Final Environmental Assessment for the
Huntsville International Airport Reentry Site Operator License
and Sierra Space Corporation Vehicle Operator License

Agencies: Federal Aviation Administration (FAA), lead federal agency; the National Aeronautics and Space Administration (NASA) and U.S. Coast Guard, cooperating agencies.

DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION: This Final EA addresses the potential environmental impacts of the Huntsville-Madison County Airport Authority (Authority) proposal to operate the Huntsville International Airport (HSV or Airport) as a reentry location for horizontally landed reentry vehicles. Under the Proposed Action, the FAA would issue a Reentry Site Operator License to the Authority in order to offer HSV as a reentry site to Sierra Space Corporation, and the FAA would provide unconditional approval of the portion of the Airport Layout Plan that shows the designation of a reentry site boundary. In addition, under the Proposed Action the FAA would issue a Vehicle Operator License to Sierra Space for conducting up to one reentry annually in 2023 to 2025, up to two reentries in 2026, and up to three reentries in 2027 of the Dream Chaser vehicle at HSV. Under the Proposed Action, the FAA would also issue Letter(s) of Agreement to HSV and Sierra Space to outline notification procedures prior to, during, and after an operation and procedures for issuing a Notice to Airmen.

This EA is submitted for review pursuant to section 102(2)(C) of the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code 4321, et seq.), Council on Environmental Quality NEPA-implementing regulations (40 Code of Federal Regulations Parts 1500 to 1508),[1,2] FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures,* and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*.

PUBLIC REVIEW PROCESS: In accordance with the applicable requirements, the FAA released the Draft EA for public review on November 12, 2021. Comments were due on December 22, 2021. The FAA provided a public notice of the availability of the Draft EA for public review and comment through the Federal Register and local newspaper advertisement. The FAA held a virtual public meeting on December 9, 2021. An electronic version of the Draft EA was made available on the FAA's website. The FAA has considered all comments received on the Draft EA in preparing this Final EA.

CONTACT INFORMATION: Questions regarding this Final EA can be addressed to Ms. Stacey Zee, Environmental Protection Specialist, Federal Aviation Administration, 800 Independence Avenue, SW, Suite 325, Washington, DC 20591; email HuntsvilleReentry@icf.com.

This EA becomes a Federal document when evaluated, signed, and dated by the responsible FAA Official.

[1] The Council on Environmental Quality (CEQ) amended its regulations implementing NEPA effective September 14, 2020. Under section 1506.13 of the amended regulations, agencies have discretion to apply the amended regulations to NEPA processes that were begun before September 14, 2020. FAA initiated its NEPA process for this action on February 6, 2020 and has decided not to apply the amended regulations. Therefore, the prior 1978 CEQ regulations continue to apply to this NEPA process.

[2] CEQ published a final rule in the Federal Register on April 20, 2022, to amend certain provisions of its regulations for implementing NEPA. The rule is effective on May 20, 2022. This Final EA was prepared in accordance with the 1978 version of CEQ's NEPA-implementing regulations.

Responsible FAA Official: MICHELLE S MURRAY Digitally signed by MICHELLE S MURRAY Date: 2022.05.11 09:26:37 -04'00' Date: May 11, 2022

Michelle S. Murray
Manager, Safety Authorization Division

FINAL ENVIRONMENTAL ASSESSMENT FOR THE HUNTSVILLE INTERNATIONAL AIRPORT REENTRY SITE OPERATOR LICENSE AND SIERRA SPACE CORPORATION VEHICLE OPERATOR LICENSE

Lead Agency:
Office of Commercial Space Transportation
Federal Aviation Administration
Stacey Zee, Environmental Protection Specialist
800 Independence Avenue, SW, Suite 325
Washington, DC 20591
202-267-9305

Cooperating Agencies:
National Aeronautics and Space Administration
U.S. Coast Guard

Madison County, City of Huntsville, Alabama

Abstract: This Final EA addresses the potential environmental impacts of the Huntsville-Madison Country Airport Authority (Authority) proposal to operate the Huntsville International Airport (HSV) as a reentry location for horizontally landed commercial space reentry vehicles. Under the Proposed Action, the FAA would issue a Reentry Site Operator License to the Authority in order to offer HSV as a reentry site to Sierra Space Corporation and the FAA would provide unconditional approval of the portion of the Airport Layout Plan that shows the designation of a reentry site boundary. In addition, under the Proposed Action the FAA would issue a Vehicle Operator License to Sierra Space for reentries of the Dream Chaser vehicle at HSV. The FAA would issue Letters of Agreement to HSV and Sierra Space to outline notification procedures prior to, during and after an operation as well as procedures for issuing a Notice to Airmen. The Proposed Action would not result in significant effects.

Final Environmental Assessment for the
Huntsville International Airport Reentry Site Operator License
and Sierra Space Corporation Vehicle Operator License

Agencies: Federal Aviation Administration (FAA), lead federal agency; the National Aeronautics and Space Administration (NASA) and U.S. Coast Guard, cooperating agencies.

DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION: This Final EA addresses the potential environmental impacts of the Huntsville-Madison County Airport Authority (Authority) proposal to operate the Huntsville International Airport (HSV or Airport) as a reentry location for horizontally landed reentry vehicles. Under the Proposed Action, the FAA would issue a Reentry Site Operator License to the Authority in order to offer HSV as a reentry site to Sierra Space Corporation, and the FAA would provide unconditional approval of the portion of the Airport Layout Plan that shows the designation of a reentry site boundary. In addition, under the Proposed Action the FAA would issue a Vehicle Operator License to Sierra Space for conducting up to one reentry annually in 2023 to 2025, up to two reentries in 2026, and up to three reentries in 2027 of the Dream Chaser vehicle at HSV. Under the Proposed Action, the FAA would also issue Letter(s) of Agreement to HSV and Sierra Space to outline notification procedures prior to, during, and after an operation and procedures for issuing a Notice to Airmen.

This EA is submitted for review pursuant to section 102(2)(C) of the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code 4321, et seq.), Council on Environmental Quality NEPA-implementing regulations (40 Code of Federal Regulations Parts 1500 to 1508),[1,2] FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures,* and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*.

PUBLIC REVIEW PROCESS: In accordance with the applicable requirements, the FAA released the Draft EA for public review on November 12, 2021. Comments were due on December 22, 2021. The FAA provided a public notice of the availability of the Draft EA for public review and comment through the Federal Register and local newspaper advertisement. The FAA held a virtual public meeting on December 9, 2021. An electronic version of the Draft EA was made available on the FAA's website. The FAA has considered all comments received on the Draft EA in preparing this Final EA.

CONTACT INFORMATION: Questions regarding this Final EA can be addressed to Ms. Stacey Zee, Environmental Protection Specialist, Federal Aviation Administration, 800 Independence Avenue, SW, Suite 325, Washington, DC 20591; email HuntsvilleReentry@icf.com.

This EA becomes a Federal document when evaluated, signed, and dated by the responsible FAA Official.

[1] The Council on Environmental Quality (CEQ) amended its regulations implementing NEPA effective September 14, 2020. Under section 1506.13 of the amended regulations, agencies have discretion to apply the amended regulations to NEPA processes that were begun before September 14, 2020. FAA initiated its NEPA process for this action on February 6, 2020 and has decided not to apply the amended regulations. Therefore, the prior 1978 CEQ regulations continue to apply to this NEPA process.

[2] CEQ published a final rule in the Federal Register on April 20, 2022, to amend certain provisions of its regulations for implementing NEPA. The rule is effective on May 20, 2022. This Final EA was prepared in accordance with the 1978 version of CEQ's NEPA-implementing regulations.

Responsible FAA Official: _____ Date: _____

Michelle Murray
Manager, Safety Authorization Division

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Acronyms and Abbreviations

A

AADT	Annual Average Daily Traffic
ADCNR	Alabama Department of Conservation and Natural Resources
ADOT	Alabama Department of Transportation
AGL	Above Ground Level
AHA	Aircraft Hazard Area
AHC	Alabama Historical Commission
AL	Alabama
ALP	Airport Layout Plan
ALTRV	Altitude Reservations
ANSP	Air Navigation Service Providers
APE	Area of Potential Effect
ARP	Federal Aviation Administration Office of Airports
ARTCC	Air Route Traffic Control Center
AST	Federal Aviation Administration Office of Commercial Space Transportation
ATC	Air Traffic Control ATCT Airport Traffic Control Tower

C

C-DNL	C-weighted DNL
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CM	Cargo Module

D

dB	Decibel
dBA	A-weighted Decibel
dBC	C-weighted Decibel
DB	Deorbit burn
DC	Dream Chaser
DNL	Day-night Average Sound Level
DOT	Department of Transportation

E

EA	Environmental Assessment
EFH	Essential Fish Habitat
EJ	Environmental Justice
EO	Executive Order
ESA	Endangered Species Act

F

FAA	Federal Aviation Administration
FOD	Foreign objects and debris
FONSI	Finding of No Significant Impact
FR	Federal Register

G

gal	Gallon
GAO	Government Accountability Office
GHG	Greenhouse Gas

H

HHS	U.S. Department of Health and Human Services
HSV	Huntsville International Airport
HUD	U.S. Department of Housing and Urban Development
H2O2	Hydrogen Peroxide

I

ISS	International Space Station

L

lbs	Pounds
LSOL	Launch Site Operator License
LOA	Letter of Agreement
LOS	Level of Service

M

MMPA	Marine Mammal Protection Act
MPS	Main Propulsion System
MSL	Mean Sea Level

N

NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NMFS	National Marine Fisheries Service
nmi	Nautical Miles
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge

O

OSHA	Occupational Safety and Health Administration

P

PIC	Pilot-in-Command
psf	Pound per Square Foot

R

RSOL	Reentry Site Operator License
RP-1	Rocket Propellant-1
RV	Reentry Vehicle

S

SD	Standard Departure Procedures
SDTSA	State Designated Tribal Statistical Area
SHPO	State Historic Preservation Officer
STAR	Standard Terminal Arrival Routes
SUA	Special Use Airspace

T

TDAT	Tribal Directory Assessment Tool
TFR	Temporary Flight Restriction
TRACON	Terminal Radar Approach Control
TVA	Tennessee Valley Authority

U

U.S.	United States
U.S.C.	United States Code

USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

V

VOL	Vehicle Operator License
VOR	Very High Frequency Omni-directional Range

CHAPTER 1

PURPOSE OF AND NEED FOR ACTION

1.0 INTRODUCTION

The Huntsville-Madison County Airport Authority (Authority), owner and operator of Huntsville International Airport (HSV or Airport) is seeking a Federal Aviation Administration (FAA) Reentry Site Operator License (14 Code of Federal Regulations [CFR] Part 433). The Authority is working with the FAA Office of Commercial Space Transportation (AST) to develop and submit a FAA Reentry Site Operator License (RSOL) application to operate a commercial reentry site at the Airport. Under the RSOL, the Authority could offer HSV to Sierra Space Corporation for the operation of the Dream Chaser reentry vehicle. Concurrently, Sierra Space is applying to the FAA for a Vehicle Operator License (VOL) to land the Dream Chaser[3] at the Airport. As authorized by Executive Order (EO) 12465, *Commercial Expendable Launch Vehicle Activities* (49 Federal Register 7099, 3 CFR, 1984 Comp., p. 163), and Chapter 509 of Title 51 of the U.S. Code, the FAA licenses and regulates U.S. commercial space launch and reentry activity, as well as the operation of non-Federal launch and reentry sites. Under the Proposed Action, the FAA would provide unconditional approval of the portion of the Airport Layout Plan (ALP) that shows the designation of a reentry site boundary and would also develop Letter(s) of Agreement (LOAs) with HSV and Sierra Space to outline notification procedures prior to, during, and after an operation as well as procedures for issuing a Notice to Airmen (NOTAM).

The FAA is responsible for considering HSV's request for a modification to the ALP. An ALP is an FAA-approved drawing or series of drawings that depicts both existing facilities and planned development for an airport. The HSV ALP must depict the boundaries to all areas owned or controlled by the sponsor for airport purposes. The Federal actions for this Environmental Assessment (EA) include the issuance of an RSOL to HSV, a VOL to Sierra Space Corporation for reentries of the Dream Chaser vehicle and unconditional approval of a modification to the ALP to reflect the reentry site boundary (FAA Order 5050.4B, Paragraph 202(c)(2)).

The FAA's issuance of an RSOL to the Authority to operate a commercial space reentry site at HSV, a VOL to Sierra Space for reentries of the Dream Chaser vehicle, and unconditional ALP approval[4] of the reentry site boundary (collectively referred to as the Proposed Action, further described in **Chapter 2** of this EA) are federal actions subject to environmental review under the National Environmental Policy Act (NEPA) of 1969 as amended (42 United States Code [U.S.C.] §4321, et seq.). The FAA is the lead federal agency and the National Aeronautics and Space Administration (NASA), and the U.S. Coast Guard (USCG) are cooperating agencies.

This EA evaluates the potential environmental impacts that may result from the FAA's issuance of a RSOL to the Authority and a VOL to Sierra Space and the FAA's unconditional approval of the portion of the ALP

[3] The Dream Chaser vehicle would be launched as a payload on a vertical launch vehicle from Cape Canaveral Space Force Station or another similar launch site. These launches would be covered by separate licenses or authorizations obtained by the launch vehicle operator and are not included as a part of the Proposed Action in this EA.

[4] Unconditional ALP approval means that environmental review has been completed and the Airport Sponsor is authorized to begin developing the project (FAA Order 5050.4B, Paragraph 202(c)(2)). Conditional ALP approval means that the FAA has not completed the environmental review process and the Airport Sponsor is not yet authorized to begin development (FAA Order 5050.4B, Paragraph 202(c)(1)).

that shows the designation of a reentry site boundary. Additionally, under the Proposed Action, the FAA would also develop LOAs with HSV and Sierra Space to outline notification procedures prior to, during and after an operation as well as procedures for issuing a NOTAM. The successful completion of the environmental review process does not guarantee that the FAA would issue a RSOL to the Authority or a VOL to Sierra Space. The Proposed Action must also meet all FAA safety, risk, and financial responsibility requirements per 14 CFR Part 400. If another prospective commercial space vehicle operator applies for a license to conduct reentry operations HSV in the future, the reentry vehicle operator would apply for a VOL and HSV may request to modify their RSOL to accommodate the additional operator. The FAA would re-evaluate the new reentry operation's potential impacts in a separate NEPA analysis.

1.1 BACKGROUND

HSV is located in Madison County, Alabama, about 9 miles southwest of downtown Huntsville. Serving more than 1.2 million passengers each year, HSV is the largest commercial airport in northern Alabama. The Airport spans about 6,000 acres and is at an elevation of 629 feet above mean sea level; a map of the airport is shown in **Figure 1-1**. HSV offers and receives flights from major destination airports including Hartsfield-Jackson Atlanta International Airport, Charlotte Douglas International Airport, Chicago O'Hare International Airport, Dallas-Ft. Worth International Airport, Denver International Airport, Detroit Metropolitan Wayne County Airport, George Bush Intercontinental/Houston Airport, Orlando International Airport, and Washington Dulles International Airport. Along with HSV, the Authority also governs the International Intermodal Center, Jetplex Industrial Park, Signature Flight Support, Four Points by Sheraton Hotel, Sunset Landing Golf Course, and Foreign Trade Zone #83, all of which reside in the Port of Huntsville.

Sierra Space is developing the Dream Chaser, a reusable spacecraft capable of carrying payloads to and from low Earth orbit, including delivering supplies to the International Space Station (ISS). **Figure 1-2** shows a complete mission of the potential reentry vehicle. The Dream Chaser would be launched to orbit as a payload atop the United Launch Alliance's (ULA) vertically launched Vulcan rocket or equivalent from Cape Canaveral Space Force Station (CCSFS). The potential environmental impacts of Vulcan or equivalent launches from Cape Canaveral were analyzed in the U.S. Space Force (USSF) June 2019 *Environmental Assessment for Vulcan Centaur Program operations and launch on Cape Canaveral Air Force Station* (June 2019 EA). The FAA was a cooperating agency and adopted the June 2019 EA and issued a Finding of No Significant Impact (FONSI) to support the potential issuance of a launch license for Vulcan operations from CCSFS on February 27, 2020. This EA analyzes the potential environmental impacts associated with the FAA's issuance of a reentry site operator license for Dream Chaser reentry operations that would occur at HSV.

1.2 FEDERAL AGENCY ROLES

1.2.1 Lead Agency Role

As the lead Federal agency of this EA (40 CFR § 1501.7), the FAA is responsible for analyzing the potential environmental impacts of the Proposed Action and reasonable alternatives. The FAA's federal actions analyzed in this EA include: the issuance of an RSOL to HSV; the issuance of a VOL to Sierra Space; the unconditional approval of a modification to the ALP to reflect the reentry site boundary at HSV; and the issuance of LOAs outlining notification procedures and procedures for issuing NOTAMs.

FIGURE 1-1: PROJECT LOCATION

Sources: ESRI, 2021; RS&H, 2021

This figure is not to scale
and is for graphic purposes only

Legend

HSV

RS&H

N

FIGURE 1-2: REENTRY VEHICLE OPERATION

Source: Sierra Space, 2019

As authorized by EO 12465, *Commercial Expendable Launch Vehicle Activities* (49 Federal Register 7099, 3 CFR, 1984 Comp., p. 163), and Chapter 509 of Title 51 of the U.S. Code, the FAA licenses and regulates U.S. commercial space launch and reentry activity, as well as the operation of non-Federal launch and reentry sites. The FAA's mission is to ensure public health and safety and the safety of property while protecting the national security and foreign policy interests of the United States during commercial launch and reentry operations. In addition, Congress directed the FAA to encourage, facilitate, and promote commercial space launches and reentries.

In addition, the FAA is responsible for considering HSV's request for a modification to the ALP. An ALP is an FAA-approved drawing or series of drawings that depicts both existing facilities and planned development for an airport. The HSV ALP must depict the boundaries to all areas owned or controlled by the sponsor for airport purposes. Unconditional ALP approval means that environmental review has been completed and the Airport Sponsor is authorized to begin developing the project (FAA Order 5050.4B, Paragraph 202(c)(2)). Conditional ALP approval means that the FAA has not completed the environmental review process and the Airport Sponsor is not yet authorized to begin development (FAA Order 5050.4B, Paragraph 202(c)(1)). Under the Proposed Action, the FAA would provide unconditional approval of the portion of the ALP that shows the designation of a reentry site boundary. As the lead agency, the FAA would also develop LOAs with HSV and Sierra Space to outline notification procedures prior to, during, and after an operation as well as procedures for issuing a NOTAM.

Issuance of a commercial space license does not relieve the Airport Sponsor of its obligations under Title 49 U.S.C. §47107 et seq., which sets forth assurances to which an Airport Sponsor agrees as a condition of receiving Federal financial assistance.

1.2.2 Cooperating Agency Roles

A cooperating agency is an agency, other than the lead agency, that has jurisdiction by law or special expertise regarding any environmental impact resulting from a proposed action or reasonable alternative. NASA and USCG are cooperating agencies for this EA due to their special expertise and jurisdictions (40 CFR §§ 1508.15 and 1508.26).

1.3 PURPOSE AND NEED

The purpose and need provides the foundation for identifying intended results or benefits and future conditions. In addition, the purpose and need establishes the basis for determining the range of reasonable alternatives to a proposed action.

The Authority's purpose is to provide a commercial space reentry facility to initiate its reentry site operator capabilities, including the recovery of horizontally landed orbital reusable vehicles. The Authority's need is to facilitate and foster the operation of new types of orbital reentry vehicles to meet the demand for lower-cost space related industries, providing benefits to both the government and the private sectors. The Authority seeks to advance the space industry and foster the local and regional growth and development of the commercial space industry.

Sierra Space's purpose is to provide payload and cargo return services to NASA for resupply of the ISS by landing the Dream Chaser at HSV. These missions are purchased by NASA to provide a commercial resupply service, but Dream Chaser remains owned and operated by Sierra Space. This relationship allows the vehicle to be used to support additional missions for other government and non-government customers. These missions, by Dream Chaser and/or other horizontal vehicles, could include experiments, space tourism, or other related commercial space activities. Sierra Space's need is to have a suitable site to reenter the Dream Chaser vehicle to complete their payload and cargo return service missions. This would further Sierra Space's service goals and support company growth by expanding the offerings to the space industry already prevalent in the U.S. and build an economic base of space-related industries.

1.4 AGENCY INVOLVEMENT

Huntsville distributed early coordination letters to various federal, state, and local agencies including but not limited to, the U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), Alabama Department of Environmental Management, Alabama State Division of Historic Resources, Tennessee Valley Authority (TVA), Morgan County, Madison County, City of Decatur, Town of Somerville, and Native American Tribes.

The early coordination letters and list of agencies contacted for this EA are incorporated in **Appendix A.** The FAA conducted National Historic Preservation Act Section 106 and Government-to-Government consultation with Native American Tribes and the Alabama State Historic Preservation Office (Alabama

Historical Commission). See **Appendix B** for Section 106 and Government-to-Government correspondence and a list of Native American Tribes contacted.

The FAA consulted with USFWS on potential impacts to biological resources. See **Appendix B** for Endangered Species Act Section 7 correspondence.

The FAA consulted with the officials with jurisdiction over the Section 4(f) resources potentially impacted by the proposed project. See Appendix C for Section 4(f) correspondence.

1.5 PUBLIC INVOLVEMENT

1.5.1 Public Review and Comment on the Draft EA

The FAA released the Draft EA for public review from November 12, 2021, to December 22, 2021. The FAA provided public notice of the availability of the Draft EA for public review and comment through the *Federal Register*[5] and multiple types of media.[6] An electronic version of the Draft EA was available on the FAA's website (see **Appendix E-1**).[7]

The FAA invited interested government agencies, organizations, Native American Tribes, and members of the public to submit comments on the scope and content of the Draft EA. Public comments were received from 40 commenters in total. Public comments received and the FAA's responses are provided in **Appendix E-2**. This Final EA reflects the FAA's review and consideration of all comments received on the Draft EA.

The FAA held a virtual public meeting[8] to solicit comments concerning the scope and content of the Draft EA on Thursday, December 9, 2021, at 5:00 p.m. Central Time. The FAA, the Authority, and Sierra Space gave a presentation on the proposed project and the FAA's licensing process, with Spanish translation also provided to attendees. The presentation shared during this meeting is provided in **Appendix E-1**. Following the presentations, meeting attendees were invited to provide up to a three-minute comment. Nine (9) members of the public provided comments during the meeting. These public comments and the FAA's responses are included in **Appendix E-2**.

[5] https://www.federalregister.gov/documents/2021/11/23/2021-25541/notice-of-availability-notice-of-public-comment-period-notice-of-public-meeting-and-request-for

[6] An email was sent to all members of the project mailing list, a press release was issued to subscribers of News updates for the FAA, an advertisement announcing the availability of the Draft EA was published in the Huntsville Times newspaper, the Madison Record and WHNT-TV posted information from the FAA's press release, and physical copies of the Draft EA were made available at the Triana Public Library in Madison, Alabama and the Downtown Huntsville Library in Huntsville, Alabama.

[7] https://www.faa.gov/space/stakeholder_engagement/huntsville_reentry/

[8] A virtual meeting was held to protect the health and safety of the public and project team in response to COVID-19.

CHAPTER 2

PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action considered in this EA. This chapter also describes a No Action Alternative. FAA Order 1050.1F, Paragraph 6-2.1 states, "An EA may limit the range of alternatives to the proposed action and no action alternative when there are no unresolved conflicts concerning alternative uses of available resources." In the absence of unresolved conflicts (**Chapter 3** provides detailed descriptions as to why there are no unresolved conflicts), the consideration of other alternatives to avoid or minimize potential effects are not warranted. Therefore, the No Action Alternative and current Proposed Action are described and analyzed in this EA.

2.1 PROPOSED ACTION

The Authority has applied to the FAA for a RSOL to operate a commercial reentry site at HSV. Under the RSOL, the Authority could offer the site to Sierra Space to conduct reentries of the Dream Chaser vehicle in compliance with 14 CFR Part 433. An authorization for an RSOL is valid for five years from the issuance date. The Authority may apply to the FAA for a renewal of the RSOL; if so, as part of the FAA's review of the license renewal application, the FAA would conduct an environmental review of the license renewal request. The Authority also seeks FAA's unconditional approval of the reentry site boundary on its ALP in support of its RSOL application.

Sierra Space has applied to the FAA for a VOL to conduct reentries of Dream Chaser, a commercial reentry vehicle, at HSV. Under the VOL, Sierra Space would land Dream Chaser at HSV in support of payload transportation services in compliance with 14 CFR Part 450. The Proposed Action includes the issuance of a VOL to Sierra Space for reentries of the Dream Chaser vehicle. An authorization for a VOL is valid for the length of time of the licensed activity but may not exceed 5 years from the issuance date. Sierra Space may apply to the FAA for a renewal of the VOL. If Sierra Space would apply for a renewal, as part of the FAA's review of the license renewal application, the FAA would conduct an environmental review of the license renewal request.

Sierra Space and the Authority anticipate up to one reentry operation at HSV per year in 2023, 2024, and 2025, up to two reentries in 2026, and up to three reentries in 2027 (see **Table 2-1**). Reentry of the Dream Chaser would occur during the daytime or nighttime depending on the mission and would occur within the anticipated frequencies described above. As a result, in a given year, reentry operations could occur solely during daytime, solely during nighttime, or (if multiple reentries occur within a single year) a combination of the daytime and nighttime reentries. Dream Chaser's cargo module would be disposed of during reentry, and any surviving debris would be intentionally placed in a remote part of the Pacific Ocean (see **Section 2.1.3.4,** *Cargo Module Disposal*).

TABLE 2-1: PROPOSED MAXIMUM NUMBER OF REENTRY OPERATIONS TO HSV

2023	2024	2025	2026	2027
1	1	1	2	3

Source: (Sierra Space, 2020).

The following subsections provide a description of the proposed HSV ALP revisions, the reentry vehicle, and proposed operations.

2.1.1 HSV Airport Layout Plan Update

The Authority must update its ALP to include a reentry site boundary, and this ALP change is subject to approval by the FAA. The ALP was sent to the FAA for preliminary review and approval. The FAA conducted an aeronautical study (2019-ASO-7554-NRA) with respect to the safe and efficient use of navigable airspace and the safety of persons and property on the ground, and the FAA conditionally approved the reentry site boundary on February 20, 2020.[9] The Authority must obtain FAA's unconditional ALP approval of the reentry site boundary as a component of the RSOL application review and approval. The reentry site boundary is established based on the public area distance.[10] The reentry site boundary shown on the ALP is defined as shown in **Appendix C.** The reentry site boundary is shown on an aerial image of HSV in **Figure 2-1**. Runway 18L-36R would be used for reentry operations and no construction would be required.

2.1.2 Reentry Vehicle

Dream Chaser's parameters considered in this EA are summarized in **Table 2-2**. The purpose of describing these parameters is to assess the potential impacts of Sierra Space's reentry vehicle operations from orbit to, and at, HSV. The concept image of the Sierra Space Dream Chaser is shown in **Figure 2-2**.

The Dream Chaser is owned and operated by Sierra Space. Dream Chaser missions are, in part, to support a NASA/Sierra Space contract to resupply the ISS. NASA purchases these missions to provide a commercial resupply service, thus allowing the vehicle to be used to support additional missions for other government and non-government customers.

TABLE 2-2: SIERRA SPACE REENTRY VEHICLE PARAMETERS

Characteristic	Data
Vehicle Length	30 feet
Wingspan	27 feet
Gross Vehicle Weight	24,600 pounds
Landing Gear Configuration	Nose skid and two rear wheels
Runway Length Required for Landing	10,000 feet
Cross-Range Capability	± 570 nautical miles
Propellants[1]	Hydrogen Peroxide (H2O2) and Kerosene (RP-1)
Pressurized/Unpressurized Cargo Capacity	5,500 kilograms, 30 cubic feet
Return Payload Capacity	1,850 kilograms

[1] Dream Chaser propellants are used by a reaction control system for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground. These propellants are residual at landing, where they would be offloaded and transported off the airport (H2O2) or to designated storage areas at the Airport (RP-1).
Source: (Sierra Space, 2019).

[9] Conditional ALP approval means that the FAA has not completed the environmental review process and the Airport Sponsor is not yet authorized to begin development.
[10] The public area distance is the minimum distance between a public area and an explosive hazard.

FIGURE 2-1: REENTRY SITE BOUNDARY

Sources: ESRI,2019; RS&H, 2019

0 0.1 0.2 0.3 0.4 0.5 Miles

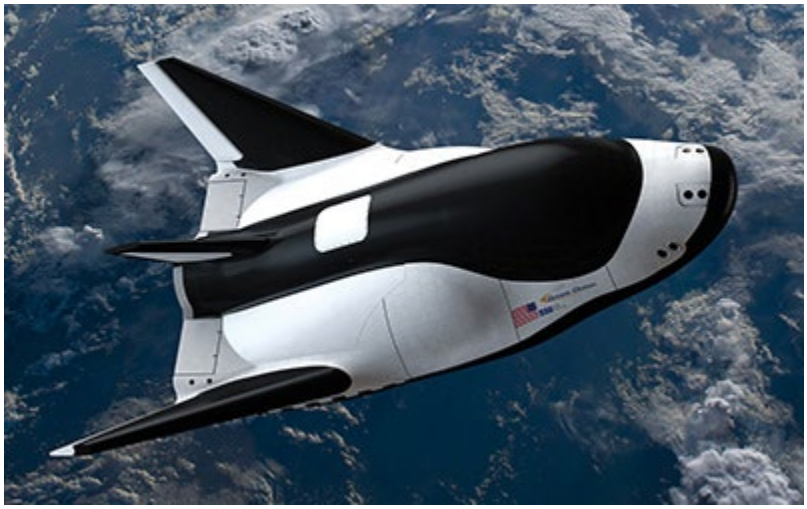
N

Legend

Reentry Site Boundary

RS&H

FIGURE 2-2: REENTRY VEHICLE



Source: (Sierra Space, 2021).

2.1.3 Reentry Operations

Reentry trajectories from orbit are dependent on the specific mission that Sierra Space's Dream Chaser vehicle flies and are defined prior to the launch of Dream Chaser. During the reentry sequence, Dream Chaser has set reentry windows, or timeframes, to begin descent into the Earth's atmosphere to meet the designed reentry trajectory. If No-Go criteria are met, Dream Chaser would remain on-orbit until the specified reentry trajectory can be received.

All reentry operations would comply with the necessary notification requirements, including issuance of Notices to Airmen (NOTAMs) for impacts to airspace during reentry operations and Notices to Mariners (NOTMARs) for impacts to navigable waterways during cargo module disposal, as defined in agreements required for a VOL issued by the FAA AST. A NOTAM provides notice of unanticipated or temporary changes to components of, or hazards in, the National Airspace System (FAA Order 7930.2S, *Notices to Airmen [NOTAM]*). The FAA issues a NOTAM at least 48-72 hours prior to a launch activity in the airspace to notify pilots and other interested parties of temporary conditions. Similarly, the National Geospatial-Intelligence Agency (NGA), in conjunction with the USCG, publishes NOTMARs weekly and as needed, informing the maritime community of temporary changes in conditions or hazards in navigable waterways. Advance notice via NOTAMs and NOTMARs and the identification of Aircraft Hazard Areas (AHAs) and Ship Hazard Areas (SHAs) would assist pilots and mariners in scheduling around any temporary disruption of flight or shipping activities in area of operation. Sierra Space would also coordinate with impacted foreign Air Navigation Service Providers (ANSPs) in defining return trajectories. Reentry operations would be infrequent (up to a maximum of three per year), or short duration, and scheduled in advance to minimize interruption to air and ship traffic.

2.1.3.1 Pre-Flight Activities

Pre-flight activities occur before a launch. Sierra Space would be required to adhere to the pre-flight activities described in a letter of agreement established between Sierra Space and the Authority, including:

- notifying the Authority before a launch of a vehicle that intends to land at the HSV,
- coordinating all operations with the FAA ATC, and
- notifying other appropriate airspace scheduling agencies in accordance with the Authority's Scheduling and Notification Plan.

Designated Authority personnel would notify Sierra Space of other activities at HSV and resolve potential conflicts for use.

2.1.3.2 Pre-Reentry Activities

Pre-reentry activities are preparations to land on Earth while the vehicle is in orbit. Following procedures and plans outlined in the RSOL application, flight and ground crews would be trained for nominal and off-nominal reentry operations before each reentry, and training would be repeated with various failure scenarios to ensure crew readiness. Pre-reentry activities include:

- notification of the specific reentry window(s) times and reentry operations;
- coordination of reentry operations with HSV, Air Traffic Control Tower (ATCT), and other appropriate agencies; and
- staging of ground support equipment at HSV for receipt of the vehicle post-landing.

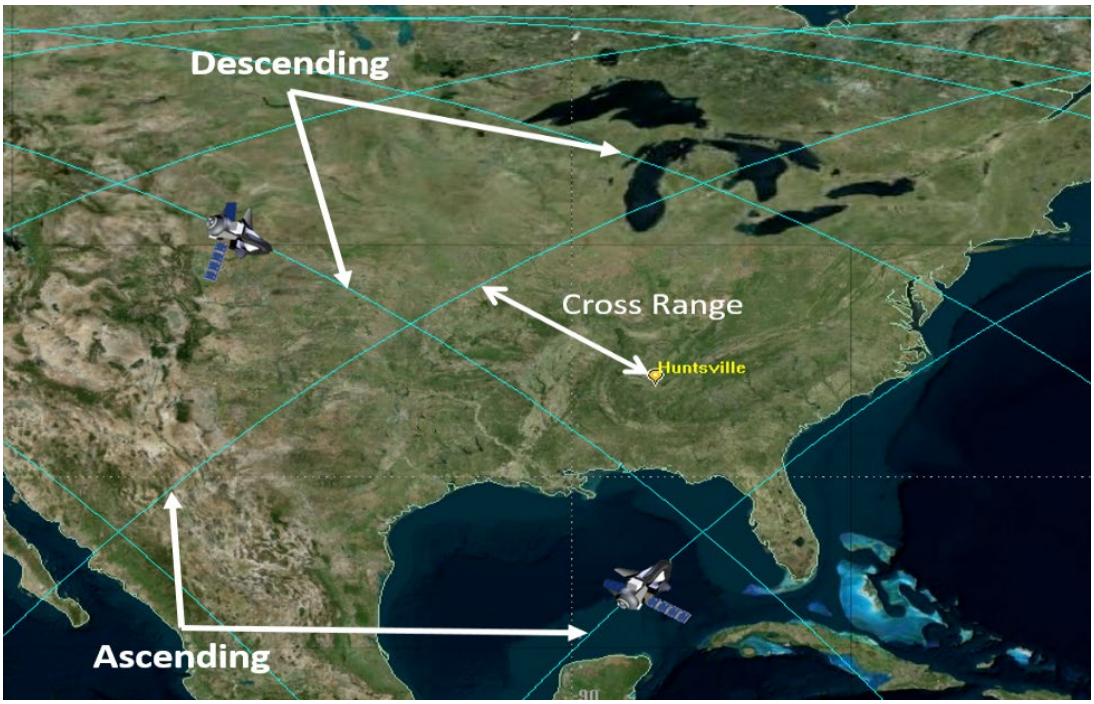
2.1.3.3 Reentry Vehicle Flight Paths

Runway 18L-36R would be the primary runway for landing. The actual reentry point and trajectory of the reentry vehicle would depend upon the characteristics of its orbital flight, including the orbital inclination and flight direction, and the control characteristics of the reentry vehicle.

The reentry vehicle would reenter from the south on an ascending trajectory (travelling in a northerly direction relative to the latitudes of earth), with high atmospheric overflight of the southwestern United States or Central American countries prior to landing at HSV. The proposed bounding trajectories are based on the maximum cross-range capability at two different orbital missions (ISS and 28.5° inclination) along with the maximum cross-range capabilities for the reentry vehicle to bound a reentry corridor (see **Figure 2-3**). The specific trajectory a reentry vehicle travels is a function of where the orbital ground track location, relative to the landing site, is at the time of departure from orbit. This is calculated as a function of reentry planning leading up to a planned deorbit burn and will be provided to necessary parties in advance of an operation as specified in the negotiated LOAs.

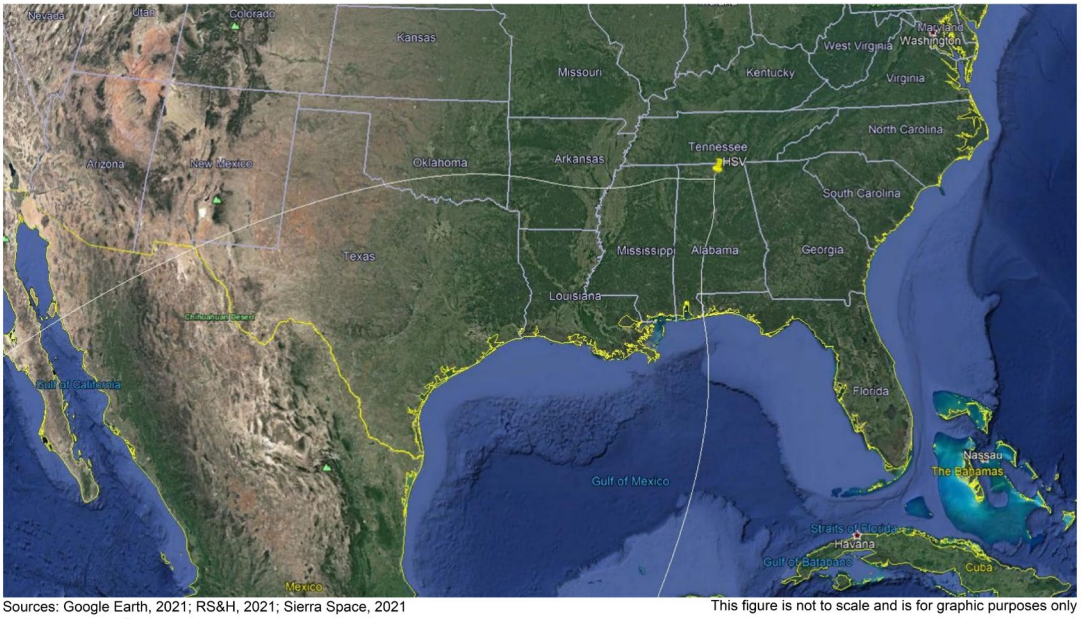
Dream Chaser has a cross range capability of ±570 nautical miles (nmi). This means the ground track of the Dream Chaser can be up to ±570 nmi away when perpendicular to the landing site to have enough energy to land. This provides Dream Chaser with added operational capability by not having to wait for an orbital ground track to align perfectly with the intended landing site. Cross Range is illustrated in **Figure 2-4.**

FIGURE 2-3: BOUNDING REENTRY TRAJECTORIES



Source: Sierra Space, 2020.

FIGURE 2-4: CROSS RANGE



Sources: Google Earth, 2021; RS&H, 2021; Sierra Space, 2021

This figure is not to scale and is for graphic purposes only

Legend

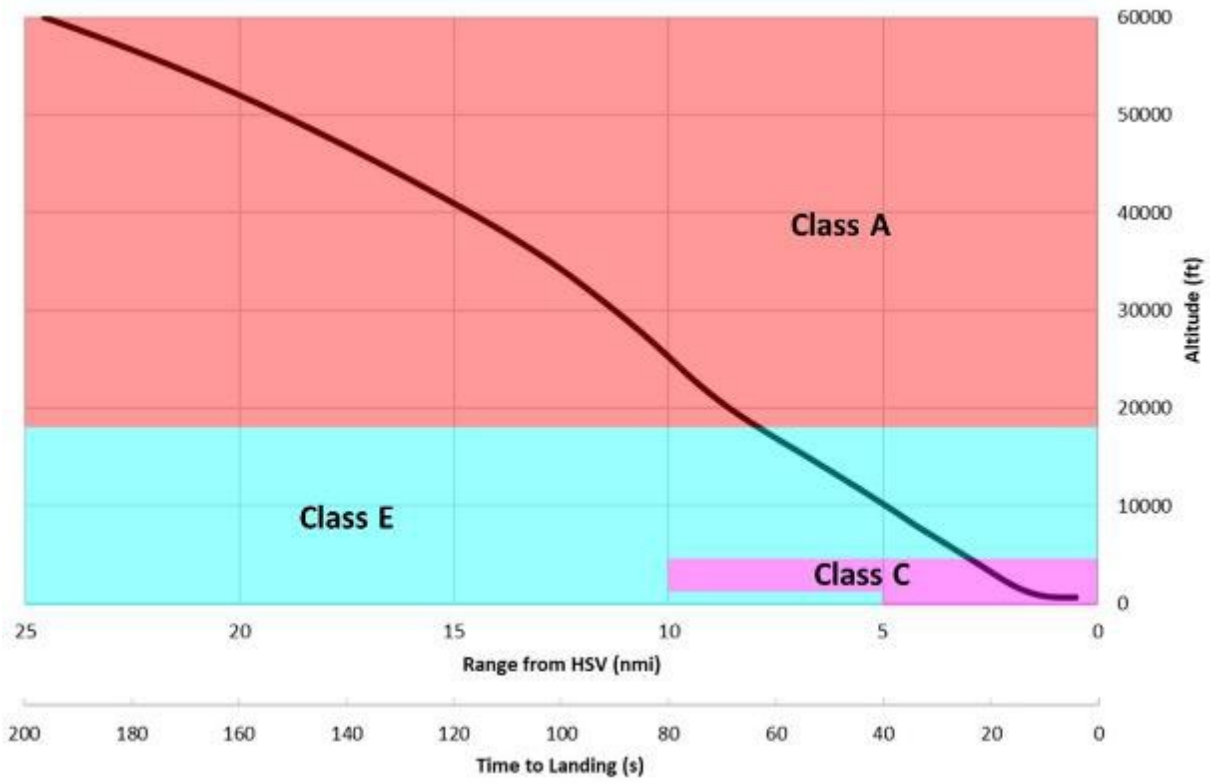
HSV

Trajectories

N

The Dream Chaser vehicle would remain above controlled airspace for the majority of the overflight of New Mexico, Texas, Oklahoma, Arkansas, Louisiana, Mississippi, Florida, and Alabama. The reentry vehicle would descend below 60,000 feet altitude above mean sea level (MSL) approximately 10-20 miles from HSV prior to landing (15 nm southwest of HSV) and would be operating below 60,000 MSL for about three to four minutes (see **Figure 2-5)**. The Dream Chaser would slow to subsonic speed at an altitude of approximately 35,000 feet while still flying northeast. The vehicle would turn directly onto an extended straight in final approach portion that commences approximately 8.5 nm from Runway 18L-36R threshold at an altitude of approximately 19,000 feet above MSL.

FIGURE 2-5: DREAM CHASER NOMINAL REENTRY THROUGH NATIONAL AIRSPACE SYSTEM



Source: (FAA, 2020) (Sierra Space, 2020).

The FAA does not anticipate altering the dimensions (shape and altitude) of the airspace. However, temporary closures of existing airspace may be necessary to ensure public safety during the proposed operations.

The FAA would issue Temporary Flight Restrictions (TFRs)[11] via a NOTAM for the reentry vehicle's operation in the controlled airspace or Altitude Reservations (ALTRVs)[12] from ATC as described in Sierra Space's LOA with FAA Air Traffic Organization ATC facilities. Airspace jurisdiction in the vicinity of the

[11] A TFR includes information such as: TFR size location, closure size, location of closure (all or portion of the TFR), length of time, and number of hours before reentry. A TFR would be mission specific by each reentry vehicle operator.
[12] An Altitude Reservation (ALTRV) is defined by the FAA as airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished.

proposed Dream Chaser flight path is held by the Memphis Air Route Traffic Control Center (ARTCC) and the Atlanta ARTCC.

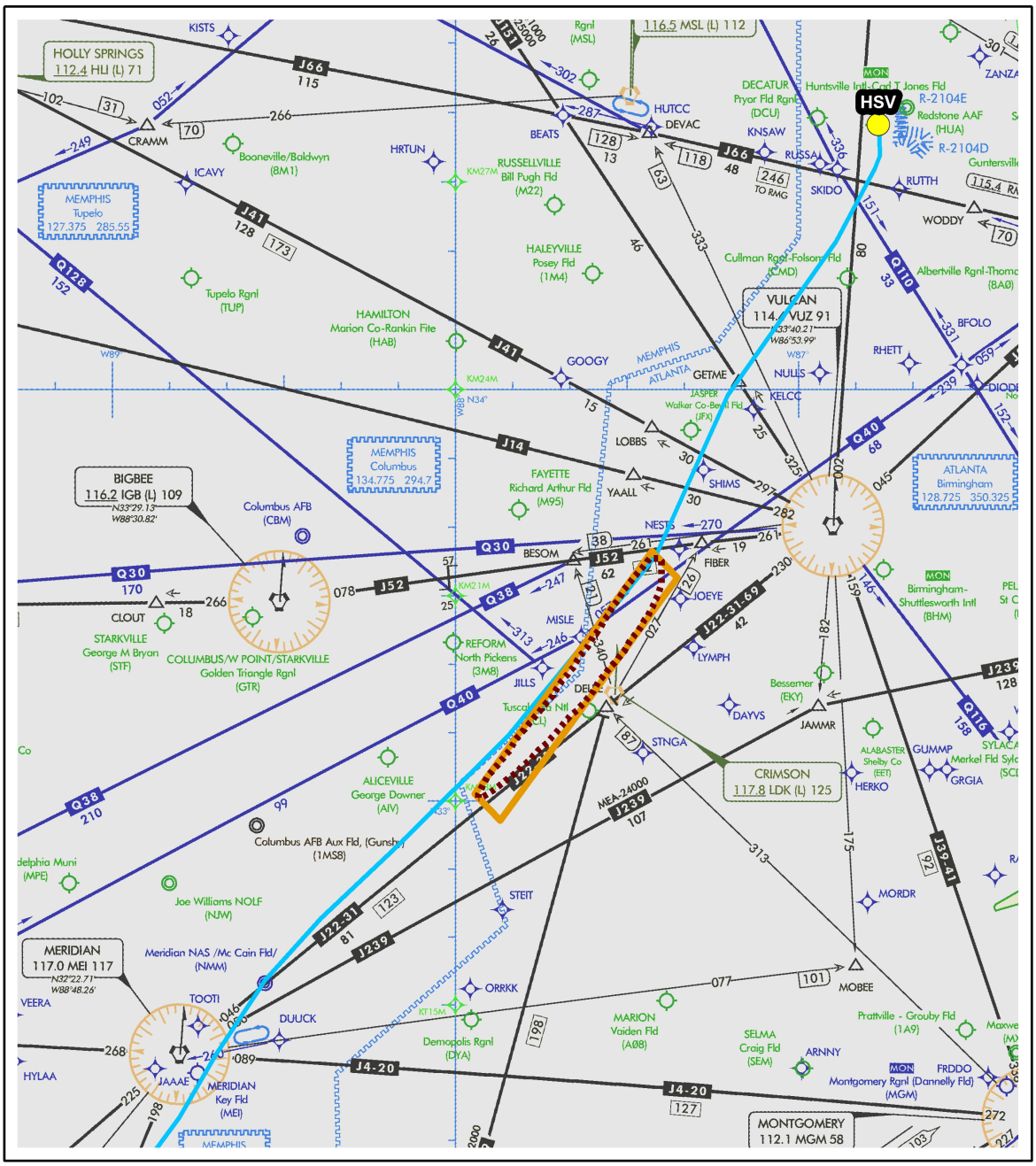
The extent of the NOTAM needed for each reentry would depend on the trajectory and associated aircraft hazard area (AHAs), which will be determined in the flight safety analysis. It should also be noted that issuance of a RSOL and/or VOL does not relieve a licensee of its obligation to comply with any other laws or regulations, nor does it confer any proprietary, property, or exclusive rights in the use of airspace or outer space (14 CFR § 420.41). For the purposes of the environmental review, **Figure 2-6** and **Figure 2-7** illustrate representative potential AHAs for Sierra Space's proposed operations.

Figure 2-6 shows the representative AHA generated for the zero nmi cross range deorbit opportunity and a potential NOTAM. The AHA was calculated using seasonal considerations of annual average winds and a calculated buffer area to account for slight flight path alternations. Seasonal considerations (e.g., wind), or operational changes (e.g., changes in the payloads being carried back from orbit), could further result in slight alterations of the nominal deorbit opportunity trajectory to the Airport. **Figure 2-7** shows the ±570 nmi cross range AHA deorbit opportunities that could result from varying seasonal winds or operational changes. For different cross range deorbit opportunities, an actual NOTAM is expected to be the same relative size as the one calculated for the zero nmi cross range case but exist somewhere within the total cross range AHA bounding box. It is possible for a mission to have two deorbit opportunities, or back-to-back deorbit opportunities, to HSV. In that case, two AHAs would occur, and two NOTAMs would need to be published. If the Dream Chaser does not deorbit on the first viable opportunity to land at HSV, then Dream Chaser would remain on orbit for one more revolution around the Earth (~90 minutes) and attempt a second deorbit on the other cross range trajectory to land at HSV.

The duration of the AHA and NOTAM is dependent on several FAA determined factors. For a nominal deorbit opportunity (i.e., deorbit burn to wheels stop on the runway), Dream Chaser's reentry would last approximately 1 hour. The AHA is generated for a subset of the reentry flight profile when a debris generating event could impact aircraft at or above the FAA criteria. The time range issued in the NOTAM assumes the time it would take debris to fall if a failure were to occur. For these reasons, the AHA and NOTAM is anticipated to be active for 1 hour, unless back-to-back deorbit attempts are needed. In that case a separate anticipated 1-hour NOTAM would be issued for the first deorbit attempt and the second deorbit attempt. More specific time ranges of the AHA and NOTAM is subject to change after further FAA refinement.

A nominal reentry to HSV is anticipated to require a NOTAM lasting 1 hour. Aircraft would be re-routed along established alternatives routes in the airspace. Aircraft travel on existing enroutes and flight paths that are used on a daily basis are routinely re-routed to account for weather and other temporary restrictions. Also, not all reentry proposed operations would affect the same aircraft routes or the same airports, and re-routing associated with the proposed reentry-related closures represents an extremely small fraction of the total amount of re-routing that occurs from all other reasons in a given year.

FIGURE 2-6: NOMINAL AHA AND NOTAM



Sources: ESRI, 2021; RS&H, 2021

This figure is not to scale and is for graphic purposes only

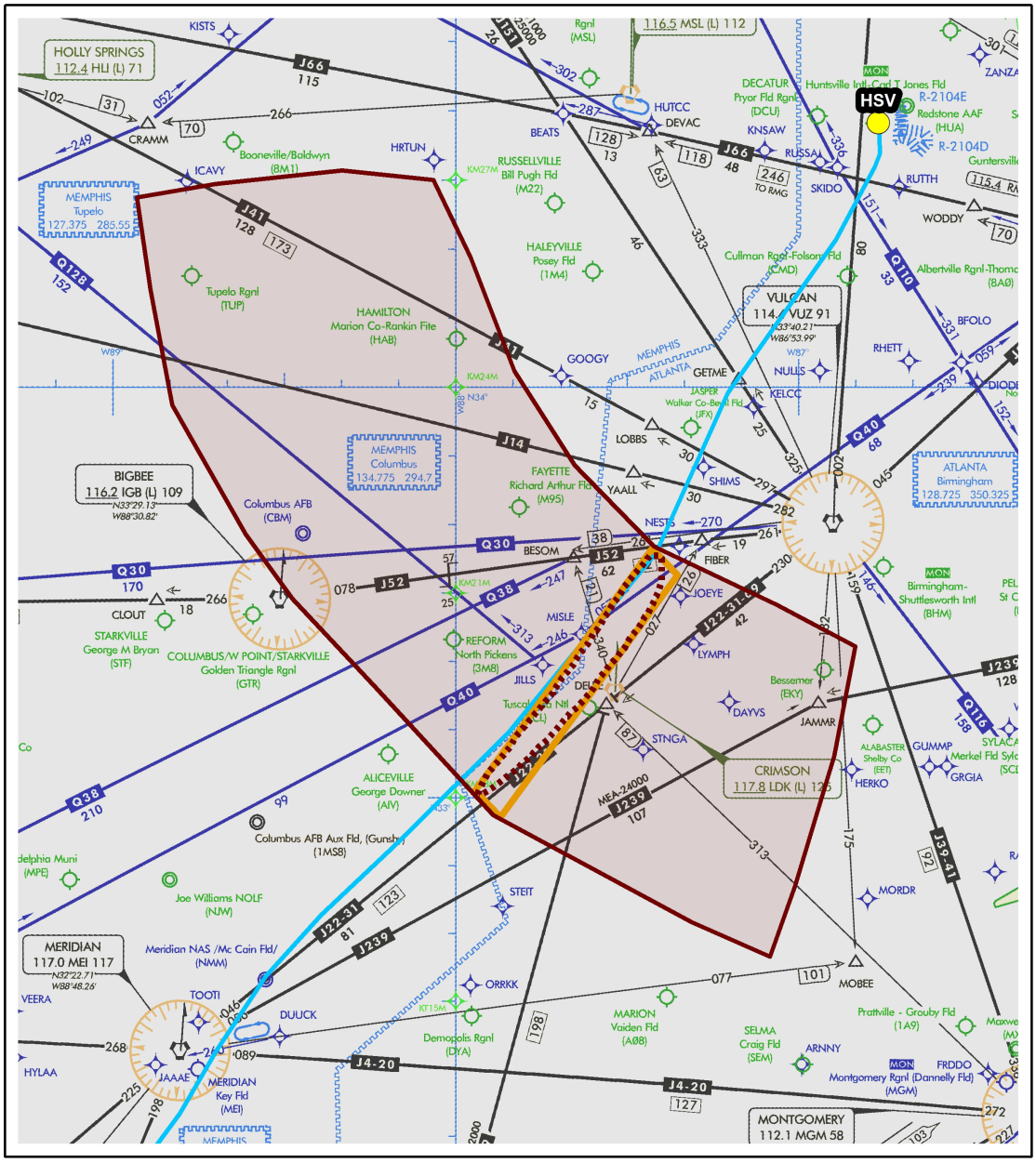
Legend

- Nominal AHA
- Nominal Trajectory
- NOTAM
- Runway 18L-36R

N

RS&H

FIGURE 2-7: CROSS RANGE AHA



Sources: ESRI, 2021; RS&H, 2021

This figure is not to scale and is for graphic purposes only

Legend

- Cross Range AHA
- Nominal Trajectory
- Nominal AHA
- Runway 18L-36R
- NOTAM

N

RS&H

All reentry operations would continue to comply with the necessary notification requirements, including issuance of NOTAMs, consistent with current procedures. Enroute flights would utilize established alternative routes to minimize interruption to air traffic. Safety and security factors dictate that use of airspace and control of air traffic be closely regulated. The alternative flight paths would be the same flight paths that are used for other re-route reasons, such as weather issues, runway closures, wildfires, military exercises, airspace congestion, and presidential flights. The magnitude of aircraft re-routing depends on several conditions, including the time of day, the day of the week, and the month of the year, since air traffic volume fluctuates over time. For example, a reentry operation occurring during the day would have more airspace-related conflicts than a nighttime operation when there are fewer aircraft competing for the affected airspace. The duration of the closure also affects the number of necessary re-routes to ensure safety in the affected airspace.

Due to the approach from the west to a landing on the Runway 18L-36R, the operation also has the potential to affect aviation operations using Runway 18R-36L. Sierra Space's Concept of Operations would indicate a time period during which Runway 18R-36L may be unavailable to landing traffic as the re-entry vehicle transits to the extended Runway 18L-36R centerline. Concurrence with the FAA ATC would be required to determine the amount of time Sierra Space would need to ensure the approach corridor was free from conflicting traffic.

Sierra Space's proposed reentry operations may affect aviation traffic from nearby airports, including Hartsfield-Jackson Atlanta International Airport, Nashville International Airport, and Birmingham Shuttlesworth International Airport. To accommodate traffic in and out of busy hubs, the FAA publishes Standard Terminal Arrival Routes (STARs) to show approach routes to an airport when coming from a particular direction. ATC then clears the pilots to approach an airport using a specific published route, which saves radio time and helps prevent confusion. Each STAR carries a unique name, and many have variations on the beginning of the route, known as transitions.

Sierra Space's proposed reentry operations have the potential to conflict with aviation traffic at other nearby airports. There are several uncontrolled airports under or near the prospective flight paths. These include:

- Northwest Alabama Regional Airport
- Courtland Airport
- Pryor Field Regional Airport
- Bill Pugh Field Airport
- Hartselle Morgan County Regional Airport
- Posey Field Airport
- Cullman Regional Airport-Folsom Field

2.1.3.4 Cargo Module Disposal

After the deorbit burn has concluded, both the Dream Chaser and the cargo module would begin a reentry trajectory. At this point, the cargo module would be jettisoned from the Dream Chaser, placing it on an unpowered ballistic reentry trajectory. The cargo module is designed to demise during reentry. If portions of the cargo module survive reentry (anticipated to be no larger than the size of a shoebox), any

remaining debris would be intentionally placed in the broad open ocean of the Pacific and would be expected to sink. Contents within the cargo module are dependent on the mission manifest. However, hazardous materials are not intended to be transported within the cargo module.

Sierra Space is entering into a Letter of Intent with the USCG, which will describe the required responsibilities and procedures for both Sierra Space and USCG during cargo module reentry and demise/disposal operations, resulting in the issuance of a Notice to Mariners (NOTMAR). The NOTMAR does not alter or close shipping lines; rather, the NOTMAR provides a notification regarding a temporary hazard within a defined Ship Hazard Area (SHA) to ensure public safety during the proposed operations. Sierra Space would use its internal SHA analysis to help USCG define NOTMARs. Sierra Space would provide coordinates to USCG, where it would be published in the Local Notice to Mariners. For international areas, the coordinates are transmitted to the USCG and the National Geospatial Intelligence Agency (NGA). NGA publishes the international notice through the Maritime Safety Office (https://www.nga.mil/). The length of the NOTMAR window is primarily intended to account for the time needed for the operator to meet its mission objectives. For cargo module reentry, the NOTMAR and associated SHA restriction would begin when just after the deorbit burn prior to the separation of the Cargo Module from the Dream Chaser Spaceplane and end when the cargo module and any potential debris have reached the ocean surface. USCG manages the duration, location, and size of its SHA in a way that is similar to how the FAA manages its reserved airspace. For example, The USCG and the operators take steps to reduce the duration of the SHA as a mission unfolds. The location of the NOTMAR is heavily dependent on mission specific items such as the particular cross range the deorbit is occurring on and the final manifest of cargo being disposed of in the Cargo Module. Given rules/regulations[13] around orbital debris mitigation, a specific disposal trajectory for the cargo module will be selected that places any surviving debris in the broad open ocean of the Pacific Ocean and well away from any inhabited coastlines or landmass. The coordinates of the resulting NOTMAR(s) will be calculated as part of Sierra Space's process leading up to reentry and coordinated with the USCG per the Letter of Intent agreed upon by both Sierra Space and USCG.

2.1.3.5 Landing and Post-Flight Handling Procedures

Runway 18L-36R would be unavailable for use by other aircraft for landings and departures from the time Sierra Space's Dream Chaser commits to its de-orbit burn until it is removed from the runway. This period of time would vary given the operational characteristics of each individual mission. Two airfield scenarios could occur after the vehicle's propellant is removed: 1) cargo is unloaded while on the runway, or 2) the vehicle is towed to an apron to unload the cargo. While Dream Chaser is on Runway 18L-36R and propellant safing activities are occurring, aircraft and vehicle movements within 435 feet of the Dream Chaser, while on Runway 18L-36R, would be restricted until the vehicle is in a safe condition and removed from the runway. The Dream Chaser's licensed operation would end when the vehicle is in a safe condition as defined in Sierra Space's VOL. After wheel stop, all traffic would be accommodated on the Airport's primary runway, Runway 18R-36L.

[13] Sierra Space complies with orbital debris mitigation by complying with applicable elements of NASA Standard 8719.14 - Process for Limiting Orbital Debris as well as the applicable portions of FAA Part 450 regarding disposal in broad open ocean areas.

An HSV-specific TFR would be active to temporarily close Runway 18R-36L to aircraft and vehicle ground movements, in addition to Runway 18L-36R, for ~15 minutes starting at deorbit burn (DB) + 30 minutes to touchdown (DB +~45 minutes or R = 0). Once Dream Chaser lands at HSV and the wheels have stopped (R), Runway 18R-36L would be reopened to landings as well as aircraft and vehicle movements.

Table 2-3 provides an overview of the Sierra Space Dream Chaser deorbit burn activities and the timeline of effects to the operational characteristics of Runway 18L-36R. Actual times will vary based on mission specifics.

TABLE 2-3: REENTRY VEHICLE'S DEORBIT TIMELINE

Time	Activity	Aircraft/Vehicle Ground Movements on Runway 18L-36R	Arrival/Departure of Aircraft on Runway 18L-36R
DB -4 hours	Initial Runway Sweep	Available	Available
DB -2 hours	Limit Access to Runway	Available	Not Available
DB -15 min	Secondary Runway Sweep	Not Available	Not Available
DB -0 min	Deorbit Burn Start	Not Available	Not Available
DB +45min (R=0)	Wheel Stop on Runway	Not Available	Not Available
R +10 minutes	Ground Approach Vehicle	Available	Not Available
R +1 hour	Start Propellant Safing[1]	Available	Not Available
R +7 hour	End Propellant Safing	Available	Not Available
R +7.5 hours	Tow to Apron/Existing Facility	Available	Not Available
R +8 hours	Begin Unload of Cargo	Available	Available

[1] - Depending on the mission profile, cargo unload could occur prior to the propellant safing.
DB – Deorbit Burn; R - Recovery/wheel stop on Runway 18L-36R. Source: (Sierra Space, 2020).

During the ground approach vehicle activity (R + 10 min)[14], Airport Operations would conduct the necessary inspections per Part 139 to verify Runway 18L-36R is safe for resumption of traffic. When the reentry vehicle is removed from Runway 18L-36R (R + 7.5 hours), Airport Operations would examine the immediate vicinity of the reentry vehicle recovery area to ensure Runway 18L-36R is free from foreign objects and debris (FOD) or damage and is capable of supporting normal aircraft operations. Runway 18L-36R would be returned to service at R + 8 hours.

Runway crossings by aircraft and vehicles can resume while the reentry vehicle cools and is returned to a safe configuration, subject to the appropriate separation distances required by the presence of residual propellant (hydrogen peroxide: 418 lbs. (36 gal) RP-1: 100 lbs. (15 gal) Total: 518 lbs.). This distance would be established on a case-by-case basis and communicated to the ATCT. With an estimated 518 lbs. of

[14] For reentry vehicles that have a front nose skid (e.g., Dream Chaser), the skid during landing on the runway can build up a large amount of heat due to friction with the runway surface. After the reentry vehicle comes to rest on the runway, a period of time is set aside for the skid to cool down, so it is safe for ground crews to remove the vehicle from the runway. A runway inspection would occur for Runway18L/36R to ensure the pavement surface meets Part 139 standards prior to resuming aircraft operations. Any damage observed would be mitigated prior to the resumption of aircraft operations on Runway 18L/36R. The airport would also be required to comply with all applicable Runway Safety Area standards.

residual propellants, aircraft and vehicle movements (other than propellant safing ground crews) would need to be 435 feet from the vehicle wheel stop until it is in a safe condition. This is known as the public transportation route distance, within which aircraft and vehicle movements should not occur. Other separation distances, the intraline distance (89 feet) and the inhabited building distance (726 feet), would not affect airfield or other HSV activities.

Propellant handling operations, following landing and wheel-stop, would occur on the Runway 18L-36R and unloading of cargo would follow procedures that are dependent on the cargo manifest needs (either on the runway or on an apron or at an existing facility). Sierra Space may employ 10 to 40 full- and part-time personnel for post-reentry procedures. This could include mechanics and ground crew, air crew staff, trainers, office staff, and flight controllers. The estimated number of employees is subject to change based on the number and type of operations.

This EA presents the potential procedures Sierra Space would conduct in order to process Dream Chaser. The first activity following landing is to approach and begin safing the Dream Chaser vehicle on the runway, within the reentry site boundary as marked on the Explosive Site Plan. This can include disengaging and locking out the Dream Chaser propulsion systems, aerodynamic systems, pressurized systems, braking systems, and other safety checks for the safe handling of the reentry vehicle. While on the runway, hydrogen peroxide would be flushed/diluted (as required), offloaded into approved storage containers, and are transported off-Airport and disposed of in an approved method by local waste management. Residual RP-1 would be stored at the existing kerosene storage area at the Airport.

As the reentry vehicle is being placed into a safe configuration and the nose skid is cooling, the reentry vehicle is opened, and all returned cargo is unloaded and prepped for transportation and/or stored at existing facilities as mission requirements dictate. The nose skid is then lifted onto a tug trailer and the reentry vehicle is tugged to an existing apron area or existing facility at HSV. After the reentry vehicle is removed from the runway, HSV would perform a runway inspection to ensure the safety of reopening the runway to other aircraft. Lastly, the reentry vehicle is prepped for transportation back to its home facility. This includes placing the reentry vehicle into a transportation safe configuration. This may include loading onto a transport fixture, folding the wings, stowing the landing gear, and/or protection of sensitive surfaces.

During the time Runway 18L-36R is in use for reentry operations, other aircraft traffic would be directed by Air Traffic Controllers to use Runway 18R-36L. Runway 18L-36R would be closed while propellant safing activities occur. Two airfield scenarios could occur after the vehicle's propellant safing activities: 1) cargo is unloaded while on the runway, or 2) the vehicle is towed to an apron or existing facility to unload the cargo. While on Runway 18L-36R and propellant safing activities are occurring, aircraft and vehicle movements within 435 feet of the Dream Chaser would be restricted until the vehicle is in a safe condition and removed from the runway. Because Runway 18R-36L is the Airport's primary runway, this is not anticipated to represent a significant operational change.

2.2 NO ACTION ALTERNATIVE

NEPA requires agencies to consider a "no action" alternative in their NEPA analyses and to compare the effects of not taking action with the effects of the action alternative(s). Thus, the No Action Alternative serves as a baseline to assess the comparative impacts of the action alternative(s), including the Proposed Action. Under the No Action Alternative, the FAA would not issue a RSOL to the Authority or unconditionally approve ALP changes depicting the reentry site boundary. Additionally, the FAA would not issue a VOL to Sierra Space to conduct reentries at HSV.

The No Action Alternative would not satisfy the Authority's need to enhance the region's economy. This need is also consistent with direction in the National Space Transportation Policy (November 21, 2013). Additionally, the No Action Alternative would not satisfy Sierra Space's need to secure an FAA 14 CFR Part 450 VOL for the area to advance the Dream Chaser vehicle's operational capabilities and ability to service regional customers.

CHAPTER 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter provides a description of the affected environment and potential environmental consequences for the environmental impact categories that have the potential to be affected by the Proposed Action and No Action Alternative. As **Chapter 2** describes, reentry operations would begin in 2023 and continue through 2027. This EA evaluates the 5-year study period from 2023 to 2027 to compare the potential environmental impacts of the Proposed Action compared to the No Action Alternative. Sierra Space's proposed reentry operations described in **Chapter 2** are used for assessing the potential effects of reentry vehicle operations at HSV (i.e., up to 1 reentry annually in 2023, 2024, and 2025; up to 2 reentries in 2026; and up to 3 reentries in 2027). The environmental impact categories assessed in detail in this EA include noise and noise-compatible land use; biological resources; Department of Transportation Act, Section 4(f); historical, architectural, archaeological, and cultural resources; and socioeconomics, environmental justice, and children's environmental health and safety risks.

The study area for this EA are the geographic areas that could be directly or indirectly affected by the Proposed Action. The Proposed Action would not result in ground disturbing activities. Therefore, the study area for this EA is based on Dream Chaser's sonic boom overpressure footprint during reentry. Dream Chaser would create a sonic boom during reentry and the FAA has defined the study area as the 1.0 pound per square foot (psf) sonic boom noise contour (see **Section 3.2.1,** *Noise and Noise-Compatible Land Uses* for a further description about how the sonic boom was calculated). The maximum peak sonic boom overpressure would be 1.25 psf. A sonic boom of this magnitude is similar to a clap of thunder. The study area, as shown in **Figure 3-1,** encompasses about 170 square miles and includes portions of Morgan and Cullman counties, and the city/towns of Hartselle, Falkville, and Somerville, Alabama.

This EA also considered the impact of airspace closures associated with Dream Chaser reentry operations. The Proposed Action could result in temporary re-routing of enroute flights on established alternate flight paths through the issuance of NOTAMs (for more information, see **Section 2.1.3.3**, *Reentry Vehicle Flight Paths*). These NOTAMs would occur for up to 1 hour annually in 2023, 2024, and 2025; up to 2 hours in 2026; and up to 3 hours in 2027, unless back-to-back deorbit attempts are needed. In the event that a back-to-back deorbit attempt is needed, two separate 1-hour NOTAMs would be issued for the first and second deorbit attempts.

FIGURE 3-1: STUDY AREA

Sources: ESRI, 2020; RS&H, 2020

This figure is not to scale and is for graphic purposes only

Legend

- Project Study Area
- Reentry Site Boundary
- County Boundaries

N

RS&H

The following environmental impact categories are not analyzed in detail for the reasons stated.

- **Air Quality** – The U.S. Environmental Protection Agency (USEPA) identifies the following six criteria air pollutants for which National Ambient Air Quality Standards (NAAQS) are applicable: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. The USEPA classifies the study area as an "attainment" area for all NAAQS air pollutants (USEPA, 2021). The reentry vehicle gliding to the Airport would not emit pollutants that would affect the NAAQS criteria air pollutants. The Proposed Action would result in additional flight miles of diverted aircraft from the NOTAMs and therefore a slight increase in emissions related to increased fuel burn from additional flight miles of diverted aircraft. However, additional flight miles are anticipated to be minimal and increases in air emissions would occur at or above 3,000 ft (the height above which pollutants released generally do not mix with ground-level emissions and would not have an effect on ground-level concentrations in the local area) and thus would not impact ambient air quality. Therefore, the Proposed Action would not impact air quality and impacts are not analyzed in detail in this EA.
- **Climate** – As described in **Table 2-2**, the reentry vehicle propellants are used by a reaction control system for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground. With the low number of proposed reentry operations (a total of eight, with up to three maximum annually), low quantity of residual propellants, and lack of engine emissions following deorbit burn completion, vehicle propulsion is anticipated to result in a small amount of greenhouse gas emissions. The Proposed Action would increase fuel burn from additional flight miles of diverted aircraft from the NOTAMs, resulting in low levels of additional greenhouse gas emissions. However, with the low number and short-term nature of re-routing of aircraft due to the Proposed Action (a total of eight, with up to three annually), resulting greenhouse gas emissions are anticipated to be small. Therefore, the Proposed Action would not impact climate and impacts are not analyzed in detail in this EA.
- **Coastal Resources** – The Proposed Action is not located within the Alabama Coastal Area Management Program boundaries and would not have effects on coastal resources. Therefore, the Proposed Action would be consistent to the maximum extent practicable with the enforceable polices of the Alabama Coastal Area Management Program and impacts are not analyzed in detail in this EA.
- **Farmlands** – The Proposed Action does not require the acquisition of land or involve ground-disturbing activities. Therefore, the Proposed Action would not affect farmland.
- **Land Use** – The Proposed Action would not change the land use of the Airport or surrounding areas.
- **Natural Resources and Energy Supply** – The Proposed Action would not involve construction activities. The Dream Chaser would use a small amount of propellant for orbital maneuvers, deorbit burn, and high-altitude control during reentry. In addition, there would also be an increase in aviation fuel consumption due to the re-routing of aircraft from NOTAMs. However, the increase in fuel consumption from the small number of aircraft diverted for brief periods of time would not be significant. Therefore, the Proposed Action would not result in significant impacts to natural resources and energy supply and impacts are not analyzed in detail in this EA.

- **Visual Effects (including Light Emissions)** – The Proposed Action would not change the visual environment. The Proposed Action would be visually similar to operations that currently occur at the Airport and only occur up to three times annually. Additionally, the Proposed Action would not increase the light emissions in the study area.
- **Water Resources –** The Proposed Action would not involve ground disturbing activities. Therefore, the Proposed Action would not affect U.S. water resources, including surface waters, groundwater, wild and scenic rivers, or affect floodplains and wetlands.

3.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, the FAA would not issue an RSOL to HSV and would not issue a VOL to Sierra Space to conduct reentries at HSV. Sierra Space's Dream Chaser reentry operations would not occur and HSV would continue to operate and serve forecast activity. Future development at the Airport would be subject to review under NEPA and is not assumed under this alternative. The affected environment under the No Action Alternative would not differ from existing conditions.

Because there would be no anticipated construction or change in airport facilities, change in HSV flight volume or flight paths, or additional sources of commercial space vehicle noise under the No Action Alternative, no impacts would be expected to occur related to Noise and Noise-Compatible Land Use; Biological Resources; Department of Transportation Act, Section 4(f); Historical, Architectural, Archaeological, and Cultural Resources; and Socioeconomics, Environmental Justice, and Children's Health and Safety Risks in the study area.

3.2 PROPOSED ACTION

3.2.1 Noise and Noise-Compatible Land Use

Sound is a physical phenomenon consisting of pressure fluctuations that travel through a medium, such as air, and are sensed by the human ear. Noise is considered any unwanted sound that interferes with normal activities (e.g., sleep, conversation, student learning) and can cause annoyance. Noise sources can be constant or of short duration and contain a wide range of frequency (pitch) content. Determining the character and level of sound aids in predicting the way it is perceived.

The compatibility of existing and planned land uses with proposed FAA actions is usually determined in relation to the level of aircraft (or reentry vehicle) noise. Federal compatible land use guidelines for a variety of land uses are provided in Table 1 in Appendix A of 14 CFR part 150, *Land Use Compatibility with Yearly Day-Night Average Sound Levels*.

The FAA has determined that the cumulative noise energy exposure of individuals to noise resulting from FAA actions must be established in terms of yearly Day-Night Average Sound Level (DNL), the FAA's primary noise metric. DNL accounts for the noise levels of all individual aircraft/reentry vehicle events, the number of times those events occur, and the period of day/night in which they occur. Both noise metrics logarithmically average aircraft sound levels at a location over a complete 24-hour period, with a 10-decibel (dB) adjustment added to those noise events occurring from 10:00 p.m. to 7:00 a.m. The 10-dB adjustment is added because of the increased sensitivity to noise during normal nighttime hours and

because ambient (without aircraft/reentry vehicles) sound levels during nighttime are typically about 10-dB lower than during daytime hours. More information on noise and noise-compatible land use can be found in the FAA Order 1050.1F Desk Reference (FAA, 2020).

3.2.1.1 Affected Environment

Existing sources of sound or noise in the study area include construction vehicles and equipment, surface transportation vehicles (e.g., personal cars), airspace vehicles, urban/residential noise, and natural noise (e.g., wind, nature sounds, thunder, etc.). According to the National Oceanic and Atmospheric Administration (NOAA), residents in Morgan County experience, on average, about 8,000 cloud-to-ground lightning flashes per year (NOAA, 2020). The average resident in Morgan and Cullman County is exposed to thunder overpressure events caused by lightning on a regular basis. Therefore, the average resident in Morgan County is exposed to natural events such as thunder overpressure caused by lightning on a regular basis which is similar to the 1.0 psf level used to establish the extent of the study area. Noise sensitive areas, such as residential and recreational land uses, are located within the study area. See **Section 3.2.3**, *Department of Transportation Act, Section 4(f)* for descriptions of noise sensitive areas within the study area.

3.2.1.2 Environmental Consequences

Noise impacts would be significant if the action would increase noise by DNL 1.5 dB or more for a noise-sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the No Action Alternative for the same timeframe. For example, an increase from DNL 65.5 dB to 67 dB is considered a significant impact, as is an increase from DNL 63.5 dB to 65 dB.

The only noise generated by the Proposed Action is the sonic boom produced during Dream Chaser reentry. The FAA-approved sonic boom model, PCBOOM4, was used to predict the location and magnitude of the sonic boom generated during reentry. The sonic boom modeling resulted in a maximum peak overpressure of 1.25 psf, which is similar to a clap of thunder. For additional information, see **Appendix D**.

Since sonic boom measurements results are presented in terms of psf, a conversion is needed to obtain C-weighted DNL (CDNL)[15] values. This allows for a comparison to FAA's significance threshold of 65 dBA DNL. The daytime or nighttime timing of Sierra Space's proposed reentry operations would depend on the specifics of each operation. A single operation (as proposed for 2023, 2024, and 2025) with a maximum overpressure of 1.25 psf would translate to an equivalent CDNL of 28.5 dBC (C-weighted dB) during the daytime, while a single nighttime operation would translate to an equivalent CDNL of 38.5 dBC. The largest number of proposed operations would be up to 3 reentries, in 2027. All possible combinations of daytime or nighttime operations could result in a CDNL of 33.3 dBC to 43.3 dBC, with the maximum value representing a scenario with three nighttime reentries in one year. The Proposed Action's noise exposure would be less than the FAA's noise compatibility threshold of DNL 65 dBA (equivalent to CDNL 60 dBC). Thus, the Proposed Action would not result in significant noise impacts.

[15] C-weighting is preferred over A-weighting for impulsive noise sources with large low-frequency content such as sonic booms.

In terms of upper limits on impulsive or impact noise levels, National Institute for Occupational Safety and Health (NIOSH) and Occupational Safety and Health Administration (OSHA) have stated that levels should not exceed 140 dB peak sound pressure level, which equates to a sonic boom level of approximately 4 psf. The potential for hearing damage is negligible, as the maximum modeled sonic boom overpressure levels over land of 1.25 psf are similar to a clap of thunder and are substantially lower than the NIOSH and OSHA ~4 psf impulsive hearing conservation noise criterion. The unexpected, loud impulsive noise of sonic booms may cause a startle effect in people.

Sonic booms can also be associated with structural damage. A large degree of variability exists in damage experience, and much of the damage depends on the pre-existing condition of a structure. For example, most damage claims are for brittle objects, such as glass and plaster. The probability of a window breaking at 1 psf is very low and ranges from one in a billion (Sutherland, 1990) to one in a million (Higgins, 1976). Damage to plaster occurs at similar ranges to glass damage. In general, for well-maintained structures, the threshold for damage from sonic booms is 2 psf (Nakaki, 1989) below which damage is unlikely. No structures in the sonic boom study area are known to be in ill-repair or another state where they could be affected the sonic boom overpressures within the study area. Therefore, the Proposed Action is not expected to result in structural damage.

The Proposed Action would also result in changes to enroute flights through the issuance of NOTAMs. These NOTAMs would occur for up to 1 hour in 2023, 2024, and 2025; up to 2 hours in 2026; and up to 3 hours in 2027. If a back-to-back deorbit attempt is needed, separate NOTAMs would be issued for the first and second deorbit attempts. Aircraft flight path changes are anticipated to infrequent and short in duration, and on existing enroutes and flight paths. As a result, increases in noise from re-routed aircraft flight paths would be minor and would not result in any changes to future day-night average sound levels (i.e., DNL) within nominal AHA. Therefore, the Proposed Action would not result in significant noise impacts.

3.2.2 Biological Resources

Biological resources are valued for their intrinsic, aesthetic, economic, and recreational qualities, and include fish, wildlife, plants, and their respective habitats. Typical categories of biological resources include terrestrial and aquatic plant and animal species, game and non-game species, special status species (state or federally listed threatened or endangered species, marine mammals, or species of concern, such as species proposed for listing or migratory birds), and environmentally sensitive or critical habitats.

Section 7(a)(2) of the Endangered Species Act (ESA) requires that each federal agency, in consultation with the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS), ensures that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. The FAA is required to consult the USFWS or NMFS if an action may affect a federally listed species or critical habitat.

The Migratory Bird Treaty Act of 1918 protects migratory birds by prohibiting private parties (and federal agencies in certain judicial circuits) from intentionally taking[16], selling, or conducting other activities that would harm migratory birds, their eggs, or nests (such as removal of an active nest or nest tree), unless the Secretary of the Interior authorizes such activities under a special permit. Administered by the USFWS, the Act implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union (now Russia) for the protection of more than 800 species of migratory birds. Coordination with the USFWS may be necessary if a proposed project has the potential to affect migratory birds.

The Marine Mammal Protection Act (MMPA) prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas. If an action has the potential to impact marine mammals, the FAA is required to consult the USFWS (for sea and marine otters, walruses, polar bears, three species of manatee, and the dugongs) and/or NMFS (for all other marine mammals). Often the marine mammals present in a project area are also listed under the ESA.

Under the Magnuson-Stevens Fishery Conservation and Management Act, the FAA must consult with NMFS if the action that may adversely affect essential fish habitat (EFH). As defined by the Act, EFH refers to waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity.

More information on biological resources, including the laws that protect them, can be found in the FAA Order 1050.1F Desk Reference (FAA, 2020).

3.2.2.1 Affected Environment

The study area encompasses a variety of habitats ranging from developed land to undeveloped forested land and some aquatic environments. Common species that could be found within the study area include, but are not limited to, white-tailed deer (*Odocoileus virginianus)*, eastern wild turkeys (*Meleagris gallapavo silvestris)*, eastern gray squirrels (*Sciurus carolinensis)*, and eastern cottontail rabbits (*Sylvilagus floridanus)* (ADCNR, 2021). Federally listed and/or state-listed threatened or endangered species may also use these habitats. **Table 3-1** lists the federally listed and state-listed threatened or endangered species that the USFWS and the Alabama Department of Conservation and Natural Resources (ADCNR) identify as having the potential to occur in the counties within the study area. No critical habitat is designated for listed wildlife species in the study area.

The Proposed Action would have no effect on plants because there are no ground-disturbing activities. Therefore, plant species are not included in **Table 3-1.**

[16] Under the Migratory Bird Treaty Act, taking is defined as "pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting".

TABLE 3-1: FEDERALLY LISTED AND STATE-LISTED THREATENED AND ENDANGERED SPECIES WITH THE POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name (*Scientific Name*)	Federal Status	State Status
Grey Bat (*Myotis grisescens*)	Endangered	Endangered
Indiana Bat (*Myotis sodalis*)	Endangered	Endangered
Northern Long-eared Bat (*Myotis septentrionalis*)	Threatened	Threatened
Dark Pigtoe (*Pleurobema furvum)*	Endangered	Endangered
Pink Mucket (pearlymussel) (*Lampsilis abrupta*)	Endangered	Endangered
Rough Pigtoe (*Pleurobema plenum*)	Endangered	Endangered
Sheepnose Mussel (*Plethobasus cyphyus*)	Endangered	Endangered
Snuffbox Mussel (*Epioblasma triquetra*)	Endangered	Endangered
Anthony's Riversnail (*Athearnia anthonyi)*	Endangered	Endangered

Source: (USFWS, 2020). (ADCNR, 2020).

3.2.2.1.1 Migratory Birds

There is the potential for migratory birds, to use the habitat in the study area (USFWS, 2020). These species include:

- Black-billed Cuckoo (*Coccyzus erythropthalmus*)
- Bobolink (*Dolichonyx oryzivorous*)
- Canadian Warbler (*Cardellina canadensis*)
- Kentucky Warbler (*Oporornis formosus*)
- Lesser Yellowlegs (*Tringa flavipes*)
- Prairie Warbler (*Dendroica discolor*)
- Red-headed Woodpecker (*Melanerpes erythrocephalus*)
- Wood Thrush (*Hylocichla mustelina*)
- Yellow-bellied Sapsucker (*Sphyrapicus varius*)

3.2.2.2 Environmental Consequences

A significant impact on biological resources would occur if the USFWS or NMFS determines that the action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species, or would result in the destruction or adverse modification of federally designated critical habitat. The FAA has not established a significance threshold for unlisted species. Factors to consider when assessing the significance of potential impacts on unlisted species include whether the action would have the potential for:

- A long-term or permanent loss of unlisted plant or wildlife species, i.e., extirpation of the species from a large project area (e.g., a new commercial service airport);

- Adverse impacts to special status species (e.g., state species of concern, species proposed for listing, migratory birds, bald and golden eagles) or their habitats;
- Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or
- Adverse impacts on a species' reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), or ability to sustain the minimum populations levels required for population maintenance.

This section describes the Proposed Action's potential effect on biological resources, including federally and state-listed species.

The Proposed Action would not include construction, and therefore, no ground disturbing activities would occur. Operational impacts associated with the Proposed Action could potentially cause noise and bird strike impacts to federally or state-listed species or common wildlife in the study area.

The reentry vehicle would produce sonic booms over the study area with a maximum sonic boom overpressure of 1.25 psf. These events have similar overpressures to natural environmental sources, such as thunder. Thunder is common in the study area; according to the NOAA, on average, about 8,000 cloud-to-ground lightning flashes per year occur in Morgan County (NOAA, 2020).

The area that has the potential to be exposed to the 1.25 psf sonic boom is smaller than, and contained within, the study area (defined by the 1.0 psf contour). Noise effects on domesticated and wild animals can include masking of auditory signals, which could disrupt a species' ability to communicate and interfere with behavioral patterns. Other impacts on animals associated with noise could include stress and hypertension (Manci, 1988). However, many animal species do not experience lasting adverse effects to sonic booms with low overpressures of 1.0 psf or less (FAA, 2014) (Manci, 1988).

The FAA reported 37 wildlife strikes between January 2019 and December 2019 at HSV. None of these documented events include migratory birds (FAA, 2020). Sierra Space's reentry activities at the Airport would not significantly increase the chance of a wildlife strike. Reentry vehicle operations at the Airport would increase vehicle activity up to one reentry operation annually in 2023, 2024, and 2025; 2 reentry operations in 2026; and up to three reentry operations in 2027. In 2019, there were 72,690 aircraft operations at HSV. Given the substantial number of operations that occur at the Airport on an annual basis, an increase of no more than up to three reentry operations per year would not significantly increase the chance of a wildlife strike during the landing of the Dream Chaser.

For these reasons, the Proposed Action "m*ay affect, but not likely to adversely affect*" threatened or endangered species in the study area. The FAA sent a Section 7 consultation letter to USFWS with this effect determination to USFWS on October 22, 2021, and USFWS concurred with the FAA's Section 7 effect determination on November 15, 2021 (see **Appendix B**).

3.2.3 Department of Transportation Act, Section 4(f)

Section 4(f) of the U.S. DOT Act of 1966 (23 CFR part 774) protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Section 4(f)

provides that the Secretary of Transportation may not approve a transportation program or project requiring the *use* of publicly owned land of a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, or land of an historic site of national, state, or local significance unless there is no feasible and prudent alternative to the *use* of that land and the program or project includes all possible planning to minimize harm resulting from the *use*. A feasible and prudent avoidance alternative would be one that avoids using Section 4(f) property and does not cause other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) property (23 CFR § 774.17). The design and engineering of such an alternative must be feasible and must also be prudent based on the criteria listed in 23 CFR 774.17(3). The FAA would consider all reasonable alternatives that meet the purpose and need of the project.

To be a Section 4(f) resource, public parks, recreation facilities, and wildlife or waterfowl refuges must be considered *significant* (USDOT 2012). Pursuant to 23 CFR §771.135(c), Section 4(f) resources are presumed to be significant unless the official having jurisdiction over the site concludes that the entire site is not significant. Historic sites qualifying for Section 4(f) protection must be officially listed on or eligible for inclusion on the National Register of Historic Places (NRHP) or contribute to a historic district that is eligible for or listed on the NRHP. More information about DOT Act, Section 4(f) can be found in Chapter 5 of the FAA Order 1050.1F Desk Reference (FAA, 2020).

The FAA uses Federal Highway Administration (FHWA) regulations (23 CFR part 774) and FHWA guidance (e.g., Section 4(f) Policy Paper) when assessing potential impacts on Section 4(f) properties. These requirements are not binding on the FAA; however, the FAA may use them as guidance to the extent relevant to FAA projects. More information on DOT Act, Section 4(f) can be found in the FAA Order 1050.1F Desk Reference (FAA, 2020).

The study area was reviewed for any Section 4(f) properties. For Section 4(f) purposes, a project may result in the *use* of a property in one of two ways:

1. *Physical use*: The project physically occupies and directly uses the Section 4(f) property. This may involve purchase of land or a permanent easement, physical occupation of a portion or all of the property, or alteration of structures or facilities on the property. Another type of use, known as *temporary occupancy*, results when a transportation project results in activities that require a temporary easement, right-of-entry, project construction, or another short-term arrangement involving a Section 4(f) property.
2. *Constructive use*: The project does not result in a physical use of a property, but by means of noise, air pollution, water pollution, or other proximity-related impacts, indirectly uses a Section 4(f) resource by substantially impairing the resource's intended use, feature, or attributes. *Constructive use* occurs when the impacts of a project on a Section 4(f) property are so severe that the activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired.

3.2.3.1 Affected Environment

The FAA conducted an initial screening of the study area to identify all properties eligible for protection under Section 4(f) that have the potential to be affected by the Proposed Action. Each property was

evaluated to determine if it is publicly owned; is open and accessible to the public; has the major or primary purpose for park, recreation, or refuge activities; and is *significant* as a park, recreation area, or refuge. Historic sites are also eligible for protection under Section 4(f) if they are identified as being listed or eligible for listing in the NRHP (see **Section 3.2.5**, *Historical, Architectural, Archeological, and Cultural Resources* for more information on historic resources in the study area and the Section 106 consultation process for NRHP-listed sites).

As **Table 3-2** shows, the FAA identified 17 properties eligible for protection under Section 4(f) within the study area: public recreational areas (e.g., parks, community aquatic centers), NRHP-listed historic sites, and a wildlife refuge area. **Figure 3-2** shows the location of these properties, including the Wheeler National Wildlife Refuge (NWR) and Tennessee Valley Authority (TVA) maintained land, that are within the study area. Additionally, there are several state and federally recognized historic places within the study area that are considered to be Section 4(f) resources.

None of the properties identified in the study area would experience *use* through *permanent incorporation* or *temporary occupancy*. The only possible Section 4(f) *use* of the properties would be *constructive use*, through noise impacts and structural damage resulting from sonic booms. Properties eligible for Section 4(f) protection were screened to determine if they required more detailed consideration under Section (4) to identify potential *constructive use*, or if they could be justifiably dismissed from further consideration.

To rise to the level of *constructive use*, a noise impact must substantially impair the activities, features, or attributes that qualify the property for protection under Section 4(f). For noise impacts to result in substantial impairment, a lack of noise must be a recognized attribute of the property. As a result, properties were screened to determine whether serenity and a quiet setting were significant attributes of the property. The eligible properties in the study area are described below, along with a discussion of whether they would be sensitive to new sources of noise. Properties for which serenity and a quiet setting are not significant attributes are dismissed from detailed consideration in this EA because a certain level of noise is an inherent and pre-existing attribute of the property or because already existing noise exposure from outside sources was identified during the screening. In these cases, the noise from the Proposed Action would not substantially impair the Section 4(f) property and further evaluation for the potential of *constructive use* due to sonic booms resulting from Sierra Space's proposed reentry operations is not necessary.

TABLE 3-2: PARKS, OTHER PUBLIC RECREATIONAL AREAS, AND NRHP-LISTED HISTORIC RESOURCES WITHIN THE STUDY AREA

Resource Name (Officials with Jurisdiction)	Resource Name (Officials with Jurisdiction)
Wheeler National Wildlife Refuge (USFWS)	Walker Field (City of Hartselle)
Tennessee Valley Authority Zone 3 Area (TVA)	Hartselle Legion (City of Hartselle)
Hartselle Aquatic Center (City of Hartselle)	Jack McCaig Park (Town of Falkville)
Grady & Margie Long Complex (City of Hartselle)	Bobby Brewer Field (Town of Falkville)
Hartselle Youth Soccer Complex (City of Hartselle)	Somerville Celebration Park (Town of Somerville)
SNAP Playground (City of Hartselle)	South Park (Town of Falkville)
Sparkman Park (City of Hartselle)	Crabb-Key House (Listed in NRHP)
Green Pryor Rice House (Listed in NRHP)	Hartselle Downtown Commercial Historic District (Listed in NRHP)
Somerville Courthouse (Listed in NRHP)	-

Source: Morgan County (2020); City of Hartselle (2020); Town of Falkville (2020); Town of Somerville (2020);

3.2.3.1.1 Wheeler National Wildlife Refuge (NWR)

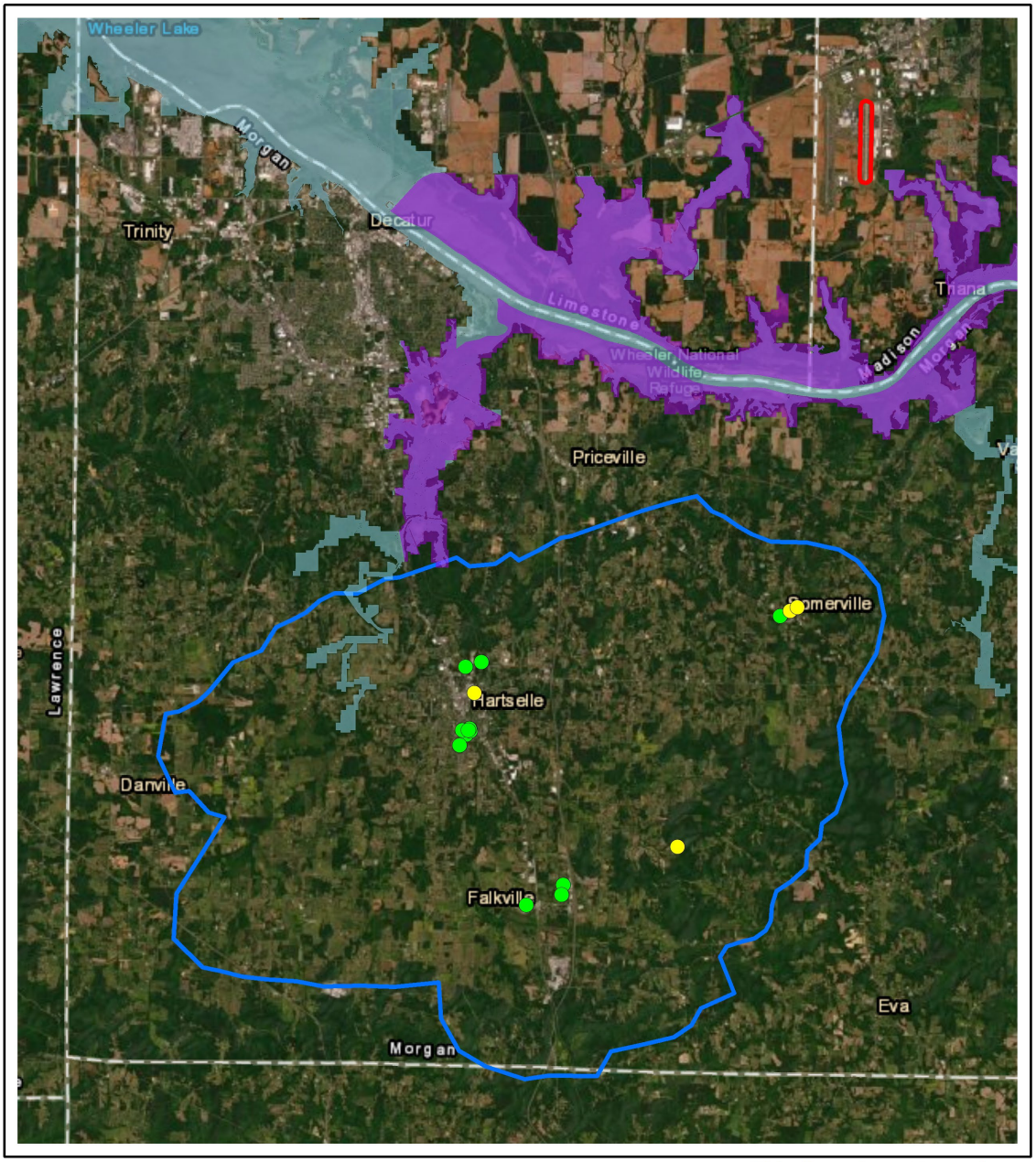
About 26 acres of the Wheeler NWR are within the study area. The Wheeler NWR was created as a result of the Migratory Bird Conservation Act (16 USC §715d, §715i), the North American Wetlands Conservation Act [16 USC §4401(2)(b)], and Public Law 93-626 [16 USC §459(j)]. The Wheeler NWR is managed by USFWS and conserves, protects, and manages migratory birds, threatened and endangered species, and wildlife and habitat diversity to preserve and protect outstanding natural, scenic, scientific, ecologic, and historic values and to provide for outdoor recreation use and enjoyment (USFWS, 2020). According to the USFWS, Wheeler NWR was established in 1938 and protects habitat for 9 federally listed endangered or threatened species and 1 migratory bird species that reside in the refuge. These species are described in **Section 3.2.2**, Biological Resources.

Given its value as a natural recreational area and the presence of wildlife, serenity and a quiet setting are significant attributes of the property. As a result, the Wheeler NWR would be sensitive to new sources of noise.

3.2.3.1.2 Tennessee Valley Authority (TVA) Wheeler Reservoir

Approximately 912 acres in the study area are owned and maintained by the TVA in the Wheeler Reservoir. The purpose of the TVA is to protect the integrated operation of the TVA reservoir and power systems, to provide for the appropriate public use and enjoyment of the reservoir system, and to promote the continuing economic development of the region (TVA, 2020).

FIGURE 3-2: SECTION 4(F) PROPERTIES WITHIN THE STUDY AREA



Sources: ESRI, 2020; NRHP, 2020; NWR, 2020; RS&H, 2020; TVA, 2020

This figure is not to scale and is for graphic purposes only

Legend

- Project Study Area
- Reentry Site Boundary
- Public Recreational Areas
- NRHP-Listed Resources
- Wheeler National Wildlife Refuge
- Tennessee Valley Authority Lands
- County Boundaries

N

RS&H

The TVA land within the study area is primarily classified as Zone 3, Sensitive Resource Management. According to the TVA, land categorized as Zone 3 is "land [that is] managed for protection and enhancement of sensitive resources". Sensitive resources, as defined by TVA, include resources protected by state or federal law or executive order and other land features/natural resources TVA considers important to the area view scape or natural environment. Recreational natural resource activities, such as hunting, wildlife observation and camping on undeveloped sites may occur in this zone, but the overriding focus is protecting and enhancing the sensitive resource the site supports." In addition to Zone 3 lands, there are also a small amount of Zone 4 and Zone 6 lands within the study area. According to the TVA, Zone 4 is classified as Natural Resource Conservation land and is "managed for the enhancement of natural resources for human use and appreciation. Management of resources is the primary focus of this zone. Appropriate activities in this zone include hunting, timber management to promote forest health, wildlife observation and camping on undeveloped sites." According to the TVA, Zone 6 is classified as Developed Recreation land which can include greenways, water accesses, public recreation facilities (including picnic areas, playgrounds, etc.) and commercial recreation.

Given their value as natural recreational areas and their value as wildlife habitat, serenity and a quiet setting are significant attributes of the property. As a result, the TVA Wheeler Reservoir lands would be sensitive to new sources of noise.

3.2.3.1.3 Local Parks

There are 11 local parks within the study area. These parks are in Hartselle, Falkville, and Somerville and provide recreational opportunities for local residents. These resources are found in urban and/or rural residential settings and typically consist of playground equipment, baseball fields, basketball and tennis courts, and other recreation infrastructure. As a result, a certain level of noise is an inherent pre-existing attribute of these properties. Those properties in urban settings already experience noise impacts based on their location. Therefore, serenity and a quiet setting are not significant attributes of these properties and would not be sensitive to the new source of noise from the Proposed Action.

3.2.3.1.4 National Register of Historic Places-listed Resources

There are four NRHP-listed resources within the study area:

- Crabb-Key House: This resource is found in a rural setting along Nat Key Road in the City of Hartselle. The resource is a residential structure that is believed to have been built in the 1800s. The home is on private property.
- Hartselle Downtown Commercial District: This resource is found near the center of downtown in the City of Hartselle. The historic commercial district was developed in the early 1800s, consists of primarily brick commercial structures, and is still actively used for commercial use to this day.
- Green Pryor Rice House: This resource is found in a rural, residential setting along Monroe Street in the Town of Somerville. The resource is a residential structure that is believed to have been built in the mid-1800s. Current use and activities of this resource are not known.
- Somerville Courthouse: This resource is found in an urban setting along Main Street in the Town of Somerville. The resource is a brick, formerly government-use structure that was built in the mid-1800s. The structure is not currently open to the public.

Serenity and a quiet setting are not attributes that contribute to the significance of these resources as historic properties. The Hartselle Downtown Commercial District and Somerville Courthouse exist in urban areas and as a result already experience noise impacts due the location. The NRHP areas of significance for Crabb-Key House and Green Pryor Rice House are exploration/settlement, architecture, and agriculture. Therefore, the significance of these properties as historic resources would not be sensitive to new sources of noise, per the land use compatibility guidelines in 14 CFR Part 150.

However, the aesthetic value and safety of NRHP-listed resources could be diminished by impacts to their structural integrity. Please see **Section 3.2.5,** *Historical, Architectural, Archaeological, and Cultural Resources* for more information on federal- and state-listed historic resources within the study area and the Section 106 consultation process for NRHP-listed resources.

3.2.3.2 Environmental Consequences

Resources protected by Section 4(f) consist of publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, and publicly or privately-owned land from a historic site of national, state, or local significance that is either listed or eligible for listing on the NRHP.

FAA Order 1050.1F, Exhibit 4-1 provides the FAA's significance threshold for Section 4(f), which states, "The action involves more than a minimal physical use of a Section 4(f) resource or constitutes a 'constructive use' based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource."

The Proposed Action would not result in ground-disturbing activities at HSV or within the study area that could cause direct impacts to Section 4(f) resources. The FAA identified 17 parks, NRHP-listed resources, TVA resource management areas, and a wildlife refuge in the study area. Operations of reentry vehicles would not result in permanent incorporation or temporary occupancy of any portion of a Section 4(f) property and, therefore, would not result in a *physical use* of Section 4(f) properties.

The Proposed Action would result in up to one sonic boom annually in 2023, 2024, and 2025; up to two sonic booms in 2026; and up to three sonic booms in 2027. The maximum sonic boom overpressure within the study area would be 1.25 psf. The intensity of sonic booms associated with operation of the Proposed Action would be similar to those produced by thunder in intensity.

A *constructive use* of a Section 4(f) resources occurs only when the protected activities, features, or attributes of the Section 4(f) property that contribute to its significance or enjoyment are substantially diminished.

As described in **Section 3.2.5**, *Historic, Architectural, Archaeological, and Cultural Resources*, the attributes, settings, and features of the local parks and NRHP-listed properties within the study area would not be sensitive to new sources of noise.

The Wheeler NWR and TVA Wheeler Reservoir lands would be sensitive to new sources of noise. Sierra Space's reentry operations would result in up to one sonic boom in 2023, 2024, and 2025, up to two sonic booms in 2026, and up to three sonic booms in 2027. The overpressure associated with a single sonic boom was modeled to be 1.25 psf, which translates to an equivalent CDNL of 28.5 dbC (if occurring during the day) or 38.5 dBC (if occurring at night). Up to three reentry operations would translate to a maximum equivalent CDNL of 43.3 dbC (for three nighttime reentries). These DNL levels are below ambient noise levels and would not exceed the FAA's DNL significance threshold of DNL 65 dBA (equivalent to CDNL 60 dbC). The intensity of sonic booms associated with operation of the Proposed Action would be similar to those produced by thunder in intensity. However, the study area already experiences thunder activity that is similar in overpressure to the sonic booms that would occur as a result of the Proposed Action, as residents in Morgan County experience, on average, about 8,000 cloud-to-ground lightning flashes per year (NOAA, 2020). Therefore, the Proposed Action's sonic boom would not substantially impair the Section 4(f) resources as a new source of noise.

Sonic booms can also be associated with structural damage. In general, for well-maintained structures, the threshold for damage from sonic booms is 2 psf (Nakaki, 1989), below which damage is unlikely. The maximum modeled overpressure from the sonic boom events is 1.25 psf. For more information on potential impacts on structural damage and historical properties, please see **Section 3.2.5**, *Historical, Architectural, Archaeological, and Cultural Resources*. Therefore, the Proposed Action is not expected to result in structural damage to NRHP-listed resources or to structural components of other 4(f) resources.

Therefore, the FAA made a preliminary determination that the Proposed Action would not cause a *constructive use* of Section 4(f) resources.. The FAA consulted with officials with jurisdiction over the Section 4(f) resources potentially impacted by the proposed project on this preliminary determination and submitted a request for coordination letter to the TVA, Alabama SHPO, and the USFWS on November 3, 2021 (See **Appendix B**). A response was received from the USFWS on February 2, 2022, concurring with the determination that there would be no significant impact to Wheeler NWR or the species utilizing the refuge. The FAA did not receive a response from the TVA[17] or Alabama SHPO. As a result, the FAA has determined that the Proposed Action would not cause a *constructive use* of Section 4(f) resources and would not result in significant impacts on Section 4(f) resources.

3.2.4 Hazardous Materials, Solid Waste, and Pollution Prevention

Hazardous materials, solid waste, and pollution prevention as an impact category includes an evaluation of the following:

- Waste streams that would be generated by a project, potential for the wastes to impact environmental resources, and the impacts on waste handling and disposal facilities that would likely receive the wastes
- Potential hazardous materials that could be used during construction and operation of a project, and applicable pollution prevention procedures
- Potential to encounter existing hazardous materials at contaminated sites during construction, operation, and decommissioning of a project

[17] A follow up email was sent to TVA on February 15, 2022.

- Potential to interfere with any ongoing remediation of existing contaminated sites at the proposed project site or in the immediate vicinity of a project site

The terms hazardous material, hazardous waste, and hazardous substance are often used interchangeably when used informally to refer to contaminants, industrial wastes, dangerous goods, and petroleum products. Each of these terms, however, has a specific technical meaning based on the relevant regulations.

Hazardous material is any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce. The term *hazardous material* includes both hazardous wastes and hazardous substances, as well as petroleum and natural gas substances and materials (see 49 CFR § 172.101).

Solid waste is defined by the implementing regulations of the Resource Conservation and Recovery Act (RCRA) generally as any discarded material that meets specific regulatory requirements, and can include such items as refuse and scrap metal, spent materials, chemical by-products, and sludge from industrial and municipal wastewater and water treatment plants.

Hazardous waste is a type of solid waste defined under the implementing regulations of RCRA. A hazardous waste is a solid waste that possesses at least one of the following four characteristics: ignitibility, corrosivity, reactivity, or toxicity as defined in 40 CFR part 261 subpart C, or is listed in one of four lists in 40 CFR part 261 subpart D, which contains a list of specific types of solid waste that the EPA has deemed hazardous. RCRA imposes stringent requirements on the handling, management, and disposal of hazardous waste, especially in comparison to requirements for non-hazardous wastes.

Hazardous substance is a term broadly defined under Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act. Hazardous substances include:

- Any element, compound, mixture, solution, or substance designated as hazardous under Section 102 of the Comprehensive Environmental Response, Compensation, and Liability Act
- Any hazardous substance designated under Section 311(b)(2)(A) or any toxic pollutant listed under Section 307(a) of the CWA
- Any hazardous waste under Section 3001 of RCRA
- Any hazardous air pollutant listed under Section 112 of the CAA
- Any imminently hazardous chemical substance or mixture for which the EPA has "taken action under" Section 7 of the Toxic Substances Control Act

Pollution prevention describes methods used to avoid, prevent, or reduce pollutant discharges or emissions through strategies such as using fewer toxic inputs, redesigning products, altering manufacturing and maintenance processes, and conserving energy.

More information about hazardous materials, solid waste, and pollution prevention can be found in Chapter 7 of the FAA *Order 1050.1F Desk Reference* (FAA, 2020).

3.2.4.1 Affected Environment

HSV operations routinely involve the transportation, use, and storage of hazardous materials. Airport activities may also generate hazardous waste. For example, ground vehicles, aircraft refueling trucks, and/or hydrant systems transport hazardous materials such as jet fuels to HSV.

HSV is not included on the USEPA's National Priorities List, which is the list of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories (USEPA, 2021). No sites listed as Brownfields or Superfund sites are located in the vicinity of the airport. There are several toxic release sites in the vicinity of HSV associated with the industrial areas surrounding its property as well as one Toxic Substances Control Act site east of HSV property (Baker, 2020).

There is no treatment or disposal of hazardous waste at HSV. Hazardous waste (oil, solvents, etc.) and municipal solid waste (food containers, cardboard packaging, and plastic) currently generated at HSV are removed for appropriate off-site recycling or disposal. Spill Prevention, Control, and Countermeasure Plans help prevent any discharge of hazardous materials into surface waters or groundwater.

3.2.4.2 Environmental Consequences

The FAA has not established a significance threshold for hazardous materials, solid waste, or pollution prevention. Factors to consider when assessing the significance of potential impacts include whether the action would have the potential to:

- Violate applicable federal, state, tribal, or local laws or regulations regarding hazardous materials and/or solid waste management
- Involve contaminated sites
- Produce an appreciably different quantity or type of hazardous waste
- Generate an appreciably different quantity or type of solid waste or using a different method of collection or disposal and/or exceeding local capacity
- Adversely affect human health and the environment

The Proposed Action would result in one new hazardous substance - hydrogen peroxide - being present at the Airport. Hydrogen peroxide would be present in residual quantities at concentrations of approximately 90% once Dream Chaser has landed on Runway 18L-36R. Hydrogen peroxide at concentrations of 52% or more is included in the Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-To-Know Act, Comprehensive Environmental Response, Compensation and Liability Act, and Section 112(r) of the Clean Air Act (USEPA, 2021). As described in **Section 2.1.3.5**, *Landing and Post-Flight Handling Procedures*, Runway 18L-36R would be closed to all except Sierra Space personnel involved in post-reentry procedures. As part of the Dream Chaser safing activities, all residual hydrogen peroxide would be flushed and/or diluted, offloaded into approved storage containers, and transported off-Airport to be disposed of in an approved method by local waste management. With proper handling of hydrogen peroxide, no adverse effects from are expected.

Dream Chaser would also contain residual amounts of RP-1 (no more than 100 lbs. or 15 gal), which would be stored at the existing kerosene storage area at the Airport. The Proposed Action would not significantly increase the amount of RP-1 stored at HSV.

There would be no significant changes in the amounts of other hazardous materials at HSV. Sierra Space would manage all hazardous materials and hazardous and non-hazardous wastes in accordance with the applicable federal, state, and local requirements and regulations at the Airport. Therefore, no significant impacts to hazardous materials, solid wastes, or pollution prevention are anticipated to result from the Proposed Action.

3.2.5 Historical, Architectural, Archaeological, and Cultural Resources

Cultural resources encompass a range of sites, properties, and physical resources relating to human activities, society, and cultural institutions. Such resources include past and present expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, structures, objects, and districts that are considered important to a culture or community. Cultural resources also include aspects of the physical environment, namely natural features and biota that are a part of traditional ways of life and practices and are associated with community values and institutions. The major law that protects cultural resources is the NHPA. Section 106 of the NHPA requires a federal agency to consider the effects of its action (referred to as the undertaking) on historic properties.

Compliance with Section 106 requires consultation with the State Historic Preservation Officer (SHPO) and other parties, including Native American tribes.

The Section 106 process is outlined in 36 CFR Part 800. Major steps in the process include identifying the Area of Potential Effects (APE) in consultation with the SHPO, identifying and evaluating any historic properties within the APE, and assessing the effect of the undertaking on any historic properties. If a historic property would be adversely affected, the consultation process includes resolution of adverse effects. More information on cultural resources can be found in the FAA Order 1050.1F Desk Reference (FAA, 2020).

3.2.5.1 Affected Environment

Historic, architectural, and cultural resources are sites recorded by the Alabama Historical Commission (AHC) or resources that are listed or eligible for listing in the NRHP. Information for tribal interests was retrieved from the Department of Housing and Urban Development's Tribal Directory Assessment Tool (HUD TDAT) and from the U.S. Census Bureau data portal for American Indian Geography.

3.2.5.1.1 Area of Potential Effects

In accordance with 36 CFR § 800.4(a)(1), the FAA established an APE for the proposed undertaking (i.e., Proposed Action). The FAA determined an APE in consideration of potential effects to historic properties from implementation of the Proposed Action. The Proposed Action does not include ground-disturbing activities; therefore, archaeological resources are not considered in this EA. Therefore, the APE is the same as the study area.

3.2.5.1.2 Section 106 Consultation

The FAA sent a formal Section 106 consultation letter to the Alabama SHPO, also known as the AHC, on October 22, 2021, describing the FAA's determination that the proposed undertaking would have "No Adverse Effect" to historic properties.

3.2.5.1.3 Tribal Consultation

In accordance with Section 106 and EO 13175 *Consultation and Coordination with Indian Tribal Governments*, FAA Order 1210.20 *American Indian and Alaska Native Tribal Consultation Policy and Procedures,* and 36 CFR § 800.2(c)(2)(B)(ii), the FAA identified Native American tribes that may have an interest in the counties within the APE:

- Alabama-Coushatta Tribe of Texas
- Alabama-Quassarte Tribal Town
- Chickasaw Nation
- Coushatta Tribe of Louisiana
- Eastern Band of Cherokee Indians
- Muscogee (Creek) Nation

These tribes were identified using the HUD TDAT, a web-accessible database that contains information about federally recognized Indian tribes and their geographic areas of current and ancestral interest (TDAT, 2020). For this EA, the TDAT database was queried for Alabama counties that intersect the APE (Morgan and Cullman counties).

The State of Alabama also recognizes tribes throughout the state. According to the U.S. Census Bureau, the following state-recognized tribe has a State Designated Tribal Statistical Area (SDTSA) within the study area; therefore, the tribe may have an interest in the Proposed Action:

- Echota Cherokee Tribe of Alabama

According to the U.S. Census Bureau, the SDTSAs "are statistical entities for state-recognized American Indian tribes that do not have a state-recognized land base (i.e., reservation). SDTSAs are identified and delineated for the Census Bureau by a state liaison identified by the governor's office in each state. SDTSAs generally encompass a compact and contiguous area that contains a concentration of people who identify with a state-recognized American Indian tribe and in which there is structured or organized tribal activity" (U.S. Census Bureau, 2019).

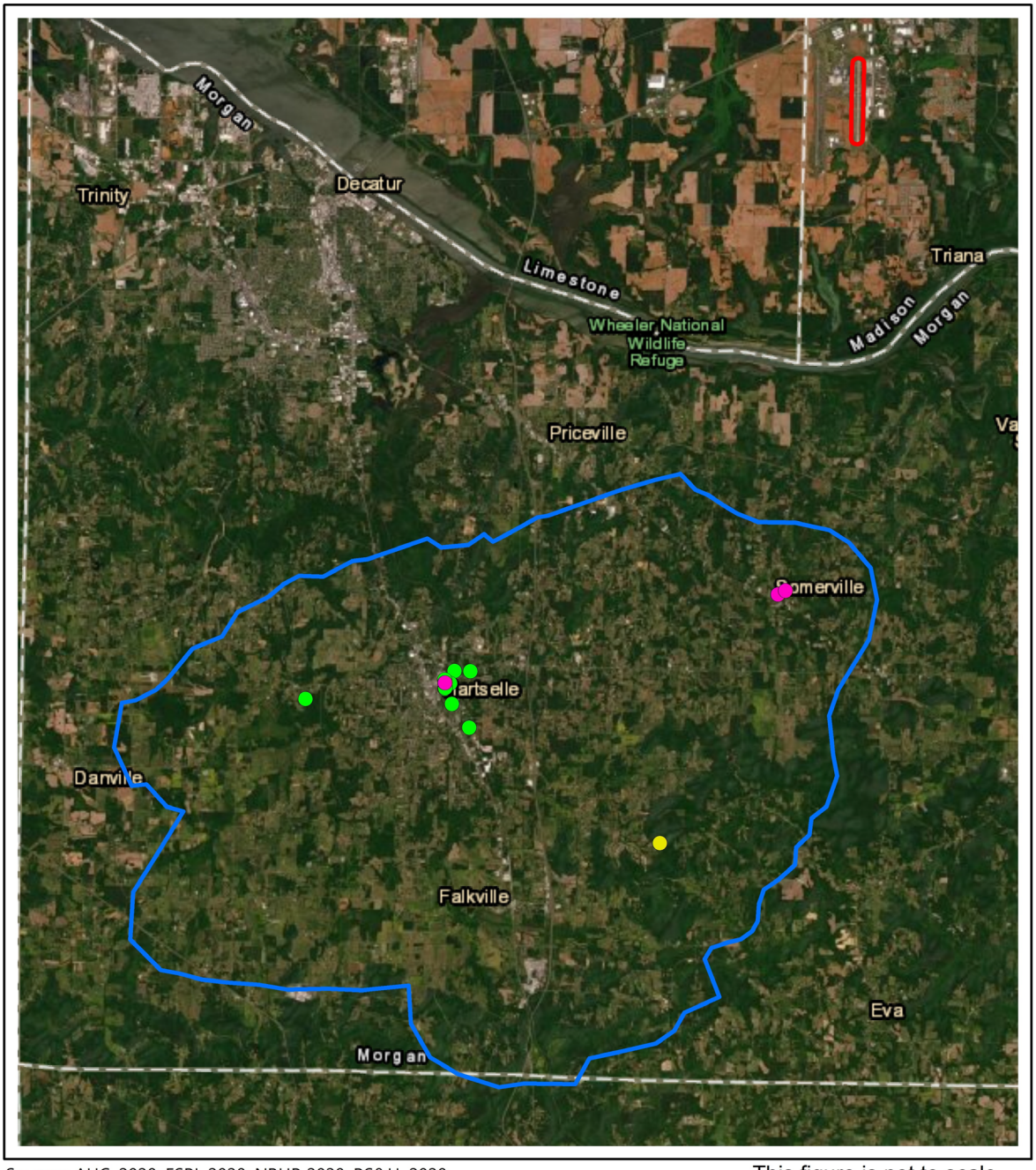
The FAA sent a letter to tribes initiating Government-to-Government consultation on October 22, 2021 (see **Appendix B**).

3.2.5.1.4 Historic Resources

Research information on historic properties within the APE was obtained from the National Park Service (NPS) NRHP and AHC's Alabama Register of Landmarks & Heritage.

Table 3-3 lists the NRHP-listed and AHC-listed sites in the APE. **Figure 3-3** shows the location of these sites in relation to the APE.

FIGURE 3-3: NRHP AND AHC RESOURCES IN APE



Sources: AHC, 2020; ESRI, 2020; NRHP, 2020; RS&H, 2020

This figure is not to scale and is for graphic purposes only

Legend

- Project Study Area
- Reentry Site Boundary
- NRHP-listed and AHC-listed Resource
- NRHP-listed Resources
- AHC-listed Resources
- County Boundaries

N

RS&H

TABLE 3-3: NRHP- AND AHC-LISTED RESOURCES IN THE APE

Resource Name	Resource Type
Barta Log Cabin	Listed in AHC
Hartselle Depot	Listed in AHC
Hartselle Elementary School	Listed in AHC
Hartselle Tabernacle	Listed in AHC
L&N Freight Depot	Listed in AHC
Old Morgan County High School	Listed in AHC
R.W. Puckett House	Listed in AHC
Roberts Duplex	Listed in AHC
U.S. Post Office (Hartselle Utilities Building)	Listed in AHC
Rev. John Paul Mose Woodall House	Listed in AHC
Crabb-Key House	Listed in both AHC and NRHP
Green Pryor Rice House	Listed in NRHP
Somerville Courthouse	Listed in NRHP
Hartselle Downtown Commercial Historic District	Listed in NRHP

Source: NPS (2020); AHC (2020)

3.2.5.2 Environmental Consequences

FAA Order 1050.1F does not define a significance threshold for historical, architectural, archaeological, and cultural resources; however, it does provide a factor to consider in evaluating potential environmental impacts. This would occur when the action would cause a finding of adverse effect through the Section 106 consultation process. An adverse effect finding does not automatically trigger preparation of an EIS (i.e., a significant impact).

Potential impacts to historic resources were assessed by determining any potential indirect impacts from noise and vibration that could potentially:

- Alter the visual, audible, or atmospheric characters of the property, if the setting contributes to the property's qualification for the NRHP.
- Cause neglect of the property resulting in the property's deterioration or destruction.

Overpressure caused by extreme sonic booms has been associated with the potential for structural damage, specifically for brittle materials such as glass and plaster. The probability of a window breaking when exposed to a sonic boom with a 1.0 psf overpressure ranges from one in a billion to one in a million, depending on the condition of the glass. The threshold for damage from overpressure on well-maintained structures (those not in ill-repair) is greater than 2 psf (BRRC, 2019). The results of the sonic boom analysis indicated that the maximum overpressure associated with operation of the Proposed Action would be 1.25 psf.

As described previously, the FAA determined an APE in consideration of potential effects to historic properties from implementation of the Proposed Action. The APE is the same as the study area and encompasses the area where a sonic boom overpressure of 1.0 psf could occur.

Indirect effects to cultural resources refer to potential effects to the property's use, physical features, or the area in a manner that may change the integrity of the property's significant historic features. Examples of indirect effects include introducing an atmospheric or visual feature or changing the noise characteristics of the area. Operation of reentry vehicles would increase flight activity at the HSV (up to one operation annually in 2023, 2024, and 2025; up to two operations in 2026; and up to three operations in 2027). A total of eight operations would be conducted. The Proposed Action would not result in air quality or visual (light or viewshed) impacts to historic resources within the APE.

Information on historic properties within the APE was obtained from the NRHP and the AHC Register of Landmarks and Heritage. An assessment of the Proposed Action's potential direct and indirect effects is described below.

Direct Effects - The Proposed Action would not result in any direct effects on historic properties.

Indirect Effects - The potential effects for architectural resources include the introduction of short-term auditory effects on noise-sensitive historic properties during operations, and vibration (overpressure) caused by sonic booms as a part of the Proposed Action. Fourteen historic resources located within the APE would potentially be affected (see **Table 3-3**).

The potential for sonic boom impacts is evaluated on a single-event and cumulative basis in relation to human annoyance, hearing conservation and structural damage criteria. The modeled maximum peak overpressure is approximately 1.25 psf. A single reentry with a modeled maximum of 1.25 psf translates to an equivalent CDNL of 28.5 dBC for a single daytime operation or 38.5 dBC for a single nighttime operation. The maximum number of proposed reentries per year (3 reentries in 2027), would result in a maximum CDNL of 43.3 dBC under a scenario where all proposed reentries occurred at night. Noise caused by the proposed reentry vehicle operations would be less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA).[18] The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf criterion described above.

3.2.5.2.1 FAA's Finding of Effect

The descent of the reentry vehicle would generate a sonic boom. The Proposed Action would result in up to one sonic boom annually in 2023, 2024, and 2025; up to two sonic booms in 2026; and up to three sonic booms in 2027. The maximum sonic boom overpressure within the study area would be 1.25 psf. The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf. In terms of auditory effects, the intensity of sonic booms associated with operation of the Proposed Action would be similar to thunder in intensity. According to NOAA, residents in Morgan County experience, on average, about 8,000 cloud-to-ground lightning flashes per year (NOAA, 2020).

[18] Areas exposed to DNL 65 dBA or lower are compatible with all land uses.

Users of the historic properties located within the study area likely already experience thunder activity that produces overpressure that is similar to the sonic booms that would occur as a result of the Proposed Action. Therefore, noise effects associated with the reentry vehicle would not have an adverse effect on historic properties in the APE.

The FAA sent a letter to the AHC initiating Section 106 consultation and requesting concurrence on the proposed APE and the FAA's Finding of No Adverse Effect on October 22, 2021 (see **Appendix B**). The AHC provided concurrence with the FAA's no adverse effect to historic properties determination on November 9, 2021 (see **Appendix B**).

The FAA sent a letter to tribes initiating Section 106 consultation and inviting tribes to cooperate as Consulting Parties on October 22, 2021. The Muscogee (Creek) Nation responded on November 16, 2021, concurring with the FAA's determination of no effects to any known historic properties (see **Appendix B**). No other tribes responded to the FAA's consultation letter as of April 2022.

3.2.6 Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

Socioeconomics is an umbrella term used to describe aspects of a project that are either social or economic in nature. A socioeconomic analysis evaluates how elements of the human environment such as population, employment, housing, and public services might be affected by the Proposed Action.

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies. Meaningful Involvement means that people have an opportunity to participate in decisions about activities that may affect their environment and/or health; the public's contribution can influence the regulatory agency's decision; their concerns will be considered in the decision-making process; and the decision makers seek out and facilitate the involvement of those potentially affected.

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* directs each federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Subsequent orders at the federal level, including DOT Order 5610.2(a), *Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, have reinforced the directives outlined in EO 12898. CEQ also developed guidelines to assist federal agencies in incorporating the goals of EO 12898 into the NEPA process (CEQ, 2020).

Impacts to children are considered separately in NEPA reviews because children may experience a different intensity of impact as compared to an adult exposed to the same event. EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, requires federal agencies to identify

disproportionately high and adverse impacts on children. Children may suffer disproportionately more environmental health and safety risks than adults because they are still developing their neurological, digestive, immunological, and other bodily systems; they eat more food, drink more fluids, and breathe more air in proportion to their body weight than adults; their behavior patterns may make them more susceptible to accidents because they are less able to protect themselves; and their size and weight may diminish their protection from standard safety features.

More information on socioeconomics, environmental justice, and children's environmental health and safety risk and regulations can be found in the FAA Order 1050.1F Desk Reference (FAA, 2020).

3.2.6.1 Affected Environment

3.2.6.1.1 Socioeconomics

Population, housing, labor force, and surface transportation data for Morgan and Cullman Counties are included as the basis for evaluating potential socioeconomic impacts.

Population – **Table 3-4** lists the population in Morgan County and Cullman County. Data for the State of Alabama and U.S. are included for comparison purposes.

TABLE 3-4: POPULATION AND HOUSING CHARACTERISTICS

Characteristic	Morgan County	Cullman County	Alabama	U.S.
Total Population	119,089	83,768	4,887,871	328,239,523
Total Housing Units	52,398	37,809	2,258,669	137,407,308
Vacant Units (Percentage)	12.9%	18.7%	18.5%	12.6%

Source: U.S. Census Bureau (2018)

Housing – **Table 3-4** also lists the total number of housing units as well as the number of vacant housing units in Morgan County and Cullman County. Information from the State of Alabama and the U.S. are included for comparison purposes. About 13 percent and 19 percent of the housing units in Morgan County and Cullman County, respectively, are vacant. Comparatively, there are about 18.5 percent and 12.6 percent vacant housing units in Alabama and the U.S., respectively (U.S. Census Bureau, 2018).

Labor Force – According to the U.S. Census Bureau, there are 45,773 employed individuals in Morgan County, and the unemployment rate is approximately 3.3 percent. In Cullman County, there are an estimated 24,938 employed individuals and the unemployment rate is approximately 4.3 percent. Comparatively, Alabama and the U.S. have an unemployment rate of approximately 5.6 percent and 3.7 percent, respectively (U.S. Census Bureau, 2018).

Surface Transportation – There are several major roadways that intersect the study area. Major roadways within the study area include Interstate 65, State Route 36 E, State Route 3, State Route 67, State Route 157, and U.S. Highway 31 S. The roadway with the highest traffic volumes in the study area is Interstate 65. According to the Alabama Department of Transportation (ADOT), the maximum Annual Average Daily

Traffic (AADT) count for reporting stations along Interstate 65 within the study area is 43,787 while the minimum AADT count for reporting stations along Interstate 65 within the study area is 36,937 (ADOT, 2018).

First Responders – The Airport provides police, fire, and first response EMS services at the Airport. The USFWS and TVA are the first responders to events or activities within the Wheeler NWR and TVA lands, respectively, including law enforcement and fire management responses. Additional health care services are available at nearby public hospitals in Decatur, Huntsville, and Moulton. Law enforcement in the study area is provided by Morgan and Cullman County sheriff departments and local police departments.

3.2.6.1.2 Environmental Justice

FAA Order 1050.1F, which is consistent with USDOT Order 5610 on Environmental Justice, establishes guidance for assessing environmental justice impacts. **Table 3-5** describes the percentage of persons in poverty within Morgan County and Cullman County as well as the State of Alabama. The U.S. Census Bureau defines poverty as when a family's total income is less than the relevant, federal poverty threshold (U.S. Census Bureau, 2021). Poverty thresholds are calculated by the U.S. Department of Health and Human Services (HHS) and do not vary geographically (HHS, 2021). Additionally, **Table 3-5** also shows the percentage of minorities within Morgan County and Cullman County as well as the State of Alabama.

TABLE 3-5: POVERTY LEVEL AND MINORITY POPULATION IN THE STUDY AREA

Characteristic	Morgan County	Cullman County	Alabama
Percentage of persons in poverty	13.2%	14.5%	16.8%
Percentage of population that are minorities	17.2%	4.3%	30.9%

Source: U.S. Census Bureau (2018)

The USEPA Environmental Justice (EJ) Screener and Mapping tool is an environmental justice mapping and screening service that provides a nationally consistent dataset and approach for combining environmental and demographic indicators. The EJ Screener and Mapping Tool's Demographic Index is an averaged combination of low-income and percent minority for each census block group as it was explicitly named in EO 12899 on Environmental Justice (USEPA, EJ Screener and Mapper Tool, 2020).

Figure 3-4 shows the study area minority and low-income percentiles. **Table 3-6** shows minority and low-income comparison data of the study area, State of Alabama, and USEPA Region 4.

TABLE 3-6: STUDY AREA DEMOGRAPHIC INDICATORS

Demographic Indicator	Study Area Average	Alabama Average
Minority Population	9%	34%
Low-Income Population	33%	39%
Demographic Index	21%	36%

Source: (USEPA, 2019)

3.2.6.1.3 Children's Environmental Health and Safety Risks

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (62 FR 19885) is the primary Executive Order related to Children's Environmental Health and Safety Risks. EO 13045 directs federal agencies to identify and assess environmental health risks and safety risks that may disproportionately affect children. **Table 3-7** shows the percentage of the population that are children (persons under 18 years) within Morgan County, Cullman County, and the State of Alabama.

TABLE 3-7: PERCENT OF POPULATION THAT ARE CHILDREN IN THE STUDY AREA

Characteristic	Morgan County	Cullman County	Alabama
Percentage of population that are children (persons under 18)	22.8%	22.5%	22.2%

Source: U.S. Census Bureau (2018)

The study area includes public schools within the Morgan County School District as well as the Hartselle City School District. As listed below, there are nine public schools and one private school located within the study area:

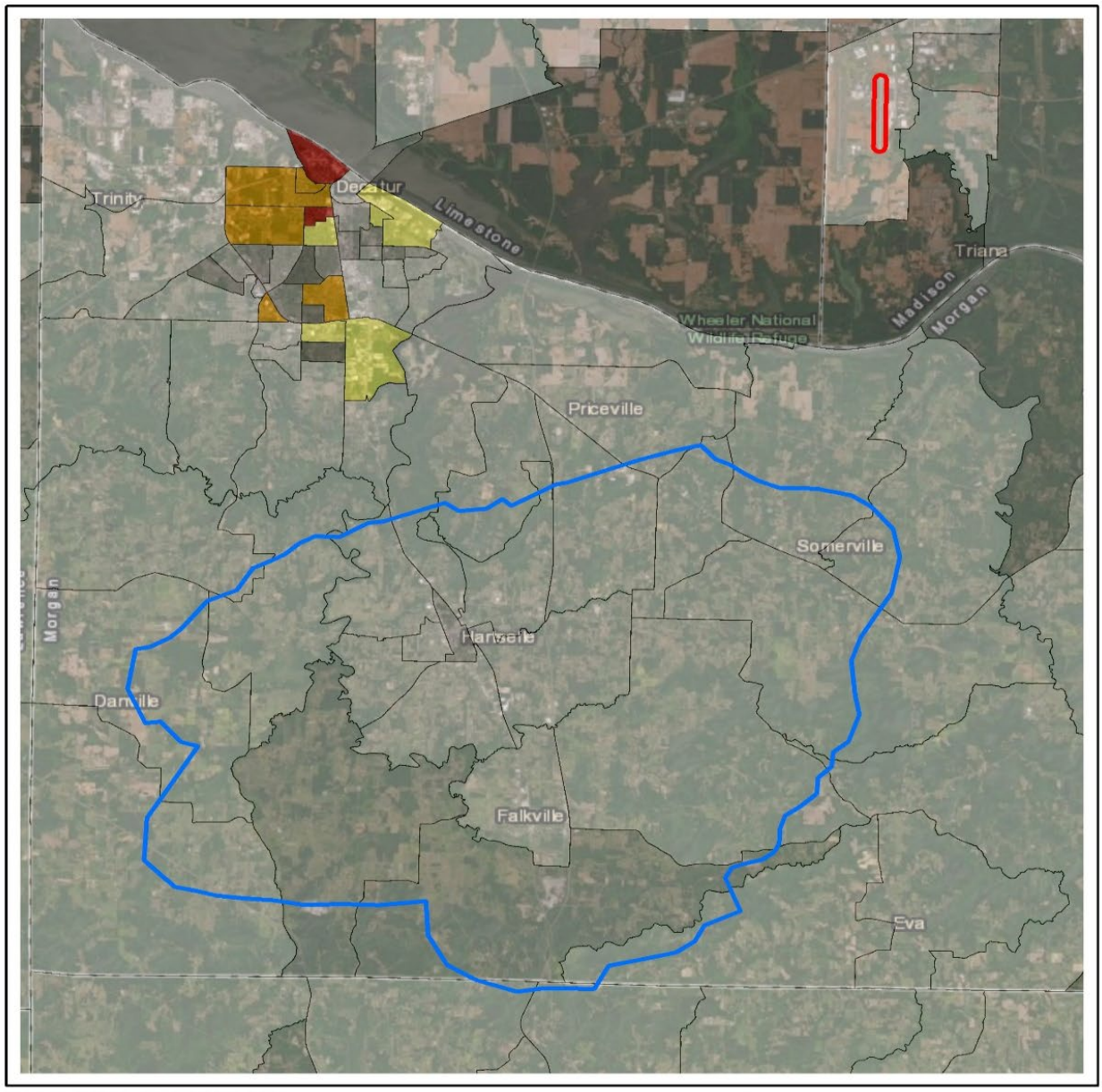
- Barkley Bridge Elementary School
- Bethel Baptist Private School
- Crestline Elementary School
- F.E. Burleson Elementary School
- Falkville Elementary School
- Falkville High School
- Hartselle High School
- Hartselle Intermediate School
- Hartselle Junior High School
- Sparkman Elementary School

Additionally, there are six daycare centers within the study area:

- Kid's Kastle Learning Center
- Kid's World Daycare
- Little Rascals Daycare Center
- Little Red School House
- Somerville Baptist Learning Center
- Union Hill Head Start

Figure 3-5 shows the public and private schools as well as the daycare centers in relation to the study area.

FIGURE 3-4: MINORITY PERCENTILES WITHIN STUDY AREA



Sources: USEPA, 2018; RS&H, 2020

This figure is not to scale
and is for graphic purposes only

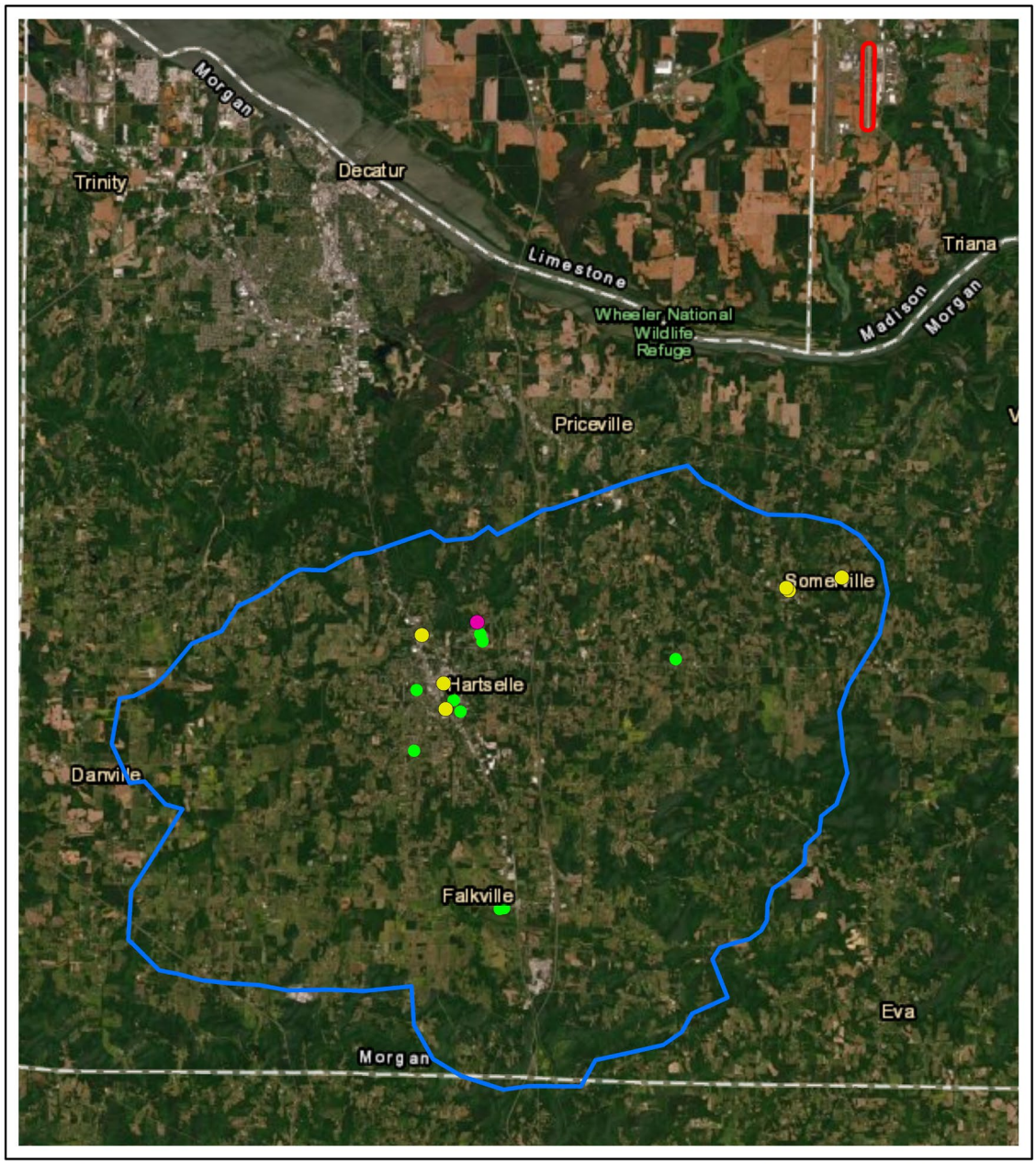
N

Legend

- Reentry Site Boundary
- Project Study Area
- Less than 50 Percentile
- 50-60 Percentile
- 60-70 Percentile
- 80-90 Percentile
- 90-95 Percentile
- 95-100 Percentile

RS&H

FIGURE 3-5: SCHOOLS AND DAYCARE CENTERS IN THE STUDY AREA



Sources: ESRI, 2020; RS&H, 2020

This figure is not to scale and is for graphic purposes only

Legend

- Project Study Area
- Reentry Site Boundary
- Daycare Centers
- Private Schools
- Public Schools
- County Boundaries

N

RS&H

3.2.6.2 Environmental Consequences

FAA Order 1050.1F does not define significance thresholds for Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks; however, it does identify the following factors to consider in evaluating the context and intensity of potential environmental impacts (see Exhibit 4-1 of FAA Order 1050.1F). Socioeconomics considerations include the potential of the action to:

- "Induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area);
- Disrupt or divide the physical arrangement of an established community;
- Cause extensive relocation when sufficient replacement housing is unavailable;
- Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities;
- Disrupt local traffic patterns and substantially reduce the levels of service of roads serving an airport and its surrounding communities; or
- Produce a substantial change in the community tax base."

Environmental justice considerations include the potential of the action to lead to a disproportionately high and adverse impact to low-income and/or minority populations from:

- "Significant impacts in other environmental impact categories; or
- Impacts on the physical or natural environment that affect an environmental justice population in a way that the FAA determines are unique to the environmental justice population and significant to that population."

Considerations for children's environmental health and safety risks include the potential of the action to lead to a disproportionate health or safety risk to children.

U.S. Census demographic data were used to evaluate the potential effects of the Proposed Action compared to the No Action Alternative.

The following subsections describe the potential effects of the Proposed Action on socioeconomics, environmental justice, and children's environmental health and safety risks.

Socioeconomics - The following analysis describes the potential effects of the Proposed Action on population and housing, labor force, and transportation and why those effects would not be significant.

Population and Housing - As described in ***Chapter 2***, Sierra Space would employ 10 to 40 people, in a mix of both full- and part-time positions, for post-reentry procedures (Sierra Space, 2021). Employees could include mechanics and ground crew, air crew staff, trainers, office staff, and flight controllers. The estimated number of employees is subject to change based on the type of operations, such as the number of payloads included per reentry, as well as the frequency of reentry operations. Workers associated with the Proposed Action are likely to commute to, or reside in, Madison County. Given the small number of new temporary or permanent residents anticipated to support Dream Chaser reentry operations, the Proposed Action would not result in an increase in population in Madison County.

The Proposed Action would not require the relocation of existing residents or disrupt or divide the physical arrangement of an established community. About 7 percent of the housing units in Madison County are vacant. Therefore, there is available housing in the area should potential future employees seek housing in the study area (U.S. Census Bureau, 2018).

Labor Force - The potential increase of up to 40 full- and part-time employees from the Proposed Action would not significantly affect the labor force in the study area or surrounding region. The Proposed Action would not require the relocation of any businesses and, therefore, would not decrease the existing labor force or local fiscal revenue, cause extensive relocation of community businesses that would cause severe economic hardship for affected communities, or produce a substantial change in the community tax base.

Transportation – The Proposed Action has the potential to produce increased surface traffic as a result of the Proposed Action. Spectators may increase traffic levels near the Airport to observe the landing of the reentry vehicle. Though there is no official observation area for spectators, the Airport recommends its parking garage for viewing takeoffs and landings. Local roadways that could experience increased traffic near the Airport are James Record Road, Houston Goodson Boulevard, and Glenn Hearn Boulevard. However, this potential increase in surface traffic from spectators and up to 40 new employees for up to one reentry annually in 2023, 2024, and 2025; two reentries in 2026; and up to three reentries in 2027 would not significantly change the level of service of local roads. There would be around one to three semi-trailer trucks used to transport the Dream Chaser and any ground transportation equipment associated with each proposed reentry operation, of which there would be a small number per year. This would likely be a minor increase in truck traffic. Therefore, the Proposed Action would not significantly disrupt local traffic patterns, nor would it substantially reduce the levels of service of roads serving HSV and its surrounding communities.

*Aircraft and Airport Operation*s – Socioeconomic impacts from re-routing aircraft due to the Proposed Action would be similar to re-rerouting aircraft for other reasons (e.g., weather issues, runway closures, wildfires, military exercises, and presidential flights). Potential socioeconomic impacts include additional airline operating costs for increased flight distances and times resulting from re-routing aircraft and increased passenger costs as a result of impacted passenger travel, including time lost from delayed flights, flight cancellations, and missed connections. Alternatively, restricting or preventing a reentry operation would have socioeconomic impacts on Sierra Space, commercial payload providers, and consumers of payload services. Operations would result in airspace and ground closures of 18R-36L at HSV for around 15 minutes. Runway 18L-36R would be closed to aircraft and vehicle ground movements for around 1 hour and unavailable for the arrival or departure of aircraft for around 10 hours; during this time, all Runway 18L-36R traffic would be accommodated on Runway 18R-36L. Given that airspace and runway closures would be temporary and infrequent, the FAA does not expect airspace closures from the Proposed Action would result in significant socioeconomic impacts. Furthermore, local air traffic controllers would coordinate with airports and aircraft operators to minimize the effect of the reentry operations on airport traffic flows as well as traffic flows in enroute airspace.

Environmental Justice - There are minority and low-income populations in Morgan and Cullman counties. However, the percentages of minority and low-income individuals within the study area are less than the

average minority and low-income percentages for the State of Alabama (see **Table 3-7**). The Proposed Action does not include construction or the development of facilities at HSV that would directly affect environmental justice minority and low-income populations. Similarly, operation of the Proposed Action would not result in significant direct impacts to any resource that would affect minority and/or low-income populations.

The analysis of potential environmental justice impacts also considered noise impacts from sonic booms. The significance threshold for impulsive noise sources is a DNL of 65 dBA, equivalent to a CDNL of 60 dBC. As described in **Section 3.2.1**, *Noise and Noise-Compatible Land Use*, a single reentry with a modeled maximum of 1.25 psf translates to an equivalent CDNL of 28.5 dBC for a single daytime operation or 38.5 dBC for a single nighttime operation. The maximum number of proposed reentries per year (3 reentries in 2027), would result in a maximum CDNL of 43.3 dBC under a scenario where all proposed reentries occurred at night. Therefore, the reentry vehicle operations do not pose a significant impact with regards to human annoyance or any disproportionate impact to environmental justice communities. As noted previously, the potential for hearing damage from sonic booms is negligible because the modeled sonic boom overpressure levels over land are substantially lower than the NIOSH and OSHO ~4 psf impulsive hearing conservation noise criterion.

Sonic booms also result in overpressure that could cause damage to structures, in particular brittle components including glass and plaster. The potential for structural damage to structures in the study area is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf. Therefore, the reentry vehicle operations do not pose a significant impact with regard to structural components or any disproportionate impact to environmental justice communities. Overall, the Proposed Action would not have disproportionately high or adverse human health or environmental affects to minority or low-income populations.

Children's Environmental Health and Safety Risks - The Proposed Action does not include construction or the development of facilities at HSV and would not directly affect surrounding communities. Access to the reentry site boundary would require security clearance/badging or escort by approved access. The operation of the Proposed Action would not affect environmental impact categories that would represent an environmental safety risk to children.

The 10 public and private schools as well as the six daycare centers within the study area would be affected by one sonic boom annually in 2023, 2024, and 2025, two sonic booms in 2026, and three sonic booms in 2027 (one of the up to three sonic booms in 2027 would occur at night when schools and daycare center s are not occupied with children). Therefore, the potential for routine classroom disruption is negligible.

As described in **Section 3.2.1**, *Noise and Noise-Compatible Land Use,* a single reentry with a modeled maximum of 1.25 psf translates to an equivalent CDNL of 28.5 dBC for a single daytime operation or 38.5 dBC for a single nighttime operation. The maximum number of proposed reentries per year (3 reentries in 2027), would result in a maximum CDNL of 43.3 dBC under a scenario where all proposed reentries occurred at night. Noise exposure from these operations would be less than the significance threshold of

CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA). Therefore, the reentry vehicle operations do not pose a significant impact with regards to human annoyance with respect to noise exposure.

The potential for hearing damage is negligible because the modeled maximum sonic boom overpressure levels over land are substantially lower than the NIOSH and OSHA ~4 psf impulsive hearing conservation noise criteria. In terms of auditory effects, the intensity of sonic booms associated with operation of the Proposed Action would be similar to thunder in intensity. As described previously, residents in Morgan County experience, on average, about 8,000 cloud-to-ground lightning flashes per year (NOAA, 2020). Users of schools and daycare centers in the study area experience overpressure from thunder activity that is similar to what would be produced during the sonic booms from the Proposed Action. Additionally, potential for structural damage to public/private schools and daycare centers in the study area is unlikely as the modeled sonic boom overpressure levels over land are less than the 2 psf threshold for potential structural damage. Therefore, the Proposed Action would not significantly affect children's environmental health and/or safety.

CHAPTER 4

LIST OF PREPARERS

4.1 LEAD AGENCY

The FAA is the lead agency for the preparation of this EA. Responsibility for review of this EA rests with the FAA. Listed below are the identities of the principal FAA individuals that participated in the preparation of this EA, in accordance with Section 1502.7 of the CEQ Regulations and FAA Order 1050.1F.

Stacey M. Zee

Position: Environmental Protection Specialist, FAA Office of Commercial Space Transportation

4.2 PRINCIPAL PREPARERS

Responsibility for preparation of this EA rests with the Authority. Listed below are the employees of the Airport and the consulting firms responsible for the preparation of this EA. The consultant to the Authority has experience in environmental planning. It is recognized that no one individual can be an expert in all of the environmental analysis presented in this EA. As such, an interdisciplinary team of technicians and experts in various topics was required to prepare this EA.

Ryan Gardner, C.M.

Position: Airport Operations Manager

Butch Roberts

Position: Chief Operating Officer

4.2.1 Teledyne Brown Engineering, Inc.

Lee Jankowski

Position: Senior Director of Space Business Development
Education: Bachelor of Science in Engineering from University of Alabama, Huntsville, 1984
Experience: Mr. Jankowski has over 35 years of experience in Humans Spaceflight Operations, Integration and Systems Engineering on NASA contracts. He has over 12 years of Business Development experience and 7 years of experience in Program Management of Large NASA contracts.

4.2.2 RS&H, Inc.

Richard Rogers

Position: Project Manager, Spaceport Planning Leader
Education: Bachelor of Science in Aerospace Engineering, University of Central Florida, 2009
Experience: Mr. Rogers has nine years of experience in the aerospace and defense industry providing spaceport planning, licensing, and the mechanical design, manufacturing, systems testing, and launch services for launch vehicles. He has

managed FAA spaceport licensing and EA projects for spaceports throughout the United States.

David Alberts

Position:	Senior Environmental Planner, Southeast Region Environmental Service Group Leader
Education:	Bachelor of Arts in Geography, University of South Florida, 1997
Experience:	Mr. Alberts has 20 years of NEPA related experience. He has managed and prepared federal EISs, EAs, and documented CATEXs, as well as state environmental documents for a variety of major air carrier and general aviation airports and spaceports throughout the United States.

Ken Ibold

Position:	Senior Aviation Planner
Education:	Master of Science in Transportation and Urban Systems Planning, North Dakota State University, 2014. Bachelor of Science in Journalism, University of Wisconsin-Madison, 1983.
Experience:	Mr. Ibold has more than 30 years of aviation experience. He is responsible for the execution of aviation planning efforts, FAA licensed commercial spaceports, Airport Master Plans, feasibility studies, and Airport Layout Plans (ALPs). Mr. Ibold is certified by the American Institute of Certified Planners and the Congress of New Urbanism

Dave Full

Position:	Senior Environmental Planner, Environmental Planning Service Group Leader
Education:	Master of Urban Planning, University of Washington, 1985; Bachelor of Arts in Urban Planning, University of Illinois, 1982
Experience:	Mr. Full has 35 years of experience in preparing NEPA documentation for aviation projects.

Monica Hamblin

Position:	Environmental Planner
Education:	Bachelors of Science, Interdisciplinary Studies-Environmental Science. University of Central Florida, 2017.
Experience:	Ms. Hamblin has experience conducting NEPA research, analysis, and documentation for commercial and general aviation airports.

Bradley Chandler

Position:	Environmental Planner
Education:	Master of Science in Environmental Health, University of South Carolina, 2019; Bachelor of Science in Marine Biology, College of Charleston, 2017.
Experience:	Mr. Chandler has experience conducting NEPA research, analysis, and documentation for commercial and general aviation airports.

CHAPTER 5

REFERENCES

ADCNR. (2020). *Outdoor Alabama*. Retrieved from https://www.outdooralabama.com/about-us/wildlife-and-freshwater-fisheries-division

ADCNR. (2021). *Mammals*. Retrieved July 2021, from Outdoor Alabama: https://www.outdooralabama.com/wildlife/mammals

ADOT. (2018). *Alabama Traffic Data*. Retrieved August 2020, from https://aldotgis.dot.state.al.us/atd/default.aspx#

AHC. (2020). *Alabama Register of Landmarks and Heritage*. Retrieved August 2020, from https://ahc.alabama.gov/alabamaregister.aspx

Baker, M. (2020, July). *HSV Airport Master Plan*. Retrieved from https://www.dropbox.com/s/zsqftkhhqtds0wp/Website%20AMP.pdf?dl=0

BRRC. (2019). *Technical Report: Shuttle Landing Facility Reentry Site Licensing Sonic Boom Analysis (FINAL)*. BRRC.

CEQ. (1997, December 10). *Environmental Justice - Guidance Under the National Environmental Policy Act*. Retrieved July 2016, from Agency Guidance Related to Environmental Justice and NEPA: https://www.epa.gov/sites/production/files/2015-02/documents/ej_guidance_nepa_ceq1297.pdf

CEQ. (2020, July). *Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act*. Retrieved from https://www.federalregister.gov/documents/2020/07/16/2020-15179/update-to-the-regulations-implementing-the-procedural-provisions-of-the-national-environmental

City of Hartselle. (2020). *Parks and Recreation*. Retrieved August 2020, from https://hartselle.org/hart/government/parks-recreation/#:~:text=The%20Hartselle%20Parks%20and%20Recreation%20Department%20consists%20of,AL%2035640.%20The%20phone%20number%20is%20%28256%29%20773-2581.

FAA. (2014). *Final Environmental Assessment for the Midland International Air and Space Port:*. Retrieved from https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/operator/

FAA. (2020). *1050.1F Desk Reference*. Retrieved August 2020, from https://www.faa.gov/documentlibrary/media/order/faa_order_1050_1f.pdf

FAA. (2020). *1050.1F Desk Reference*. Retrieved from https://www.faa.gov/about/office_org/headquarters_offices/apl/environ_policy_guidance/policy/faa_nepa_order/desk_ref/media/desk-ref.pdf

FAA. (2020). FAA Airspace Classifications.

FAA. (2020). *FAA Wildlife Strike Database*. Retrieved from https://wildlife.faa.gov/home

FAA. (2020, February 21). Letter Correspondence from Brian Hendry, FAA Jackson ADO to Richard Tucker, Executive Director, Huntsville-Madison County Airport Authority. Huntsville, AL.

HHS. (2021). *Poverty Guidelines*. Retrieved July 2021, from https://aspe.hhs.gov/poverty-guidelines

Higgins, R. (1976). *Statistical Model of Sonic Boom Structural Damage. RD-76-87,. FAA*.

Manci, K. (1988). *Effects of aircraft noise and sonic booms on domestic animals and wildlife: a literature synthesis.* . Ft. Collins, CO. NERC-88/.: U.S. Fish and Wildlife. Serv. National Ecology Research Center.

Morgan County. (2020). *Parks and Recreation*. Retrieved August 2020, from http://www.co.morgan.al.us/parkandrecindex.html

Nakaki, J. (1989). *Sonic Boom Damage to Conventional Structures. HSD-TR-89.*
NOAA. (2020). *Cloud-to-Ground Lightning Flashes: County and State Summaries*. Retrieved August 2020, from https://www.ncdc.noaa.gov/data-access/severe-weather/lightning-products-and-services
NPS. (2020). *National Register of Historic Places*. Retrieved August 2020, from https://www.nps.gov/subjects/nationalregister/index.htm
Sierra Space. (2019). Sierra Space Reentry Vehicle Parameters.
Sierra Space. (2020). Dream Chaser Nominal Reentry Through National Airspace System.
Sierra Space. (2020). Proposed Maximum Number of Reentry Operations to HSV.
Sierra Space. (2020). Reentry Vehicle's Deorbit Timeline.
Sierra Space. (2021). Reentry Vehicle illustration.
Sutherland, L. (1990). *Effects of Sonic Boom on Structures, Lecture 3 of Sonic Boom: Prediction and Effects. AIAA Short Course.*
TDAT. (2020). *Database search for Morgan and Cullman Counties*. Retrieved August 2020, from https://egis.hud.gov/tdat/
Town of Falkville. (2020). *Parks & Recreation*. Retrieved August 2020, from https://falkville.org/ParkAndRecreation.aspx
Town of Somerville. (2020). *Municipal Services*. Retrieved August 2020, from http://www.townofsomerville.org/municipal-services.html
TVA. (2020). *Reservoir Land Management Plans*. Retrieved August 2020, from https://www.tva.com/Environment/Environmental-Stewardship/Land-Management/Reservoir-Land-Management-Plans
U.S. Census Bureau. (2018). *American Community Survey*. Retrieved August 2020, from https://data.census.gov/cedsci/table?q=madison%20County,%20Alabama%20Housing&g=1400000US12033001101&tid=ACSDP1Y2018.DP04&hidePreview=false
U.S. Census Bureau. (2019). *American Indian GIS Data*. Retrieved August 2020, from https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2019&layergroup=American+Indian+Area+Geography
U.S. Census Bureau. (2021, July). *How the Census Bureau Measures Poverty*. Retrieved July 2021, from https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html#:~:text=If%20a%20family's%20total%20income,it%20is%20considered%20in%20poverty.&text=The%20official%20poverty%20definition%20uses,Medicaid%2C%20and%20food%20stamps).
USEPA. (2019). Retrieved from EJSCREEN: Environmental Justice Screening and Mapping Tool: https://www.epa.gov/ejscreen
USEPA. (2020). *EJ Screener and Mapper Tool*. Retrieved August 2020, from https://www.epa.gov/ejscreen/overview-demographic-indicators-ejscreen
USEPA. (2021, July). *Alabama Nonattainmanet/Maintenance Status by County*. Retrieved July 2021, from USEPA Green Book: https://www3.epa.gov/airquality/greenbook/anayo_al.html
USEPA. (2021, October). *Hydrogen Peroxide*. Retrieved from https://sor.epa.gov/sor_internet/registry/substreg/searchandretrieve/substancesearch/search.do?details=displayDetails&selectedSubstanceId=38481
USEPA. (2021, October). *Superfund: National Priorites List (NPL)*. Retrieved from https://www.epa.gov/superfund/superfund-national-priorities-list-npl

USFWS. (2020). *About Wheeler*. Retrieved from https://www.fws.gov/refuge/Wheeler/about.html
USFWS. (2020). *IPaC*. Retrieved June 2020, from https://ecos.fws.gov/ipac/