 (Land Use) and 4.5 (Natural Resources).

In addition, in 2002, California amended city and county general plan requirements to include a requirement that the land use element consider the impact of new growth on military readiness activities carried out on military bases, installations, and operating and training areas, when proposing zoning ordinances or designating land uses covered by the general plan for land or other territory adjacent to those military facilities, or underlying designated military aviation routes and airspace (California Government Code, Section 65302). Both San Bernardino County and Los Angeles County have included such provisions in their latest General Plan Land Use Elements (San Bernardino County 2020; Los Angeles County 2015). Kern County has not yet updated its Land Use Element to reflect this consideration.

California also requires that a local agency that receives an application for a small wind energy system on a site within a specified restricted military airspace to forward a copy of the

application to the governing authority of that airspace and to consider any written comments received from the governing authority (California Government Code, Section 65892.13).

Slow growth and compatible land uses limit the potential for large projects and growth in the Edwards Restricted Airspace, as well as provisions in the San Bernardino County and Los Angeles County General Plans to coordinate with military stakeholders to ensure compatible land uses in areas with military operations, thereby limiting conflicts between users of the airspace and land uses in the area. In addition, most activities occurring in the ROI are associated with ongoing operations at Edwards AFB and the Edwards Restricted Airspace. As such, no specific projects have been identified to be included in the cumulative analysis.

4.8.2 Alternative 1 – No Action Alternative

Under the No Action Alternative, there would be no long-term changes in aircraft mix or operations due to the Proposed Action. The environment in the Edwards Restricted Area would remain unchanged when compared to existing conditions. No cumulative impacts are anticipated, and no mitigation would be required.

4.8.3 Alternative 2 – Proposed Action Alternative

Airspace Use and Management

The Edwards Restricted Airspace is used primarily by the 412 TW at Edwards AFB, with continual use by other entities based at Edwards AFB, and consistent use by other entities located off-base. If cumulative actions were to overload the capacity of the airspace or the controller's ability to manage flight activity, then cumulative impacts would be considered significant. However, because Alternative 2 adds only a nominal amount of testing operations, and because the airspace is managed and controlled by Edwards AFB, cumulative impacts to airspace use and management would be negligible. No mitigation would be required.

Air Quality

Alternative 2 would have long-term negligible adverse cumulative impacts. Cumulative impacts would be from the change in aircraft mix, and subsequent increase in air operations within Edwards Restricted Airspace. California takes into account the impacts of all past and present emissions in the state. This structure of rules and regulations are contained in the state implementation plan (SIP). SIPs are the regulations and other materials for meeting clean air standards and associated Clean Air Act (CAA) requirements. SIPs include the following:

- State and local air regulations that USEPA has approved;
- State- and locally-issued, USEPA-approved orders requiring pollution control at individual facilities and installations; and
- Planning documents such as area-specific compilations of emissions estimates and computer simulations (modeling analyses) demonstrating that regulatory limits ensure that the air will meet air quality standards.

The SIP process applies either specifically or indirectly to all activities in the region. No projects or proposals have been identified that, when combined with the proposed action, would threaten the state's timely attainment of the NAAQS, or would lead to a violation of any federal, state, or local air regulation. Therefore, cumulative impacts would be negligible, and no mitigation would be required.

Cultural Resources

Alternative 2 would add a nominal amount of testing operations, thereby incrementally increasing noise in the Edwards Restricted Airspace and affecting sensitive cultural resources. However, the increase would be trivial relative to the total amount of current air operations in the area and would have a less than significant impact on cultural resources. No other increases in air operations are expected in the area and, therefore, there would be no cumulative cultural resources impacts, and no mitigation would be required.

Land Use

Implementation of Alternative 2 would not result in conflicts with existing land use, policies, or controls in the Edwards Restricted Airspace, primarily because much of the area is public land that will be preserved and population growth in the area is slow. In addition, local cities and counties are required to address military operations, including airspace use, in updates to their General Plan Land Use Elements. There would be no cumulative land use impacts, and no mitigation would be required.

Natural Resources

As discussed for cultural resources, Alternative 2 would add a nominal amount of testing operations, thereby incrementally increasing noise in the Edwards Restricted Airspace and potentially affecting sensitive natural resources. However, the increase would be trivial relative to the total amount of current air operations in the area and would have a less than significant impact on natural resources. No other increases in air operations are expected in the area and, therefore, there would be no cumulative natural resources impacts, and no mitigation would be required.

Noise

The Proposed Action would have the potential for long-term minor adverse impacts on the noise environment. Impacts would be due to small changes in the fleet mix of aircraft conducting, and a small increase in testing and training activities in Edwards Restricted Airspace. The Proposed Action would not increase noise levels by more than 1.5 dBA CNEL in a noise sensitive area that is exposed to noise above 65 dBA CNEL, or generate individual acoustic events loud enough to damage hearing or structures. No projects or proposals have been identified that, when combined with the Proposed Action, would have greater than significant effects on the noise environment. Therefore, cumulative noise impacts would be minor, and no mitigation would be required.

Safety

The Proposed Action would not change the existing airspace structure or the parameters that control the safe use of the airspace. Ongoing actions on the lands underlying the airspace are not expected to change significantly. There would be no cumulative safety impacts, and no mitigation would be required.

4.8.4 Alternative 3 – Additional Operations (Surge)

Airspace Use and Management

As discussed for Alternative 2, the Edwards Restricted Airspace is managed and controlled by Edwards AFB. As discussed in Section 3.1, there are systems in place for managing the different types of activities that take place in the airspace and these systems are set up to accommodate fluctuating workloads, including a surge in operations. Even though Alternative 3 doubles the amount of testing operations in the Edwards Restricted Airspace, the airspace would still be managed and controlled by Edwards AFB and, therefore, cumulative impacts to airspace use and management would be less than significant. No mitigation would be required.

Air Quality

Alternative 3 would have long-term minor adverse cumulative impacts. Cumulative impacts would be from the change in aircraft mix, and subsequent surge increase in air operations within the Edwards Restricted Airspace. As discussed for Alternative 2, California takes into account the impacts of all past and present emissions in the state, which is summarized in the SIP.

No projects or proposals have been identified that, when combined with the proposed action, would threaten the state's timely attainment of the NAAQS, or would lead to a violation of any federal, state, or local air regulation. Therefore, cumulative impacts would be minor, and no mitigation would be required.

Cultural Resources

Alternative 3 would add a surge of testing operations, thereby potentially increasing noise in the Edwards Restricted Airspace and affecting sensitive cultural resources. However, the increased operations would still be managed by Edwards AFB to be safe and to avoid sensitive resources. This would be a less than significant impact on cultural resources. No other increases in air operations are expected in the area and, therefore, there would be no cumulative cultural resources impacts, and no mitigation would be required.

Land Use

Implementation of Alternative 3 would not result in conflicts with existing land use, policies, or controls in the Edwards Restricted Airspace, primarily because much of the area is public land that will be preserved and population growth in the area is slow. In addition, local cities and counties are required to address military operations, including airspace use, in updates to their General Plan Land Use Elements. There would be no cumulative land use impacts, and no mitigation would be required.

Natural Resources

As discussed for cultural resources, Alternative 3 would add a surge of testing operations, thereby potentially increasing noise in the Edwards Restricted Airspace and affecting sensitive natural resources. However, the increased operations would still be managed by Edwards AFB to be safe and to avoid sensitive resources. This would be a less than significant impact on natural resources. No other increases in air operations are expected in the area and, therefore, there would be no cumulative natural resources impacts, and no mitigation would be required.

Noise

Alternative 3 would have the potential for long-term minor adverse impacts on the noise environment. Impacts would be due to small changes in the fleet mix of aircraft conducting, and a potential doubling of testing and training activities in Edwards Restricted Airspace. The Proposed Action would not increase noise levels by more than 3 dBA CNEL in a noise sensitive area that is exposed to noise above 65 dBA CNEL, or generate individual acoustic events loud enough to damage hearing or structures. No projects or proposals have been identified that, when combined with the Proposed Action, would have greater than significant effects on the noise environment. Therefore, cumulative noise impacts would be minor, and no mitigation would be required.

Safety

Alternative 3 would not change the existing airspace structure or the parameters that control the safe use of the airspace. Ongoing actions on the lands underlying the airspace are not expected to change significantly. There would be no cumulative safety impacts, and no mitigation would be required.

4.9 OTHER NEPA CONSIDERATIONS

4.9.1 Unavoidable Adverse Effects

This EA establishes that there would be no impacts associated with Alternative 1 (No Action Alternative), and that there would be less than significant impacts for all resource areas discussed in Sections 4.1 through 4.7 for Alternative 2 (Proposed Action) and Alternative 3 (Additional Operations Surge). No significant unavoidable adverse effects (impacts) would occur with any of the alternatives.

4.9.2 Relationship of Short-Term Uses and Long-Term Productivity

The relationship between short-term uses and enhancement of long-term productivity from implementation of the Proposed Action and Alternatives is evaluated from the standpoint of short-term effects and long-term effects. Examples of short-term uses of the environment include direct, construction-related disturbances and direct impacts associated with the indirect increase in population and activity that occurs over a period of typically less than 5 years, including permanent resource loss. Long-term uses of the environment include impacts occurring over a period of more than 5 years, including permanent loss.

There would be no construction or short-term only activities associated with any of the alternatives and, therefore, no short-term commitments or uses of the environment. Over the long-term, Alternatives 2 and 3 would involve increased use of jet fuel for additional operations, although environmental resources on the ground would not be significantly affected by changes in airspace operations in the Edwards Restricted Airspace.

4.9.3 Irreversible and Irretrievable Commitments of Resources

This EA identifies any irreversible and irretrievable commitments of resources that would be involved in the Proposed Action if implemented. An irreversible effect results from the use or destruction of resources (e.g., energy) that cannot be replaced within a reasonable time. An irretrievable effect results from loss of resources (e.g., endangered species) that cannot be restored as a result of the Proposed Action. Alternatives 2 and 3 would involve increased use of jet fuel for additional operations, which would be an irreversible commitment of resources. However, environmental resources on the ground would not be significantly affected by changes in airspace operations in the Edwards Restricted Airspace, and no irretrievable commitment of resources would occur.

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7.0 PERSONS AND AGENCIES CONSULTED/COORDINATED

The following Persons were contacted and interviewed in the preparation of this EA:

- Mr. Jeremy Beecher-FAA-JCF
- Mr. Nicholas Booker-412 OSS/OSAT
- Mr. Johnnie Davis-412 OSS/OSAT
- CPT Adam Devalon 412 OG/OGV
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- Mr. Matt Fisher-Airspace Manager
- Ms. Christy Haggerty-412 CEGA/CEVA
- Mr. Ken Hansing-412 ROC
- Mr. John Himes-MHV Airspace Manager
- Ms. Angelica Jackson-NASA AFRC/CEVA
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- Ms. Alison Sims-412 OG/OGV
- Mr. Chesley Vansickle-412 OSS/OSOM-SPORT
- Mr. John Vidic-412 CEV

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APPENDIX A

Sidewinder and JEDI Transition Corridor Technical Memorandum

TECHNICAL MEMORANDUM

SUBJECT: SIDEWINDER LOW-LEVEL ROUTE WITH JEDI TRANSITION

DATE: MARCH 2021

OVERVIEW

This Technical Memorandum is regarding the continued use of the Sidewinder Low-Level Route and JEDI Transition Corridor, which are not in Edwards Restricted Airspace (R-2515) but are used by the U.S. Air Force and other Edwards Restricted Airspace users. This Route and Corridor had not been established at the time previous environmental documents were prepared for this airspace, including the *Environmental Assessment for Low-Level Flight Testing, Evaluation, and Training,* (U.S. Air Force 2005). The analysis of potential environmental impacts of using low-level routes provided in the *Low-Level Flight Testing* EA was used to summarize potential impacts from use of the Sidewinder Low-Level Route and JEDI Transition Corridor. Impacts associated with other low-level routes were analyzed in this EA as well, and include Terrain-Following Routes (TFRs) and Military Training Routes (MTRs). The TFRs are within R-2515 and are analyzed most recently in the *Environmental Assessment for Continued Use of Edwards Restricted Airspace in Southeastern California* (U.S. Air Force 2021; November). MTRs lie within or originate in the larger R-2508 Complex, with a couple of them outside the R-2508 Complex. The Sidewinder Route is in another category of low-level routes that were formerly known as Colored Routes.

BACKGROUND ON LOW-LEVEL ROUTES IN THE R-2508 COMPLEX

There were 11 unpublished low-level routes (formerly known as Colored Routes) in the R-2508 Complex used by 412 TW for test missions, test mission preparation, and proficiency training. The Sidewinder Route replaces those routes and is located entirely within Restricted Airspace or Military Operating Areas (MOAs) within the R-2508 Complex. These routes were not published on standard aeronautical charts because they were within Restricted Airspace or MOAs.

The R-2508 Complex has unique characteristics that allow the U.S. Air Force, U.S. Navy, U.S. Marine Corps, U.S. Army, National Aeronautics and Space Administration (NASA), and other federal and commercial testing entities to conduct safe, large-scale testing and training activities for aircraft, spacecraft, and advanced weapons systems. Restricted Airspace is established by

the Federal Aviation Administration (FAA) to contain and segregate activities, such as ordnance delivery or air-to-air gunnery that would be hazardous to non-participating aircraft.

Low-level military routes generally avoid:

- Following highways or valleys;
- Uncontrolled airports by keeping route centerlines at least 3 nautical miles (NM) away or 1,500 feet above ground level (AGL) vertically;
- Controlled airports by keeping route centerlines at least 5 NM away or 2,500 feet above ground level (AGL) vertically;
- Overflight of National Parks, National Monuments, and some wilderness areas;
- Known major bird flyways and habitats; and
- Heavily populated areas.

ROUTE DESCRIPTION

The Sidewinder Low-Level Route is a route through the R-2508 Complex with alternate entry and exit points. The route width is 4 NM (2 NM on either side of centerline) and must be -flown in a clockwise direction, sequentially from Point A to Point M. Figure A-1 provides a regional overview of the Sidewinder Route and JEDI Transition, and Figure A-2 shows them on an aeronautical chart. Opposite direction flight is prohibited. Preferred alternate entry can be accessed via Points C or E. The JEDI transition provides for a shorter route that may satisfy certain mission requirements and runs from Point C to Point J (west to east) (U.S. Department of Defense 2020 [R-2508 Handbook]).

The permitted altitudes for flight are as follows:

- No lower than (NLT) 200 feet AGL to 3,000 feet AGL from Points A to B;
- NLT 200 feet AGL from Points B to K;
- NLT 500 feet AGL from Points K to M; and
- Climb as required to avoid noise sensitive areas and airports.

Most of the operations flown on this route usually come and go from the airfield at Edwards AFB and, therefore, were accounted for in the *Continued Use of Restricted Airspace R-2515 EA* as operations within Restricted Area R-2515.

SUMMARY OF ENVIRONMENTAL IMPACTS FOR USE OF SIDEWINDER LOW-LEVEL ROUTE AND JEDI TRANSITION

The analysis in the Environmental Assessment for Low-Level Flight Testing, Evaluation, and Training, (U.S. Air Force 2005) and the more recent analysis in the *Environmental Assessment for Continued Use of Edwards Restricted Airspace in Southeastern California* (U.S. Air Force 2021; November), were used as the basis for the analysis of impacts resulting from use of the Sidewinder Low-Level Route and JEDI Transition. The following is a summary of expected issues and impacts for the Route and Transition:

Airspace Use and Management. The Sidewinder Low-level Route and JEDI Transition are located entirely within Restricted Airspace or MOAs within the R-2508 Complex, thereby allowing the use to be safely managed and segregated from other activities. In addition, use of the Route and Transition would not change the overall airspace structural or procedural components of low-level routes in the R-2508 Complex, although specific instructions and restrictions associated with the Sidewinder Route are provided in the *R-2508 Complex Users Guide* (Department of Defense 2020) and shown in Figure A-3. In particular, there are altitude requirements along certain segments of the Route and altitude restrictions over airports, local communities, and noise-sensitive land uses. No significant impacts would occur, and no mitigation would be required.

Air Quality. Depending on the intensity of use of the Sidewinder Route, long-term minor adverse impacts on air quality may occur from incremental increases in emissions from changes in aircraft mix or increases in use of the Router when compared to existing training and testing activities. However, given that the alternatives analyzed in both EAs referenced here included more flight activity and higher levels emissions, and in those cases, emissions were estimated to be below the *de minimis* thresholds and would not contribute to a violation of any federal, state, or local air regulations. Therefore, there would be no significant air quality impacts and no mitigation would be required.

Cultural Resources. While there is some risk of visual intrusion or subsonic noise, sonic boom noise and vibration, there has been no specific damage to cultural resources documented by 412 TW from low-level flights, although damage from repeat vibrations and noise is capable of damaging resources. In addition, the flight restrictions and provisions described in the *R-2508 Complex Users Guide* (Department of Defense 2020) and shown in Figure A-3 would minimize

impacts to sensitive cultural resources. No significant cultural resources impacts would occur, and no mitigation would be required.

Land Use. Activities are similar to other testing activities that have occurred for decades within the R-2508 Complex and would not result in new or appreciably greater impacts to the land uses in the area. Following current procedures and restrictions, as previously described, should be adequate for the continued avoidance of sensitive land uses. No significant land use impacts are anticipated, and no mitigation would be required.

Natural Resources. Potential impacts to wildlife, sensitive species, migratory birds, or sensitive habitats would be similar to current conditions in the R-2508 Complex, with some possibility of startle effects or other short-term behavioral modifications such as temporary interruptions for foraging. However, noise from aircraft is temporary and of short duration. No significant natural resources impacts would occur, and no mitigation would be required.

Noise. Long-term negligible adverse impacts on the noise environment would occur due to incremental changes in the low-level flights associated with the Sidewinder Route and JEDI Transition. However, overall noise levels would not be increased significantly. No significant noise impacts are anticipated, and no mitigation would be required.

Safety. Safety procedures within the R-2508 Complex with respect to areas of concentrated air traffic, BASH hazards, or other potential safety concerns would continue to be in place. No significant safety impacts are anticipated, and no mitigation would be required.

Figure A-1 Sidewinder Low-Level Route with JEDI Transition

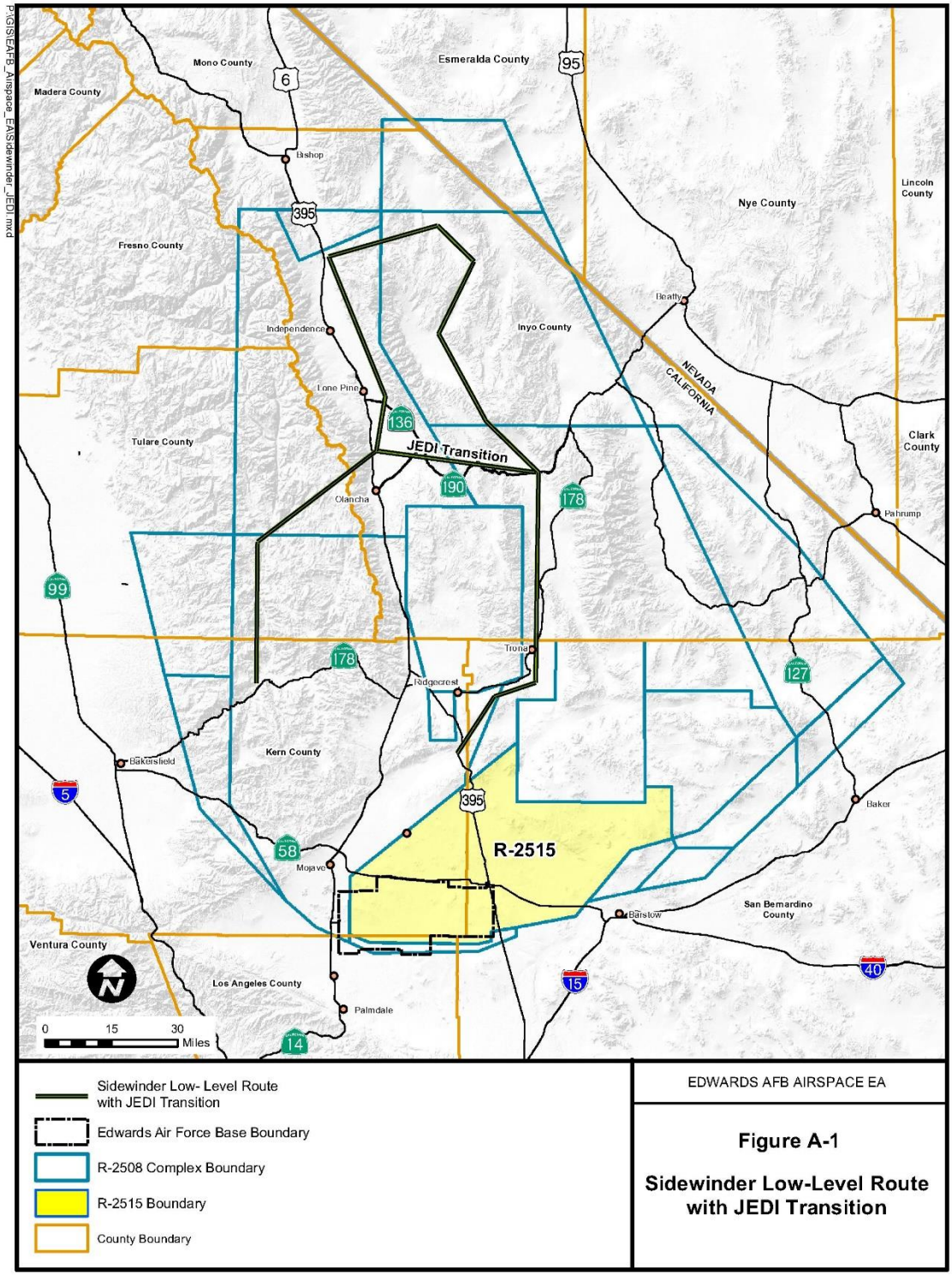

Figure A-2 Sidewinder Low-Level Route with JEDI Transition on Aeronautical Chart

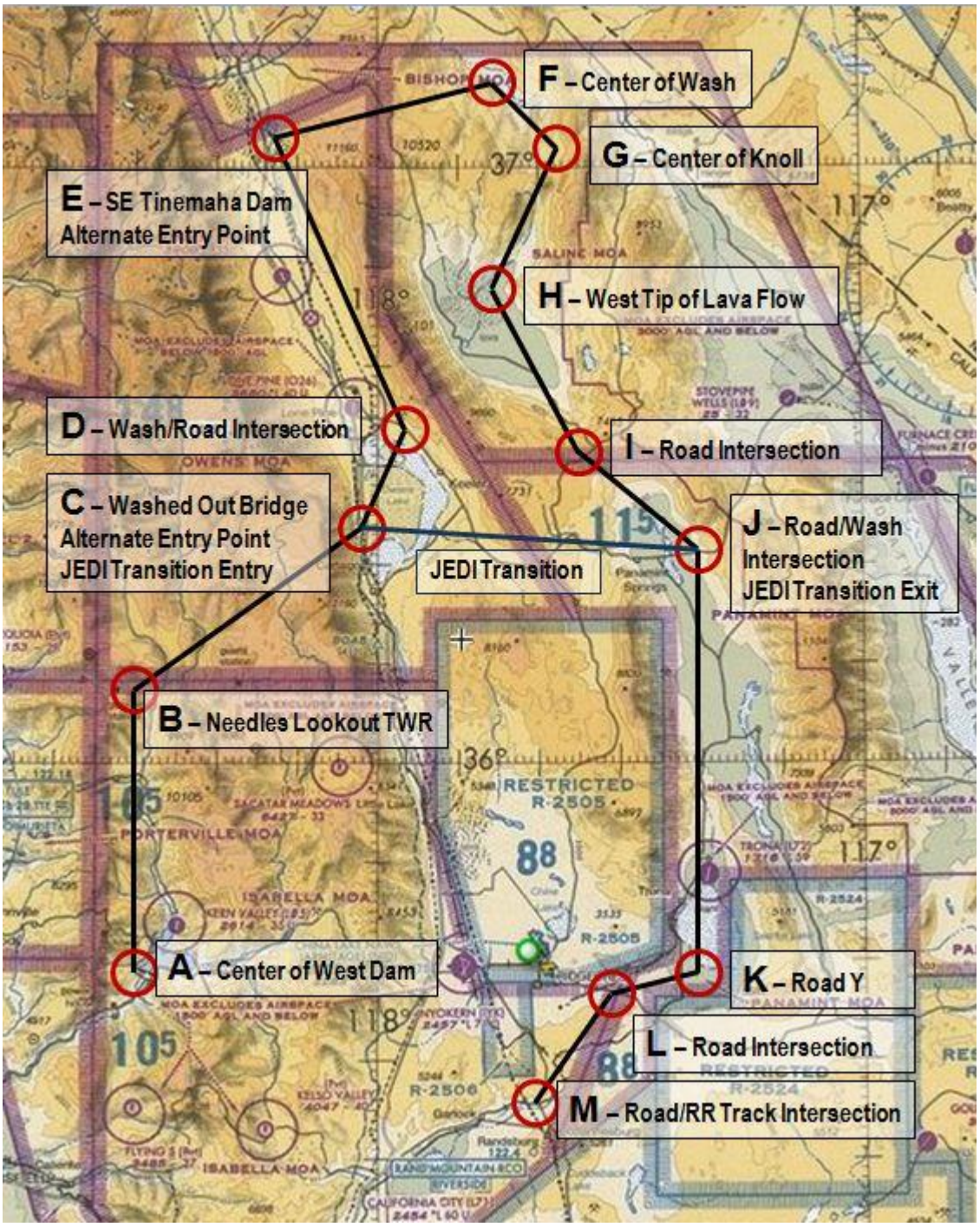

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Figure A- Sidewinder Low-Level Route R-2508 Procedural Controls

SIDEWINDER LOW LEVEL (Rev 2)
11 Feb 2015

CAUTION: These are R-2508 procedural controls for local use only. Points will be flown sequentially (i.e. A, B, C…M or C, J, K…M, etc). OPPOSITE DIRECTION IS PROHIBITED.

The SIDEWINDER and JEDI Transition are not published MTRs.

ROUTE DESCRIPTION:

PT	Lat/Long	Pt Description/Elevation
A	N 35 38.75 W118 28.94	Ctr of West Dam/2575
B	N 36 06.60 W118 29.12	Needles Lookout Twr/8107
C	N 36 24.74 W118 00.57	Washed Out Bridge/3615
D	N 36 35.61 W117 58.53	Wash/Road Int/3635
E	N 37 02.88 W118 12.79	SE Tinemaha Dam/3894
F	N 37 09.18 W117 46.19	Center of Wash/2956
G	N 37 02.17 W117 37.09	Center of Knoll/4738
H	N 36 47.95 W117 45.69	West Tip Lava Flow/1352
I	N 36 30.84 W117 34.05	Road Int/6109
J	N 36 20.69 W117 21.08	Road/Wash Int/2093
K	N 35 39.34 W117 21.62	Road Y/1624
L	N 35 36.61 W117 31.56	Road Int/2480
M	N 35 25.40 W117 40.32	Road/RR Int/2785

ALTITUDE: ALTITUDE: NLT 200' AGL to 3000' AGL (points A to B); NLT 200' AGL (points B to K); NLT 500' AGL (points K to M). Climb as required to avoid noise sensitive areas and airports (note 8).

ROUTE WIDTH – 2 NM either side of centerline.

Special Operating Procedures:

(1) Entry Procedure: Prior to entry notify Joshua of intentions and planned Entry/Exit point. Above 3000 AGL and prior to route entry make intentions call on Low Level Common (315.9). Give way to any traffic already established on the route prior to entry.

(2) A to B remain above 3000 AGL until 3 NM North of Kern Valley Airport to avoid Lake Isabella and surrounding communities.

(3) Alternate Entry: This is a procedural control and traffic may enter at any point. Preferred alternate entry points are C and E.

(4) Alternate Exit: This is a procedural control and traffic may exit at any point. Preferred alternate exit points are H and K.

(5) All aircraft operating on the Sidewinder/Jedi Transition will utilize the R-2508 low altitude common frequency 315.9. When entering low level environment transmit in the blind call sign, number and type of aircraft, and intentions. Monitor 315.9 until exiting low altitude regime. Repeat calls entering new areas, or crossing ridge lines.

(6) Slower aircraft (i.e. C-12, T-34) may be on the route at the same time. Use caution for airspeed variations that may exist between aircraft. Aircraft being overtaken has the right of way.

(7) To mitigate the risk of opposite direction traffic, offset right of centerline when transiting saddles between valleys. Rising terrain may mask advisory calls.

(8) Avoid all noise sensitive areas by 3000'AGL or 3000' laterally. Avoid all airports along route by 1500' AGL or 3 NM.

(9) Point B to C, avoid the extremely noise sensitive areas of Olancha and Cartago.

(10) Point C to D, avoid the extremely noise sensitive areas of Keeler and Lone Pine. Caution: intensive hang glider activity in the vicinity of Dolomite and northeast shore of Owens lake.

(11) Caution: high migratory bird activity between F and H during daylight hours.

(12) **CAUTION**: Possible merging traffic from aircraft on Jedi Transition (approaching from west via Point C). Sidewinder users offset east of Point J for deconfliction. Sidewinder users make mandatory radio call approaching Point J "Call sign, Sidewinder, approaching Point Juliet". Make calls on 315.9

(13) Point J to K. 198' multi unlit towers N35°53.797 W117°17.558. Avoid Trona Airport by 1500' AGL or 3 NM.

(14) Point K to M. Watch for traffic northbound to China Lake initial at 4000' MSL.

(15) Point L to M, route transits underneath instrument procedure at NID (arc and final approach). Use caution if exiting route prior to point M.

(16) Conflicts: A to L: IR-236; B to D: VR-1255; E to I: VR-1205-1255-1262; I to L: VR-1262, IR-200; K to M: IR-200-211.

JEDI TRANSITION: At Point C proceed east to Point J. **CAUTION**: Possible merging Sidewinder traffic from the north via Point I. Jedi users offset west of Point J for deconfliction. Jedi users make mandatory radio call approaching Point J "Call sign, Jedi Transition, approaching Point Juliet". Make calls on 315.9.

2

APPENDIX B

Airspace Supporting Information

The information provided here supplements the Airspace Use and Management discussion in Section 3.1 of the EA.

Controlled airspace is defined as a limited section of airspace of established dimensions within which, ATC is provided to instrument flight rules (IFR) and to visual flight rules (VFR) traffic. IFR and VFR are the two basic modes of flying and are described as follows:

- IFR is a method of air travel that relies on instrumentation rather than visual reference, and which is always under the direction of ATC to provide proper separation of aircraft. As aircraft launch at one airport, traverse the sky, and then land at a different airport, every movement is directed by the ATC of authority for each given area. Control is transferred from one ATC to another as aircraft cross jurisdictional lines defined on maps prepared by the FAA.

- VFR is a method of air travel that relies primarily on visual reference (dead reckoning) for location and see-and-avoid techniques for safe separation of aircraft while in Class-G or Class-E Airspace or as granted by ATC within their defined areas of control. VFR flying is inherently subject to weather conditions.

Controlled airspace has a set of classifications indicated on Sectional Maps to include Classes A through E, and Class G (there is no Class-F). The following text further describes these airspace classifications and Figure B-1 provides a vertical depiction:

- Class-A airspace refers to the region between above 17,999 ft above MSL and FL600 over the contiguous U.S. All traffic in this airspace follows IFR. The airspace is dominated by commercial traffic using high-altitude jet routes between 18,000 ft above MSL and FL450.

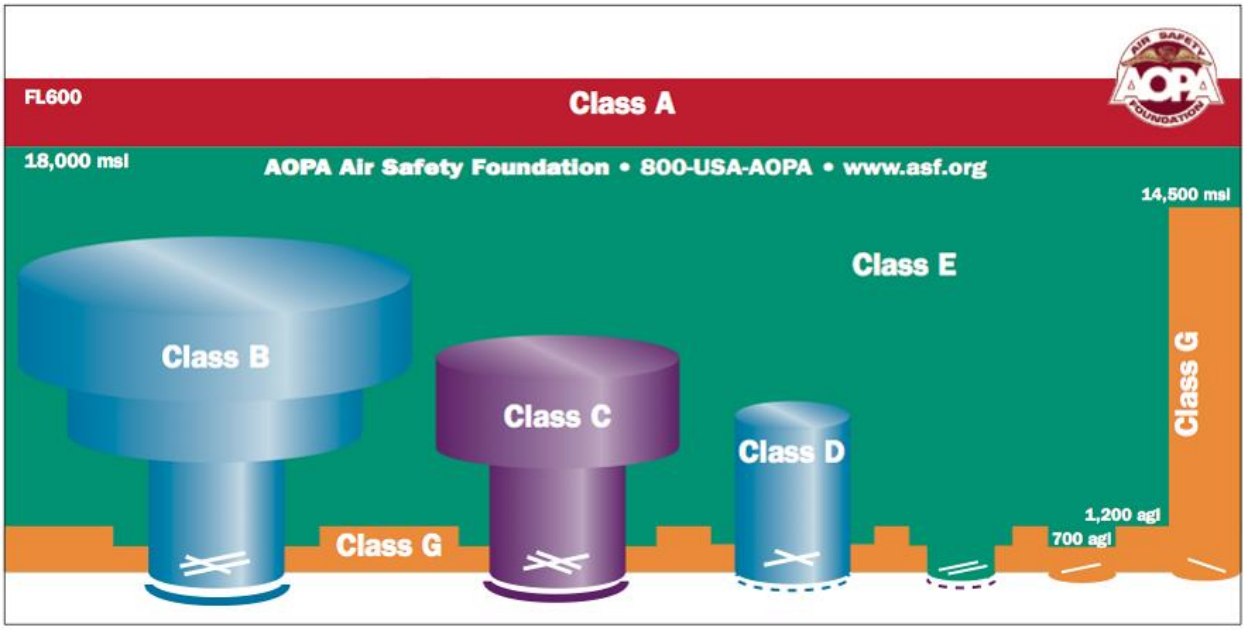
- Class-B airspace is typically associated with larger airports as a control mechanism for the large number of sorties and types of aircraft. It is typically configured in multiple layers resembling an upside-down layer cake. The first layer (inner circle) is typically from surface to 10,000 ft above MSL. This circle could be in the range of 10 nautical miles (NM) to 20 NM in diameter. The next circle typically extends from 1,200 ft AGL to 10,000 ft above MSL and might be 30 NM in diameter. The outer circle lies outside of the second and may extend from 2,500 ft AGL to 10,000 ft above MSL. This largest circle could be as large as 40 NM. Each airport is potentially different in terms of area coverage and elevations defined on sectional maps. Aircraft must be equipped with specialized electronics that allow ATC to track their altitude, heading and speed. They are also required to maintain radio communication while in the airspace and are given direction as to altitude, heading, and airspeed at all times.

- Class-C airspace is associated with medium-sized airports and is the most common class for airports with control towers, radar approach control, and a certain number of IFR operations. While each is specifically tailored to the needs of the airport, a typical Class-C configuration consists of an inner circle of 5 NM extending from surface to 4,000 ft above MSL and an outer circle of ten NM extending from 1,200 ft AGL to 4,000 ft above MSL. Again, each airport is potentially different in terms of area coverage and elevations defined on sectional maps. Aircraft must have an operable radar beacon

transponder with automatic altitude reporting equipment and are required to maintain radio communication while in the airspace. Pilots are given direction as to altitude, heading, and airspeed at all times.

- Class-D airspace extends upward from the surface to 2,500 ft above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designated to contain those procedures.
- Class-E airspace is any controlled airspace that is not Class A, B, C, or D. It extends upward from either the surface (around airports) or a designated altitude to the overlying or adjacent controlled airspace. Class-E transitional airspace is also used by transiting aircraft to and from the terminal or an enroute environment normally beginning at 700 ft AGL up to 17,999 ft above MSL. Class-E airspace ensures that IFR traffic remains in controlled airspace when approaching aircraft within otherwise classified airspace. Notably, Federal airways are Class E airspace, as well as offshore airspace areas below 18,000 ft above MSL.
- Class-G airspace is otherwise uncontrolled airspace that has not been designated as Class A, B, C, D, or E. IFR traffic does not operate in Class-G airspace with the possible exception of aligning an approach or departure on an IFR flight plan. This is done at their own risk, as ATC does not track VFR activity in these areas.

Figure B-1 Airspace Classification Diagram



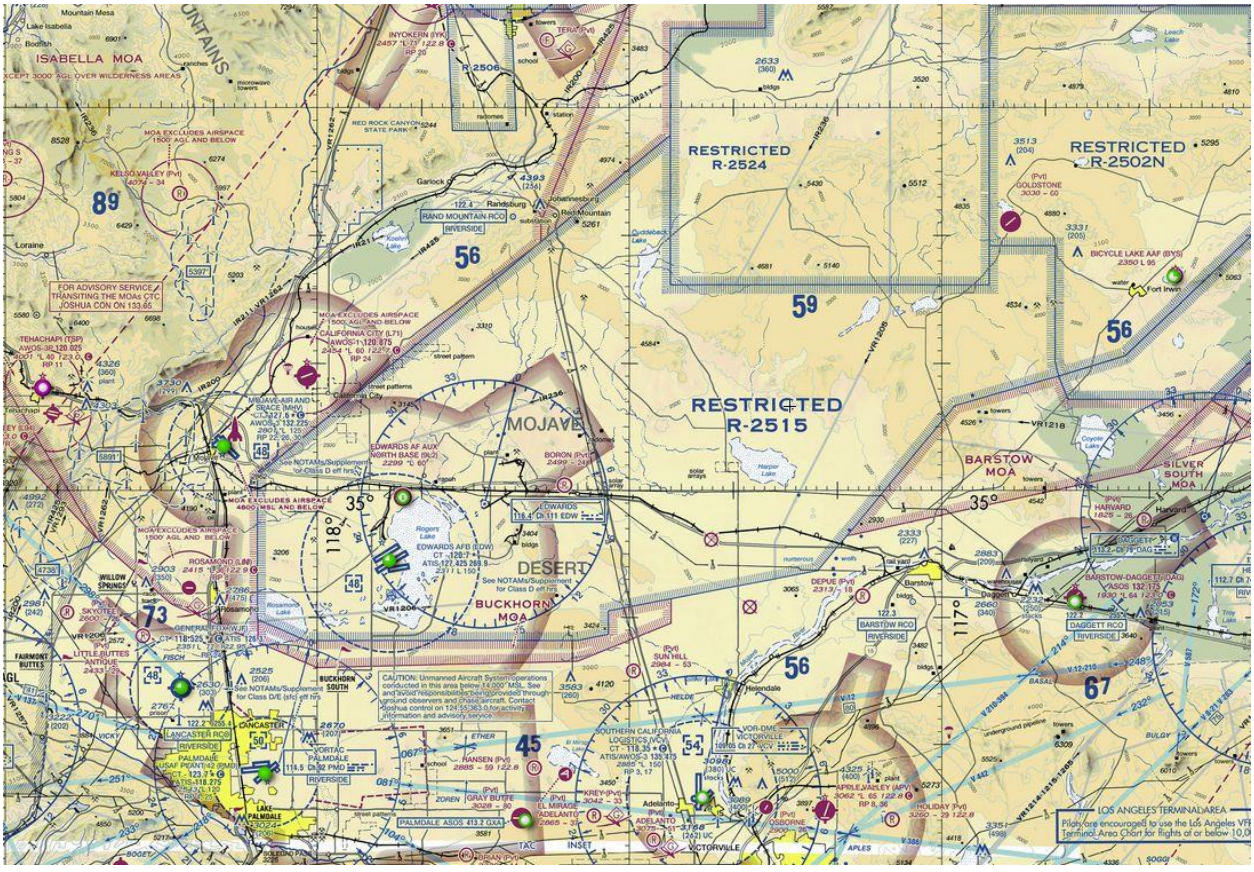
Source: AOPA Air Safety Foundation, https://www.aopa.org/-/media/Files/AOPA/Home/Pilot%20Resources/ASI/various%20safety%20pdfs/airspace2011.pdf

There are also Special Use Airspace (SUAs) that are designed to ensure the separation of non-participating (non-military) aircraft from potentially hazardous operations or conflict with military operations. SUAs typically include Restricted Areas (RAs and referred to in this EA as Restricted Airspace), Military Operations Areas (MOAs) and Air Traffic Control Assigned Airspace (ATCAAs).

Airspace Components

The region of influence (ROI) is considered to be an area extending approximately ten NM beyond the boundary of the Edwards Restricted Airspace (R-2515) and includes all major airports and activities that interact with or are affected by the presence of the Edwards Restricted Airspace (R-2515). Airspace components within the ROI include other SUA such as RA, MOA, ATCAA, Controlled Fire Areas (CFAs), military traffic routes (MTRs), civilian air routes (V-Routes, Q-Routes and Jet-routes), as well as other military, civilian and private airports. Figure B-2 depicts the ROI on a typical airspace Sectional Map. Figure B-3 depicts a graphic representation of the vertical section of that airspace.

Figure B-2 Region of Influence



Restricted Airspace. RAs are regulatory SUA and are established in 14 CFR Part 73 through the rulemaking process. RA airspace defines areas where operations are hazardous to non-participating aircraft which are not permitted between the designated altitudes and during the time of designation without advanced permission of the using agency or the controlling agency. The FAA stipulates that RA should not be established over private or community owned properties or those properties should have conditional use agreements or deed restrictions identifying the property as being under airspace used for hazardous military flight activities. The Edwards RA (R-2515) was established in 1942 before those rules were established. However, because the RA extends to surface and much of it exists over privately owned property, population centers and noise sensitive areas, a 3,000 ft AGL over-flight restriction applies to those areas (Figure 4-1, in Section 4.1 of the EA).

Usage of the Edwards RA (R-2515) for the fiscal year (FY) 2018 included 13,233 sorties by multiple on- and off-base organizations flying 307 different airframes. The average number of sorties for the past eight years was slightly lower at 12,907 sorties. These are relatively low by comparison to earlier decades. In 1996 there were 21,175 sorties (*EA of the R-2515, Edwards AFB, CA-June 1998*) and in 1993 there were 16,615 sorties (*R-2508 Complex Environmental Baseline Study-1995*).

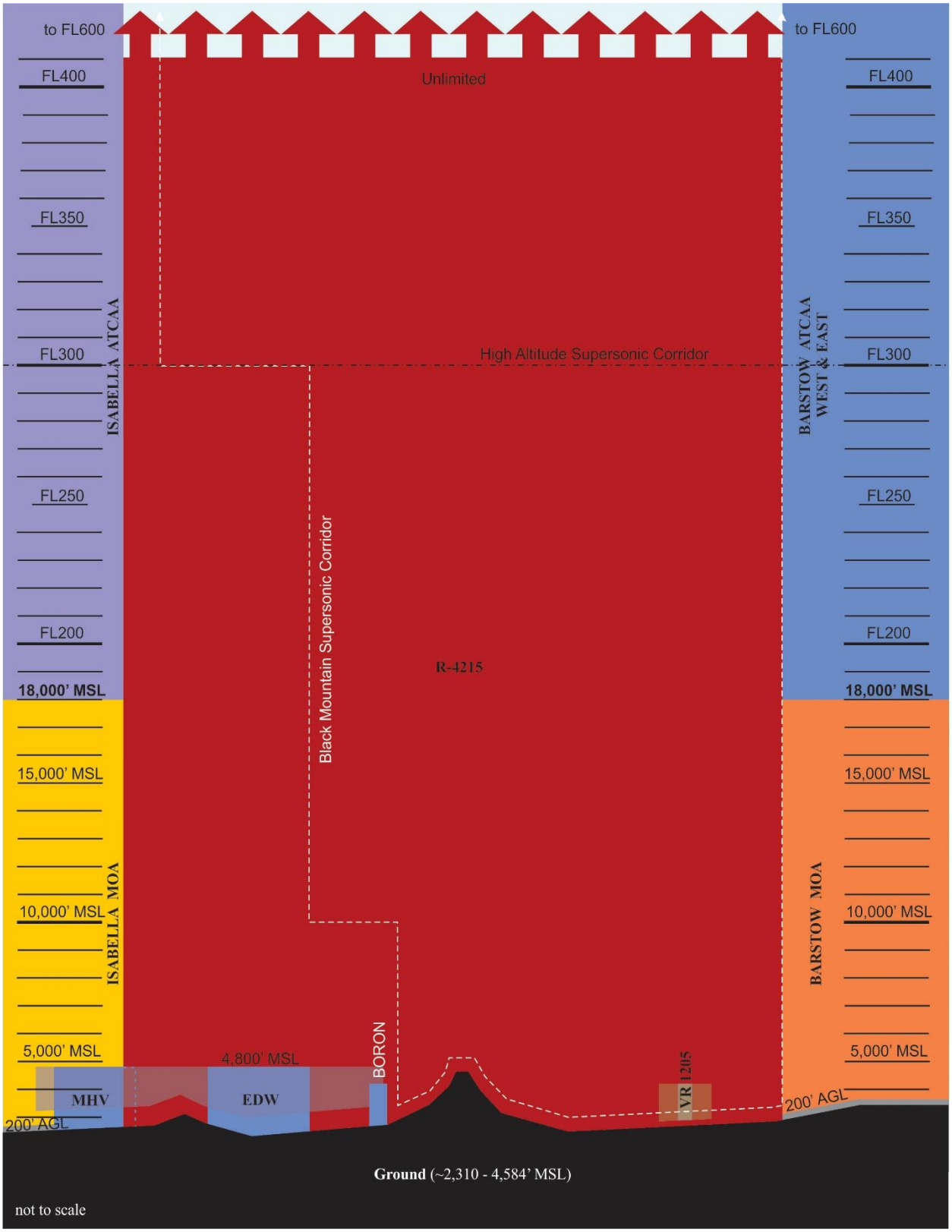
In addition to the Edwards RA (R-2515) there are several other RAs within the ROI. Table B-1 identifies each with their effective altitudes, times of activation, and controlling agency. Activities within the Edwards RA (R-2515) often extend into adjacent airspaces and vice versa (Figure 1-1, in Section 1.2 of the EA).

Table B-1 Restricted Airspace in the ROI

NAME	EFFECTIVE ALTITUDE	TIME OF USE	CONTROLLING
R-2515	Surface to Unlimited	Continuous	Joshua Control Facility
R-2524	Surface to Unlimited	Continuous	Joshua Control Facility
R-2502N	Surface to Unlimited	Continuous	Joshua Control Facility
R-2502E	Surface to Unlimited	Continuous	Los Angeles Center
R-2502A	Surface to 16,000 ft above	Continuous	Los Angeles Center

Source: Federal Aviation Administration - Los Angeles Sectional

Figure B-3 Airspace Vertical Section



Military Operations Areas. MOAs are SUA with defined vertical and lateral limits established for the purpose of separating certain military training activities from IFR traffic. IFR traffic may be cleared to enter and pass through a MOA if adequate IFR separation criteria can be met and procedures are described in a Letter of Agreement (LOA) between the unit and the ATC controlling agency (FAA Order JO 7400.2). Nonparticipating VFR aircraft are not prohibited from entering an active MOA; however, extreme caution is advised when such aircraft transit the area during military operations. MOAs cannot extend higher than 18,000 ft above MSL. When not in use, these airspaces are returned to the FAA for use by non-participating aircraft.

MOAs often support the activities of RAs by providing additional protected airspace surrounding the activity to act as a safety buffer and extended operations airspace. The Edwards RA (R-2515) is surrounded by four MOAs with several others beyond, all connected as one large contiguous SUA (Figures B-2 and B-3). Although the floor goes down to 200 feet AGL, population centers and noise sensitive areas require a 3,000 ft AGL over-flight restriction. Table B-2 identifies each of the immediate four MOAs with their effective altitudes, times of activation, and controlling agency.

Table B-2 Military Operations Areas in the ROI

NAME	EFFECTIVE ALTITUDE	TIME OF USE	CONTROLLING
Isabella MOA	200 ft AGL to 17,999 ft above	0600-2200 M-F	Joshua Control Facility
Panamint	200 ft AGL to 17,999 ft above	0600-2200 M-F	Joshua Control Facility
Buckhorn	200 ft AGL to 17,999 ft above	0600-2200 M-F	Los Angeles Center
Barstow	200 ft AGL to 17,999 ft above	0600-2200 M-F	Los Angeles Center

Source: Federal Aviation Administration - Los Angeles Sectional

Air Traffic Control Assigned Airspace. Air Traffic Control Assigned Airspaces (ATCAAs) are another type of SUA above 17,999 ft above MSL designed to accommodate non-hazardous high-altitude military flight training; this airspace remains under the control of the FAA, and when not in use by the military, may be used to support civil aviation activities. ATCAAs permit military aircraft to conduct high-altitude combat training, perform aerial refueling, and initiate or egress from attacks on targets within a range. ATC routes IFR traffic around this airspace when activated. ATCAAs do not appear on any sectional or enroute aeronautical charts. ATCAA will often reside above MOAs as a means to extend protected airspace above 18,000 ft above MSL.

There are five ATCAAs within the ROI that follow the naming convention of and general area of their corresponding MOAs below them (Table B-3). Scheduling use of these ATCAAs is accomplished through the Central Coordinating Facility (CCF) at Edwards AFB.

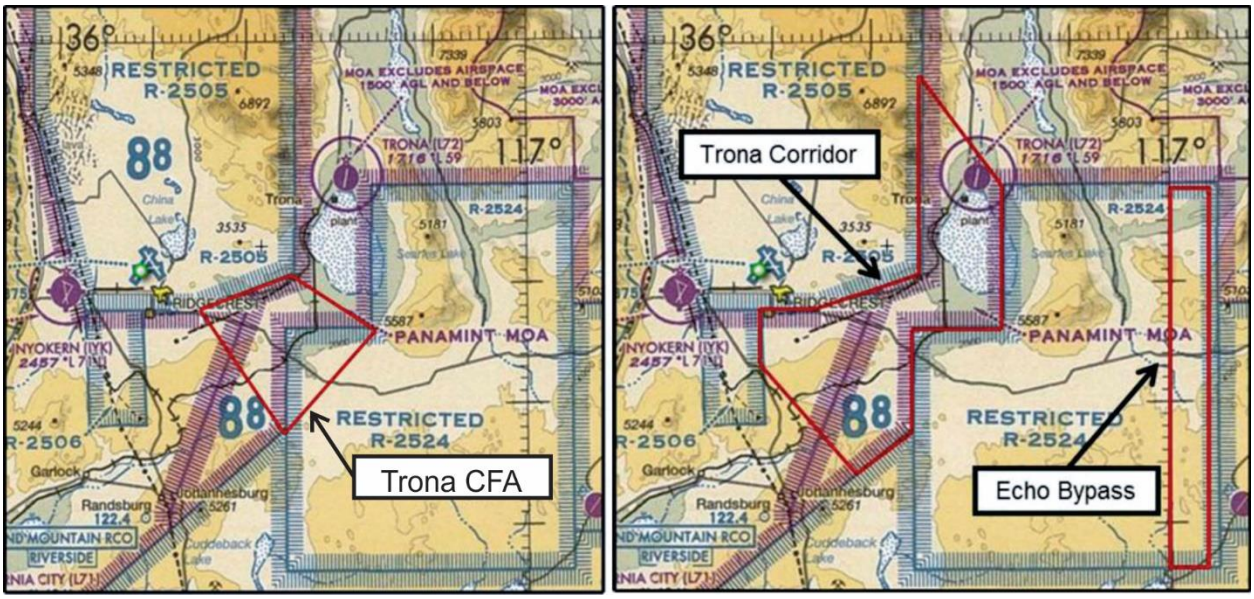
Table B-3 Air Traffic Control Assigned Airspace in the ROI

NAME	EFFECTIVE	TIME OF USE	CONTROLLING
Isabella ATCAA	FL180 to FL600	As Requested	Los Angeles Center
Panamint ATCAA	FL180 to FL600	As Requested	Los Angeles Center
Buckhorn ATCAA	FL180 to FL600	0600-2200 M-F OTB NOTAM	Los Angeles Center
Barstow West	FL180 to FL600	0600-2200 M-F OTB NOTAM	Los Angeles Center
Barstow East	FL180 to FL600	0600-2200 M-F OTB NOTAM	Los Angeles Center

Source: R-2508 Handbook, 2017
Notes: OTB = Other Times By
NOTAM = Notice to Airmen

Controlled Firing Areas. A CFA exists north of the Edwards RA (R-2515) between two RAs associated with NAWS China Lake, including R-2505 and R-2524. The area between these RA is known as the Trona Corridor, which is the site of heavy military and civilian traffic transiting north-south through the R-2508. The Trona CFA allows for free flight weapons systems transiting from launch areas within R-2505 to target areas within R-2524 and vice versa. When the Trona CFA is activated, a by-pass corridor is also activated along the eastern edge of the R-2524 to facilitate north-south military air traffic impeded by the Trona CFA. The southern connection point provides ingress and egress through the Echo Bypass from the R-2515 (Figure B-4).

Figure B-4 Trona CFA and Echo Bypass



Source: R-2508 Handbook, 2017

Military Training Routes. MTRs are designated by three categories including visual routes (VR), instrument routes (IR) and slow routes (SR). VRs are for VFR type traffic at altitudes below 1,500 ft AGL. IRs are designated for IFR military traffic that is flown between 1,500 and 18,000 feet above MSL. SRs are similar to VRs, but are reserved for slow speed VFR traffic such as helicopters and smaller fixed wing aircraft. Traffic along VRs is managed by SPORT

while traffic on the IR is provided ATC by Joshua Approach. There are no SRs in the Edwards RA (R-2515).

There are three MTRs that transit through the Edwards RA (R-2515). Table B-4 identifies these routes and their characteristics.

Table B-4 MTRs in the Edwards RA (R-2515)

ROUTE	Way Points	WIDTH	ALTITUDE	USAGE Sorties/yr	AGENCY	AIRCRAFT
VR-1205	F-H	4 NM	200 AGL-1500 AGL	20	412 OSS	B-1B, B-52, C-12
VR-1206	A-B	4 NM	200 AGL-1500 AGL	0	412 OSS	
IR-236	A-C	4 NM	A: Assigned, B: 200 AGL-5000 MSL, C: 200 AGL-5500 MSL	2	412 OSS	C-12

Source: DoD Flight Information Publication AP/1B, Area Planning, Military Training Routes, North and South America, July 2016.
Usage Data: – 412th OSS, FY18, Number of sorties/year

Federal Airways. Federal airways are designated linear routes that extend between navigational beacons that broadcast directional information used by pilots to maintain course along the route. Federal airways include low-altitude Victor Routes and high-altitude jet routes. Victor Routes extend from 1,200 ft AGL up to but not including 18,000 ft above MSL in Class-E airspace. There are no Victor Routes that traverse the Edwards RA (R-2515) but several that exist around its perimeter.

High-altitude jet routes extend from FL180 to FL450. Traffic on jet routes is controlled by the FAA at all times. There are no high-altitude jet routes that traverse the Edwards RA (R-2515) but several exist around its perimeter.

Airports. There are several airports within the ROI including three within the Edwards RA (R-2515). Table B-5 identifies each airport in the ROI with airport statistics including controlling agency and number of airport operations per year. The busiest airport in the ROI is General William J Fox Airport at nearly 82,000 operations per year, located southwest of the Edwards RA (R-2515) and northwest of Plant 42 at Lancaster, CA. Edwards AFB is a close second at just over 78,000 operations per year although many of those are short-duration training flights, touch-and-go, or otherwise restricted

to their Class-D airspace only.

Table B-5 Airports

AIRPORT NAME	ID	PUBLIC/ PRIVATE	ARTCC	A/D	AIRPORT AIRSPACE CLASS	ILS	RNAV	AVG OPS/YR
Within Edwards RA (R-2515)								
Boron Airstrip	57C	Private	ZLA	JCF	E	-	-	696
Edwards AFB	ED	Private	ZLA	ED	D	X	X	78,575
Edwards AF Auxiliary North Base	9L2	Private	ZLA	ED	D	-	-	unknow
Within ROI								
Apple Valley	APV	Public	ZLA	JCF	Trans-E	-	X	37,595
Barstow-Daggett Airport	DAG	Public	ZLA	ZLA	Trans-E	-	X	36,500
Bicycle Lake AAF (Ft Irwin)	BYS	Private	ZLA	ZLA	E	-	-	unknow
California City Municipal Airport	L71	Public	ZLA	JCF	E	-	X	3,536
China Lake Naval Air Weapons Station	NID	Private	ZLA	CLT	D	-	X	unknow
Depue Airport	6CA	Private	ZLA	ZLA	E	-	-	N/A
El Mirage Field Adelanto Airport	99C	Private	ZLA	ZLA	E	-	-	unknow
General William J Fox Airfield	WJF	Public	ZLA	FT	D	-	X	81,760
Goldstone Airport (NASA)	00C	Private	ZLA	JCF	RA	-	-	unknow
Mojave Air and Space Port	MHV	Public	ZLA	MHV	D	-	X	17,520
Palmdale-USAF Plant 42 Airport	PMD	Public	ZLA	PMD	D	X	X	64,240
Rosamond Skypark Airport	L00	Public	ZLA	ZLA	E	-	-	10,585
Sun Hill Ranch Airport	CA7	Private	ZLA	ZLA	E	-	-	300
Trona Airport	L72	Public	ZLA	ZLA	E	-	-	4,472
Southern California Logistics Airport	VCV	Public	ZLA	VCV	D	X	X	22,630

Source: AirNav.com, 2020; EDW Ops from Edwards AFB AICUZ Resource Book, November 2016

A/D: Approach / Departure Services

ARTCC: Air Route Traffic Control Centers

ILS: Instrument Landing System

RNAV: Area Navigation Landing System

ZLA: Los Angeles Center

EDW: Edwards Tower

JCF: Joshua Control Facility

CLT: China Lake Tower

FT: Fox Tower

MHV: Mojave Tower

PMD: Palmdale Tower

VCV: Victorville Tower

There are several unregistered airfields located within the Edwards RA (R-2515). Most of these see little or no traffic due to lack of supporting infrastructure. However, it has been reported by SPORT that private airstrips within the R-2515 do generate minimal amounts of small aircraft traffic.

Boron Airstrip is the only, registered and active non-military airfield within the Edwards RA (R-2515). It flies approximately 700 operations per year into active restricted airspace with no official exclusion area to conduct approach / departure activities. The R-2515 Handbook requires military pilots to remain above 3,000 ft AGL when near the airfield. Joshua Approach and SPORT require that aircraft coming from or going to Boron through the Edwards RA (R-2515) must request access and await clearance before takeoff or entering the RA. These protocols would significantly impact operations at this airstrip, although Joshua Approach and SPORT state that there are no operations being conducted at Boron Airstrip, and therefore it poses no conflict. The Boron airfield manager has confirmed airfield activity and constraining requirements.

Airspace Control Agencies. The primary authority over the Edwards RA (R-2515) is the FAA and the Los Angeles Air Route Traffic Control Center (ARTCC), located near Palmdale Plant 42 Airport (PMD). Daily IFR activities requiring ATC are managed by Joshua Control Facility (JCF) otherwise known by their callsign Joshua Approach. Joshua Approach manages activity throughout the R-2508 Complex as well as approach / departure services for airports outside of RA but within their transitional Class-E airspace including California City, Mojave Air and Space Port, General William J Fox Airfield, and Palmdale Plant 42 Airport. Joshua Approach will hand-off control to Mojave Tower, Palmdale Tower, and Fox Tower when aircraft enter each airport's respective Class-D airspace.

SPORT provides non-ATC advisory services to VFR aircraft operating within the Edwards RA (R-2515) and throughout the R-2508 Complex. The vast majority of flight in the Edwards RA (R-2515) is conducted VFR. When VFR meteorological conditions (VMC) are not present, those portions of the airspace will revert to Joshua Approach for IFR guidance until VMC is regained, then reverting back to VFR under SPORT.

The Edwards Control Tower manages all flight activity within their Class-D circle from surface up to 4,800 ft above MSL with a few exceptions. When the PIRA supersonic corridor is activated, aircraft fly VFR under SPORT advisory through the Edwards Tower Class-D airspace. Edwards Tower will divert all other flight to avoid that area. Similarly, in the same general area, the Alpha corridor can become activated, following the same flight protocols. The unmanned aerial system (UAS) Work Area and the North UAS Extension Area over the northern half of Roger's Dry Lake is also exempted from Class-D airspace when activated and transferred to SPORT. The UAS corridor connects the UAS work area to the PIRA at elevations above 5,000 ft above MSL, which is above the Edwards Class-D airspace and therefore does not affect tower operations. Edwards Tower hours of operation are 6:00 am to 10:00 pm (0600-2200) Monday through Friday.

PIRA Range Operations Center, callsign Downfall, provides ATC for flight and range activities when aircraft enter that airspace. SPORT will coordinate handoffs of aircraft entering the PIRA, to Downfall and vice versa. Area of control follows the lateral limit of PIRA from surface to unlimited altitude. Times of activation are from 7:00 am to 5:00 pm (0700-1700) Monday through Friday. The AFRL area extends south well into the PIRA along Mars Road in what is referred to as the “shoehorn”. This area has a continuous no-fly protection zone up to 5,300 ft above MSL. It is often closed during bombing and strafing runs in case of accidental early or late release of munitions.

There are two towers on the PIRA used for Joint Tactical Attack Control (JTAC) operations providing control of aircraft munitions release. DAGRAG tower sits near the dual aerial gunnery range in West Range and Cowbell tower resides in East Range. JTACs can also operate at ground locations or from vehicles. Aircraft control handoffs occur between Downfall and JTACs located in the range.

APPENDIX C

Air Quality Supporting Information

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF CONFORMITY ANALYSIS (ROCA)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Instruction 32-7040, Air Quality Compliance And Resource Management; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: R-2515/EDWARDS AFB
State: California

b. Action Title: Continued Use of R-2515

c. Project Number/s (if applicable):

d. Projected Action Start Date: 1 / 2021

e. Action Description: Continued Use of R-2515

2. Analysis: Total combined direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the "worst-case" and "steady state" (net gain/loss upon action fully implemented) emissions. General Conformity under the Clean Air Act, Section 1.76 has been evaluated for the action described above according to the requirements of 40 CFR 93, Subpart B.

Based on the analysis, the requirements of this rule are: _____ applicable
__X__ not applicable

Conformity Analysis Summary:

Pollutant	Net Change in Emissions (ton/yr)		GENERAL CONFORMITY	
	Alternative 1 Proposed Action	Alternative 2 Surge	Threshold (ton/yr)	Exceedance (Yes or No)
VOC	0.3	0.8	25	No
NO_x	3.3	18.2	25	No
CO	(3.5)	(2.8)	-	-
SO_x	0.2	1.0	-	-
PM_{10}	(0.1)	0.7	100	No
$PM_{2.5}$	(0.0)	0.7	-	-
Pb	0.0	0.0	-	-
NH3	0.0	0.0	-	-
CO_2e	472.1	2,978.5	-	-

None of estimated emissions associated with this action are above the conformity threshold values established at 40 CFR 93.153 (b); Therefore, the requirements of the General Conformity Rule are not applicable.

1. General Information

- Action Location
Base: EDWARDS AFB
State: California
County(s): Kern
Regulatory Area(s): San Joaquin Valley, CA

- Action Title: Continued Use of R-2515

- Project Number/s (if applicable):

- Projected Action Start Date: 1 / 2021

- Action Purpose and Need:
Continued Use of R-2515

- Action Description:
Continued Use of R-2515

- Activity List:

	Activity Type	Activity Title
2.	Aircraft	F-35
3.	Aircraft	T38
4.	Aircraft	F-16D
5.	Aircraft	C-12/King Air
6.	Aircraft	F-22

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: Kern
Regulatory Area(s): San Joaquin Valley, CA

- Activity Title: F-35

- Activity Description:
F-35

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.382647
NO_x	6.678273
CO	0.216593
PM 10	0.476504

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.429575
Pb	0.000000
NH_3	0.000000
CO_2e	1167.4

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.382647
NO_x	6.678273
CO	0.216593
PM 10	0.476504

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.429575
Pb	0.000000
NH_3	0.000000
CO_2e	1167.4

2.2 Aircraft & Engines

2.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: F-35A
Engine Model: F135-PW-100
Primary Function: Combat
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

2.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)
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: 1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 5991
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins):	0
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0
Climb Out [Intermediate] (mins):	0.45
Approach [Approach] (mins):	0
Taxi/Idle In [Idle] (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)

2.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

3. Aircraft

- Activity Title: T38

- Activity Description:
T-38 in R-2515

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.055901
SO_x	0.021315
NO_x	0.014076
CO	1.308439
PM 10	0.035994

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.013875
Pb	0.000000
NH_3	0.000000
CO_2e	65.0

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.055901
SO_x	0.021315
NO_x	0.014076
CO	1.308439
PM 10	0.035994

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.013875
Pb	0.000000
NH_3	0.000000
CO_2e	65.0

3.2 Aircraft & Engines

3.2.1 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

3.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	520.00	16.80	1.06	1.08	177.45	4.70	4.02	3234
Approach	854.00	7.84	1.06	0.84	106.29	2.80	1.85	3234
Intermediate	1030.00	2.78	1.06	0.70	65.07	1.79	0.69	3234
Military	2220.00	0.75	1.06	1.92	30.99	1.13	0.04	3234
After Burn	7695.00	6.97	1.06	6.23	53.43	0.25	0.09	3234

3.3 Flight Operations

3.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 2603
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins): 0
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0
Climb Out [Intermediate] (mins): 0.45
Approach [Approach] (mins): 0
Taxi/Idle In [Idle] (mins): 0

4. Aircraft

4.1 General Information & Timeline Assumptions

- Activity Title: F-16D

- Activity Description:
F-16D in R-2515

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.003712
SO_x	0.057029
NO_x	1.428423
CO	0.020391
PM 10	0.085006

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.076505
Pb	0.000000
NH_3	0.000000
CO_2e	174.0

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.003712
SO_x	0.057029
NO_x	1.428423
CO	0.020391
PM 10	0.085006

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.076505
Pb	0.000000
NH_3	0.000000
CO_2e	174.0

4.2 Aircraft & Engines

4.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: NF-16D
Engine Model: F100-PW-200
Primary Function: Combat
Aircraft has After burn: Yes
Number of Engines: 1

4.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	1005.95	2.05	1.06	6.21	24.06	2.49	2.24	3234
Approach	3251.45	0.05	1.06	17.93	1.22	2.37	2.13	3234
Intermediate	5650.65	0.07	1.06	26.55	0.38	1.58	1.42	3234
Military	8888.05	0.11	1.06	34.32	0.56	1.58	1.42	3234
After Burn	40122.70	0.69	1.06	6.63	10.42	3.04	2.74	3234

4.3 Flight Operations

4.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 2539

Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins):	0
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0
Climb Out [Intermediate] (mins):	0.45
Approach [Approach] (mins):	0
Taxi/Idle In [Idle] (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)

5. Aircraft

- Activity Title: C-12/King Air

- Activity Description:
C-12/King Air in R-2515

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.003498
NO_x	0.022707
CO	0.006436
PM 10	0.000792

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000726
Pb	0.000000
NH_3	0.000000
CO_2e	10.7

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.003498
NO_x	0.022707
CO	0.006436
PM 10	0.000792

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000726
Pb	0.000000
NH_3	0.000000
CO_2e	10.7

5.2 Aircraft & Engines

5.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation:	C-12U
Engine Model:	PT6A-42
Primary Function:	General - Turboprop
Aircraft has After burn:	No
Number of Engines:	2

5.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	102.81	16.61	1.06	2.16	76.55	0.45	0.41	3234
Approach	275.16	0.00	1.06	4.89	6.89	0.10	0.09	3234
Intermediate	466.16	0.00	1.06	6.88	1.95	0.24	0.22	3234
Military	512.86	0.00	1.06	7.28	1.95	0.23	0.21	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

5.3 Flight Operations

5.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 944
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins): 0
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0
Climb Out [Intermediate] (mins): 0.45
Approach [Approach] (mins): 0
Taxi/Idle In [Idle] (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)

6. Aircraft

6.1 General Information & Timeline Assumptions

- Activity Title: F-22

- Activity Description:
F-22 in R-2515

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.001167
SO_x	0.038660
NO_x	0.452251
CO	0.078050
PM 10	0.051024

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.039754
Pb	0.000000
NH_3	0.000000
CO_2e	117.9

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.001167
SO_x	0.038660
NO_x	0.452251
CO	0.078050
PM 10	0.051024

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.039754
Pb	0.000000
NH_3	0.000000
CO_2e	117.9

6.2 Aircraft & Engines

6.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: F-22A
Engine Model: F119-PW-100
Primary Function: Combat
Aircraft has After burn: Yes
Number of Engines: 2

6.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	1377.00	1.67	1.06	3.01	48.15	2.42	1.76	3234
Approach	2740.00	0.05	1.06	6.59	7.92	1.96	1.73	3234
Intermediate	10110.00	0.03	1.06	12.40	2.14	1.40	1.09	3234
Military	18612.00	0.01	1.06	19.81	0.75	1.12	0.97	3234
After Burn	50170.00	0.00	1.06	7.37	16.10	0.85	0.75	3234

6.3 Flight Operations

6.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 481
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins): 0
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0
Climb Out [Intermediate] (mins): 0.45
Approach [Approach] (mins): 0
Taxi/Idle In [Idle] (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)

Alternative 2 – Proposed Action

3. Aircraft

3.1 General Information & Timeline Assumptions

- Activity Title: T-7

- Activity Description:
T-7 in R-2515

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.464920
SO_x	0.219147
NO_x	3.358893
CO	0.382996
PM 10	0.026625

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.022529
Pb	0.000000
NH_3	0.000000
CO_2e	662.4

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.464920
SO_x	0.219147
NO_x	3.358893
CO	0.382996
PM 10	0.026625

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.022529
Pb	0.000000
NH_3	0.000000
CO_2e	662.4

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

3.3 Flight Operations

3.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 1

Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 2603
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi/Idle Out [Idle] (mins): 0
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0
Climb Out [Intermediate] (mins): 1.35
Approach [Approach] (mins): 0
Taxi/Idle In [Idle] (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)

7. Aircraft

7.1 General Information & Timeline Assumptions

- Activity Title: B-21

- Activity Description:
B-21 in R-2515

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.001612
NO_x	0.027868
CO	0.000904
PM 10	0.001988

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.001793
Pb	0.000000
NH_3	0.000000
CO_2e	4.9

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.001612
NO_x	0.027868
CO	0.000904
PM 10	0.001988

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.001793
Pb	0.000000
NH_3	0.000000
CO_2e	4.9

7.2 Aircraft & Engines

7.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation:	F-35A
Engine Model:	F135-PW-100
Primary Function:	Combat
Aircraft has After burn:	Yes
Number of Engines:	1

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate?	Yes
Original Aircraft Name:	B-21
Original Engine Name:	F135-PW-100

7.3 Flight Operations

7.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft:	1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft:	25
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft:	0
Number of Annual Trim Test(s) per Aircraft:	0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins):	0
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0
Climb Out [Intermediate] (mins):	0.45
Approach [Approach] (mins):	0
Taxi/Idle In [Idle] (mins):	0

Alternative 3 – Surge

2. Aircraft

2.1 General Information & Timeline Assumptions

- Activity Title: F-35

- Activity Description:
F-35 in R-2515

- Activity Start Date

Start Month:	1
Start Year:	2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.772514
NO_x	13.356545
CO	0.433185
PM 10	0.953008

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.859151
Pb	0.000000
NH_3	0.000000
CO_2e	2334.9

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.772514
NO_x	13.356545
CO	0.433185
PM 10	0.953008

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.859151
Pb	0.000000
NH_3	0.000000
CO_2e	2334.9

2.2 Aircraft & Engines

2.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: F-35A
Engine Model: F135-PW-100
Primary Function: Combat
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

2.3 Flight Operations

2.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 11982
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins):	0
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0
Climb Out [Intermediate] (mins):	0.45
Approach [Approach] (mins):	0
Taxi/Idle In [Idle] (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)

3. Aircraft

3.1 General Information & Timeline Assumptions

- Activity Title: T-7

- Activity Description:
T-7 in R-2515

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.929661
SO_x	0.438210
NO_x	6.716496
CO	0.765844
PM 10	0.053241

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.045050
Pb	0.000000
NH_3	0.000000
CO_2e	1324.5

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.929661
SO_x	0.438210
NO_x	6.716496
CO	0.765844
PM 10	0.053241

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.045050
Pb	0.000000
NH_3	0.000000
CO_2e	1324.5

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:

3.3 Flight Operations

3.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft:	1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft:	5205
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft:	0
Number of Annual Trim Test(s) per Aircraft:	0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins):	0
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0
Climb Out [Intermediate] (mins):	1.35
Approach [Approach] (mins):	0
Taxi/Idle In [Idle] (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)

4. Aircraft

4.1 General Information & Timeline Assumptions

- Activity Title: F-16

- Activity Description:
F-16 in R-2515

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.022278
SO_x	0.345472
NO_x	8.572227
CO	0.122368
PM 10	0.510136

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.459123
Pb	0.000000
NH_3	0.000000
CO_2e	1044.2

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.022278
SO_x	0.345472
NO_x	8.572227
CO	0.122368
PM 10	0.510136

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.459123
Pb	0.000000
NH_3	0.000000
CO_2e	1044.2

4.2 Aircraft & Engines

4.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: NF-16D
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:

4.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	1005.95	2.05	1.07	6.21	24.06	2.49	2.24	3234
Approach	3251.45	0.05	1.07	17.93	1.22	2.37	2.13	3234
Intermediate	5650.65	0.07	1.07	26.55	0.38	1.58	1.42	3234
Military	8888.05	0.11	1.07	34.32	0.56	1.58	1.42	3234
After Burn	40122.70	0.69	1.07	6.63	10.42	3.04	2.74	3234

4.3 Flight Operations

4.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 1

Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 5079
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi/Idle Out [Idle] (mins): 0
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0
Climb Out [Intermediate] (mins): 1.35
Approach [Approach] (mins): 0
Taxi/Idle In [Idle] (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)

5. Aircraft

5.1 General Information & Timeline Assumptions

- Activity Title: C-12/King Air

- Activity Description:
C-12/King Air in R-2515

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.021200
NO_x	0.136313
CO	0.038635
PM 10	0.004755

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.004359
Pb	0.000000
NH_3	0.000000
CO_2e	64.1

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.021200
NO_x	0.136313
CO	0.038635
PM 10	0.004755

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.004359
Pb	0.000000
NH_3	0.000000
CO_2e	64.1

5.2 Aircraft & Engines

5.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: C-12U
Engine Model: PT6A-42
Primary Function: General - Turboprop
Aircraft has After burn: No
Number of Engines: 2

- 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 Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	102.81	16.61	1.07	2.16	76.55	0.45	0.41	3234
Approach	275.16	0.00	1.07	4.89	6.89	0.10	0.09	3234
Intermediate	466.16	0.00	1.07	6.88	1.95	0.24	0.22	3234
Military	512.86	0.00	1.07	7.28	1.95	0.23	0.21	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

5.3 Flight Operations

5.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 1889
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins): 0
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0
Climb Out [Intermediate] (mins): 1.35
Approach [Approach] (mins): 0
Taxi/Idle In [Idle] (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)

6. Aircraft

6.1 General Information & Timeline Assumptions

- Activity Title: F-22

- Activity Description:
F-22 in R-2515

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.002332
SO_x	0.077969
NO_x	0.903561
CO	0.155937
PM 10	0.101942

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.079426
Pb	0.000000
NH_3	0.000000
CO_2e	235.7

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.002332
SO_x	0.077969
NO_x	0.903561
CO	0.155937
PM 10	0.101942

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.079426
Pb	0.000000
NH_3	0.000000
CO_2e	235.7

6.2 Aircraft & Engines

6.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: F-22A
Engine Model: F119-PW-100
Primary Function: Combat
Aircraft has After burn: Yes
Number of Engines: 2

- 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 Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	1377.00	1.67	1.07	3.01	48.15	2.42	1.76	3234
Approach	2740.00	0.05	1.07	6.59	7.92	1.96	1.73	3234
Intermediate	10110.00	0.03	1.07	12.40	2.14	1.40	1.09	3234
Military	18612.00	0.01	1.07	19.81	0.75	1.12	0.97	3234
After Burn	50170.00	0.00	1.07	7.37	16.10	0.85	0.75	3234

6.3 Flight Operations

6.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 961
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins): 0
Takeoff [Military] (mins): 0
Takeoff [After Burn] (mins): 0
Climb Out [Intermediate] (mins): 0.45
Approach [Approach] (mins): 0
Taxi/Idle In [Idle] (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)

7. Aircraft

7.1 General Information & Timeline Assumptions

- Activity Title: B-21

- Activity Description:
B-21 in R-2515

- Activity Start Date
Start Month: 1
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.003224
NO_x	0.055736
CO	0.001808
PM 10	0.003977

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.003585
Pb	0.000000
NH_3	0.000000
CO_2e	9.7

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.000000
SO_x	0.003224
NO_x	0.055736
CO	0.001808
PM 10	0.003977

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.003585
Pb	0.000000
NH_3	0.000000
CO_2e	9.7

7.2 Aircraft & Engines

7.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine

Aircraft Designation: F-35A
Engine Model: F135-PW-100
Primary Function: Combat
Aircraft has After burn: Yes
Number of Engines: 1

- Aircraft & Engine Surrogate

Is Aircraft & Engine a Surrogate? No
Original Aircraft Name:
Original Engine Name:

7.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions 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: 1
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 50
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins):	0
Takeoff [Military] (mins):	0
Takeoff [After Burn] (mins):	0
Climb Out [Intermediate] (mins):	0.45
Approach [Approach] (mins):	0
Taxi/Idle In [Idle] (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)

APPENDIX D

Noise Supporting Information

A.1 U.S. Air Force Land Use Compatibility Guidelines

The Air Force guidelines for land use compatibility in aircraft noise zones is shown in the table below and are extracted from Appendix A of AFI 32-7084 dated November 2017. These land use compatibility guidelines have been included for reference purposes (Table 1).

Table 1. Land Use Compatibility Guidelines

SLUCM NO.	LAND USE NAME	DNL 65-69	DNL 70-74	DNL 75-79	DNL 80-84	DNL 85+
10	Residential					
11	Household units	N1	N1	N	N	N
11.11	Single units: detached	N1	N1	N	N	N
11.12	Single units: semidetached	N1	N1	N	N	N
11.13	Single units: attached row	N1	N1	N	N	N
11.21	Two units: side-by-side	N1	N1	N	N	N
11.22	Two units: one above the other	N1	N1	N	N	N
11.31	Apartments: walk-up	N1	N1	N	N	N
11.32	Apartment: elevator	N1	N1	N	N	N
12	Group quarters	N1	N1	N	N	N
13	Residential hotels	N1	N1	N	N	N
14	Mobile home parks or courts	N	N	N	N	N
15	Transient lodgings	N1	N1	N1	N	N
16	Other residential	N1	N1	N	N	N
20	Manufacturing					
21	Food and kindred products; manufacturing	Y	Y2	Y3	Y4	N
22	Textile mill products; manufacturing	Y	Y2	Y3	Y4	N
23	Apparel and other finished products; products made from fabrics, leather, and similar materials; manufacturing	Y	Y2	Y3	Y4	N
24	Lumber and wood products (except furniture); manufacturing	Y	Y2	Y3	Y4	N
25	Furniture and fixtures; manufacturing	Y	Y2	Y3	Y4	N
26	Paper and allied products; manufacturing	Y	Y2	Y3	Y4	N
27	Printing, publishing, and allied industries	Y	Y2	Y3	Y4	N
28	Chemicals and allied	Y	Y2	Y3	Y4	N
29	Petroleum refining and related industries	Y	Y2	Y3	Y4	N
30	Manufacturing (continued)					
31	Rubber and misc. plastic products; manufacturing	Y	Y2	Y3	Y4	N
32	Stone, clay and glass products; manufacturing	Y	Y2	Y3	Y4	N
33	Primary metal products; manufacturing	Y	Y2	Y3	Y4	N
34	Fabricated metal products; manufacturing	Y	Y2	Y3	Y4	N
35	Professional scientific, and controlling instruments; photographic and optical goods; watches and clocks	Y	25	30	N	N
39	Miscellaneous manufacturing	Y	Y2	Y3	Y4	N
40	Transportation, communication and utilities					
41	Railroad, rapid rail transit, and street railway transportation	Y	Y2	Y3	Y4	N
42	Motor vehicle transportation	Y	Y2	Y 3	Y4	N
43	Aircraft transportation	Y	Y2	Y3	Y4	N
44	Marine craft transportation	Y	Y2	Y3	Y4	N

45	Highway and street right-of-way	Y	Y	Y	Y	N
46	Automobile parking	Y	Y	Y	Y	N
47	Communication	Y	255	305	N	N
48	Utilities	Y	Y2	Y3	Y4	N
49	Other transportation, communication and utilities	Y	255	305	N	N
50	Trade					
51	Wholesale trade	Y	Y2	Y3	Y4	N
52	Retail trade – building materials, hardware and farm equipment	Y	25	30	Y4	N
53	Retail trade – including shopping centers, discount clubs, home improvement stores, electronics superstores, etc.	Y	25	30	N	N
54	Retail trade – food	Y	25	30	N	N
55	Retail trade – automotive, marine craft, aircraft and accessories	Y	25	30	N	N
56	Retail trade – apparel and accessories	Y	25	30	N	N
57	Retail trade – furniture, home,	Y	25	30	N	N
58	Retail trade – eating and drinking establishments	Y	25	30	N	N
59	Other retail trade	Y	25	30	N	N
60	Services					
61	Finance, insurance and real estate services	Y	25	30	N	N
62	Personal services	Y	25	30	N	N
62.4	Cemeteries	Y	Y2	Y3	Y4,11	Y6,11
63	Business services	Y	25	30	N	N
63.7	Warehousing and storage	Y	Y2	Y3	Y4	N
64	Repair services	Y	Y2	Y3	Y4	N
65	Professional services	Y	25	30	N	N
65.1	Hospitals, other medical facilities	25	30	N	N	N
65.16	Nursing homes	N1	N1	N	N	N
66	Contract construction services	Y	25	30	N	N
67	Government services	Y1	25	30	N	N
68	Educational services	25	30	N	N	N
68.1	Child care services, child development centers, and nurseries	25	30	N	N	N
69	Miscellaneous Services	Y	25	30	N	N
69.1	Religious activities (including places of worship)	Y	25	30	N	N
70	Cultural, entertainment and recreational					
71	Cultural activities	25	30	N	N	N
71.2	Nature exhibits	Y1	N	N	N	N
72	Public assembly	Y	N	N	N	N
72.1	Auditoriums, concert halls	25	30	N	N	N
72.11	Outdoor music shells, amphitheaters	N	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	Y	Y	N	N	N
73	Amusements	Y	Y	N	N	N
74	Recreational activities	Y	25	30	N	N
75	Resorts and group camps	Y	25	N	N	N
76	Parks	Y	25	N	N	N
79	Other cultural, entertainment and recreation	Y	25	N	N	N
80	Resource production and extraction					
81	Agriculture (except live- stock)	Y8	Y9	Y10	Y10,11	Y10,11

81.5-81.7	Agriculture-Livestock farming including grazing and feedlots	Y8	Y9	N	N	N
82	Agriculture related activities	Y8	Y9	Y10	Y10,11	Y10,11
83	Forestry activities	Y8	Y9	Y10	Y10,11	Y10,11
84	Fishing activities	Y	Y	Y	Y	Y
85	Mining activities	Y	Y	Y	Y	Y
89	Other resource production or extraction	Y	Y	Y	Y	Y

KEY:
SLUCM – Standard Land Use Coding Manual, U.S. Department of Transportation
Y (Yes) – Land use and related structures compatible without restrictions.
N (No) – Land use and related structures are not compatible and should be prohibited.
Yx – Yes with restrictions. The land use and related structures generally are compatible. However, see note(s) indicated by the superscript.
Nx – No with exceptions. The land use and related structures are generally incompatible. However, see note(s) indicated by the superscript.
25, 30, or 35 – The numbers refer to noise level reduction (NLR) levels. NLR (outdoor to indoor) is achieved through the incorporation of noise attenuation into the design and construction of a structure. Land use and related structures are generally compatible; however, measures to achieve NLR of 25, 30, or 35 must be incorporated into design and construction of structures. However, measures to achieve an overall noise reduction do not necessarily solve noise difficulties outside the structure and additional evaluation is warranted. Also, see notes indicated by superscripts where they appear with one of these numbers.
DNL – Day-Night Average Sound Level.
CNEL – Community Noise Equivalent Level (normally within a very small decibel difference of DNL)
Ldn – Mathematical symbol for DNL.

NOTES:
1. General
a. Although local conditions regarding the need for housing may require residential use in these zones, residential use is discouraged in DNL 65-69 and strongly discouraged in DNL 70-74. The absence of viable alternative development options should be determined and an evaluation should be conducted locally prior to local approvals indicating that a demonstrated community need for the residential use would not be met if development were prohibited in these zones. Existing residential development is considered as pre-existing, non-conforming land uses.
b. Where the community determines that these uses must be allowed, measures to achieve outdoor to indoor NLR of at least 25 decibels (dB) in DNL 65-69 and 30 dB in DNL 70-74 should be incorporated into building codes and be considered in individual approvals; for transient housing, an NLR of at least 35 dB should be incorporated in DNL 75-79.
c. Normal permanent construction can be expected to provide an NLR of 20 dB, thus the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation, upgraded sound transmission class ratings in windows and doors, and closed windows year round. Additional consideration should be given to modifying NLR levels based on peak noise levels or vibrations.
d. NLR criteria will not eliminate outdoor noise problems. However, building location, site planning, design, and use of berms and barriers can help mitigate outdoor noise exposure particularly from ground level sources. Measures that reduce noise at a site should be used wherever practical in preference to measures that only protect interior spaces.
2. Measures to achieve NLR of 25 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
3. Measures to achieve NLR of 30 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
4. Measures to achieve NLR of 35 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
5. If project or proposed development is noise sensitive, use indicated NLR; if not, land use is compatible without NLR.
6. Buildings are not permitted.
7. Land use is compatible provided special sound reinforcement systems are installed.

8. Residential buildings require an NLR of 25
9. Residential buildings require an NLR of 30.
10. Residential buildings are not permitted.
11. Land use that involves outdoor activities is not recommended, but if the community allows such activities, hearing protection devices should be worn when noise sources are present. Long-term exposure (multiple hours per day over many years) to high noise levels can cause hearing loss in some unprotected individuals.

A.2 MR_NMAP Outputs

***** MOA RANGE NOISEMAP *****
Version 3.0
Release Date 2/7/2013

CASE INFORMATION
Case Name: R-2515 - Baseline Scenario
Site Name: R-2515

SETUP PARAMETERS
Number of MOAs and Ranges = 1 Number of tracks = 0
Lower Left Corner of Grid in feet (X Y pair) = -50000., -50000.
Upper Right Corner of Grid in feet (X Y pair) = 50000., 50000.
Grid spacing = 1000. feet Number of events above an SEL of 65.0 dB
Temperature = 59 F Humidity = 70 Flying days per month = 30

MOA SPECIFICATIONS

MOA name R-2515

Lat (deg)	Long (deg)
35.31667	-116.81749
35.16667	-116.81749
35.14722	-116.81194
35.10834	-116.97860
34.89167	-117.19805
34.83889	-117.53416
34.80833	-117.53416
34.80000	-117.58417
34.80000	-118.01751
34.82778	-118.09667
35.01667	-118.09667
35.46112	-117.43417
35.26556	-117.43417
35.26556	-116.92305
35.31667	-116.92305
35.31667	-116.81749

Floor = 500 feet AGL Ceiling = 60000 feet AGL

MISSION DATA
Mission name = C-12
Aircraft code =FM0190100 Speed = 175 kias Power = 90.0
Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	1.0
1000	3000	2.0

3000	10000	7.0
10000	18000	60.0
18000	30000	30.0

Mission name = F-16D
Aircraft code =FM0440200 Speed = 225 kias Power = 86.0

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	1.0
1000	3000	2.0
3000	10000	7.0
10000	18000	25.0
18000	30000	60.0
30000	60000	5.0

Mission name = F-22
Aircraft code =FM0850100 Speed = 250 kias Power = 35.0

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	0.5
1000	3000	0.5
3000	10000	1.0
10000	18000	10.0
18000	30000	70.0
30000	60000	18.0

Mission name = F-35A
Aircraft code =FM0890200 Speed = 250 kias Power = 75.0

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	0.5
1000	3000	0.5
3000	10000	1.0
10000	18000	10.0
18000	30000	70.0
30000	60000	18.0

Mission name = KC-135R
Aircraft code =FM0310400 Speed = 175 kias Power = 80.3

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	0.0
1000	3000	0.0
3000	10000	0.0
10000	18000	10.0
18000	30000	40.0

30000 60000 50.0

Mission name = T-38C
Aircraft code =FM0880100 Speed = 200 kias Power = 91.0

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	1.0
1000	3000	2.0
3000	10000	7.0
10000	18000	20.0
18000	30000	70.0

MOA OPERATION DATA

MOA name = R-2515

Mission Name	Daily Day OPS	Daily Evening OPS	Daily Night OPS	Monthly Day OPS	Monthly Evening OPS	Monthly Night OPS	Yearly Day OPS	Yearly Evening OPS	Yearly Night OPS	Time On Range (minutes)
C-12	2.550	0.072	0.008	76.50	2.17	0.25	918.	26.	3.	45.
F-16D	6.792	0.203	0.075	203.75	6.08	2.25	2445.	73.	27.	45.
F-22	1.306	0.028	0.006	39.17	0.83	0.17	470.	10.	2.	45.
F-35A	15.411	1.092	0.103	462.33	32.75	3.08	5548.	393.	37.	45.
KC-135R	1.814	0.083	0.000	54.42	2.50	0.00	653.	30.	0.	90.
T-38C	7.003	0.239	0.000	210.08	7.17	0.00	2521.	86.	0.	45.

***** MOA RANGE NOISEMAP *****
RESULTS

The noise metric is CNEL.

MOA RESULTS

MOA Name	MOA Area (sq statute miles)	Uniform Distributed Sound Level (dB)	Number of Daily Events Above SEL of 65.0 dB
R-2515	1812.5	54.8	0.0

<Run Log>
Date: 9/14/2020
Start Time: 12:57:46
Stop Time: 12:58: 3
Total Running Time: 0 minutes and 17 seconds.

***** MOA RANGE NOISEMAP *****
Version 3.0
Release Date 2/7/2013

CASE INFORMATION
Case Name:R-2515 - Alternative 1 - Proposed Action Scenario
Site Name:R-2515

SETUP PARAMETERS
Number of MOAs and Ranges = 1 Number of tracks = 0
Lower Left Corner of Grid in feet (X Y pair) = -50000., -50000.
Upper Right Corner of Grid in feet (X Y pair) = 50000., 50000.
Grid spacing = 1000. feet Number of events above an SEL of 65.0 dB
Temperature = 59 F Humidity = 70 Flying days per month = 30

MOA SPECIFICATIONS

MOA name R-2515

Lat (deg)	Long (deg)
35.31667	-116.81749
35.16667	-116.81749
35.14722	-116.81194
35.10834	-116.97860
34.89167	-117.19805
34.83889	-117.53416
34.80833	-117.53416
34.80000	-117.58417
34.80000	-118.01751
34.82778	-118.09667
35.01667	-118.09667
35.46112	-117.43417
35.26556	-117.43417
35.26556	-116.92305
35.31667	-116.92305
35.31667	-116.81749

Floor = 500 feet AGL Ceiling = 60000 feet AGL

MISSION DATA
Mission name = B-21
Aircraft code =FM0130100 Speed = 175 kias Power = 70.0
Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	0.0
1000	3000	0.0
3000	10000	0.0
10000	18000	10.0
18000	30000	40.0

30000	60000	50.0

Mission name = C-12_2
Aircraft code =FM0190100 Speed = 175 kias Power = 90.0

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	1.0
1000	3000	2.0
3000	10000	7.0
10000	18000	60.0
18000	30000	30.0

Mission name = F-16D_2
Aircraft code =FM0440200 Speed = 225 kias Power = 86.0

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	1.0
1000	3000	2.0
3000	10000	7.0
10000	18000	25.0
18000	30000	60.0
30000	60000	5.0

Mission name = F-22_2
Aircraft code =FM0850100 Speed = 250 kias Power = 35.0

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	0.5
1000	3000	0.5
3000	10000	1.0
10000	18000	10.0
18000	30000	70.0
30000	60000	18.0

Mission name = F-35A_2
Aircraft code =FM0890200 Speed = 250 kias Power = 75.0

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	0.5
1000	3000	0.5
3000	10000	1.0
10000	18000	10.0
18000	30000	70.0
30000	60000	18.0

Mission name = KC-46
Aircraft code =FC1040100 Speed = 175 kias Power = 85.0

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	0.0
1000	3000	0.0
3000	10000	0.0
10000	18000	10.0
18000	30000	40.0
30000	60000	50.0

Mission name = T-7
Aircraft code =FM0500200 Speed = 200 kias Power = 82.1

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	1.0
1000	3000	2.0
3000	10000	7.0
10000	18000	20.0
18000	30000	70.0

MOA OPERATION DATA

MOA name = R-2515

Mission Name	Daily Day OPS	Daily Evening OPS	Daily Night OPS	Monthly Day OPS	Monthly Evening OPS	Monthly Night OPS	Yearly Day OPS	Yearly Evening OPS	Yearly Night OPS	Time On Range (minutes)
B-21	0.067	0.003	0.000	2.00	0.08	0.00	24.	1.	0.	90.
C-12_2	2.550	0.072	0.008	76.50	2.17	0.25	918.	26.	3.	45.
F-16D_2	6.792	0.203	0.075	203.75	6.08	2.25	2445.	73.	27.	45.
F-22_2	1.306	0.028	0.006	39.17	0.83	0.17	470.	10.	2.	45.
F-35A_2	15.411	1.092	0.103	462.33	32.75	3.08	5548.	393.	37.	45.
KC-46	1.814	0.083	0.000	54.42	2.50	0.00	653.	30.	0.	90.
T-7	7.003	0.239	0.000	210.08	7.17	0.00	2521.	86.	0.	45.

***** MOA RANGE NOISEMAP *****
RESULTS

The noise metric is CNEL.

MOA RESULTS

MOA Name	MOA Area (sq statute miles)	Uniform Distributed Sound Level (dB)	Number of Daily Events Above SEL of 65.0 dB
R-2515	1812.5	54.8	0.0

<Run Log>
Date: 9/14/2020
Start Time: 12:57: 5
Stop Time: 12:57:24
Total Running Time: 0 minutes and 20 seconds.

***** MOA RANGE NOISEMAP *****
Version 3.0
Release Date 2/7/2013

CASE INFORMATION
Case Name:R-2515 - Alternative 2 - Surge Scenario
Site Name:R-2515

SETUP PARAMETERS
Number of MOAs and Ranges = 1 Number of tracks = 0
Lower Left Corner of Grid in feet (X Y pair) = -50000., -50000.
Upper Right Corner of Grid in feet (X Y pair) = 50000., 50000.
Grid spacing = 1000. feet Number of events above an SEL of 65.0 dB
Temperature = 59 F Humidity = 70 Flying days per month = 30

MOA SPECIFICATIONS

MOA name R-2515

Lat (deg)	Long (deg)
35.31667	-116.81749
35.16667	-116.81749
35.14722	-116.81194
35.10834	-116.97860
34.89167	-117.19805
34.83889	-117.53416
34.80833	-117.53416
34.80000	-117.58417
34.80000	-118.01751
34.82778	-118.09667
35.01667	-118.09667
35.46112	-117.43417
35.26556	-117.43417
35.26556	-116.92305
35.31667	-116.92305
35.31667	-116.81749

Floor = 500 feet AGL Ceiling = 60000 feet AGL

MISSION DATA
Mission name = B-21_2
Aircraft code =FM0130100 Speed = 175 kias Power = 70.0
Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	0.0
1000	3000	0.0
3000	10000	0.0
10000	18000	10.0
18000	30000	40.0
30000	60000	50.0

Mission name = C-12_3
Aircraft code =FM0190100 Speed = 175 kias Power = 90.0
Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	1.0
1000	3000	2.0
3000	10000	7.0
10000	18000	60.0
18000	30000	30.0

Mission name = F-16D_3
Aircraft code =FM0440200 Speed = 225 kias Power = 86.0
Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	1.0
1000	3000	2.0
3000	10000	7.0
10000	18000	25.0
18000	30000	60.0
30000	60000	5.0

Mission name = F-22_3
Aircraft code =FM0850100 Speed = 250 kias Power = 35.0
Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	0.5
1000	3000	0.5
3000	10000	1.0
10000	18000	10.0
18000	30000	70.0
30000	60000	18.0

Mission name = F-35A_3
Aircraft code =FM0890200 Speed = 250 kias Power = 75.0
Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization

500	1000	0.5
1000	3000	0.5
3000	10000	1.0
10000	18000	10.0
18000	30000	70.0
30000	60000	18.0

Mission name = KC-46_2
Aircraft code =FC1040100 Speed = 175 kias Power = 85.0

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	0.0
1000	3000	0.0
3000	10000	0.0
10000	18000	10.0
18000	30000	40.0
30000	60000	50.0

Mission name = T-7_2
Aircraft code =FM0500200 Speed = 200 kias Power = 82.1

Altitude Distribution

Lower Alt (feet AGL)	Upper Alt (feet AGL)	Percent Utilization
500	1000	1.0
1000	3000	2.0
3000	10000	7.0
10000	18000	20.0
18000	30000	70.0

MOA OPERATION DATA

MOA name = R-2515

Mission Name	Daily Day OPS	Daily Evening OPS	Daily Night OPS	Monthly Day OPS	Monthly Evening OPS	Monthly Night OPS	Yearly Day OPS	Yearly Evening OPS	Yearly Night OPS	Time On Range (minutes)
B-21_2	0.133	0.006	0.000	4.00	0.17	0.00	48.	2.	0.	90.
C-12_3	5.100	0.144	0.014	153.00	4.33	0.42	1836.	52.	5.	45.
F-16D_3	13.583	0.406	0.153	407.50	12.17	4.58	4890.	146.	55.	45.
F-22_3	2.611	0.058	0.008	78.33	1.75	0.25	940.	21.	3.	45.
F-35A_3	30.819	2.181	0.206	924.58	65.42	6.17	11095.	785.	74.	45.
KC-46_2	13.583	0.406	0.153	407.50	12.17	4.58	4890.	146.	55.	0.
T-7_2	14.006	0.475	0.000	420.17	14.25	0.00	5042.	171.	0.	45.

***** MOA RANGE NOISEMAP *****
RESULTS

The noise metric is CNEL.

MOA RESULTS

MOA Name	MOA Area (sq statute miles)	Uniform Distributed Sound Level (dB)	Number of Daily Events Above SEL of 65.0 dB
R-2515	1812.5	57.8	0.1

<Run Log>
Date: 9/14/2020
Start Time: 12:57:26
Stop Time: 12:57:45
Total Running Time: 0 minutes and 19 seconds.