## APPENDICES

APPENDIX A: EA/STAKEHOLDER COORDINATION



HUNTSVILLE INTERNATIONAL AIRPORT • INTERNATIONAL INTERMODAL CENTER • JETPLEX INDUSTRIAL PARK

October 30, 2020

[via email: email address]

#### Name Company Address

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Huntsville-Madison County Airport Authority Intent to Apply for a FAA Part 433 License

Dear :

RE:

The purpose of this letter is to formally notify our stakeholders of the Huntsville-Madison County Airport Authority's (Authority) intent to apply for a Federal Aviation Administration (FAA) Part 433 license that will allow Huntsville International Airport (HSV) to become a licensed reentry site for spacecraft, specifically the Sierra Nevada Corporation (SNC) Dream Chaser.

This effort began in 2015 when the Authority conducted a Phase 1 technical study to determine the feasibility of landing the Dream Chaser at HSV. The study concluded that HSV is capable of supporting a Dream Chaser reentry and landing and that no prohibitive challenges were found. With the support of the City of Huntsville, Madison County, the Alabama Military Stability Foundation, and the State of Alabama we immediately proceeded to Phase 2 and began the Part 433 license application process. We would anticipate reentry vehicle operators conducting up to 6 reentries annually over the next five years.

#### **Estimated Annual Number of Reentries**

|           | 2022 | 2023 | 2024 | 2025 | 2026 |  |
|-----------|------|------|------|------|------|--|
| Vehicle   | 1    | 2    | 2    | 5    | 6    |  |
| Reentries | L    | 2    | 5    | 5    | 0    |  |

Huntsville-Madison County Airport Authority Intent to Apply for a FAA Part 433 License Page Two

During the next month or two the FAA will be contacting your organization directly to begin early stakeholder engagement to communicate how the licensing process will work and how your organizations can participate.

We would like to thank you for your interest in this project and we look forward to working with you. If you have any questions or comments please contact the Authority's Director of Operations, Kevin Vandeberg at kvandeberg@hsvairport.org.

Sincerel

Richard Tucker CEO

cc: Emily Afifi, FAA Stacey Zee, FAA Wes Mittlesteadt, FAA Butch Roberts, HSV Kevin Vandeberg, HSV Ryan Gardner, HSV Lee Jankowski, Teledyne-Brown Engineering Christopher Allison, SNC Rick Rogers, RS&H Dave Alberts, RS&H



O 904-256-2500 F 904-256-2501 *rsandh.com* 

#### DATE

NAME TITLE AGENCY STREET CITY, STATE, ZIP

[via email: \_\_\_\_\_]

RE: National Environmental Policy Act (NEPA) Early Agency Coordination Environmental Assessment (EA) for Operation of Reentry Vehicles to Huntsville International Airport, Huntsville, AL

#### Dear Mr./ Mrs.,

The purpose of this letter is to seek input regarding potential environmental impacts that may be associated with the operation of reentry vehicles landing at Huntsville International Airport (HSV or Airport) (see **Attachment 1**).

Under the Proposed Action, the FAA would issue a Reentry Site Operator License (RSOL) to the Huntsville-Madison Country Airport Authority (Authority) for the operation of a commercial space reentry site at HSV and provide unconditional approval of the portion of the Airport Layout Plan (ALP) that shows the designation of a reentry site boundary.

The purpose of the Authority's proposal is to provide a reentry facility to initiate its reentry site capabilities, including the recovery of horizontally launched orbital reusable vehicles. The Authority seeks to advance the space industry and foster the local and regional growth and development of commercial space industry. The Authority's need to acquire a reentry site operator license would 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.

Commercial space operators may also use the EA to support their application to acquire a reentry license to allow them to conduct horizontal landings of reentry vehicles at HSV should their operations match those described and assessed within the EA. However, should a prospective vehicle operator's reentry footprint fall outside that analyzed in the EA, the FAA would re-evaluate the potential impacts and, if necessary, prepare additional NEPA documentation.





The Proposed Action is subject to environmental review under NEPA. The FAA is the lead Federal agency and is preparing an EA in accordance with NEPA, Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The purpose of a NEPA analysis is to ensure full disclosure and consideration of environmental information in federal agency decision-making.

Under the Proposed Action to be addressed in the EA, the FAA would issue a RSOL for the landing of a reentry vehicle at HSV. The FAA may use the EA to support the issuance of licenses to prospective operators (when their operations match those described and assessed within the EA) that would allow them to conduct reentry vehicle landings at HSV.

#### **Reentry Vehicle**

The reentry vehicle parameters considered in the EA are summarized in the **Table 1**. The purpose of describing these parameters is to broadly assess the potential impacts of reentry vehicle operations at HSV. This information does not necessarily reflect the exact reentry vehicle(s) that would operate at HSV. However, if a prospective operator's reentry vehicle parameters fall outside the parameters analyzed in the EA, or otherwise involve new circumstances or information relevant to environmental concerns, the FAA would re-evaluate the potential impacts and, if necessary, prepare additional NEPA analysis (FAA Order 1050.1F, Paragraph 9-3).

The reentry vehicle parameters considered in the EA is similar to, but not limited to, the Sierra Nevada Corporation (SNC) *Dream Chaser*<sup>®</sup> spacecraft. **Attachment 2** depicts a reentry vehicle.

| Characteristic                     | Data   |
|------------------------------------|--|
| Vehicle Length                     | 30 ft  |
| Wingspan                           | 27 ft  |
| Gross Vehicle Weight               | 24,600 lbs                                   |
| Landing Gear Configuration         | Nose skid and two rear wheels                |
| Runway Length Required for Landing | 10,000 ft                                    |
| Cross-Range Capability             | ± 700 nm                                     |
| Propellants1                       | Hydrogen Peroxide (H2O2) and Kerosene (RP-1) |
| Return Payload Capacity            | 1,850 kg                                     |

#### **Table 1: Reentry Vehicle Parameters**

Note: 1 - Dream Chaser propellants are used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and highaltitude control during reentry. The system is not used near or on the ground. These propellants are residual at landing Source: SNC, 2020.



Reentry vehicle operators would conduct up to 6 reentries annually over the next five years (see Table 2).

|                   | 2022 | 2023 | 2024 | 2025 | 2026 |
|-------------------|------|------|------|------|------|
| Vehicle Reentries | 1    | 2    | 3    | 5    | 6    |
| C                 |      |      |      |      |      |

Source: SNC, 2020.

The reentry vehicle would reenter from south on an ascending trajectory before landing at HSV. Ascending trajectories include high atmospheric overflight of the southwest United States or Central American countries prior to landing at HSV. The bounding trajectories of the reentry vehicle are based on the maximum cross-range capability at two different orbital missions (International Space Station and 28.5° inclination) along with the maximum cross-range capabilities for the reentry vehicle to bound a reentry corridor (see **Attachment 3**). The reentry vehicle would remain above controlled airspace for the majority of the overflight of Texas, Arkansas, Louisiana, Mississippi, 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 and would be operating below 60,000 MSL for about three to four minutes.

The project study area for the EA is a geographic area that could be directly or indirectly affected by the Proposed Action. The EA's Proposed Action would not result in ground disturbing activities; therefore, the project study area for this EA is based on the footprint of the reentry vehicle's 1.0 pounds per square foot (psf) sonic boom noise contour. This metric was determined because the potential for structural damage is unlikely for the modeled sonic boom overpressure levels less than 1.0 psf. For perspective, nearby thunder would be approximated at 1.0 psf or above. The potential for hearing damage (with regards to humans) is insignificant, as the modeled sonic boom overpressure levels over land are substantially lower than the approximate 4.0 psf impulsive hearing conservation noise criteria. The project study area encompasses about 170 square miles and includes portions of Morgan and Cullman counties Alabama and is shown in **Attachment 4**.

In accordance with NEPA and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, the EA will analyze the potential environmental effects of the Proposed Action and the No Action Alternative. On behalf of the Authority, we are sending you this early notification letter to:

- » Advise your agency of the preparation of the EA;
- » Request any relevant information that your agency may have regarding the project study area; and
- » Solicit early comments regarding potential environmental, social, and economic issues for consideration during the preparation of the EA.



rsandh.com

You may send any information and comments to Leslie Grey, FAA Environmental Specialist at <u>leslie.grey@faa.gov</u> or to myself at <u>david.alberts@rsandh.com</u> or the mailing address provided at the top of this letter. We would appreciate your prompt response within 30 days.

On behalf of the Authority, we would like to thank you for your interest in this project and we look forward to working with you as we prepare the EA. If you have any questions or need additional information regarding the Proposed Action or EA, please do not hesitate to contact Leslie Grey or myself.

Sincerely,

D. Offerto

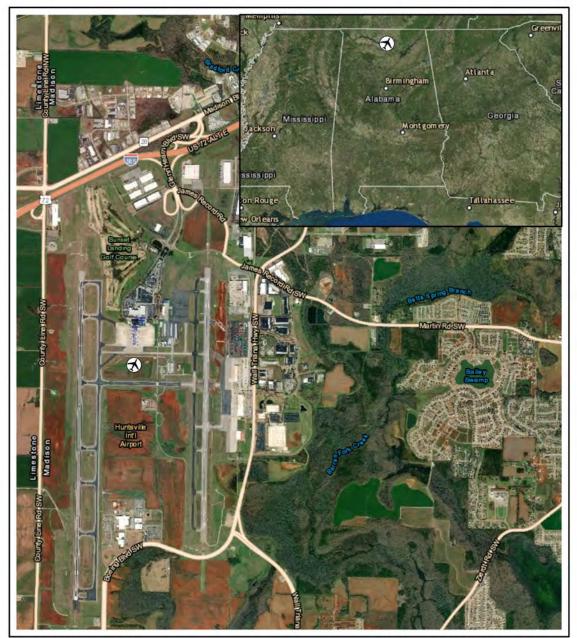
David Alberts Sr. Project Manager RS&H, Inc.

#### Attachments

cc: Stacey Zee, FAA Leslie Grey, FAA Kevin Vandeberg, HSV Lee Jankowski, Teledyne-Brown Engineering Christopher Allison, SNC Rick Rogers, RS&H Project File



#### **Attachment 1: Vicinity Map**

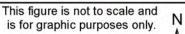


Sources: ESRI, 2019; RS&H, 2019.

#### Legend

Airport Location

Source: ESRI, 2020. RS&H, 2020.





#### **Attachment 2: Reentry Vehicle and Operation**



Source: SNC, 2020.



Source: SNC, 2020.





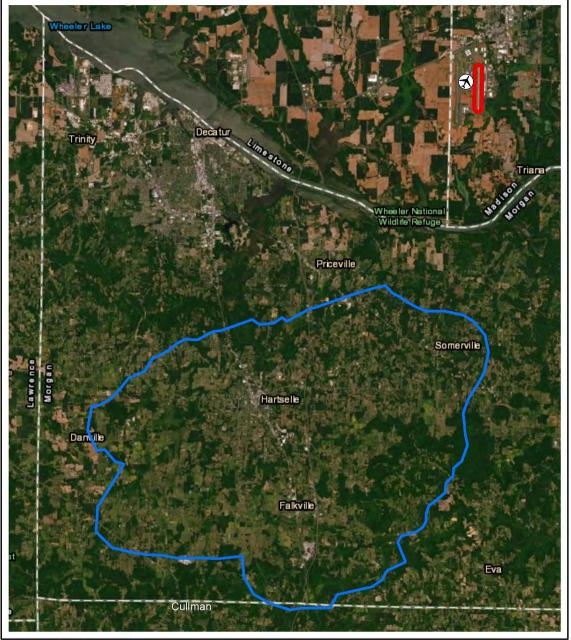


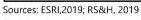
#### Attachment 3: Bounding Reentry Vehicle Flight Path Approaches

Source: SNC, 2020, Google, 2020.



#### Attachment 4: EA Project Study Area





#### Legend

Huntsville International Airport



Study Alea

Reentry Site Boundary

Figure is not to scale and is for graphic purposes only.



### HSV RSOL EA Agency Distriubtion List

| Municipality       | Contact Type             | Name         | Email                         | Phone        | Address                         | Additonal Contact                         | Link             |
|--------------------|--------------------------|--------------|-------------------------------|--------------|---------------------------------|---|------------------|
| Madison County     | Planning and Economic    |              | ped@madisoncountyal.gov       | 256-532-3505 | 819 Cook Avenue, Suite 137      | Anne W. Burkett, Director of Planning and | https://         |
|                    | Development              |              |                               |              | Huntsville Al 35801             | Economic Development                      |                  |
| Morgan County      | County Engineering       | G Bodely     | gbodley@co.morgan.al.us       | 256-773-5297 | 560 Shull Road. Hartselle, AL   |   | http://          |
|                    | Department               |              |                               |              | 35640                           |   |                  |
| Cullman County     | County Admin. Assistant: | Meleigh Hitt | mhitt@co.cullman.al.us        | 256-775-4878 | 500 2nd Ave SW. Room 105.       |   | http://\         |
|                    | Meleigh Hitt             |              |                               |              | Cullamn, AL 35055               |   |                  |
| City of Huntsville | Manager of Planning      | Thomas Nunez | Thomas.Nunez@HuntsvilleAl.gov | 256-427-5109 | 308 Fountain Circle Huntsville, | Kelly Schrimsher, Director of             | https://         |
|                    | Services                 |              |                               |              | AL 35801                        | Communication Kelly.Schrimsher 256-427    | -                |
|                    |                          |              |                               |              |                                 | 5006                                      |                  |
| City of Hartselle  | Generic                  |              | info@hartselle.org            | 256-773-2535 |                                 |   | https://         |
| City of Decatur    | Generic                  |              | webadmin@decatur-al.gov       | 256-341-4500 |                                 | City Clerk Office                         | https://         |
| "                  | City planning department | Kim Stone    | kstone@decatur-al.gov         | 256-341-4720 | 308 Cain Street SE. City Hall   | planning@decatur-al.gov                   |                  |
|                    |                          |              |                               |              | Annex. Decatur, AL 35601        |   |                  |
| Town of Falkville  | Generic                  |              | <u>contact@falkville.org</u>  | 256-784-5922 |                                 |   | https://         |
| Town of Somerville | Generic                  |              | townofsomerville@aol.com      | 256-778-8282 |                                 |   | <u>http://</u> \ |
| Town of Priceville | Generic                  |              | <u>N/A</u>                    | 256-355-3576 |                                 | Tommy Perry (Mayor Pro-Tem),              | https://         |
|                    |                          |              |                               |              |                                 | Communuty Relations Chairman:             | https://         |
|                    |                          |              |                               |              |                                 | tperry1704@charter.net                    |                  |
|                    |                          |              |                               |              |                                 |   |                  |

| Agency                       | Contact Type                | Name                           | Email                            | Phone        | Address                        | Additonal Contact | Link            |
|------------------------------|-----------------------------|--------------------------------|----------------------------------|--------------|--------------------------------|-------------------|-----------------|
| Alabama Dept. of Env.        | Administrative Office       |                                | permitsmail@adem.alabama.gov     | 534-271-7710 |                                |                   | http://a        |
| Management                   |                             |                                |                                  |              |                                |                   |                 |
| Alabama DOT                  | Generic                     |                                | aldotinfo@dot.state.al.us        | 334-353-6554 |                                |                   | <u>https://</u> |
| Alabama Historial            | Deputy SHPO                 | Lee Anne Wofford               | leeanne.wofford@ahc.alabama.gov  | 334-230-2659 |                                |                   | https://        |
| Commission                   |                             |                                |                                  |              |                                |                   |                 |
| National Park Service        | Region 2 (Atlanta) Regional | Stan Austin                    | <u>N/A</u>                       | 404-507-5600 | 100 Alabama St, SW 1924        |                   | <u>https://</u> |
|                              | Director                    |                                |                                  |              | Building. Atlanta, GA 30303    |                   |                 |
| Tennessee Valley Authority   | Chattanooga Office          | Reached out to TVA to get best | tvainfo@tva.gov                  | 423-751-0011 | TVA 1101 Market St.            |                   | https://        |
|                              |                             | contact info                   |                                  |              | Chattanooga, TN 37402          |                   |                 |
| U.S. Environmental           | Region 4                    | Larry Gissentenna              | <u>Gissentanna.larry@epa.gov</u> | 404-562-9512 | USEPA Region 4 NEPA Program    |                   |                 |
| Protection Agency            |                             |                                |                                  |              | Office 61 Forsyth Street SW:   |                   |                 |
|                              |                             |                                |                                  |              | Mailcods 9T25. Atlanta, GA     |                   |                 |
|                              |                             |                                |                                  |              | 30303                          |                   |                 |
| U.S. Fish & Wildlife Service | Southeast Office (Atlanta)  | Allan Brown                    | <u>Allan_brown@fws.gov</u>       | 404-679-4000 | 1875 Century Blvd. Atlanta, GA |                   | <u>https://</u> |
|                              |                             |                                |                                  |              | 30345                          |                   |                 |

| Tribes                    | Recognition | Contact Type                      | Email                      | Phone        | Address                        | Additional Contact          | Link      |
|---------------------------|-------------|-----------------------------------|----------------------------|--------------|--------------------------------|-----------------------------|-----------|
| Alabama-Coushatta Tribe o | f Federal   | Generic                           | information@actribe.org    | 936-563-1100 | 571 State Park 56 Linvingston, | N/A                         | http://al |
| Texas                     |             |                                   |                            |              | TX 77351                       |                             |           |
| Alabama-Quassarte Tribal  | Federal     | Generic                           | info@alabama-quassarte.org | 405-452-3987 | 101 E. Broadway Wetumka, OK    | N/A                         | http://a  |
| Town                      |             |                                   |                            |              | 74883                          |                             |           |
| Chickasaw Nation          | Federal     | Generic                           | N/A                        | 580-436-2603 | 520 E. Arlington Ada, OK 74820 | N/A                         | https://o |
| Coushatta Tribe of        | Federal     | Dept. of Cultural, Historical and | N/A                        | 337-584-1585 | P.O. Box 818 1940 C C Bel Rd.  | Raynella Fontenot, Director | https://v |
| Louisiana                 |             | Natural Resources                 |                            |              | Elton, LA 70532                |                             |           |
| Eastern Band of Cherokee  | Federal     | Public Relations Officer          | ashIstep@nc-cherokee.com   | 828-359-7007 | 88 Council House Loop Chokee,  | Ashleigh Stephens           | https://e |
| Indians                   |             |                                   |                            |              | NC 28719                       |                             |           |
| Echota Cherokee Tribe of  | State       | Generic                           | echota.cherokee@yahoo.com  | 256-734-7337 | 630 County Rd. 1281 Falkville, | N/A                         | http://e  |
| Alabama                   |             |                                   |                            |              | AL 35622                       |                             |           |
| Muscogee (Creek) Nation   | Federal     | Office of Public Relations        | arutland@mcn-nsn.gov       | 918-732-7615 |                                | Amanda Rutland, Manager     | https://\ |
|                           |             |                                   |                            |              |                                |                             |           |

://www.madisoncountyal.gov/departments/department-listing

://www.co.morgan.al.us/aboutus.html

//www.co.cullman.al.us/commission.html

s://www.huntsvilleal.gov/government/departments/

://hartselle.org/hart/

://www.decaturalabamausa.com/contact/

://falkville.org/

//www.townofsomerville.org/town-hall.html

s://www.townofpriceville.com/contact/;

s://www.townofpriceville.com/leaders/

://adem.alabama.gov/inside/contact.cnt

s://www.dot.state.al.us/contact\_us.html s://ahc.alabama.gov/staffdirectory.aspx

s://www.nps.gov/aboutus/contactinformation.htm

s://www.tva.com/about-tva/contact-us

s://www.fws.gov/info/pocketguide/regionalcontactsfieldlocations.html

//alabama-coushatta.com/

//alabama-quassarte.org/contact/

://chickasaw.net/Our-Nation/Contact.aspx ://www.coushattatribe.com/services

://ebci.com/government/

//echotacherokee.org/contact.html

://www.mcn-nsn.gov/services/public-relations/



Federal Aviation Administration

## Proposed Reentry Site Operator License and Vehicle Operator License at Huntsville International Airport, Huntsville, Alabama

The Huntsville-Madison County Airport Authority (Authority) is proposing to operate the Huntsville International Airport (HSV) as a commercial space reentry site and Sierra Space is proposing to reenter its Dream Chaser vehicle at HSV. For more information on the Authority's and Sierra Space's proposed commercial space reentry operations, visit the <u>Proposed Huntsville Commercial Space Reentry</u> <u>Operations</u> page.

To operate a commercial space reentry site at HSV, the Authority must obtain a Reentry Site Operator License from the FAA. To reenter the Dream Chaser vehicle at HSV, Sierra Space must obtain a Vehicle Operator License from the FAA. If and when the Authority and Sierra Space submit applications that the FAA accepts as complete, the FAA will evaluate the applications before making determinations on approval/disapproval of the licenses. Through the evaluation processes, the FAA will complete reviews on safety, environmental impacts, airspace integration, policy, and reentry site location, in accordance with relevant FAA regulations and the National Environmental Policy Act. For more information, visit the <u>FAA License Review Process</u> project page.

### **Project Updates**

Updates on the project, including the FAA's decisions on the license applications and publication of relevant environmental documents, will be added to this website. To receive project updates via email, subscribe to the <u>project mailing list</u>.

### **Public Involvement Opportunities**

Thank you for your interest in engaging in the licensing review process. Opportunities for stakeholder engagement, including participation in the environmental review process, will be posted here as they are available.

https://www.faa.gov/space/stakeholder\_engagement/huntsville\_reentry/

To receive notifications of public involvement opportunities, subscribe to the <u>project</u> <u>mailing list</u>.

Page last modified: June 09, 2021 2:44:48 PM EDT



### Federal Aviation Administration

## Proposed Huntsville Commercial Space Reentry Operations

### Huntsville International Airport (HSV)

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. HSV spans about 6,000 acres (see below for an image of HSV). HSV offers and receives flights from nine major cities including Atlanta, Charlotte, Chicago, Dallas, Denver, Detroit, Houston, and Dulles and Washington D.C.

Currently, the Authority is proposing to offer HSV as a reentry site for Sierra Space's proposed operations as described below. Should additional reentry vehicle operators express interest in HSV as their reentry site, the additional reentry vehicle operators would need to apply to the FAA for a vehicle operator license, and the Authority would need to modify its Reentry Site Operator License. For more information, visit the <u>FAA License Review Process</u> page.

Proposed reentry operations would occur at Runway 18L/36R, circled in blue in the aerial image of HSV below. As reentry vehicle operations would be confined to this area, the blue line also marks the proposed reentry site boundary.



Huntsville International Airport and proposed reentry site

# Sierra Space Proposed Operations of the Dream Chaser

Sierra Space is developing the Dream Chaser, a reusable reentry vehicle capable of carrying payloads to and from low Earth orbit, including delivering supplies to the International Space Station under the Commercial Resupply Services 2 (CRS-2) contract with the National Aeronautics and Space Administration.

The below image shows Sierra Space's proposed operations. The Dream Chaser vehicle would be carried as payload on a vertically-launched United Launch Alliance Atlas 5. HSV does not support vertical launches of space vehicles; therefore, launch activities would occur at another site, such as Cape Canaveral. Sierra Space proposes that the Dream Chaser vehicle would deliver up to 5,500 kilograms of pressurized and unpressurized cargo to the International Space Station. Sierra Space would also offer disposal services over the open ocean via a transport vehicle that could separate from Dream Chaser and burn up safely in the Earth's atmosphere.

The Dream Chaser vehicle's reentry trajectories from orbit would be dependent on the specific mission being flown and would be defined prior to launch. During the reentry sequence, Dream Chaser would have set reentry windows, or timeframes, to begin descent into the Earth's atmosphere to meet the designated reentry trajectory. If No-Go criteria are met, the Dream Chaser vehicle would remain in orbit until the specific reentry trajectory could be received or a contingency trajectory is called upon. The reentry vehicle would reenter from the south on an ascending trajectory, with high atmospheric overflight of the southwestern U.S. or Central American countries, before landing at HSV. The reentry vehicle would remain above 60,000 feet altitude above mean sea level for the majority of the overflight of Texas, Arkansas, Louisiana, Mississippi, and Alabama. The reentry vehicle would descend below 60,000 feet altitude above mean sea level approximately 10 to 20 miles from HSV prior to landing and would operate below 60,000 mean sea level for about three to four minutes.



A complete proposed mission of Sierra Space's Dream Chaser vehicle

Page last modified: June 09, 2021 2:49:12 PM EDT



Environmental Assessment

Huntsville International Airport Reentry Site Operator License and Sierra Space Corporation Reentry Vehicle License



#### Huntsville International Airport Reentry Site Operator License and Sierra Space Corporation Vehicle Operator License Project Stakeholder Informational Call

## Meeting Instructions and Agenda

The FAA is coordinating with the Huntsville Madison County Airport Authority (Authority) on their intent to apply for an FAA Part 433 license, which would allow Huntsville International Airport (HSV) to operate as a licensed commercial space reentry site. The FAA is also coordinating with the Sierra Space Corporation on their intent to apply for an FAA Part 450 license needed to conduct reentries of its Dream Chaser vehicle at HSV. The activities that would be authorized under these licenses are referred to as the proposed project.

As a part of this process, the FAA is engaging stakeholders to provide information on the proposed project and solicit input. The FAA invites stakeholders to attend a conference call in which the Authority and Sierra Space Corporation will provide an overview of the proposed project and the FAA will describe the licensing review process. Participants will be given a chance to ask questions.

#### **MEETING INSTRUCTIONS:**

#### Tuesday, July 27, 2021

1:00 p.m. to 2:00 p.m. (Central Time)

- Connect using the Zoom link below.
  - o https://us02web.zoom.us/j/85327524633
  - o Password: HSV2021
- Or join by phone.
  - o **1-877-853-5247**
  - o Meeting ID: 853 2752 4633
  - o Meeting Password: 6019931

#### **ONLINE MEETING TIPS:**

- Prior to the meeting, **please access the Zoom link above and download any needed software**. This may take a few minutes, so it is best to download software in advance of the meeting.
- When logging-on to the meeting, please indicate your organization name in parentheses after your last name, if you represent one.
- Please **NEVER** put your line on hold, as this will put the audio for the entire meeting on hold.
- All lines will be muted during the meeting.

• To hear audio when connecting through the Zoom link, please make sure the volume on your computer speakers is on and that you do not have any programs with audio features (e.g., Skype, Pandora, YouTube) open that may interfere with the online meeting audio.

#### **MEETING AGENDA:**

- 1. Introductions
  - a. FAA
  - b. Huntsville International Airport
  - c. Sierra Space
- 2. Presentation
  - a. Project Overview
  - b. FAA licensing process
  - c. FAA environmental review process
  - d. Stakeholder involvement
- 3. Next Steps/Schedule
- 4. Comments and Questions?

AST Commercial Space Transportation Go for launch \*

## **Commercial Space Transportation**

Huntsville Reentry Project Stakeholder Informational Call July 27, 2021

## faa.gov/space



Federal Aviation Administration

# **Zoom Platform**

- Indicate your organization name in parenthesis after your last name
- All lines will be muted during the meeting; raise your hand and the facilitator will call on you and prompt you to unmute
- Please do NOT put your line on hold, as this will put the audio for the entire meeting on hold
- To hear audio, make sure the volume on your computer speakers is on and no other programs with audio features are open



# Purpose & Agenda

## Purpose

- Discuss Huntsville Madison County Airport (Authority) and Sierra Space Corporation proposed commercial space reentry operations at Huntsville International Airport (HSV)
- Engaging stakeholders to provide information on the proposed project and solicit input

## Agenda

- Introductions
- Presentation
- Comments and Questions
- Next Steps



AST Commercial Space Transportation



# **AST Stakeholder Engagement**

- Begins early in the licensing application consultation
- Coordination with:
  - FAA Lines of Business
  - Federal Cooperating and Coordinating Agencies
  - Interested stakeholders
- AST project website: <u>https://www.faa.gov/space/stakeholder\_engagement</u> /huntsville\_reentry/



# **Stakeholder Engagement for HSV**

- Airport user meetings
- Aviation stakeholder meetings
  - Industry groups
  - Affected airports
  - Neighboring areas
- NEPA meeting virtual public meeting following the release of the draft environmental document





# **Project Overview**

- The Huntsville Madison County Airport Authority (Authority) is proposing to operate a commercial space reentry site at the Huntsville International Airport (HSV) under a Federal Aviation Administration (FAA) Reentry Site Operator License.
- Sierra Space Corporation (Sierra Space) is proposing to conduct reentries of its Dream Chaser vehicle at HSV under an FAA Vehicle Operator License.



Federal Aviation Administration

**AST** Commercial Space Transportation

July 27, 2021 | 5

# **Project Overview - HSV**





Federal Aviation Administration

#### **AST** Commercial Space Transportation

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## **Project Overview – Sierra Space**





Federal Aviation Administration

#### **AST** Commercial Space Transportation

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## Who Needs a License or Permit?

# A U.S. citizen or an entity organized under the laws of the United States or any State must obtain a license:

- To *launch or reenter* a vehicle *inside* or *outside* the United States;
- To <u>operate</u> a launch or reentry site *inside* or *outside* of the United States;

### An entity may obtain an experimental permit:

• To <u>launch</u> a reusable suborbital vehicle from the United States for research and development, or prior to obtaining a launch license, to show compliance with requirements for a license or crew training.

# FAA does <u>not</u> license launches or reentries "the Government carries out for the Government":

• NASA and the Department of Defense typically carry out their own launches.

SUMMARY: If the company is U.S incorporated or operated in U.S. territory, it needs authorization.

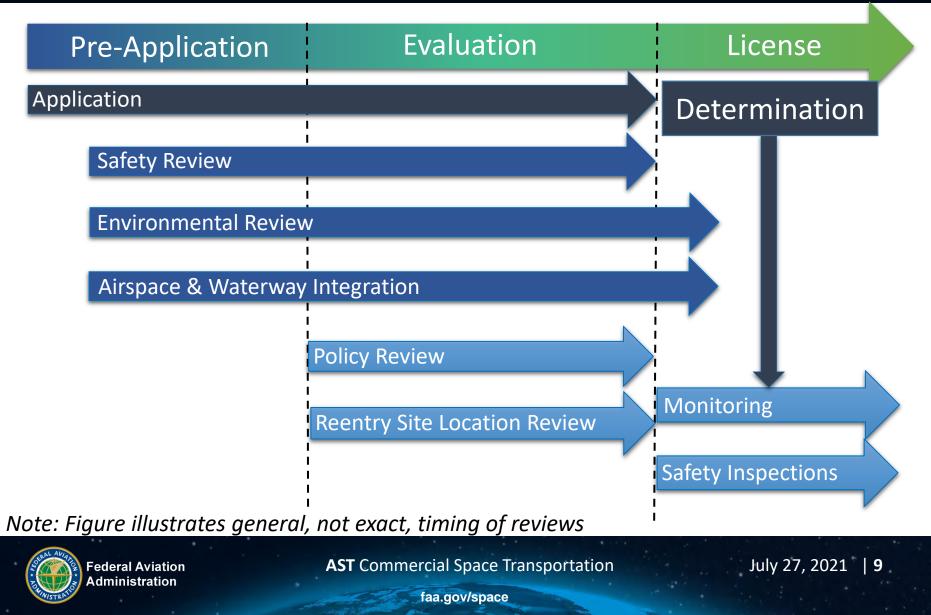


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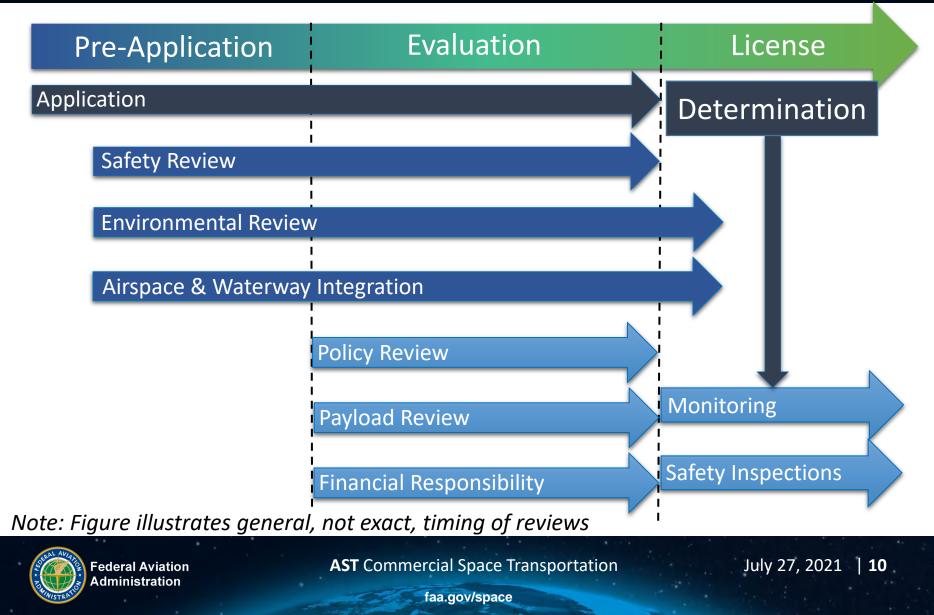




## FAA Licensing Process Reentry Site Operator License



## FAA Licensing Process Vehicle Operator License



# Safety Review – Reentry Site

## What is it?

- Control of public access prevent unauthorized access to the site and hazards
- Explosive Site Plan ensure configuration of site conforms to explosive siting standards
- Reentry Site Location Review an applicant shall demonstrate that for each reentry point proposed for the site, at least one type of reentry vehicle can reenter safely



# Safety Review – Reentry Vehicle

- Flight Safety Analysis risk of the operation to the public
- Maximum Probable Loss minimum insurance requirements for government property, third parties, and third party property
- System Safety Analysis system safety program to demonstrate acceptable mission risk
- Mission Rules operating requirements and restrictions necessary for public safety



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# Payload Review – Reentry Vehicle

- Payload specification dimensions and weight
- Payload owner and operator
- Hazardous materials
- Delivery point when the payload will no longer be under the licensee's control





# Financial Responsibility Review – Reentry Vehicle

- Maximum Probably Loss (MPL) probabilistic assessment of the amount of insurance or escrow needed to cover damage incurred to life or property as a result of a mishap during launch or reentry
- Evidence of financial responsibility evidence of funds equal to the MPL





# **Airspace Integration**

What is it? An applicant for a license or permit must complete a Letter of Agreement (LOA) with the FAA Air Traffic Control facility having jurisdiction over the airspace through which operations will take place

What does it contain? LOAs establish procedures for:

- Notification, including the issuance of a Notice to Airmen (NOTAM),
- Communication before, during, and after the operation,
- Contingencies/emergencies, and
- Any additional measures deemed necessary to protect public health and safety

When is it coordinated? Draft LOAs are required (by policy) for application acceptance; final signed LOAs are required for license/permit determination



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July 27, 2021 | **15** 

# **Environmental Review**

What is it? The FAA must complete an environmental review under the National Environmental Policy Act (NEPA) by assessing the environmental impacts of the proposed licensing actions

 FAA is planning the development of an Environmental Assessment (EA) associated with the Authority's proposed reentry site and Sierra Space's proposed reentry operations

### When is it coordinated?

- Draft EA or EIS is released for public review
- Agency consultations are integrated into or referenced in environmental document
- Final EA or Final EIS is released for public review
- EA end in Finding of No Significant Impact or preparation of an EIS



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## Q&A

- Does the group have any questions or concerns?
- Responses will be provided in future materials
- Contact <u>huntsvillereentry@icf.com</u> with additional questions or to be added to the project mailing list

### **Next Steps**

- Meeting summary
- Q&As
- Future meetings
  - Soon: Industry groups and neighboring airports
  - Later: NEPA public meeting

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Federal Aviation Administration



Environmental Assessment

Huntsville International Airport Reentry Site Operator License and Sierra Space Corporation Reentry Vehicle License



#### Huntsville International Airport Reentry Site Operator License and Sierra Space Corporation Vehicle Operator License Project Stakeholder Meeting

#### Meeting Instructions and Agenda

\_\_\_\_\_

The FAA is coordinating with the Huntsville Madison County Airport Authority (Authority) on their intent to apply for an FAA Part 433 license, which would allow Huntsville International Airport (HSV) to operate as a licensed commercial space reentry site. The FAA is also coordinating with the Sierra Space Corporation on their intent to apply for an FAA Part 450 license needed to conduct reentries of its Dream Chaser vehicle at HSV. The activities that would be authorized under these licenses are referred to as the proposed project.

As a part of this process, the FAA is engaging stakeholders to provide information on the proposed project and solicit input. The FAA invites stakeholders to attend a conference call in which the Authority and Sierra Space Corporation will provide an overview of the proposed project and the FAA will describe the licensing review process. Participants will be given a chance to ask questions.

#### **MEETING INSTRUCTIONS:**

#### Wednesday, September 29, 2021

11:00 a.m. to 12:00 p.m. (Central Time)

- Connect using the Microsoft link below.
  - o Click here to join the meeting
- Or join by phone.
  - o **1-213-493-7443**
  - Meeting Password: 430 922 652#

#### **ONLINE MEETING TIPS:**

- Prior to the meeting, **please access the Teams link above and download any needed software**. This may take a few minutes, so it is best to download software in advance of the meeting.
- When logging-on to the meeting, please indicate your organization name in parentheses after your last name, if you represent one.
- All lines will be muted during the meeting.
- To hear audio when connecting through the Teams link, please make sure the volume on your computer speakers is on and that you do not have any programs with audio features (e.g., Skype, Pandora, YouTube) open that may interfere with the online meeting audio.

#### **MEETING AGENDA:**

1. Introductions

- a. FAA
- b. Huntsville International Airport
- c. Sierra Space
- 2. FAA Presentation
  - a. Stakeholder involvement
  - b. Project overview
  - c. FAA licensing process
- 3. Next Steps
- 4. Comments and Questions?

AST Commercial Space Transportation Go for launch \*

### **Commercial Space Transportation**

Huntsville Reentry Project Stakeholder Informational Call September 29, 2021

faa.gov/space



Federal Aviation Administration

## **Microsoft Teams Platform**

- Indicate your organization name in parenthesis after your last name
- All lines will be muted during the meeting; raise your hand and the facilitator will call on you and prompt you to unmute
- To hear audio, make sure the volume on your computer speakers is on and no other programs with audio features are open



# Purpose & Agenda

### Purpose

- Discuss Huntsville Madison County Airport (Authority) and Sierra Space Corporation proposed commercial space reentry operations at Huntsville International Airport (HSV)
- Engaging stakeholders to provide information on the proposed project and solicit input

### Agenda

- Introductions
- FAA Presentation
- Comments and Questions
- Next Steps



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## **AST Stakeholder Engagement**

- Begins early in the licensing application consultation
- Coordination with:
  - FAA Lines of Business
  - Federal Cooperating and Coordinating Agencies
  - Interested stakeholders
- AST project website: <u>https://www.faa.gov/space/stakeholder\_engagement</u> /huntsville\_reentry/



# **Stakeholder Engagement for HSV**

- Airport user meetings
- Aviation stakeholder meetings
  - Industry groups
  - Affected airports
  - Neighboring areas
- NEPA meeting virtual public meeting following the release of the draft environmental document



# **Project Overview**

- The Huntsville Madison County Airport Authority (Authority) is proposing to operate a commercial space reentry site at the Huntsville International Airport (HSV) under a Federal Aviation Administration (FAA) Reentry Site Operator License.
- Sierra Space Corporation (Sierra Space) is proposing to conduct reentries of its Dream Chaser vehicle at HSV under an FAA Vehicle Operator License.
- Maximum number of proposed reentries, annually (could be daytime or nighttime):

| 2023 | 2024 | 2025 | 2026 | 2027 |
|------|------|------|------|------|
| 1    | 1    | 1    | 2    | 3    |



Federal Aviation Administration **AST** Commercial Space Transportation

# **Project Overview - HSV**





Federal Aviation Administration

#### **AST** Commercial Space Transportation

September 29, 2021 | 6

### **Project Overview – Sierra Space**





Federal Aviation Administration

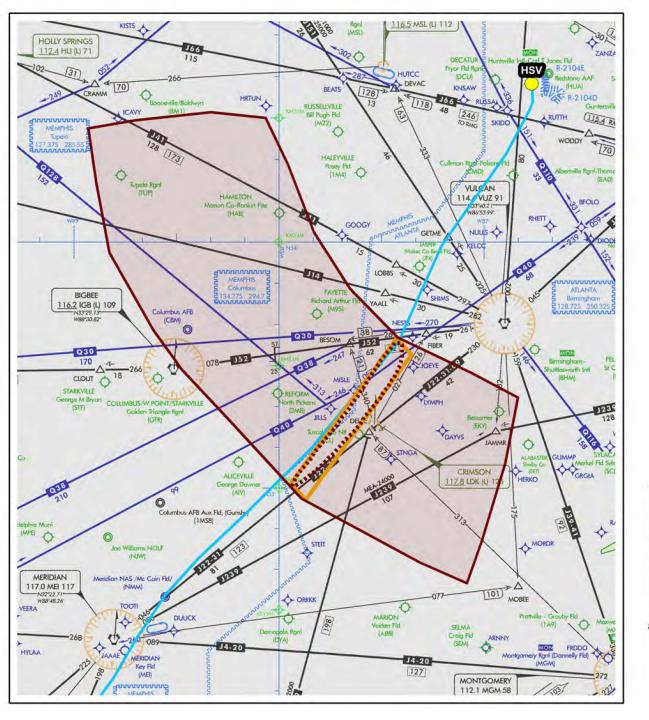
#### **AST** Commercial Space Transportation

September 29, 2021 | 7

# **Airspace Closures**

- A NOTAM will be issued for each reentry opportunity
- Potentially impacted air traffic and nearby airports:
  - Hartsfield-Jackson Atlanta International Airport
  - Nashville International Airport
  - Birmingham Shuttlesworth International Airport
- Uncontrolled airports under or near the proposed flight path could also be affected

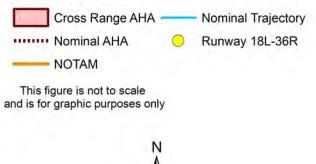




### Preliminary Draft Subject to Change

Sources: ESRI, 2021; RS&H, 2021

#### Legend



# **Runway Closures**

- TFRs would be issued
- From deorbit burn + 30 minutes until touchdown at deorbit burn + 45 minutes (around 15 minutes total), both Runway 18L-36R and Runway 18R-36L to aircraft and vehicle ground movements
- Runway 18L-36R would be closed for a total of around 10 hours; during this time, Runway 18R-36L would accommodate landings and aircraft and vehicle movements
- The following slide shows a timeline of the Runway 18L-36R closures



# **18L-36R Runway Closures**

| Time            | Activity                             | Aircraft/Vehicle Ground<br>Movements on Runway<br>18L-36R | Arrival/Departure of<br>Aircraft on Runway 18L-<br>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 <sup>1</sup> | Available   | Not Available  |
| R +7 hour       | End Propellant Safing                | Available   | Not Available  |
| R +7.5 hours    | Tow to Apron/Existing                | Available   | Not Available  |
|                 | Facility                             |   |  |
| R +8 hours      | Begin Unload of Cargo                | Available   | Available  |

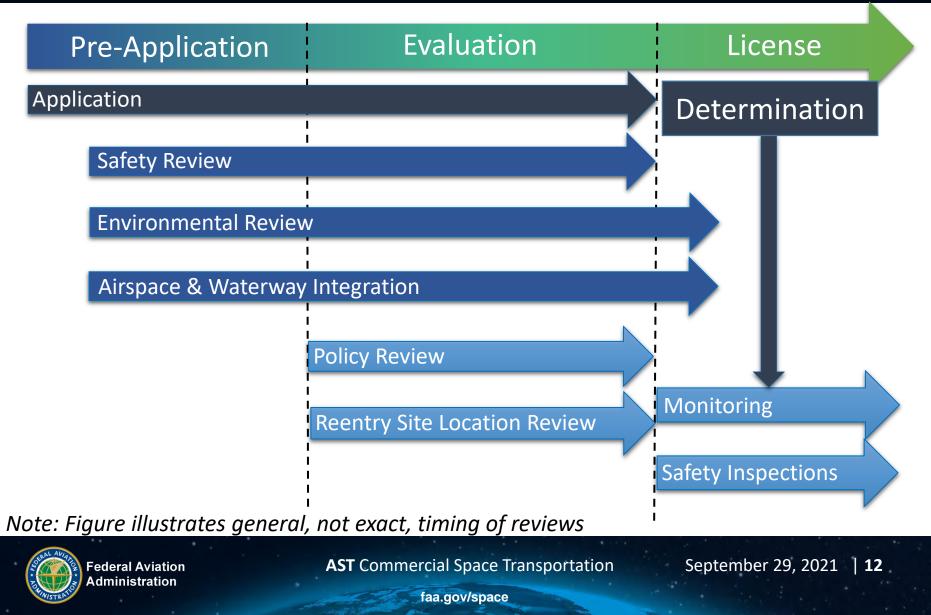
<sup>1</sup> - Depending on the mission profile, cargo unload could occur prior to the propellant safing.

DB – Deorbit Burn; R - Recovery/wheel stop on Runway 18L-36R.

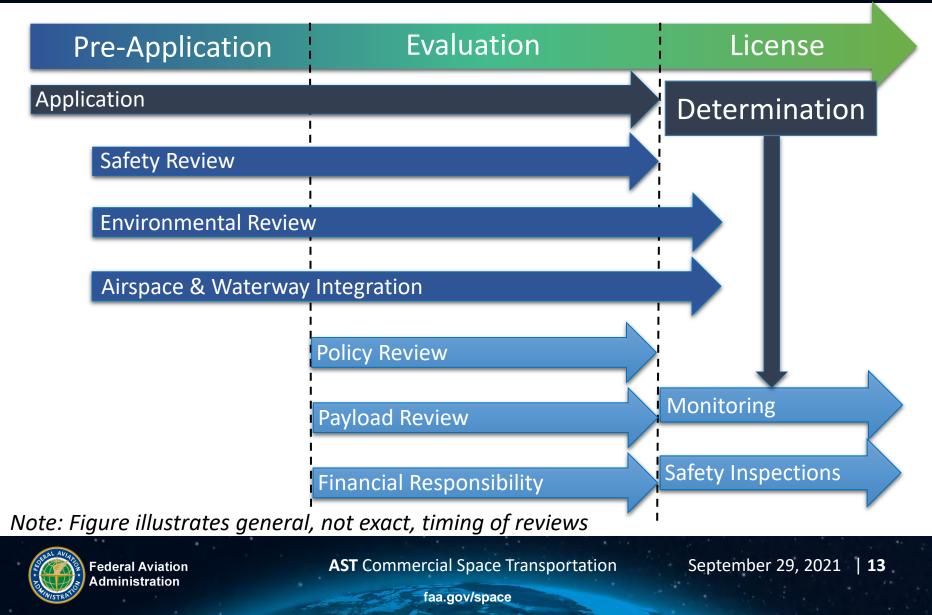
Source: Sierra Space, 2020.



### FAA Licensing Process Reentry Site Operator License



### FAA Licensing Process Vehicle Operator License



## Safety Review – Reentry Site

### What is it?

- Control of public access prevent unauthorized access to the site and hazards
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### What is it?

- Flight Safety Analysis risk of the operation to the public
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When is it coordinated? Draft LOAs are required (by policy) for application acceptance; final signed LOAs are required for license/permit determination



**AST** Commercial Space Transportation

# **Environmental Review**

What is it? The FAA must complete an environmental review under the National Environmental Policy Act (NEPA) by assessing the environmental impacts of the proposed licensing actions

 FAA is planning the development of an Environmental Assessment (EA) associated with the Authority's proposed reentry site and Sierra Space's proposed reentry operations

### When is it coordinated?

- Draft EA or EIS is released for public review
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## Q&A

- Does the group have any questions or concerns?
- Responses will be provided in future materials
- Contact <u>huntsvillereentry@icf.com</u> with additional questions or to be added to the project mailing list



### **Next Steps**

- Meeting summary
- Q&As
- Future meetings
  - Soon: neighboring entities
  - Later: NEPA public meeting



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Federal Aviation Administration APPENDIX B: GOVERNTMENT-TO-GOVERNMENT CONSULTATION



Commercial Space Transportation

800 Independence Ave., SW. Washington, DC 20591

October 22, 2021

Mr. Bill Pearson U.S. Fish and Wildlife Service Alabama Ecological Services Field Office 1208 Main Street, Daphne, AL 36526 Via email: <u>bill\_pearson@fws.gov</u>

### RE: Endangered Species Act Consultation for Proposed Sierra Space Corporation Reentry Operations at the Huntsville International Airport, Huntsville, Alabama

The Federal Aviation Administration (FAA) is initiating Endangered Species Act (ESA) Section 7 consultation and requesting concurrence with our assessment and determination of the potential effects on ESA-listed species for the proposed Sierra Space Corporation (Sierra Space) Dream Chaser reentry operations at the Huntsville International Airport (HSV or Airport).

The Huntsville-Madison County Airport Authority (Authority), owner and operator of HSV is seeking an FAA Reentry Site Operator License to operate a commercial reentry site at the Airport. Under the Reentry Site Operator License, the Authority could offer HSV to Sierra Space for reentry operation of the Dream Chaser vehicle. Concurrently, Sierra Space is applying to the FAA for a Vehicle Operator License to land Dream Chaser at the Airport. A description of the proposed project is included as **Attachment 1**.

The following sections of this letter provide the list of ESA-listed species and designated critical habitat found in the project action area, discuss potential effects to the listed species and critical habitat, and provide FAA's effect determination for each species and critical habitat.

#### ESA-Listed Species and Critical Habitat in the Action Area

The action area refers to the area directly or indirectly affected by the proposed action. The action area for Dream Chaser reentry operations is based on the sonic boom footprint created by the Dream Chaser vehicle upon reentry and is defined by the distance to which the sonic boom would be 1 pound per square foot (psf) (see **Attachment 2**). Within the action area, the maximum peak overpressure from the Dream Chaser sonic boom could reach 1.25 psf, less than a clap of thunder. The action area encompasses a variety of habitats ranging from developed land to undeveloped forested land and some aquatic environments. Federally listed threatened or endangered species may use these habitats. **Table 1** lists the federally listed threatened or endangered species that the USFWS identify as occurring or potentially occurring in the action area.

| angered Species that Occur or Potentially Occur in the Project Action A |                         |  |  |  |
|---|-------------------------|--|--|--|
| Common Name   | Federal Status          |  |  |  |
| (Scientific Name)   |                         |  |  |  |
|   |                         |  |  |  |
| Grey Bat (Myotis grisescens)  | Endangered              |  |  |  |
| Indiana Bat ( <i>Myotis sodalis</i> )                                   | Endangered <sup>1</sup> |  |  |  |
| Northern Long-eared Bat (Myotis   | Threatened              |  |  |  |
| septentrionalis)  |                         |  |  |  |
| Dark Pigtoe (Pleurobema furvum)   | Endangered <sup>1</sup> |  |  |  |
| Pink Mucket (pearlymussel) ( <i>Lampsilis abrupta</i> )                 | Endangered              |  |  |  |
| Rough Pigtoe (Pleurobema plenum)  | Endangered              |  |  |  |
| Sheepnose Mussel (Plethobasus cyphyus)                                  | Endangered              |  |  |  |
| Snuffbox Mussel (Epioblasma triquetra)                                  | Endangered              |  |  |  |
| Anthony's Riversnail (Athearnia anthonyi)                               | Endangered              |  |  |  |
| Fleshy-fruit Gladecress (Leavenworthia crassa)                          | Endangered <sup>2</sup> |  |  |  |
| Leafy Prairie-clover (Dalea foliosa)                                    | Endangered              |  |  |  |
| Morefields Leather Flower (Clematis morefieldii)                        | Endangered              |  |  |  |
| American Hart's-tongue Fern   | Threatened              |  |  |  |
|   |                         |  |  |  |

Table 1: Federally Listed Threatened and Endangered Species that Occur or Potentially Occur in the Project Action Area

Source: USFWS 2021.

<sup>1</sup>Critical habitat is designated for these species, but it is not present in the action area.

<sup>2</sup> Critical habitat is designated for this species and is present in the action area.

#### Potential Effects to ESA-listed Species and Critical Habitat

The Proposed Action would have no effect on ESA-listed plants in the action area because the action does not involve activities with the potential to affect these plants (e.g., no construction or other ground-disturbing activities). Similarly, the Proposed Action would have no effect on the only designated critical habitat in the action area – for fleshy-fruit gladecress – because the action does not involve activities with the potential to affect this habitat.

Noise (including sonic booms) produced during reentry operations has the potential to affect ESA-listed animal species in the action area. Animal species differ greatly in their responses to noise. Noise effects on domestic animals and wildlife are classified as primary, secondary, and tertiary.

• **Primary** effects are direct, physiological changes to the auditory system, and most likely include the masking of auditory signals. Masking is defined as the inability of an individual to hear important environmental signals that may arise from mates, predators, or prey. There is some potential that noise could disrupt a species' ability to communicate or could interfere with behavioral patterns (Manci et al. 1988). Although the effects are likely temporal, sonic booms may cause masking of auditory signals within exposed faunal communities. Animals rely on hearing to avoid predators, obtain food, and communicate with, and attract, other members of their species. Sonic booms may mask or interfere with these functions.

- **Secondary** effects may include non-auditory effects such as stress and hypertension; behavioral modifications; interference with mating or reproduction; and impaired ability to obtain adequate food, cover, or water.
- **Tertiary** effects are the direct result of primary and secondary effects, and include population decline and habitat loss.

Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) also influence secondary and tertiary effects, and confound the ability to identify the ultimate factor in limiting productivity of a certain nest, area, or region. Overall, the literature suggests that species differ in their response to various types, durations, and sources of noise (Manci et al. 1988; Bowles 1995).

Many scientific studies have investigated the effects of sonic booms on wildlife, and some have focused on wildlife "flight" due to noise. Natural factors which affect reaction include season, group size, age and sex composition, on-going activity, motivational state, reproductive condition, terrain, weather, and temperament (Bowles 1995). Individual animal response to a given noise event or series of events also can vary widely due to a variety of factors, including time of day, physical condition of the animal, physical environment, the experience of the individual animal with noises, and whether or not other physical stressors (e.g., drought) are present (Manci et al. 1988). Consequently, it is difficult to generalize animal responses to noise disturbances across species.

One result of the Manci et al. (1988) literature review was the conclusion that, while behavioral observation studies were relatively limited, a general behavioral reaction in animals from exposure to aircraft noise is the "startle response." The intensity and duration of the startle response appears to be dependent on which species is exposed, whether there is a group or an individual, and whether there have been some previous exposures. Responses range from flight, trampling, stampeding, jumping, or running, to movement of the head in the apparent direction of the noise source. Manci et al. (1988) reported that the literature indicated that avian species may be more sensitive to aircraft noise than mammals.

The following discussion presents a summary of some of the more relevant studies addressing the potential impacts to wildlife from sonic booms.

Teer and Truett (1973) tested quail eggs subjected to sonic booms at 2, 4, and 5.5 pounds per square foot (psf) and found no adverse effects. Heinemann and LeBrocq (1965) exposed chicken eggs to sonic booms at 3–18 psf and found no adverse effects. In a mathematical analysis of the response of avian eggs to sonic boom overpressures, Ting et al. (2002) determined that it would take a sonic boom of 250 psf to crack an egg. Bowles (1995) states that it is physically impossible for a sonic boom to crack an egg because one cannot generate sufficient sound pressure in air to crack eggs.

Teer and Truett (1973) examined reproductive success in mourning doves, mockingbirds, northern cardinals, and lark sparrows when exposed to sonic booms of 1 psf or greater and found no adverse effects. Awbrey and Bowles (1990) in a review of the literature on the effects of aircraft noise and sonic booms on raptors found that the available evidence shows very marginal effects on reproductive success. Ellis et al. (1991) examined the effects of sonic booms (actual and simulated) on nesting peregrine falcons, prairie falcons, and six other raptor species. While some individuals did respond by leaving the nest, the response was temporary and overall there were no adverse effects on nesting. Lynch and Speake (1978) studied the effects of both real and simulated sonic booms on the nesting and brooding of eastern wild turkey in Alabama. Hens at four nest sites were subjected to between 8 and 11 combined real and simulated sonic booms. All tests elicited similar responses, including quick lifting of

the head and apparent alertness for between 10 and 20 seconds. No apparent nest failure occurred as a result of the sonic booms.

The literature suggests that common animal responses to noise include the startle response and, ultimately, habituation. It has been reported that the intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects. The majority of the literature suggests that domestic animal species (cows, horses, chickens) and wildlife species exhibit adaptation, acclimation, and habituation after repeated exposure to jet aircraft noise and sonic booms.

Potential Proposed Action-related noise such as a sonic booms are temporal, not sustained, and not fixed in location. The change in air pressure associated with a sonic boom is only a few psf greater than normal atmospheric pressure. This additional pressure above normal atmospheric pressure is called overpressure. Overpressures greater than 1.5 psf generally elicit public reaction. The maximum peak overpressure from a Dream Chaser sonic boom would be 1.25 psf, less than a clap of thunder. The duration of a sonic boom is brief, less than a second, and the intensity is greatest directly under the flight path and weakens as distance from the flight path increases. The ESA-listed animal species in the action area would experience a maximum of one sonic boom in 2023, 2024, and 2025; up to two in 2026, and up to three in 2027. These events are expected to produce infrequent startle effects.

Based on the lack of observed effects to wildlife in the studies mentioned above, the low number of sonic booms that would occur each year, the brief duration of a sonic boom (less than a second), and the peak overpressure of 1.25 psf (less than a thunder clap), the FAA expects that sonic booms associated with the Proposed Action **may affect**, **but would not likely adversely effect**, ESA-listed wildlife species in the project action area.

#### Conclusion

In summary, the FAA anticipates reentry operations (sonic booms) **may affect, but would not likely adversely effect**, all of the ESA-listed wildlife species in Table 1. The FAA seeks your concurrence on our effect determination and welcomes any additional comments. Reentry operations would have **no effect** on federally listed plant species and designated critical habitat. Thank you for your assistance in this matter. Please provide your response to Ms. Stacey Zee of my staff at <u>Stacey.Zee@faa.gov</u>.

Sincerely,

JAMES R Digitally signed by JAMES R REPCHECK REPCHECK Date: 2021.10.22 16:49:00 -04'00'

Randy Repcheck Manager, Safety Authorization Division

Enclosures:

Attachment 1 – Project Description

#### **ATTACHMENT 1**

**Project Description** 

Sierra Space and the Authority anticipate up to one Dream Chaser reentry operation at HSV per year in 2023, 2024, and 2025; up to two reentries in 2026; and up to three reentries in 2027. Based on the mission requirements, reentries of Dream Chaser could occur during the daytime or nighttime, but the total number of reentries would not exceed the number of operations presented above.

Sierra Space is developing the Dream Chaser, a reusable spacecraft capable of carrying payloads to and from low Earth orbit. Figure 1 shows an illustration of the Dream Chaser in its reentry configuration. Dream Chaser missions are, in part, to support a National Aeronautics and Space Administration (NASA)/Sierra Space contract to resupply the International Space Station. 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. Figure 2 shows a proposed mission to the International Space Station. Dream Chaser would be launched as a payload on a rocket from an existing launch site and would reenter as a glider at HSV.



Figure 1. Sierra Space Dream Chaser Vehicle



**Figure 2. Dream Chaser Mission** Source: Sierra Space Corporation (2021)

Dream Chaser would reenter from the south on an ascending trajectory (traveling in a northerly direction relative to the latitudes of the earth), with high atmospheric overflight of the southwestern United States or Central American countries prior to landing at HSV. Dream Chaser would remain above controlled airspace for the majority of the overflight of Texas, Arkansas, Louisiana, Mississippi, and Alabama. Dream Chaser would descend below 60,000 feet altitude above mean sea level approximately 10-20 miles (15 nautical miles) southwest of HSV prior to landing and would be operating below 60,000 feet altitude above mean sea level for about three to four minutes. The proposed bounding trajectories are based on the maximum cross-range capability (the longest distance between the ground track of the vehicle orbit and the reentry site from which the Dream Chaser is still able to land) at two different orbital missions (International Space Station and 28.5° inclination) along with the maximum cross-range capabilities for the reentry vehicle to bound a reentry corridor (see **Figure 3**). The specific trajectory the Dream Chaser travels would be a function of where the orbital ground track location, relative to the landing site, 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 the FAA and pilots in advance of an operation as specified in the negotiated Letters of Agreement with relevant Air Traffic Control facilities.

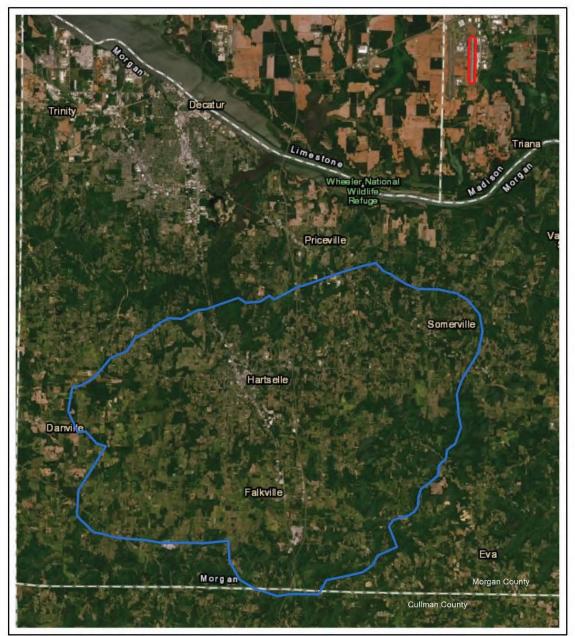




Dream chaser would use a reaction control system for orbital maneuvers, deorbit burn, and highaltitude control during reentry. This would not be used near or on the ground, so there would be no engine noise close to the ground or emissions below the mixing layer. Any propellants would be residual at landing, where they would be offloaded and transported off the airport or small amounts stored with other hazardous waste at the airport, so there are no anticipated significant hazardous materials, pollution prevention, or solid waste impacts.

#### **ATTACHMENT 2**

Action Area (Project Study Area)

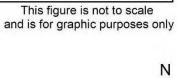


Sources: ESRI, 2020; RS&H, 2020

# Legend

- Project Study Area
- Reentry Site Boundary
- - County Boundaries

**RS&H** 





U.S. Department of Transportation

Federal Aviation Administration

October 22, 2021

Commercial Space Transportation

800 Independence Ave., SW. Washington, DC 20591

Ms. Lisa D. Jones State Historic Preservation Officer, Executive Director Alabama Historical Commission 468 South Perry Street, P.O. Box 300900 Montgomery, Alabama 36130-0900 Via email: <u>lisa.jones@ahc.alabama.gov</u>

# RE: Section 106 Consultation Initiation and Request for Concurrence on Area of Potential Effects and Finding of No Adverse Effect for Sierra Space Dream Chaser Reentry Operations at the Huntsville International Airport, Huntsville, Alabama

Dear Ms. Jones,

The Federal Aviation Administration (FAA) is initiating Section 106 consultation and soliciting concurrence with an Area of Potential Effects and the FAA's Finding of No Adverse Effect.

The Huntsville-Madison County Airport Authority (Authority), owner and operator of Huntsville International Airport (HSV or Airport) is seeking an FAA Reentry Site Operator License to operate a commercial reentry site at the Airport. Under the Reentry Site Operator License, the Authority could offer HSV to Sierra Space Corporation (Sierra Space) for the reentry operation of the Dream Chaser vehicle. Concurrently, Sierra Space is applying to the FAA for a Vehicle Operator License to land Dream Chaser at the Airport. A description of the Proposed Project is included as **Attachment 1**.

This project has been determined to be an 'undertaking' subject to the National Historic Preservation Act (NHPA) and its implementing regulations under Section 106, 36 CFR part 800 (as amended). The Proposed Action is also subject to the National Environmental Policy Act (NEPA) and the FAA has initiated preparation of an Environmental Assessment to meet its regulatory obligations. The agency intends to complete Section 106 in conjunction with the NEPA process. The FAA will also coordinate with your office under Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 U.S.C. § 303(c)) within two weeks.

The FAA is inviting the following tribes to participate in this consultation: Alabama-Coushatta Tribe of Texas, Alabama-Quassarte Tribal Town, Chickasaw Nation, Coushatta Tribe of Louisiana, Eastern Band of Cherokee Indians, Muscogee (Creek) Nation.

#### Area of Potential Effects (APE)

In accordance with 36 CFR § 800.4(a)(1), an APE needs to be established for the proposed undertaking in consultation with your office. The FAA has defined an APE in consideration of both potential direct and indirect effects associated with proposed reentry operations.

The proposed APE is based on the sound or noise generated by the proposed undertaking. Dream Chaser would create a sonic boom during reentry and the FAA has defined the APE as the 1.0 pound per square foot (psf) sonic boom noise contour (see **Attachment 2**). The APE encompasses about 170 square miles and includes portions of Morgan and Cullman counties, and the city/towns of Hartselle, Falkville, and Somerville, Alabama.

#### **Historic Resources in the APE**

The FAA identified historic, architectural, and cultural resources within the APE through a search of the National Park Service (NPS) National Register of Historic Places (NRHP) and the Alabama Historical Commission (AHC) Alabama Register of Landmarks and Heritage. A list of historic properties identified is included in **Attachment 3**.

The proposed undertaking does not include ground-disturbing activities; therefore, archaeological resources are not considered.

#### **Preliminary Finding of Effects**

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 at 1 psf is unlikely, as the threshold for damage from overpressure on well-maintained structures is greater 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. 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: according to NOAA, residents in Morgan County experience, on average, about 8,000 cloud-to-ground lightning flashes per year during thunderstorms (NOAA, 2020). Therefore, noise effects associated with the reentry vehicle would not have an adverse effect on historic properties in the APE.

Based on the results of the studies and an assessment of effects to historic properties, the FAA has determined that this undertaking will have No Adverse Effect on historic properties. Please review this finding and the enclosed documentation in accordance with 36 CFR § 800.5 and provide either your concurrence or non-concurrence.

#### Conclusion

The FAA requests your concurrence on the determination of the APE, identification of historic properties in the APE, and preliminary finding of effects within 30 days. If you have any questions or need additional information on the project, please contact Ms. Stacey Zee of my staff at <u>Stacey.Zee@faa.gov</u>. Thank you in advance for your input on this project.

Sincerely,

JAMES R Digitally signed by JAMES R REPCHECK REPCHECK Date: 2021.10.22 16:51:56 -04'00'

Randy Repcheck Manager, Safety Authorization Division

Enclosures:

Attachment 1 – Project Description Attachment 2 – Area of Potential Effects Attachment 3 – Historic Resources in the Area of Potential Effects

**Project Description** 

Sierra Space and the Authority anticipate up to one Dream Chaser reentry operation at HSV per year in 2023, 2024, and 2025; up to two reentries in 2026; and up to three reentries in 2027. Based on the mission requirements, reentries of Dream Chaser could occur during the daytime or nighttime, but the total number of reentries would not exceed the number of operations presented above.

Sierra Space is developing the Dream Chaser, a reusable spacecraft capable of carrying payloads to and from low Earth orbit. Figure 1 shows an illustration of the Dream Chaser in its reentry configuration. Dream Chaser missions are, in part, to support a National Aeronautics and Space Administration (NASA)/Sierra Space contract to resupply the International Space Station. 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. Figure 2 shows a proposed mission to the International Space Station. Dream Chaser would be launched as a payload on a rocket from an existing launch site and would reenter as a glider at HSV.

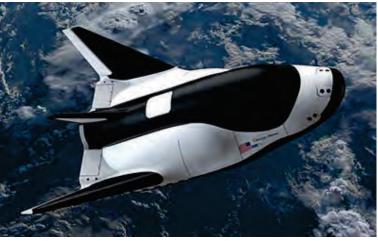


Figure 1. Sierra Space Dream Chaser Vehicle



Figure 2. Dream Chaser Mission Source: Sierra Space Corporation (2021)

Dream Chaser would reenter from the south on an ascending trajectory (traveling in a northerly direction relative to the latitudes of the earth), with high atmospheric overflight of the southwestern United States or Central American countries prior to landing at HSV. Dream Chaser would remain above controlled airspace for the majority of the overflight of Texas, Arkansas, Louisiana, Mississippi, and Alabama. Dream Chaser would descend below 60,000 feet altitude above mean sea level approximately 10-20 miles (15 nautical miles) southwest of HSV prior to landing and would be operating below 60,000 feet altitude above mean sea level for about three to four minutes. The proposed bounding trajectories are based on the maximum cross-range capability (the longest distance between the ground track of the vehicle orbit and the reentry site from which the Dream Chaser is still able to land) at two different orbital missions (International Space Station and 28.5° inclination) along with the maximum cross-range capabilities for the reentry vehicle to bound a reentry corridor (see Figure 3). The specific trajectory the Dream Chaser travels would be a function of where the orbital ground track location, relative to the landing site, 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 the FAA and pilots in advance of an operation as specified in the negotiated Letters of Agreement with relevant Air Traffic Control facilities.

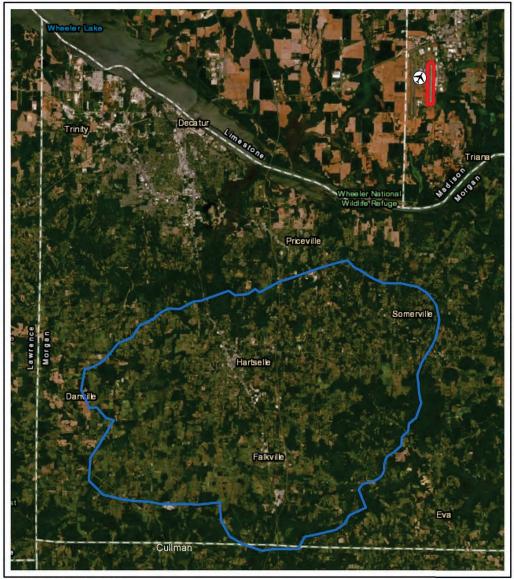




Dream chaser would use a reaction control system for orbital maneuvers, deorbit burn, and highaltitude control during reentry. This would not be used near or on the ground, so there would be no engine noise close to the ground or emissions below the mixing layer. Any propellants would be residual at landing, where they would be offloaded and transported off the airport or small amounts stored with other hazardous waste at the airport, so there is no anticipated significant hazardous materials, pollution prevention, or solid waste impacts.

**Area of Potential Effects** 

The Area of Potential Effects (APE) is a geographic area that could be directly or indirectly affected by the Proposed Action. The Proposed Action would not result in ground disturbing activities in the reentry site boundary (shown in red below); therefore, the APE is based on the footprint of the concept reentry vehicle's 1.0 pounds per square foot (psf) sonic boom noise contour (shown in blue below). This metric was determined because the potential for structural damage is unlikely for the modeled sonic boom overpressure levels less than 1.0 psf (similar in magnitude to thunder).





Historic Resources in the Area of Potential Effects

| 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              |

#### Table 1: NRHP- and AHC-Listed Resources in the APE

ACH = Alabama Historical Commission, NRHP = National Register of Historic Places Source: National Park Service (2021); AHC (2021)



U.S. Department of Transportation

Federal Aviation Administration

October 25, 2021

Bill Anoatubby Governor Chickasaw Nation PO Box 1548 Ada, OK 74821 Via email: tammy.gray@chickasaw.net

# RE: Invitation for Government-to-Government Tribal Consultation for Sierra Space Corporation Reentry Operations at the Huntsville International Airport, Huntsville, Alabama

Dear Governor Anoatubby,

The Federal Aviation Administration (FAA) is initiating government-to-government consultation for a proposed project for Sierra Space Corporation (Sierra Space) to conduct commercial space reentry operations at the Huntsville International Airport (HSV or Airport) in Huntsville, Alabama. The Huntsville-Madison County Airport Authority, owner and operator of Huntsville International Airport, is applying to the FAA for a Reentry Site Operator License to operate a commercial reentry site at the Airport. Concurrently, Sierra Space is applying to the FAA for a Vehicle Operator License to land Dream Chaser at Huntsville International Airport. Sierra Space's proposed operations are described in **Attachment 1**.

The FAA is preparing environmental documentation under the National Environmental Policy Act (NEPA of 1969, as amended) for the proposed Sierra Space reentry operations at Huntsville International Airport. The FAA is the lead federal agency for Government-to Government consultation for the proposed action. Tribal sovereignty, culture, traditional values and customs will be respected at all times during the consultation process.

#### Purpose of Government-to-Government Consultation

The FAA has identified your tribe as potentially having an interest in the project area. Pursuant to Executive Order 13175 *Consultation and Coordination with Indian Tribal Governments* and FAA Order 1210.20 *American Indian and Alaska Native Tribal Consultation Policy and Procedures*, the FAA is initiating government-to-government consultation for this proposed action. The FAA is seeking input on properties of cultural or religious significance that may be affected by the proposed action, and inviting you to participate in government-to-government consultation. Please see the Area of Potential Effects outlined in **Attachment 2**.

#### **Consultation Initiation**

The FAA seeks input on concerns that uniquely or significantly affect your Tribe related to the proposed project. Early identification of Tribal concerns, or known properties of traditional religious and cultural importance, will allow the FAA to consider ways to avoid or minimize potential impacts to Tribal resources as project planning and alternatives are developed and refined. We are available to discuss the details of the proposed project with you.

Commercial Space Transportation

800 Independence Ave., SW. Washington, DC 20591

#### Confidentiality

We understand that you may have concerns about the confidentiality of information on areas or resources of religious, traditional and cultural importance to your Tribe. We are available to discuss these concerns and develop procedures to ensure the confidentiality of such information is maintained.

#### **FAA Contact Information**

Your timely response within 30-days of receipt of this correspondence will greatly assist us in incorporating your concerns into project planning. If you wish to provide comments related to this proposed project, please contact contact Ms. Stacey Zee of my staff at 202-267-9305 or <u>Stacey.Zee@faa.gov.</u> Please feel free to contact me directly at 202-267-8760 or <u>Randy.Repcheck@faa.gov</u>.

Sincerely,

Digitally signed by JAMES R REPCHECK JAMES R REPCHECK Date: 2021.10.25 16:27:26 -04'00'

Randy Repcheck Manager, Safety Authorization Division

cc: THPO

Enclosures:

Attachment 1 – Project Description Attachment 2 – Area of Potential Effects

**Project Description** 

Sierra Space and the Authority anticipate up to one Dream Chaser reentry operation at HSV per year in 2023, 2024, and 2025; up to two reentries in 2026; and up to three reentries in 2027. Based on the mission requirements, reentries of Dream Chaser could occur during the daytime or nighttime, but the total number of reentries would not exceed the number of operations presented above.

Sierra Space is developing the Dream Chaser, a reusable spacecraft capable of carrying payloads to and from low Earth orbit. Figure 1 shows an illustration of the Dream Chaser in its reentry configuration. Dream Chaser missions are, in part, to support a National Aeronautics and Space Administration (NASA)/Sierra Space contract to resupply the International Space Station. 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. Figure 2 shows a proposed mission to the International Space Station. Dream Chaser would be launched as a payload on a rocket from an existing launch site and would reenter as a glider at HSV.



Figure 1. Sierra Space Dream Chaser Vehicle



Figure 2. Dream Chaser Mission Source: Sierra Space Corporation, 2021

Dream Chaser would reenter from the south on an ascending trajectory (traveling in a northerly direction relative to the latitudes of the earth), with high atmospheric overflight of the southwestern United States or Central American countries prior to landing at HSV. Dream Chaser would remain above controlled airspace for the majority of the overflight of Texas, Arkansas, Louisiana, Mississippi, and Alabama. Dream Chaser would descend below 60,000 feet altitude above mean sea level approximately 10-20 miles (15 nautical miles) southwest of HSV prior to landing and would be operating below 60,000 feet altitude above mean sea level for about three to four minutes. The proposed bounding trajectories are based on the maximum cross-range capability (the longest distance between the ground track of the vehicle orbit and the reentry site from which the Dream Chaser is still able to land) at two different orbital missions (International Space Station and 28.5° inclination) along with the maximum cross-range capabilities for the reentry vehicle to bound a reentry corridor (see Figure 3). The specific trajectory the Dream Chaser travels would be a function of where the orbital ground track location, relative to the landing site, 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 the FAA and pilots in advance of an operation as specified in the negotiated Letters of Agreement with relevant Air Traffic Control facilities.



#### Figure 3. Bounding Flight Path Approaches

Dream chaser would use a reaction control system for orbital maneuvers, deorbit burn, and highaltitude control during reentry. This would not be used near or on the ground, so there would be no engine noise close to the ground or emissions below the mixing layer. Any propellants would be residual at landing, where they would be offloaded and transported off the airport or small amounts stored with other hazardous waste at the airport, so there is no anticipated significant hazardous materials, pollution prevention, or solid waste impacts.

**Area of Potential Effects** 

The Area of Potential Effects (APE) is a geographic area that could be directly or indirectly affected by the Proposed Action. The Proposed Action would not result in ground disturbing activities in the reentry site boundary (shown in red below); therefore, the APE is based on the footprint of the concept reentry vehicle's 1.0 pounds per square foot (psf) sonic boom noise contour (shown in blue below). This metric was determined because the potential for structural damage is unlikely for the modeled sonic boom overpressure levels less than 1.0 psf (similar in magnitude to thunder).







U.S. Department of Transportation

Federal Aviation Administration Commercial Space Transportation

800 Independence Ave., SW. Washington, DC 20591

November 3, 2021

Ms. Lisa D. Jones State Historic Preservation Officer, Executive Director Alabama Historical Commission 468 South Perry Street, P.O. Box 300900 Montgomery, Alabama 36130-0900 Via email: <u>lisa.jones@ahc.alabama.gov</u>

#### RE: Request for Coordination Regarding the Section 4(f) Determination for Proposed Sierra Space Reentry Operations at the Huntsville International Airport, Huntsville, Alabama

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 to operate a commercial space reentry site at the Airport. Under the Reentry Site Operator License, the Authority could offer HSV to Sierra Space Corporation (Sierra Space) for reentry operation of the Dream Chaser vehicle. Concurrently, Sierra Space is applying to the FAA for a Vehicle Operator License to land Dream Chaser at the Airport.

The Proposed Action is subject to the National Environmental Policy Act (NEPA) and the FAA is preparing an Environmental Assessment (EA) to meet its regulatory obligations. A full description of the FAA's Proposed Action will be included in the Draft EA when it is published for public review.

Section 4(f) of the Department of Transportation Act and associated regulations (23 CFR part 774) provide that the Secretary of Transportation will not approve any transportation project that requires the *use* of any publicly owned and publicly accessible land from a park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, or land from any publicly or privately owned historic site of national, state, or local significance, unless there is no feasible and prudent alternative to the *use* of such land and the transportation project includes all possible planning to minimize harm resulting from the use. There are four historic resources in the project study area for Section 4(f) that are listed on the National Register of Historic Place (NRHP): Crabb-Key House, Green Pryor Rice House, Somerville Courthouse, and Hartselle Downtown Commercial Historic District.

The FAA will also coordinate with your office under Section 106 of the National Historic Preservation Act (40 CFR Part 800, as amended).

The purpose of this letter is to notify you of the FAA's preliminary Section 4(f) determination for the NRHP-listed historic resources in the study area and to request your concurrence. A description of the proposed project is included as **Attachment 1**. The following sections of this letter include pertinent regulatory background and the FAA's preliminary Section 4(f) determination.

#### **Regulatory Background**

The FAA's procedural requirements for complying with Section 4(f) are set forth in DOT Order 5610.1C, *Procedures for Considering Environmental Impacts*. The FAA also uses Federal Highway Administration (FHWA) regulations (23 CFR part 774) and FHWA guidance (e.g., Section 4(f) Policy

Paper) when assessing the potential for *use* of 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.

A *use* under Section 4(f) can occur when 1) land from a Section 4(f) property is permanently incorporated into a transportation project, 2) there is a *temporary occupancy* of a Section 4(f) property, or 3) the transportation project's proximity to a Section 4(f) property results in indirect impacts that would substantially impair the current use of the property. The first two types of *use* are referred to as a physical *use*. The latter type of use is identified as *constructive use*.

#### Physical Use

A permanent incorporation involves a right-of-way acquisition of Section 4(f) property as part of a transportation project either as a purchase of land or a permanent easement.

*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. A *temporary occupancy* is considered a Section 4(f) *use* unless all the conditions listed in 23 CFR § 774.13(d) are satisfied:

- 1. Duration must be temporary, i.e., less than the time needed for construction of the project, and there should be no change in ownership of the land;
- 2. Scope of the work must be minor, i.e., both the nature and the magnitude of the changes to the Section 4(f) property are minimal;
- 3. There are no anticipated permanent adverse physical impacts, nor will there be interference with the protected activities, features, or attributes of the property, on either a temporary or permanent basis;
- 4. The land being used must be fully restored, i.e., the property must be returned to a condition which is at least as good as that which existed prior to the project; and
- 5. There must be documented agreement of the official(s) with jurisdiction over the Section 4(f) resource regarding the above conditions.

A physical *use* may be considered *de minimis* if, after taking into account avoidance, minimization, mitigation, and enhancement measures, the result is either 1) a determination that the project would not adversely affect the activities, features, or attributes qualifying a park, recreation area, or wildlife or waterfowl refuge for protection under Section 4(f); or 2) a Section 106 *finding of no adverse effect* or *no historic properties affected*.

A *de minimis* impact determination requires agency coordination and public involvement. For historic sites, the FAA must consult the consulting parties identified in accordance with 36 CFR part 800 and inform the officials with jurisdiction of the intent to make a *de minimis* impact determination. The officials with jurisdiction must concur in a *finding of no adverse effect* or *no historic properties affected*. Compliance with 36 CFR part 800 satisfies the public involvement and agency coordination requirement for *de minimis* findings for historic sites.

#### Constructive Use

In order for a *constructive use* to occur, a transportation project must result in substantial impairment to the property's activities, features, or attributes to the extent that the value of the resource, in terms of its Section 4(f) purpose and significance, will be meaningfully reduced or lost. As

noted in FHWA's Section 4(f) Tutorial,<sup>1</sup> "[c]onstructive use involves an indirect impact to the Section 4(f) property of such magnitude as to effectively act as a permanent incorporation." The FAA's 1050.1F Desk Reference,<sup>2</sup> which provides guidance for FAA NEPA practitioners and is used to help FAA integrate applicable special purpose laws and requirements, also indicates that a proximity-related impact's consequences must amount to "taking" a property or a portion of a property in order for a *constructive use* determination to be made.

For historic properties protected under Section 4(f), an adverse effect finding under Section 106 does not automatically mean that there will be a *use* under Section 4(f). When a project does not permanently incorporate land of a historic site, but results in an adverse effect finding under Section 106, further assessment in terms of the potential for *constructive use* is necessary. This requires consideration of the proximity impacts of the transportation project to determine if it substantially impairs the Section 4(f) historic property. Consultation with officials with jurisdiction is required to identify and analyze impacts on the features and attributes that contribute to the National Register eligibility of the property. If there is no substantial impairment, there is no *constructive use* and Section 4(f) does not apply.

A *de minimis* impact determination is not appropriate for *constructive use* of a Section 4(f) property because *constructive use* is defined as substantial impairment, and substantial impairment cannot be considered a *de minimis* impact.

#### Section 4(f) Preliminary Determination

The FAA is in the process of evaluating the potential impacts of Sierra Space's proposed Dream Chaser operations to determine if the Proposed Action would result in a *use* of the property through permanent incorporation, *temporary occupancy*, or *constructive use*.

The Proposed Action would not result in ground disturbing activities at HSV or within the project study area that could cause direct impacts to Section 4(f) resources. Operations of reentry vehicles would not require the closure of any Section 4(f) properties and, therefore, would not require the *physical use* (direct impact) of Section 4(f) properties.

Noise (including sonic booms) produced during reentry operations has the potential to affect Section 4(f) properties in the project study area. The project study area is based on the sonic boom footprint created by the Dream Chaser vehicle upon reentry and is defined by the distance to which the sonic boom would be 1 pound per square foot (psf). Within the project study area, the maximum peak overpressure from the Dream Chaser sonic boom could reach 1.25 psf.

There are four NRHP-listed resources within the study area (see Attachment 2):

• 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.

<sup>&</sup>lt;sup>1</sup> Available online at: <u>https://www.environment.fhwa.dot.gov/section4f/default.aspx</u>

<sup>&</sup>lt;sup>2</sup> Available online at:

https://www.faa.gov/about/office\_org/headquarters\_offices/apl/environ\_policy\_guidance/policy/faa\_nepa\_order/desk\_ref/

• 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.

The two NRHP-listed resources in urban settings (Hartselle Downtown Commercial District and Somerville Courthouse) would not be noise-sensitive locations as they already experience urban noise levels and therefore quiet does not their significance as a historic property. The two NRHP-listed resources in rural, residential settings (Crabb-Key House and Green Pryor Rice House) likely currently experience low noise levels. However, their areas of significance as listed in the NRHP are architecture and exploration/settlement, so quiet does not add to their significance as a historic property.

Potential Proposed Action-related noise such as sonic booms are temporal, not sustained, and not fixed in location. The change in air pressure associated with a sonic boom is only a few psf greater than normal atmospheric pressure. This additional pressure above normal atmospheric pressure is called overpressure. Overpressures greater than 1.5 psf generally elicit public reaction. The maximum peak overpressure from a Dream Chaser sonic boom, 1.25 psf, would be less than a clap of thunder. The duration of a sonic boom is brief, less than a second, and the intensity is greatest directly under the flight path and weakens as distance from the flight path increases. The Section 4(f) properties in the project study area would experience a maximum of one sonic boom in 2023, 2024, and 2025; up to two in 2026; and up to three in 2027.

The FAA has made a preliminary determination that the Proposed Action would not substantially diminish the attributes that contribute to the enjoyment or quality of the four NRHP-listed properties in the study area because of the short-term and infrequent nature of the sonic booms. Therefore, the FAA has made a preliminary determination that the noise generated by the Proposed Action would not constitute a *constructive use* of the NRHP-listed properties in the study area.

#### Conclusion

The FAA seeks your comments on the Proposed Action and concurrence on the FAA's Section 4(f) preliminary determination stated above. Please provide your response by December 3, 2021 to Ms. Stacey Zee of my staff at <u>Stacey.Zee@faa.gov</u>.

Sincerely,

Ansel Collins Deputy Manager (Acting), Safety Authorization Division

Enclosures:

Attachment 1 – Project Description Attachment 2 – Section 4(f) Resources within the Project Study Area

**Project Description** 

Sierra Space and the Authority anticipate up to one Dream Chaser reentry operation at HSV per year in 2023, 2024, and 2025; up to two reentries in 2026; and up to three reentries in 2027. Based on the mission requirements, reentries of Dream Chaser could occur during the daytime or nighttime, but the total number of reentries would not exceed the number of operations presented above.

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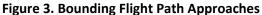
Figure 1. Sierra Space Dream Chaser Vehicle



Figure 2. Dream Chaser Mission Source: Sierra Space Corporation (2021)

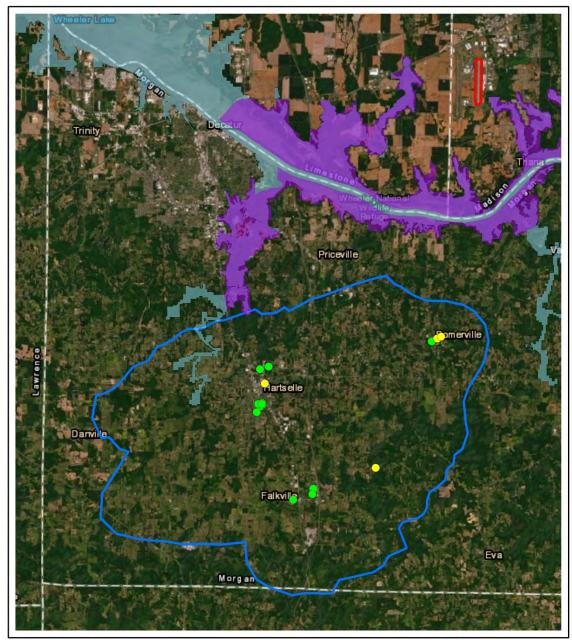
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Dream chaser would use a reaction control system for orbital maneuvers, deorbit burn, and highaltitude control during reentry. This would not be used near or on the ground, so there would be no engine noise close to the ground or emissions below the mixing layer. Any propellants would be residual at landing, where they would be offloaded and transported off the airport or small amounts stored with other hazardous waste at the airport, so there are no anticipated significant hazardous materials, pollution prevention, or solid waste impacts.

Section 4(f) Resources in the Project Study Area



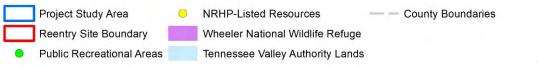
Section 4(f) Resources in the Project Study Area

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

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

N





# **RS&H**



U.S. Department of Transportation

Federal Aviation Administration

November 3, 2021

Warren Hicks Tennessee Valley Authority 307 Clinton Avenue, Suite 300 Huntsville, AL 35801 via email: <u>wphicks@tva.gov</u> Commercial Space Transportation

800 Independence Ave., SW. Washington, DC 20591

#### RE: Request for Coordination Regarding the Section 4(f) Determination for Proposed Sierra Space Reentry Operations at the Huntsville International Airport, Huntsville, Alabama

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 to operate a commercial space reentry site at the Airport. Under the Reentry Site Operator License, the Authority could offer HSV to Sierra Space Corporation (Sierra Space) for reentry operation of the Dream Chaser vehicle. Concurrently, Sierra Space is applying to the FAA for a Vehicle Operator License to land Dream Chaser at the Airport.

The Proposed Action is subject to the National Environmental Policy Act (NEPA) and the FAA is preparing an Environmental Assessment (EA) to meet its regulatory obligations. A full description of the FAA's Proposed Action will be included in the Draft EA when it is published for public review.

Section 4(f) of the Department of Transportation Act and associated regulations (23 CFR part 774) provide that the Secretary of Transportation will not approve any transportation project that requires the *use* of any publicly owned and publicly accessible land from a park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, or land from any publicly or privately owned historic site of national, state, or local significance, unless there is no feasible and prudent alternative to the *use* of such land and the transportation project includes all possible planning to minimize harm resulting from the use. There is one Section 4(f) property located in the project study area for Section 4(f) that falls under the jurisdiction of the Tennessee Valley Authority (TVA): the TVA Wheeler Reservoir.

The purpose of this letter is to notify you of the Proposed Action FAA's preliminary Section 4(f) determination for the TVA Wheeler Reservoir and to request your concurrence. A description of the proposed project is included as **Attachment 1**. The following sections of this letter include pertinent regulatory background and the FAA's preliminary Section 4(f) determination.

#### **Regulatory Background**

The FAA's procedural requirements for complying with Section 4(f) are set forth in DOT Order 5610.1C, *Procedures for Considering Environmental Impacts*. The FAA also uses Federal Highway Administration (FHWA) regulations (23 CFR part 774) and FHWA guidance (e.g., Section 4(f) Policy Paper) when assessing the potential for *use* of 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.

A *use* under Section 4(f) can occur when 1) land from a Section 4(f) property is permanently incorporated into a transportation project, 2) there is a *temporary occupancy* of a Section 4(f) property, or 3) the transportation project's proximity to a Section 4(f) property results in indirect impacts that would substantially impair the current use of the property. The first two types of *use* are referred to as a physical *use*. The latter type of use is identified as *constructive use*.

#### Physical Use

A permanent incorporation involves a right-of-way acquisition of Section 4(f) property as part of a transportation project either as a purchase of land or a permanent easement.

*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. A *temporary occupancy* is considered a Section 4(f) *use* unless all the conditions listed in 23 CFR § 774.13(d) are satisfied:

- 1. Duration must be temporary, i.e., less than the time needed for construction of the project, and there should be no change in ownership of the land;
- 2. Scope of the work must be minor, i.e., both the nature and the magnitude of the changes to the Section 4(f) property are minimal;
- 3. There are no anticipated permanent adverse physical impacts, nor will there be interference with the protected activities, features, or attributes of the property, on either a temporary or permanent basis;
- 4. The land being used must be fully restored, i.e., the property must be returned to a condition which is at least as good as that which existed prior to the project; and
- 5. There must be documented agreement of the official(s) with jurisdiction over the Section 4(f) resource regarding the above conditions.

A physical *use* may be considered *de minimis* if, after taking into account avoidance, minimization, mitigation, and enhancement measures, the result is either 1) a determination that the project would not adversely affect the activities, features, or attributes qualifying a park, recreation area, or wildlife or waterfowl refuge for protection under Section 4(f); or 2) a Section 106 *finding of no adverse effect* or *no historic properties affected*.

A *de minimis* impact determination requires agency coordination and public involvement. For historic sites, the FAA must consult the consulting parties identified in accordance with 36 CFR part 800 and inform the officials with jurisdiction of the intent to make a *de minimis* impact determination. The officials with jurisdiction must concur in a *finding of no adverse effect* or *no historic properties affected*. Compliance with 36 CFR part 800 satisfies the public involvement and agency coordination requirement for *de minimis* findings for historic sites.

#### Constructive Use

In order for a *constructive use* to occur, a transportation project must result in substantial impairment to the property's activities, features, or attributes to the extent that the value of the resource, in terms of its Section 4(f) purpose and significance, will be meaningfully reduced or lost. As noted in FHWA's Section 4(f) Tutorial,<sup>1</sup> "[c]onstructive use involves an indirect impact to the Section 4(f) property of such magnitude as to effectively act as a permanent incorporation." The FAA's

<sup>&</sup>lt;sup>1</sup> Available online at: <u>https://www.environment.fhwa.dot.gov/section4f/default.aspx</u>

1050.1F Desk Reference,<sup>2</sup> which provides guidance for FAA NEPA practitioners and is used to help FAA integrate applicable special purpose laws and requirements, also indicates that a proximity-related impact's consequences must amount to "taking" a property or a portion of a property in order for a *constructive use* determination to be made.

For historic properties protected under Section 4(f), an adverse effect finding under Section 106 does not automatically mean that there will be a *use* under Section 4(f). When a project does not permanently incorporate land of a historic site, but results in an adverse effect finding under Section 106, further assessment in terms of the potential for *constructive use* is necessary. This requires consideration of the proximity impacts of the transportation project to determine if it substantially impairs the Section 4(f) historic property. Consultation with officials with jurisdiction is required to identify and analyze impacts on the features and attributes that contribute to the National Register eligibility of the property. If there is no substantial impairment, there is no *constructive use* and Section 4(f) does not apply.

A *de minimis* impact determination is not appropriate for *constructive use* of a Section 4(f) property because *constructive use* is defined as substantial impairment, and substantial impairment cannot be considered a *de minimis* impact.

#### Section 4(f) Preliminary Determination

The FAA is in the process of evaluating the potential impacts of Sierra Space's proposed Dream Chaser operations to determine if the Proposed Action would result in a *use* of the property through permanent incorporation, *temporary occupancy*, or *constructive use*.

The Proposed Action would not result in ground disturbing activities at HSV or within the project study area that could cause direct impacts to Section 4(f) resources. Operations of reentry vehicles would not require the closure of any Section 4(f) properties and, therefore, would not require the *physical use* (direct impact) of Section 4(f) properties.

Noise (including sonic booms) produced during reentry operations has the potential to affect Section 4(f) properties in the project study area. The project study area is based on the sonic boom footprint created by the Dream Chaser vehicle upon reentry and is defined by the distance to which the sonic boom would be 1 pound per square foot (psf). Within the project study area, the maximum peak overpressure from the Dream Chaser sonic boom could reach 1.25 psf.

Of the TVA Wheeler Reservoir's approximately 293,000 acres, 912 acres are located within the project study area (see **Attachment 2**). 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<sup>3</sup>). The TVA land within the study area is primarily classified as Zone 3, Sensitive Resource Management, "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." 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

<sup>&</sup>lt;sup>2</sup> Available online at:

https://www.faa.gov/about/office\_org/headquarters\_offices/apl/environ\_policy\_guidance/policy/faa\_nepa\_order/desk\_ref/ <sup>3</sup> TVA. (2020). *Reservoir Land Management Plans*. Retrieved August 2020, from

https://www.tva.com/Environment/Environmental-Stewardship/Land-Management/Reservoir-Land-Management-Plans.

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. The TVA lands in the study area would be sensitive to new sources of noise, given their aesthetic value as natural recreational areas and their value as wildlife habitat.

Potential Proposed Action-related noise such as sonic booms are temporal, not sustained, and not fixed in location. The change in air pressure associated with a sonic boom is only a few psf greater than normal atmospheric pressure. This additional pressure above normal atmospheric pressure is called overpressure. Overpressures greater than 1.5 psf generally elicit public reaction. The maximum peak overpressure from a Dream Chaser sonic boom, 1.25 psf, would be less than a clap of thunder. The duration of a sonic boom is brief, less than a second, and the intensity is greatest directly under the flight path and weakens as distance from the flight path increases. The Section 4(f) properties in the project study area would experience a maximum of one sonic boom in 2023, 2024, and 2025; up to two in 2026; and up to three in 2027.

The FAA has made a preliminary determination that the Proposed Action would not substantially diminish the attributes that contribute to the enjoyment or quality of the TVA Wheeler Reservoir because of the short-term and infrequent nature of the sonic booms. Therefore, the FAA has made a preliminary determination that the noise generated by the Proposed Action would not constitute a *constructive use* of the TVA Wheeler Reservoir.

#### Conclusion

The FAA seeks your comments on the Proposed Action and concurrence on the FAA's Section 4(f) preliminary determination stated above. Please provide your response by December 3, 2021 to Ms. Stacey Zee of my staff at <u>Stacey.Zee@faa.gov</u>.

Sincerely,

Ansel Collins Deputy Manager (Acting), Safety Authorization Division

Enclosures:

Attachment 1 – Project Description Attachment 2 – Section 4(f) Resources within the Project Study Area

**Project Description** 

Sierra Space and the Authority anticipate up to one Dream Chaser reentry operation at HSV per year in 2023, 2024, and 2025; up to two reentries in 2026; and up to three reentries in 2027. Based on the mission requirements, reentries of Dream Chaser could occur during the daytime or nighttime, but the total number of reentries would not exceed the number of operations presented above.

Sierra Space is developing the Dream Chaser, a reusable spacecraft capable of carrying payloads to and from low Earth orbit. Figure 1 shows an illustration of the Dream Chaser in its reentry configuration. Dream Chaser missions are, in part, to support a National Aeronautics and Space Administration (NASA)/Sierra Space contract to resupply the International Space Station. 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. Figure 2 shows a proposed mission to the International Space Station. Dream Chaser would be launched as a payload on a rocket from an existing launch site and would reenter as a glider at HSV.

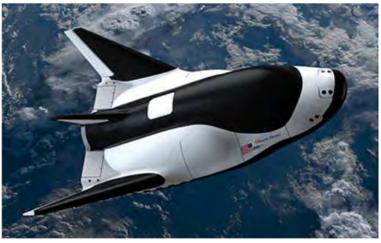


Figure 1. Sierra Space Dream Chaser Vehicle



**Figure 2. Dream Chaser Mission** Source: Sierra Space Corporation (2021)

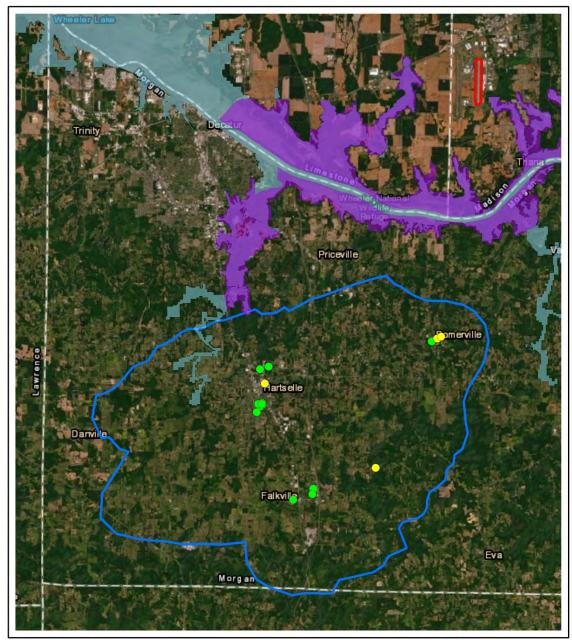
Dream Chaser would reenter from the south on an ascending trajectory (traveling in a northerly direction relative to the latitudes of the earth), with high atmospheric overflight of the southwestern United States or Central American countries prior to landing at HSV. Dream Chaser would remain above controlled airspace for the majority of the overflight of Texas, Arkansas, Louisiana, Mississippi, and Alabama. Dream Chaser would descend below 60,000 feet altitude above mean sea level approximately 10-20 miles (15 nautical miles) southwest of HSV prior to landing and would be operating below 60,000 feet altitude above mean sea level for about three to four minutes. The proposed bounding trajectories are based on the maximum cross-range capability (the longest distance between the ground track of the vehicle orbit and the reentry site from which the Dream Chaser is still able to land) at two different orbital missions (International Space Station and 28.5° inclination) along with the maximum cross-range capabilities for the reentry vehicle to bound a reentry corridor (see Figure 3). The specific trajectory the Dream Chaser travels would be a function of where the orbital ground track location, relative to the landing site, 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 the FAA and pilots in advance of an operation as specified in the negotiated Letters of Agreement with relevant Air Traffic Control facilities.





Dream chaser would use a reaction control system for orbital maneuvers, deorbit burn, and highaltitude control during reentry. This would not be used near or on the ground, so there would be no engine noise close to the ground or emissions below the mixing layer. Any propellants would be residual at landing, where they would be offloaded and transported off the airport or small amounts stored with other hazardous waste at the airport, so there are no anticipated significant hazardous materials, pollution prevention, or solid waste impacts.

Section 4(f) Resources in the Project Study Area



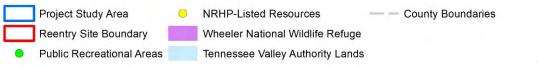
Section 4(f) Resources in the Project Study Area

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

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

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# **RS&H**



U.S. Department of Transportation

Federal Aviation Administration

November 3, 2021

Ricky Ingram Wheeler National Wildlife Refuge Headquarters U.S. Fish and Wildlife Service 2700 Refuge Headquarters Road, Decatur, AL 35603 via email: rick\_ingram@fws.gov

#### RE: Request for Coordination Regarding the Section 4(f) Determination for Proposed Sierra Space Reentry Operations at the Huntsville International Airport, Huntsville, Alabama

Commercial Space Transportation

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 to operate a commercial space reentry site at the Airport. Under the Reentry Site Operator License, the Authority could offer HSV to Sierra Space Corporation (Sierra Space) for reentry operation of the Dream Chaser vehicle. Concurrently, Sierra Space is applying to the FAA for a Vehicle Operator License to land Dream Chaser at the Airport.

The Proposed Action is subject to the National Environmental Policy Act (NEPA) and the FAA is preparing an Environmental Assessment (EA) to meet its regulatory obligations. A full description of the FAA's Proposed Action will be included in the Draft EA when it is published for public review.

Section 4(f) of the Department of Transportation Act and associated regulations (23 CFR part 774) provide that the Secretary of Transportation will not approve any transportation project that requires the *use* of any publicly owned and publicly accessible land from a park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, or land from any publicly or privately owned historic site of national, state, or local significance, unless there is no feasible and prudent alternative to the *use* of such land and the transportation project includes all possible planning to minimize harm resulting from the use. There is one Section 4(f) property located in the project study area for Section 4(f) that falls under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS): the Wheeler National Wildlife Refuge (NWR).

The purpose of this letter is to notify you of the FAA's preliminary Section 4(f) determination for the Wheeler NWR and to request your concurrence. A description of the proposed project is included as **Attachment 1**. The following sections of this letter include pertinent regulatory background and the FAA's preliminary Section 4(f) determination.

#### **Regulatory Background**

The FAA's procedural requirements for complying with Section 4(f) are set forth in DOT Order 5610.1C, *Procedures for Considering Environmental Impacts*. The FAA also uses Federal Highway Administration (FHWA) regulations (23 CFR part 774) and FHWA guidance (e.g., Section 4(f) Policy Paper) when assessing the potential for *use* of 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.

800 Independence Ave., SW. Washington, DC 20591

A *use* under Section 4(f) can occur when 1) land from a Section 4(f) property is permanently incorporated into a transportation project, 2) there is a *temporary occupancy* of a Section 4(f) property, or 3) the transportation project's proximity to a Section 4(f) property results in indirect impacts that would substantially impair the current use of the property. The first two types of *use* are referred to as a physical *use*. The latter type of use is identified as *constructive use*.

#### Physical Use

A permanent incorporation involves a right-of-way acquisition of Section 4(f) property as part of a transportation project either as a purchase of land or a permanent easement.

*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. A *temporary occupancy* is considered a Section 4(f) *use* unless all the conditions listed in 23 CFR § 774.13(d) are satisfied:

- 1. Duration must be temporary, i.e., less than the time needed for construction of the project, and there should be no change in ownership of the land;
- 2. Scope of the work must be minor, i.e., both the nature and the magnitude of the changes to the Section 4(f) property are minimal;
- 3. There are no anticipated permanent adverse physical impacts, nor will there be interference with the protected activities, features, or attributes of the property, on either a temporary or permanent basis;
- 4. The land being used must be fully restored, i.e., the property must be returned to a condition which is at least as good as that which existed prior to the project; and
- 5. There must be documented agreement of the official(s) with jurisdiction over the Section 4(f) resource regarding the above conditions.

A physical *use* may be considered *de minimis* if, after taking into account avoidance, minimization, mitigation, and enhancement measures, the result is either 1) a determination that the project would not adversely affect the activities, features, or attributes qualifying a park, recreation area, or wildlife or waterfowl refuge for protection under Section 4(f); or 2) a Section 106 *finding of no adverse effect* or *no historic properties affected*.

A *de minimis* impact determination requires agency coordination and public involvement. For historic sites, the FAA must consult the consulting parties identified in accordance with 36 CFR part 800 and inform the officials with jurisdiction of the intent to make a *de minimis* impact determination. The officials with jurisdiction must concur in a *finding of no adverse effect* or *no historic properties affected*. Compliance with 36 CFR part 800 satisfies the public involvement and agency coordination requirement for *de minimis* findings for historic sites.

#### Constructive Use

In order for a *constructive use* to occur, a transportation project must result in substantial impairment to the property's activities, features, or attributes to the extent that the value of the resource, in terms of its Section 4(f) purpose and significance, will be meaningfully reduced or lost. As noted in FHWA's Section 4(f) Tutorial,<sup>1</sup> "[c]onstructive use involves an indirect impact to the Section 4(f) property of such magnitude as to effectively act as a permanent incorporation." The FAA's

<sup>&</sup>lt;sup>1</sup> Available online at: <u>https://www.environment.fhwa.dot.gov/section4f/default.aspx</u>

1050.1F Desk Reference,<sup>2</sup> which provides guidance for FAA NEPA practitioners and is used to help FAA integrate applicable special purpose laws and requirements, also indicates that a proximity-related impact's consequences must amount to "taking" a property or a portion of a property in order for a *constructive use* determination to be made.

For historic properties protected under Section 4(f), an adverse effect finding under Section 106 does not automatically mean that there will be a *use* under Section 4(f). When a project does not permanently incorporate land of a historic site, but results in an adverse effect finding under Section 106, further assessment in terms of the potential for *constructive use* is necessary. This requires consideration of the proximity impacts of the transportation project to determine if it substantially impairs the Section 4(f) historic property. Consultation with officials with jurisdiction is required to identify and analyze impacts on the features and attributes that contribute to the National Register eligibility of the property. If there is no substantial impairment, there is no *constructive use* and Section 4(f) does not apply.

A *de minimis* impact determination is not appropriate for *constructive use* of a Section 4(f) property because *constructive use* is defined as substantial impairment, and substantial impairment cannot be considered a *de minimis* impact.

#### Section 4(f) Preliminary Determination

The FAA is in the process of evaluating the potential impacts of Sierra Space's proposed Dream Chaser operations to determine if the Proposed Action would result in a *use* of the property through permanent incorporation, *temporary occupancy*, or *constructive use*.

The Proposed Action would not result in ground disturbing activities at HSV or within the project study area that could cause direct impacts to Section 4(f) resources. Operations of reentry vehicles would not require the closure of any Section 4(f) properties and, therefore, would not require the *physical use* (direct impact) of Section 4(f) properties.

Noise (including sonic booms) produced during reentry operations has the potential to affect Section 4(f) properties in the project study area. The project study area is based on the sonic boom footprint created by the Dream Chaser vehicle upon reentry and is defined by the distance to which the sonic boom would be 1 pound per square foot (psf). Within the project study area, the maximum peak overpressure from the Dream Chaser sonic boom could reach 1.25 psf.

Of the 35,000 acres of the Wheeler NWR, only 26 acres are located within the project study area (see **Attachment 2**). 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<sup>3</sup>). Wheeler NWR protects habitat for 9 federally listed endangered or threatened species and 1 migratory bird species that reside in the refuge. The Wheeler NWR land within the study area would be sensitive to new sources of noise, given its aesthetic value as a natural recreational area and the presence of wildlife.

Potential Proposed Action-related noise such as sonic booms are temporal, not sustained, and not fixed in location. The change in air pressure associated with a sonic boom is only a few psf greater than normal atmospheric pressure. This additional pressure above normal atmospheric pressure is called overpressure. Overpressures greater than 1.5 psf generally elicit public reaction. The maximum

<sup>&</sup>lt;sup>2</sup> Available online at:

https://www.faa.gov/about/office\_org/headquarters\_offices/apl/environ\_policy\_guidance/policy/faa\_nepa\_order/desk\_ref/ <sup>3</sup> USFWS. (2020). *About Wheeler*. Retrieved from <u>https://www.fws.gov/refuge/Wheeler/bout.html</u>.

peak overpressure from a Dream Chaser sonic boom, 1.25 psf, would be less than a clap of thunder. The duration of a sonic boom is brief, less than a second, and the intensity is greatest directly under the flight path and weakens as distance from the flight path increases. The Section 4(f) properties in the project study area would experience a maximum of one sonic boom in 2023, 2024, and 2025; up to two in 2026; and up to three in 2027.

The FAA has made a preliminary determination that the Proposed Action would not substantially diminish the attributes that contribute to the enjoyment or quality of the Wheeler NWR because of the short-term and infrequent nature of the sonic booms. Therefore, the FAA has made a preliminary determination that the noise generated by the Proposed Action would not constitute a *constructive use* of the Wheeler NWR.

#### Conclusion

The FAA seeks your comments on the Proposed Action and concurrence on the FAA's Section 4(f) preliminary determination stated above. Please provide your response by December 2, 2021 to Ms. Stacey Zee of my staff at <u>Stacey.Zee@faa.gov</u>.

Sincerely,

Ansel Collins Deputy Manager (Acting), Safety Authorization Division

Enclosures:

Attachment 1 – Project Description Attachment 2 – Section 4(f) Resources within the Project Study Area

# **ATTACHMENT 1**

**Project Description** 

Sierra Space and the Authority anticipate up to one Dream Chaser reentry operation at HSV per year in 2023, 2024, and 2025; up to two reentries in 2026; and up to three reentries in 2027. Based on the mission requirements, reentries of Dream Chaser could occur during the daytime or nighttime, but the total number of reentries would not exceed the number of operations presented above.

Sierra Space is developing the Dream Chaser, a reusable spacecraft capable of carrying payloads to and from low Earth orbit. Figure 1 shows an illustration of the Dream Chaser in its reentry configuration. Dream Chaser missions are, in part, to support a National Aeronautics and Space Administration (NASA)/Sierra Space contract to resupply the International Space Station. 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. Figure 2 shows a proposed mission to the International Space Station. Dream Chaser would be launched as a payload on a rocket from an existing launch site and would reenter as a glider at HSV.



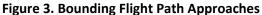
Figure 1. Sierra Space Dream Chaser Vehicle



Figure 2. Dream Chaser Mission Source: Sierra Space Corporation (2021)

Dream Chaser would reenter from the south on an ascending trajectory (traveling in a northerly direction relative to the latitudes of the earth), with high atmospheric overflight of the southwestern United States or Central American countries prior to landing at HSV. Dream Chaser would remain above controlled airspace for the majority of the overflight of Texas, Arkansas, Louisiana, Mississippi, and Alabama. Dream Chaser would descend below 60,000 feet altitude above mean sea level approximately 10-20 miles (15 nautical miles) southwest of HSV prior to landing and would be operating below 60,000 feet altitude above mean sea level for about three to four minutes. The proposed bounding trajectories are based on the maximum cross-range capability (the longest distance between the ground track of the vehicle orbit and the reentry site from which the Dream Chaser is still able to land) at two different orbital missions (International Space Station and 28.5° inclination) along with the maximum cross-range capabilities for the reentry vehicle to bound a reentry corridor (see Figure 3). The specific trajectory the Dream Chaser travels would be a function of where the orbital ground track location, relative to the landing site, 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 the FAA and pilots in advance of an operation as specified in the negotiated Letters of Agreement with relevant Air Traffic Control facilities.

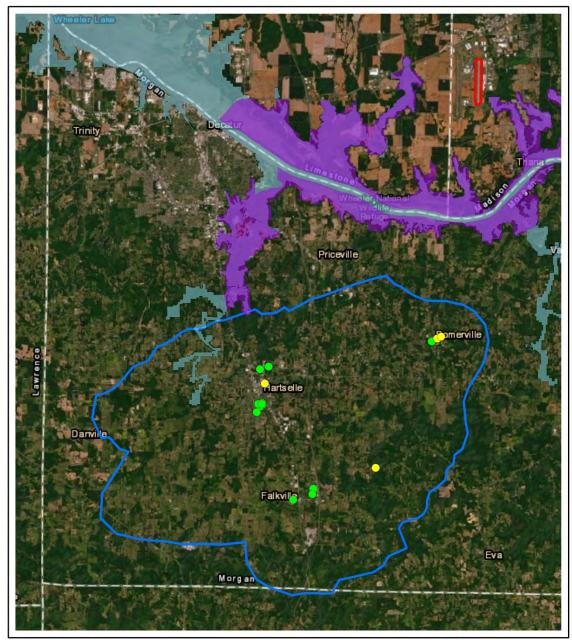




Dream chaser would use a reaction control system for orbital maneuvers, deorbit burn, and highaltitude control during reentry. This would not be used near or on the ground, so there would be no engine noise close to the ground or emissions below the mixing layer. Any propellants would be residual at landing, where they would be offloaded and transported off the airport or small amounts stored with other hazardous waste at the airport, so there are no anticipated significant hazardous materials, pollution prevention, or solid waste impacts.

## **ATTACHMENT 2**

Section 4(f) Resources in the Project Study Area



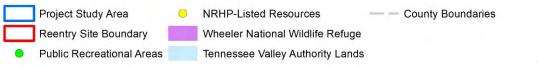
Section 4(f) Resources in the Project Study Area

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

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

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# **RS&H**



# ALABAMA HISTORICAL COMMISSION

468 South Perry Street Montgomery, Alabama 36130-0900 Tel: 334-242-3184 Fax: 334-242-1083

November 9, 2021

Amy Hanson FAA 800 Independence Ave. SW Washington, D.C. 20591

Re: AHC 22-0074 Sierra Space Dream Chaser Reentry Operations Madison County

Dear Ms. Hanson:

Upon review of the above referenced project, we concur that project activities will have no effect on cultural resources eligible for or listed on the National Register of Historic Places. Therefore, we concur with the determination of no effect to historic properties.

Consultation with the State Historic Preservation Office does not constitute consultation with Tribal Historic Preservation Offices, other Native American tribes, local governments, or the public. If archaeological materials are encountered during construction, the procedures codified at 36 CFR 800.13(b) will apply. Archaeological materials consist of any items, fifty years old or older, which were made or used by man. These items include but are not limited to, stone projectile points (arrowheads), ceramic sherds, bricks, worked wood, bone and stone, metal, and glass objects. The federal agency or the applicant receiving federal assistance should contact our office immediately. If human remains are encountered, the provisions of the Alabama Burial Act (*Code of Alabama* 1975, §13A-7-23.1, as amended; Alabama Historical Commission Administrative Code Chapter 460-X-10 Burials) should be followed. This stipulation shall be placed on the construction plans to ensure contractors are aware of it.

We appreciate your commitment to helping us preserve Alabama's historic archaeological and architectural resources. Should you have any questions, please contact Eric Sipes at 334.230.2667 or Eric.Sipes@ahc.alabama.gov. Have the AHC tracking number referenced above available and include it with any future correspondence.

Sincerely,

Le anne Woffe

Lee Anne Wofford Deputy State Historic Preservation Officer

LAW/EDS/law

TA/SL 2022. TA. D123

U.S. Department of Transportation Federal Aviation Administration

**Commercial Space Transportation** 

800 Independence Ave., SW. Washington, DC 20591

October 22, 2021

Mr. Bill Pearson U.S. Fish and Wildlife Service Alabama Ecological Services Field Office 1208 Main Street, Daphne, AL 36526 Via email: <u>bill pearson@fws.gov</u>

# RE: Endangered Species Act Consultation for Proposed Sierra Space Corporation Reentry Operations at the Huntsville International Airport, Huntsville, Alabama

The Federal Aviation Administration (FAA) is initiating Endangered Species Act (ESA) Section 7 consultation and requesting concurrence with our assessment and determination of the potential effects on ESA-listed species for the proposed Sierra Space Corporation (Sierra Space) Dream Chaser reentry operations at the Huntsville International Airport (HSV or Airport).

The Huntsville-Madison County Airport Authority (Authority), owner and operator of HSV is seeking an FAA Reentry Site Operator License to operate a commercial reentry site at the Airport. Under the Reentry Site Operator License, the Authority could offer HSV to Sierra Space for reentry operation of the Dream Chaser vehicle. Concurrently, Sierra Space is applying to the FAA for a Vehicle Operator License to land Dream Chaser at the Airport. A description of the proposed project is included as **Attachment 1**.

The following sections of this letter provide the list of ESA-listed species and designated critical habitat found in the project action area, discuss potential effects to the listed species and critical habitat, and provide FAA's effect determination for each species and critical habitat.

#### ESA-Listed Species and Critical Habitat in the Action Area

The action area refers to the area directly or indirectly affected by the proposed action. The action area for Dream Chaser reentry operations is based on the sonic boom footprint created by the Dream Chaser vehicle upon reentry and is defined by the distance to which the sonic boom would be 1 pound per square foot (psf) (see **Attachment 2**). Within the action area, the maximum peak overpressure from the Dream Chaser sonic boom could reach 1.25 psf, less than a clap of thunder. The action area encompasses a variety of habitats ranging from developed land to undeveloped forested land and some aquatic environments. Federally listed threatened or endangered species may use these habitats. **Table 1** lists the federally listed threatened or endangered species that the USFWS identify as occurring or potentially occurring in the action area.

| Common Name<br>(Scientific Name)                 | Federal Status          |
|--|-------------------------|
| Grey Bat (Myotis grisescens)                     | Endangered              |
| Indiana Bat ( <i>Myotis sodalis</i> )            | Endangered <sup>1</sup> |
| Northern Long-eared Bat (Myotis septentrionalis) | Threatened              |
| Dark Pigtoe (Pleurobema furvum)                  | Endangered <sup>1</sup> |
| Pink Mucket (pearlymussel) (Lampsilis abrupta)   | Endangered              |
| Rough Pigtoe (Pleurobema plenum)                 | Endangered              |
| Sheepnose Mussel (Plethobasus cyphyus)           | Endangered              |
| Snuffbox Mussel (Epioblasma triquetra)           | Endangered              |
| Anthony's Riversnail (Athearnia anthonyi)        | Endangered              |
| Fleshy-fruit Gladecress (Leavenworthia crassa)   | Endangered <sup>2</sup> |
| Leafy Prairie-clover (Dalea foliosa)             | Endangered              |
| Morefields Leather Flower (Clematis morefieldii) | Endangered              |
| American Hart's-tongue Fern                      | Threatened              |

# Table 1: Federally Listed Threatened and Endangered Species that Occur or Potentially Occur in the Project Action Area

Source: USFWS 2021.

<sup>1</sup>Critical habitat is designated for these species, but it is not present in the action area.

<sup>2</sup> Critical habitat is designated for this species and is present in the action area.

#### **Potential Effects to ESA-listed Species and Critical Habitat**

The Proposed Action would have no effect on ESA-listed plants in the action area because the action does not involve activities with the potential to affect these plants (e.g., no construction or other ground-disturbing activities). Similarly, the Proposed Action would have no effect on the only designated critical habitat in the action area – for fleshy-fruit gladecress – because the action does not involve activities with the potential to affect this habitat.

Noise (including sonic booms) produced during reentry operations has the potential to affect ESA-listed animal species in the action area. Animal species differ greatly in their responses to noise. Noise effects on domestic animals and wildlife are classified as primary, secondary, and tertiary.

• **Primary** effects are direct, physiological changes to the auditory system, and most likely include the masking of auditory signals. Masking is defined as the inability of an individual to hear important environmental signals that may arise from mates, predators, or prey. There is some potential that noise could disrupt a species' ability to communicate or could interfere with behavioral patterns (Manci et al. 1988). Although the effects are likely temporal, sonic booms may cause masking of auditory signals within exposed faunal communities. Animals rely on hearing to avoid predators, obtain food, and communicate with, and attract, other members of their species. Sonic booms may mask or interfere with these functions.

the head and apparent alertness for between 10 and 20 seconds. No apparent nest failure occurred as a result of the sonic booms.

The literature suggests that common animal responses to noise include the startle response and, ultimately, habituation. It has been reported that the intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects. The majority of the literature suggests that domestic animal species (cows, horses, chickens) and wildlife species exhibit adaptation, acclimation, and habituation after repeated exposure to jet aircraft noise and sonic booms.

Potential Proposed Action-related noise such as a sonic booms are temporal, not sustained, and not fixed in location. The change in air pressure associated with a sonic boom is only a few psf greater than normal atmospheric pressure. This additional pressure above normal atmospheric pressure is called overpressure. Overpressures greater than 1.5 psf generally elicit public reaction. The maximum peak overpressure from a Dream Chaser sonic boom would be 1.25 psf, less than a clap of thunder. The duration of a sonic boom is brief, less than a second, and the intensity is greatest directly under the flight path and weakens as distance from the flight path increases. The ESA-listed animal species in the action area would experience a maximum of one sonic boom in 2023, 2024, and 2025; up to two in 2026, and up to three in 2027. These events are expected to produce infrequent startle effects.

Based on the lack of observed effects to wildlife in the studies mentioned above, the low number of sonic booms that would occur each year, the brief duration of a sonic boom (less than a second), and the peak overpressure of 1.25 psf (less than a thunder clap), the FAA expects that sonic booms associated with the Proposed Action **may affect**, **but would not likely adversely effect**, ESA-listed wildlife species in the project action area.

#### Conclusion

In summary, the FAA anticipates reentry operations (sonic booms) **may affect, but would not likely adversely effect**, all of the ESA-listed wildlife species in Table 1. The FAA seeks your concurrence on our effect determination and welcomes any additional comments. Reentry operations would have **no effect** on federally listed plant species and designated critical habitat. Thank you for your assistance in this matter. Please provide your response to Ms. Stacey Zee of my staff at Stacey.Zee@faa.gov.

Sincerely,

JAMES R Digitally signed by JAMES R REPCHECK REPCHECK Date: 2021.10.22 16:49:00 -04'00'

Randy Repcheck Manager, Safety Authorization Division

Enclosures: Attachment 1 – Project Description A Construction of the second s

U.S. Fish and Wildlife Service 1208-B Main Street – Daphne. Alabama 36526 Phone: 251-441-5181 Fax: 251-441-6222

Based upon our records and the information provided in your letter, we agree with your findings that no federally listed species/critical habitat occur in the project area. If project design changes are made, please submit new plans for review.

um illiam J Pearson, Field Supervisor

NOV 1 5 2021

Date

# 6

- Secondary effects may include non-auditory effects such as stress and hypertension; behavioral modifications; interference with mating or reproduction; and impaired ability to obtain adequate food, cover, or water.
- **Tertiary** effects are the direct result of primary and secondary effects, and include population decline and habitat loss.

Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) also influence secondary and tertiary effects, and confound the ability to identify the ultimate factor in limiting productivity of a certain nest, area, or region. Overall, the literature suggests that species differ in their response to various types, durations, and sources of noise (Manci et al. 1988; Bowles 1995).

Many scientific studies have investigated the effects of sonic booms on wildlife, and some have focused on wildlife "flight" due to noise. Natural factors which affect reaction include season, group size, age and sex composition, on-going activity, motivational state, reproductive condition, terrain, weather, and temperament (Bowles 1995). Individual animal response to a given noise event or series of events also can vary widely due to a variety of factors, including time of day, physical condition of the animal, physical environment, the experience of the individual animal with noises, and whether or not other physical stressors (e.g., drought) are present (Manci et al. 1988). Consequently, it is difficult to generalize animal responses to noise disturbances across species.

One result of the Manci et al. (1988) literature review was the conclusion that, while behavioral observation studies were relatively limited, a general behavioral reaction in animals from exposure to aircraft noise is the "startle response." The intensity and duration of the startle response appears to be dependent on which species is exposed, whether there is a group or an individual, and whether there have been some previous exposures. Responses range from flight, trampling, stampeding, jumping, or running, to movement of the head in the apparent direction of the noise source. Manci et al. (1988) reported that the literature indicated that avian species may be more sensitive to aircraft noise than mammals.

The following discussion presents a summary of some of the more relevant studies addressing the potential impacts to wildlife from sonic booms.

Teer and Truett (1973) tested quail eggs subjected to sonic booms at 2, 4, and 5.5 pounds per square foot (psf) and found no adverse effects. Heinemann and LeBrocq (1965) exposed chicken eggs to sonic booms at 3–18 psf and found no adverse effects. In a mathematical analysis of the response of avian eggs to sonic boom overpressures, Ting et al. (2002) determined that it would take a sonic boom of 250 psf to crack an egg. Bowles (1995) states that it is physically impossible for a sonic boom to crack an egg because one cannot generate sufficient sound pressure in air to crack eggs.

Teer and Truett (1973) examined reproductive success in mourning doves, mockingbirds, northern cardinals, and lark sparrows when exposed to sonic booms of 1 psf or greater and found no adverse effects. Awbrey and Bowles (1990) in a review of the literature on the effects of aircraft noise and sonic booms on raptors found that the available evidence shows very marginal effects on reproductive success. Ellis et al. (1991) examined the effects of sonic booms (actual and simulated) on nesting peregrine falcons, prairie falcons, and six other raptor species. While some individuals did respond by leaving the nest, the response was temporary and overall there were no adverse effects on nesting. Lynch and Speake (1978) studied the effects of both real and simulated sonic booms on the nesting and brooding of eastern wild turkey in Alabama. Hens at four nest sites were subjected to between 8 and 11 combined real and simulated sonic booms. All tests elicited similar responses, including quick lifting of

| From:    | Hanson, Amy (FAA)  |
|----------|--|
| To:      | Section106   |
| Cc:      | Zee, Stacey (FAA); Fownes, Jennifer  |
| Subject: | RE: Invitation for Government-to-Government Tribal Consultation for Sierra Space Corporation Reentry Operations at the Huntsville International Airport, Huntsville, Alabama |
| Date:    | Tuesday, November 16, 2021 12:18:17 PM   |

Thank you very much for your quick reply Mr. Soweka.

Amy

From: Section106 <Section106@muscogeenation.com>
Sent: Tuesday, November 16, 2021 11:13 AM
To: Hanson, Amy (FAA) <Amy.Hanson@faa.gov>
Subject: Re: Invitation for Government-to-Government Tribal Consultation for Sierra Space
Corporation Reentry Operations at the Huntsville International Airport, Huntsville, Alabama

Good morning Ms. Hanson,

Thank you for sending the correspondence regarding the proposed commercial space reentry operations located at the Huntsville International Airport located in Huntsville, Madison County, Alabama. Madison County is located within the Muscogee (Creek) Nation's historic area of interest and is of importance to us. After review, the Muscogee Nation is unaware of any Muscogee sacred sites or other properties of cultural and religious significance that may be affected by the reentry operations. The Muscogee Nation concurs that there should be **no effects to any known historic properties** and that operations should proceed as planned. Please feel free to contact me if there are any questions or concerns.

Thank you,

Robin Soweka, Jr. Cultural Resource Specialist, Historic and Cultural Preservation Department The Muscogee Nation P.O. Box 580 | Okmulgee, OK 74447 T 918.732.7726 | F 918.758.0649 rosoweka@MuscogeeNation.com MuscogeeNation.com



From: Hanson, Amy (FAA) <<u>Amy.Hanson@faa.gov</u>>
Sent: Monday, October 25, 2021 4:43 PM
To: David Hill <<u>dhill@muscogeenation.com</u>>
Cc: Section106 <<u>Section106@muscogeenation.com</u>>; Zee, Stacey (FAA) <<u>Stacey.Zee@faa.gov</u>>;
Repcheck, Randy (FAA) <<u>Randy.Repcheck@faa.gov</u>>; Fownes, Jennifer <<u>Jennifer.Fownes@icf.com</u>>

**Subject:** Invitation for Government-to-Government Tribal Consultation for Sierra Space Corporation Reentry Operations at the Huntsville International Airport, Huntsville, Alabama

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Principal Chief Hill,

Please see the attached invitation for Government-to-Government Tribal Consultation for Sierra Space Corporation Reentry Operations at the Huntsville International Airport, Huntsville, Alabama.

Amy B. Hanson Environmental Protection Specialist Chicago Airports District Office Federal Aviation Administration and Environmental Protection Specialist on Detail Safety Authorization Division (ASA-100) Operational Safety Directorate | Commercial Space Transportation Federal Aviation Administration

Office: 847-294-7354 Cell: 847-571-3425

#### **Fownes, Jennifer**

| From:<br>Sent:<br>To: | Ingram, Ricky <ricky_ingram@fws.gov><br/>Wednesday, February 2, 2022 3:19 PM<br/>Hanson, Amy (FAA)</ricky_ingram@fws.gov>  |
|-----------------------|--|
| Cc:                   | Fownes, Jennifer; Piggott, Jennifer; Zee, Stacey (FAA); Afifi, Emily K (FAA); Sisneros, Emily (FAA);   |
|                       | Wirwa, Drew  |
| Subject:              | Re: [EXTERNAL] Draft responses to Section 4(f) questions and comments for the proposed Huntsville<br>Reentry Site Operator License and Sierra Space Vehicle Operator License |
| Attachments:          | 20220202 Wheeler NWR Section 4f Question Responses.docx  |
| Categories:           | FAA  |

Amy,

Thank you for your responses to my questions. I concur with your conclusions that there should not be any significant impact to Wheeler NWR or the species utilizing the refuge. We appreciate your coordination with the Refuge on your project.

Ricky Ingram Project Leader Wheeler NWR Complex 256-353-7243 ext 46142

From: Hanson, Amy (FAA) <Amy.Hanson@faa.gov>
Sent: Wednesday, February 2, 2022 2:04 PM
To: Ingram, Ricky <ricky\_ingram@fws.gov>
Cc: Fownes, Jennifer <jennifer.fownes@icf.com>; Piggott, Jennifer <jennifer.piggott@icf.com>; Zee, Stacey (FAA)
<Stacey.Zee@faa.gov>; Afifi, Emily K (FAA) <Emily.K.Afifi@faa.gov>; Sisneros, Emily (FAA) <emily.sisneros@faa.gov>
Subject: [EXTERNAL] Draft responses to Section 4(f) questions and comments for the proposed Huntsville Reentry Site
Operator License and Sierra Space Vehicle Operator License

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

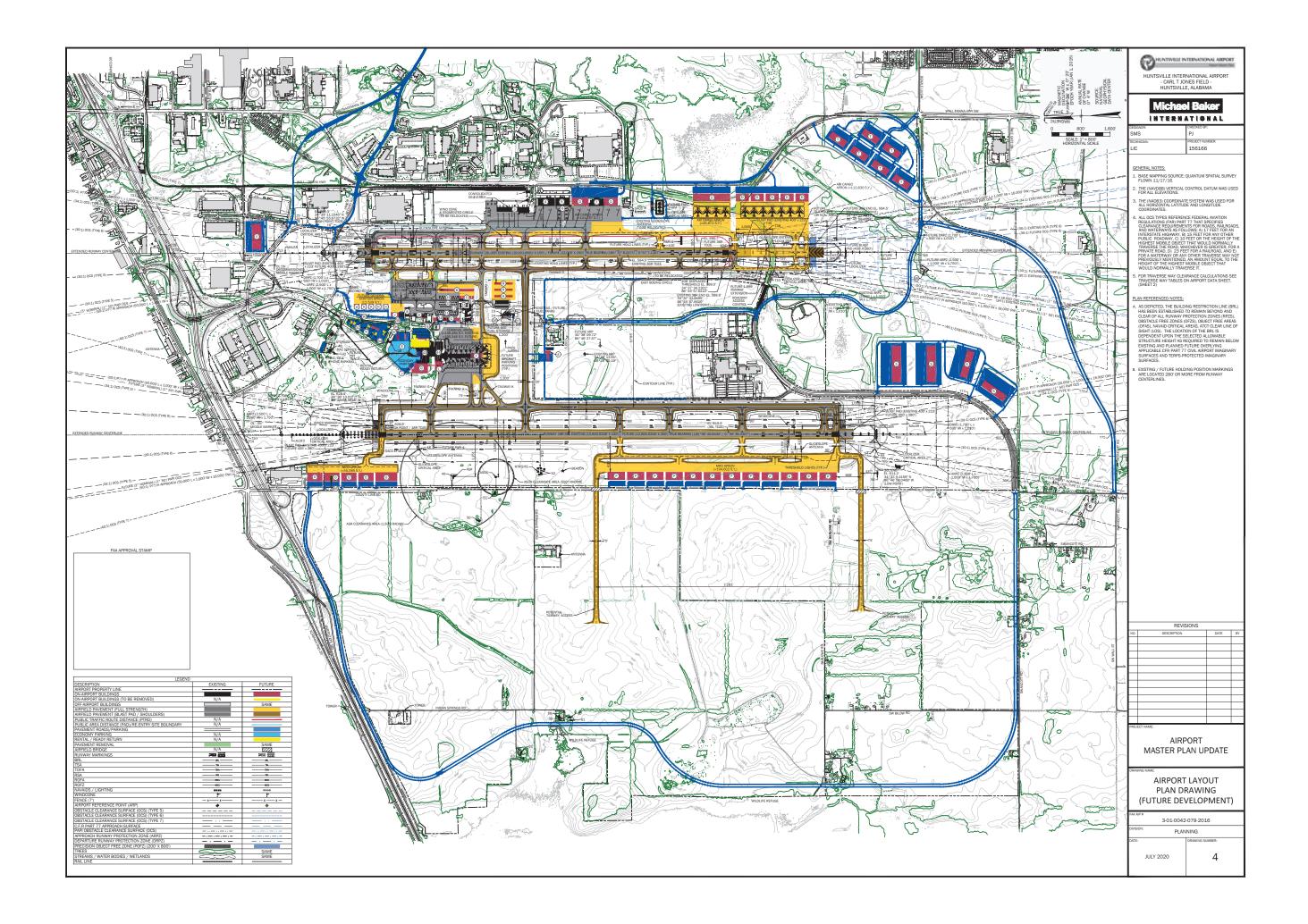
Ricky –

Thank you for your questions on the Huntsville Reentry Site Operator License and Sierra Space Vehicle Operator License. We have prepared the draft responses (attached) for your review and are happy to schedule a time to talk, if that would help.

Thank you for your consultation efforts on this project.

Amy B. Hanson Environmental Protection Specialist Safety Authorization Division (ASA-100) Operational Safety Directorate | Commercial Space Transportation Federal Aviation Administration and Environmental Protection Specialist on Detail Chicago Airports District Office Federal Aviation Administration

Office: 847-294-7354 Cell: 847-571-3425 APPENDIX C: AIRPORT LAYOUT PLAN (ALP)



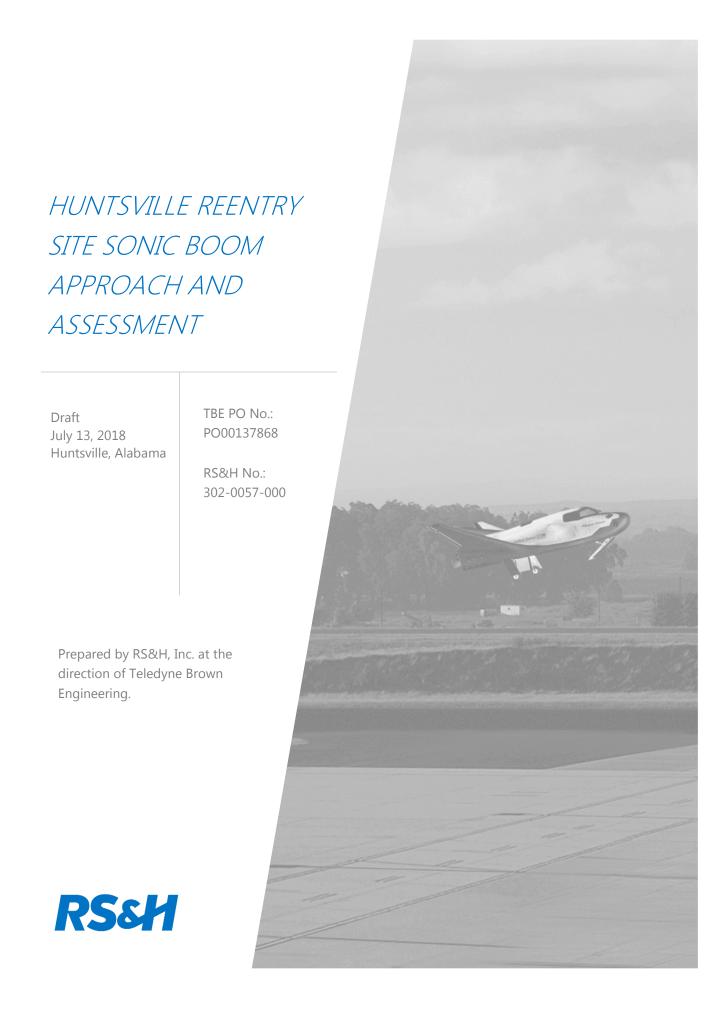
APPENDIX D: SONIC BOOM ANALYSIS

# HUNTSVILLE REENTRY SITE SONIC BOOM APPROACH AND ASSESSMENT

JULY 13, 2018







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## **EXECUTIVE SUMMARY**

This study was prepared to determine if the reentry and landing of the SNC Dream Chaser at Huntsville International Airport would result in a significant noise impact, per FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The analyses discloses the potential noise effects of the vehicle's reentry in terms of sonic booms generated by the vehicle at velocities greater than Mach 1 (i.e., speed of sound).

Any unwanted sound that interferes with normal activities or the natural environment can be defined as noise. Sonic boom noise levels are described in units of peak overpressure in pounds per square foot (psf). The Day-Night Average Sound Level (DNL) is a cumulative noise metric that accounts for the single event level of all noise events in a 24-hour period. According to FAA Order 1050.1, Desk Reference (Draft Update – May 2018), the psf metric is used to determine potential structural damage to buildings, while C-weighted DNL (or CDNL) is applied during the assessment of potential human annoyance.

Sonic booms have the potential to damage structures. For well-maintained structures the threshold for damage from sonic booms is 2 psf, below which is unlikely and generally limited to "bric-a-brac" or structural elements that are in ill-repair. Overpressures less than or equal to 1 psf, no structural damage is to be expected. This allows the overpressures below 1 psf to be assumed as negligible when considering structural effects. NASA has stated that overpressures greater than 1.5 psf generally elicit a public reaction.

The Dream Chaser is 30 feet long with a wingspan of 24 feet and having a landing weight of approximately 24,000 lbs. The launch of Dream Chaser to suborbit or orbit would occur at another approved location; not HSV. The frequency of reentry to HSV is projected to be one reentry in 2022 with a potential increase of up to three total reentries by 2025. SNC has two potential orbital missions for the Dream Chaser at HSV; cargo missions to and from the ISS and missions from 28.5° inclination. SNC provided the latitude and longitude, velocities, altitudes, flight azimuth and heading direction of the Dream Chaser for each of these design reference orbits (DRO) (five reentry trajectories in total). Both data sets provided trajectory information from 400,000 feet in altitude to landing.

Based on PCBOOM's sonic boom modeling results, a sonic boom of  $\geq$  1 psf from the reentry of the SNC Dream Chaser to HSV would affect a maximum area 134 square miles of the southern U.S. Buildings and structures, depending on their condition, could be affected. In 2022, one daytime reentry to HSV would result in a maximum 1.25 psf equaling 28.5 CDNL. In 2025, two daytime and one nighttime reentries to HSV would result in a maximum 39.3 CDNL.

The potential for structural damage is unlikely for the modeled sonic boom overpressure levels less than 1.0 psf. The potential for hearing damage (with regards to humans) is insignificant, as the modeled sonic boom overpressure levels over land are substantially lower than the approximate 4 psf impulsive hearing conservation noise criteria. Based on the FAA's draft guidance, the CDNL of the proposed reentries of the SNC Dream Chaser to HSV in 2022 and 2025 would not significantly result in human annoyance.

# <u>CHAPTER 1</u> INTRODUCTION

# 1.1 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 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 application to operate a commercial reentry site at the Airport. Under the reentry site operator license, the Authority could offer HSV to commercial reentry vehicle operators (e.g., SNC) for the operation of reentry vehicles (e.g., Dream Chaser). If successful, the Airport would operate in accordance with a 5-year reentry site operator license. Concurrently, SNC is seeking a FAA reentry vehicle license (14 CFR Part 435) for landing the SNC's commercial reentry vehicle, the Dream Chaser® spacecraft, at the Airport. SNC would operate the Dream Chaser in accordance with a 5-year reentry vehicle operator license and would be subject to permits and licenses issued by the FAA under 14 CFR Chapter III, Parts 400-450.

SNC is working with the FAA AST to develop and submit a FAA reentry vehicle operator license application to land the Dream Chaser at the Airport. SNC is also working with the Authority for consistency between the license applications. With an approved FAA reentry vehicle operator license and the Authority's approved FAA reentry site operator license, SNC could land Dream Chaser at the Airport in support of payload transportation services.

This study was prepared to determine if the reentry of the SNC Dream Chaser to HSV would result in a significant noise impact, per FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The analyses discloses the potential noise effects of the vehicle's reentry in terms of sonic booms generated by the vehicle at velocities greater than Mach 1 (i.e., speed of sound).

Chapter 1 describes the Airport location, noise metrics and criteria, sonic boom and its effects, and FAA's draft guidance. Chapter 2 summarizes the sonic boom methodology and model inputs. Section 3 presents the sonic boom modeling results. The conclusion is provided in Chapter 3 describing the findings of this noise study.

## 1.2 LANDING SITE OVERVIEW

Huntsville International Airport is located in Madison County, about 9 miles southwest of downtown Huntsville. Serving more than 1.2 million passengers each year, HSV is the largest commercial airport in north 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 Error! Reference source not found.. HSV offers and receives flights from nine major destinations including Atlanta, Charlotte, Chicago, Dallas, Denver, Detroit, Houston, and Dulles and Nation airports in Washington D.C. 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.



FIGURE 0-1 HUNTSVILLE INTERNATIONAL AIRPORT LOCATION

# 1.3 NOISE METRICS AND CRITERIA

#### 1.3.1 Noise Metrics

Any unwanted sound that interferes with normal activities or the natural environment can be defined as noise. Noise sources can be constant or short-duration and contain a wide range of frequency content. Determining the character and level of sound aids in predicting the way it is perceived. Sonic booms are classified as short-duration noise events.

Noise metrics are used to describe the noise event and to identify any potential impacts to receptors within the environment. These metrics are based on the nature of the event and who or what is affected by the sound. Individual time-varying noise events have two main characteristics: a sound level that changes throughout the event and a period of time the event is heard. Sonic boom noise levels are described in units of peak overpressure in pounds per square foot (psf).

The Day-Night Average Sound Level (DNL) is an annual cumulative noise metric that accounts for the single event level of all noise events in a 24-hour period. DNL values are expressed as the level over a 24-hour annual average day. To account for increased human sensitivity to noise at night, a 10 dB penalty is applied to nighttime events (occurring between the hours of 10:00 p.m. and 7:00 a.m.). Therefore, the DNL is dependent on the number of annual daytime and nighttime events.

#### 1.3.2 Noise Criteria

Noise criteria have been developed to protect the public health and welfare of the surrounding communities. Sonic boom impacts are evaluated on a single-event basis in relation to hearing conservation and structural damage criteria. Although FAA Order 1050.1F does not have guidance on hearing conservation or structural damage criteria, it recognizes the use of supplemental noise analysis to describe the noise impact and assist the public's understanding of the potential noise impact.

#### 1.3.2.1 Human Annoyance

FAA Order 1050.1F, states that a significant noise impact would occur 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 this level due to the increase, when compared to the No Action Alternative for the same timeframe." DNL is based on long-term cumulative noise exposure and has been found to correlate well with adverse community impacts for regularly occurring events including aircraft, rail, and road noise. DNL metrics are provided in compliance with FAA requirements as the FAA considers DNL the best available metric to estimate the potential long-term annoyance.

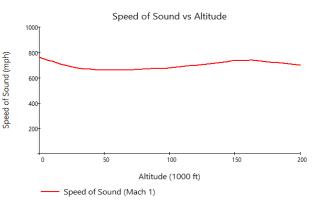
#### 1.3.2.2 Hearing Conservation

Multiple federal government agencies have provided guidelines on permissible noise exposure limits on impulsive noise such as a sonic boom. These documented guidelines are in place to protect one's hearing from exposures to high noise levels and aid in the prevention of noise induced hearing loss. In terms of upper limits on impulsive or impact noise levels, National Institute for Occupational Safety and Health Administration have stated that levels should not exceed 140 dB peak sound pressure level, which equates to a sonic boom level of approximately 4 psf.

## 1.4 SONIC BOOM

Sonic booms occur when an object's speed surpasses the speed of sound. The speed of sound varies depending on the altitude due to the changes in atmospheric density and temperature, as shown in Figure 0-2.

During flight, pressure waves that travel at the speed of sound form in front and behind the object, and as the object's speed increases, the pressure waves become more compressed. Eventually, these pressure waves merge into a single shock wave that resembles a cone; this





effect is shown in Figure 0-3. This pressure wave expands until the energy is dissipated, potentially impacting the ground level enabling an observer to hear it. A sonic boom is the sound result from this effect.

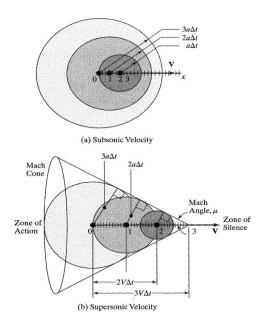


FIGURE 0-3 COMPARISON OF SUBSONIC AND SUPERSONIC VELOCITIES

Sonic booms can occur both naturally and artificially. Thunder, the most common sonic boom, is created naturally from lightning passing through air. Aircraft and spacecraft that have supersonic capability will produce sonic booms when travelling faster than the speed of sound. A sonic boom's strength, referred to as overpressure, is largely dependent on the object's speed, shape, and altitude, but is also affected by the composition of the atmosphere.

At ground level, a sonic boom is heard as two shock waves, one from the forward part of the craft and one from the rear, of nearly equal strength. These noises are separated by less than a second in time. The sonic boom forms a cone around the object which extends to the ground creating a hyperbolic profile under the trajectory. These shapes, called isopemps, track the progression of the sonic boom. The intensity of the boom is measured laterally along the isopemp, and the highest levels of strength are

typically found directly under the flight path of the vehicle.

Overpressure is the additional pressure above normal atmospheric pressure. Sonic boom noise levels are described using units of peak overpressure in pounds per square foot (psf). The change in air pressure associated with a sonic boom is only a couple pounds per square foot greater than normal atmospheric pressure. A pressure change of 1 psf would also be experienced though an elevation change of about 20 feet. A sonic boom is only audible when the pressure change is sudden, like in the case of the flying vehicle or thunder. For reference, a thunder clap is commonly estimated to have an overpressure of 0.5 psf and thunder that is nearby would approximated at 1.0 psf or above.

A sonic boom's effect on the affected area varies with its strength. It can be quiet and easily ignored, disturb the population, or even cause structural damage and personal injury. Another event that has the potential for happening is a "superboom," which is when the overpressure is focused on a smaller area due to a turn or other flight

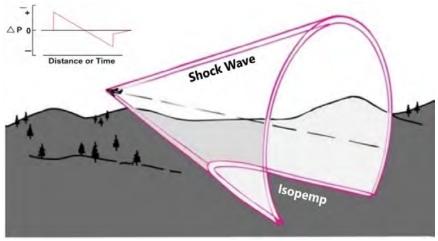


FIGURE 0-4 SHOCK WAVE, N-WAVE, AND ISOPEMP EXAMPLE FOR A SUPERSONIC VEHICLE [3]

maneuver. All of these effects result in a need to identify how strong a sonic boom could be and where it would impact the ground.

#### 1.4.1 Sonic Boom Effects

Sonic booms have the potential to damage structures. For well-maintained structures the threshold for damage from sonic booms is 2 psf, below which is unlikely and generally limited to "bric-a-brac" or structural elements that are in ill-repair. Table 0-1 provides a generalization that can be followed when dealing with such overpressures. Much of the structural damage is a result of existing damage, with the exception of "bric-a-bac," which simply describes loose objects that are subject to falling. NASA reported in August 2017 that at overpressures less than or equal to 1 psf, no structural damage is to be expected. This allows the overpressures below 1 psf to be assumed as negligible when considering structural effects. NASA also stated that overpressures greater than 1.5 psf generally elicit a public reaction.

#### 1.4.2 FAA Draft Guidance

FAA policy states that sonic booms over US territorial properties are prohibited without an appropriate waiver. Currently, there is no published FAA policy regarding what are "acceptable" overland sonic booms.

As described in the FAA Oder 1050.1 Desk Reference (Draft Update - May 2018):

"Noise analyses and evaluations of potential impacts for commercial space launch vehicles and sites can vary substantially from approaches used by the FAA for civil aircraft and airports for several reasons. One reason is the low-frequencies component of the spectral characteristic of the launch vehicle noise. Such low frequency noise can propagate for much longer distances than that of jet or propeller aircraft noise, and can be perceived as a "rumbling" noise. Commercial space launch vehicles create sonic booms when they operate above the speed of sound.

As a result, noise modeling and assessment for launch vehicles and sites differs from modeling and assessment of civil aircraft and airports. Nevertheless, the basic elements of FAA noise assessment for NEPA, including the proximity of noise sensitive receptors and the DNL 65 dB significance threshold, currently remain applicable...

Since sonic boom measurements results are typically presented in terms of psf, a conversion is needed to obtain CDNL<sup>1</sup> values. This allows for a comparison to FAA's significance threshold in DNL. It should be noted that both psf and CDNL results are usually needed for most commercial space launch proposals. The psf metric is used to determine potential structural damage to buildings, while CDNL is applied during the assessment of potential human annoyance."

<sup>&</sup>lt;sup>1</sup> CDNL is the C-weighted DNL. C-weighting is preferred over A-weighting for impulsive noise sources with large low-frequency content such as sonic booms.

TABLE 0-1 POTENTIAL DAMAGE TO CONVENTIONAL STRUCTURES DUE TO SONIC BOOMS

| Sonic Boom              |  | IL STRUCTURES DUE TO SONIC BOOMS   |
|-------------------------|--|--|
| Overpressure<br>Nominal | Type of<br>Damage                        | Item Affected  |
|                         | Plaster                                  | Fine cracks; extension of existing cracks; more in ceilings; over doorframes; between some plasterboards.  |
|                         | Glass                                    | Rarely shattered; either partial or extension of existing.   |
|                         | Roof                                     | Slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole.  |
| 0.5 - 2                 | Damage to<br>outside<br>walls            | Existing cracks in stucco extended.  |
|                         | Bric-a-brac                              | Those carefully balanced or on edges can fall; fine glass, such as large goblets, can fall and break.  |
|                         | Other                                    | Dust falls in chimneys.  |
| 2-4                     | Glass,<br>plaster,<br>roofs,<br>ceilings | Failures show that would have been difficult to forecast<br>in terms of their existing localized condition. Nominally<br>in good condition.  |
|                         | Glass                                    | Regular failures within a population of well-installed glass; industrial as well as domestic greenhouses.  |
|                         | Plaster                                  | Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.  |
| 4-10                    | Roofs                                    | High probability rate of failure in nominally good state,<br>slurry-wash; some chance of failures in tiles on modern<br>roofs; light roofs (bungalow) or large area can move bodily.   |
|                         | Walls (out)                              | Old, free standing, in fairly good condition can collapse.   |
|                         | Walls (in)                               | Inside ("party") walls known to move at 10 psf.  |
|                         | Glass                                    | Some good glass will fail regularly to sonic booms from the same direction. Glass with existing faults could shatter and fly. Large window frames move.  |
|                         | Plaster                                  | Most plaster affected.   |
| Greater than 10         | Ceilings                                 | Plasterboards displaced by nail popping.   |
|                         | Roofs                                    | Most slate/slurry roofs affected, some badly; large roofs<br>having good tile can be affected; some roofs bodily displaced<br>causing gale-end and will-plate cracks; domestic chimneys<br>dislodged if not in good condition. |
|                         | Walls                                    | Internal party walls can move even if carrying fittings such<br>as hand basins or taps; secondary damage due to water<br>leakage.  |
|                         | Bric-a-brac                              | Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.  |

<u>CHAPTER 2</u> SONIC BOOM METHODOLOGY AND MODEL

# 2.1 PCBOOM MODELING IMPACTS

FAA Office of Environment and Energy (AEE) has approved a number of models for detailed noise analysis. PCBoom4 is used to calculate the location and magnitude of sonic boom overpressures on the ground due to supersonic flight and commercial space operations. This software has been used for years by the Air Force Center for Engineering and Environment to determine the amplitude and path of sonic boom contours. It considers the effects of the atmosphere, vehicle shape and velocity, and altitude to accurately predict the intensity and propagation of the sonic booms resulting from supersonic flight. The complete ground pattern of a sonic boom depends on the size, weight, shape, speed, and trajectory of the vehicle.

## 2.2 DREAM CHASER

SNC developed the Dream Chaser, a reusable spacecraft capable of carrying payloads to and from low Earth orbit, as well as delivering supplies to the International Space Station (ISS) (see Figure 2-1). The Dream Chaser is 30 feet long with a wingspan of 24 feet and having a landing weight of approximately 24,000 lbs.

The Dream Chaser launches vertically, atop an Atlas V rocket or other suitable launch vehicle (at another location), and lands horizontally on a conventional runway, similar to the landing of the Space Shuttle.



FIGURE 2-1 SNC DREAM CHASER LANDING - NOVEMBER 2017

The frequency of reentry missions to HSV is projected to be one reentry in 2022 with a potential increase of up to three total reentries by 2025.

## 2.3 RENTRY TRAJECTORIES

SNC provided the latitude and longitude, velocities, altitudes, flight azimuth and heading direction of the Dream Chaser for each of these design reference orbits (DRO). Both data sets provided trajectory information from 400,000 feet in altitude to landing.

The two trajectories shown in are from DRO-1, which is a reentry from the ISS. These trajectories depict the maximum cross range scenarios for the DRO; one approaching from the west of HSV and one approaching from further south of HSV. These trajectories act as limits and the final mission trajectory would likely fall somewhere between them. Both trajectories involve energy reductions maneuvers during the supersonic portion of the flight; these are shallow "S" turns that are used to reduce the speed of the spacecraft.



FIGURE 2-2 DESIGN REFERENCE ORBIT ONE REENTRY TRAJECTORIES

The five trajectories shown in are from DRO-2; reentry from 28.5° inclination. These trajectories are maximum cross range capabilities of Dream Chaser at this orbital inclination, which include two maximum, two minimum, and one nominal trajectory. These trajectories act as limits and the final mission trajectory, represented by the nominal trajectory, would likely lie somewhere between them.



FIGURE 2-3 DESIGN REFERENCE ORBIT TWO REENTRY TRAJECTORIES

## 2.4 SONIC BOOM METHODOLOGY

Reentry of the Dream Chaser from orbit or sub-orbit has the potential to create a sonic boom. Using PCBoom4, a sonic boom analysis was completed for the supersonic portions of the DRO trajectories. Trajectory details provided by SNC and publically available atmospheric data was used to set up the PCBoom model.

## 2.4.1 Atmospheric Data

The atmospheric data used in the analysis was separated into two categories: the lower atmosphere (below 50,000 feet), and the upper atmosphere (above 50,000 feet). The lower atmospheric data used in this assessment is from the "Integrated Global Radiosonde Archive" provided by the National Climatic Data Center (NCDC). More specifically, the data was from Station #72230 at Shelby Country Airport, Alabama (33.17N -86.77W) and contains monthly averages for 2014 (the most recent data available). This station was chosen since it is the closest to Huntsville International Airport, therefore it was the most reasonable option. For the upper atmosphere, the data for the atmospheric properties was acquired from the "Handbook of Astronautical Engineering" which has generalized atmospheric data ranging from 0 to 140 km (about 450,000 feet) in altitude. This approach to creating the atmospheric profile assumes that the entire length of each trajectory has the same atmosphere characteristics as that of Station #72230 in Alabama.

## 2.4.2 PCBoom4 Setup

The SNC data that was provided was transformed into a format that PCBoom could use. Although SNC provided trajectory data for every tenth of a second, PCBoom limits the time stepping to whole seconds. During the analysis, PCBoom struggled to complete calculations beyond a certain altitude threshold, which varied on a case by case basis. In the first DRO cases, the first trajectory is analyzed up to 204,000 feet, and the second trajectory is calculated up to 187,000 feet. For the second DRO, all trajectories are measured up to 150,000 feet.

When interpreting the location of the ground, PCBoom considers a ground altitude "carpet" to be a constant across the length of the flight path. The final altitude value provided in the trajectory data, 595 feet, was used for this altitude. Since the PCBoom carpet value remains constant along the entire trajectory, the sonic boom isopemps assume flat ground and variations of ground height (e.g. hills and valleys) are not considered in the results. As the sonic boom propagates away from the vehicle, the cone expands and the overpressure lessens; the further away from the supersonic vehicle, the less the sonic boom. Therefore, the resulting sonic boom overpressure may be higher or lower at a specific location beneath the flight path due to the difference in ground level altitude. The height above sea-level at HSV is also used to describe the ambient ground pressure, which was set to 2,116.8 pounds per square foot.

Three characteristics are input into the program to describe the supersonic vehicle (see Table 2-1). These are length, weight, and shape factor, which is related to aspect ratio, cross sectional area, and Mach number. The PCBoom shape factors are related to styles or general shape of the aircraft. The shape factor utilized for this analysis conservatively assumes similarity to the Space Shuttle.

# TABLE 2-1 PCBOOM VEHICLE CHARACTERISTICS Characteristic Input

| Characteristic      | Input |
|---------------------|-------|
| Shape Factor        | 8     |
| Length (feet)       | 30    |
| Weight (1,000 lbs.) | 24    |

<u>CHAPTER 3</u> SONIC BOOM ANALYSIS AND RESULTS

### 3.1 SONIC BOOM ANALYSIS AND RESULTS

This section presents the analysis and results of the sonic boom noise associated with two design reference missions and seven reentry trajectories of the Dream Chaser at HSV.

#### 3.1.1 Design Reference Orbit One

Design Reference Orbit One (DRO-1) considers two reentry trajectories originating from the International Space Station and landing at Huntsville International Airport.

#### 3.1.1.1 DRO-1 Trajectory 1

For the first trajectory, the sonic boom analysis began at 204,000 feet. Figure 3-1 shows the flight profile for DRO-1 Trajectory 1, demonstrating its supersonic and subsonic vertical flight path as a function of time. It demonstrates that Dream Chaser becomes subsonic at about 38,000 feet. It also shows that when the vehicle enters the National Airspace System at 60,000 feet, it is travelling at supersonic speed.

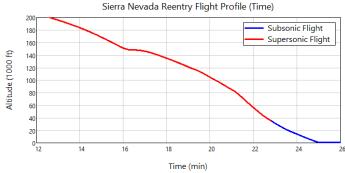


FIGURE 3-1 TRAJECTORY 1 VERTICAL FLIGHT PROFILE AS A FUNCTION OF TIME

The  $\geq$ 0.5 psf sonic boom contours of the DRO-1 Trajectory 1 are shown in Figure 3-2. This shows the range of area that would be affected by the shockwave of the Dream Chaser overhead, all of which is over land and spreading across two states. The overpressure focuses on a smaller area when the vehicle finishes its final energy reduction maneuver, shown by the large spike on the map in the 0.5 psf and 0.75 psf contours.

As the Dream Chaser approaches the final turn to the runway the overpressure reaches 1.0 psf. The vehicle becomes subsonic before it makes its final turn towards the runway.

The DRO-1 Trajectory 1 sonic boom contour reaches the maximum overpressure of 1.25 psf. The conversion of the maximum psf for 1 daytime landing in 2022 is 28.5 CDNL. The conversion of the maximum psf for 3 reentry/landings (2 daytime and 1 nighttime) in 2025 is 39.3 CDNL.

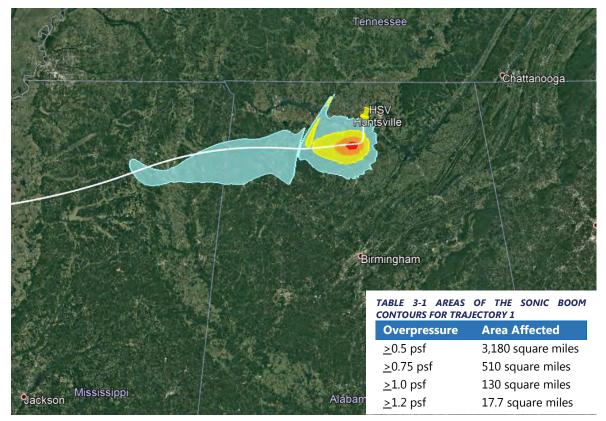


FIGURE 3-2 SONIC BOOM CONTOURS OF DRO-1 TRAJECTORY 1

#### 3.1.1.2 DRO-1 Trajectory 2

The sonic boom analysis for DRO-1 Trajectory 2 began at 187,500 feet because a sonic boom would not be heard before this altitude. Figure 3-3 shows the flight profile for trajectory 2 of the Dream Chaser, also demonstrating its supersonic and subsonic vertical flight path as a function of time. Much like Figure 3-1, it demonstrates when the Dream

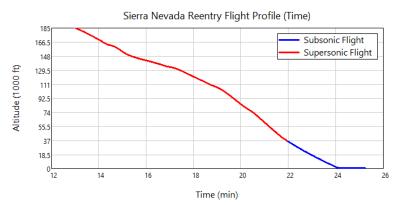


FIGURE 3-3 TRAJECTORY 2 VERTICAL FLIGHT PROFILE AS A FUNCTION OF TIME

Chaser becomes subsonic, which is at about 37,000 feet. It also shows that, like in the first trajectory, when the vehicle enters the National Airspace System at 60,000 feet, it is at a supersonic velocity. The sonic boom contours of the DRO-1 Trajectory 2 are shown in **Error! Reference source not found.** This shows the range of area that would be affected by the 0.5 psf sonic boom of the Dream Chaser overhead. As the vehicle finishes its final energy reduction maneuver, much like above, a focused overpressure forms in the 0.75 psf contour.

The overpressure then reaches 1.0 psf shortly after the final energy reduction maneuver. The final sonic boom contour shows the max overpressure of 1.18 psf (labeled as 1.2 psf in Table 3-2) as the vehicle begins its final descent to the Airport.

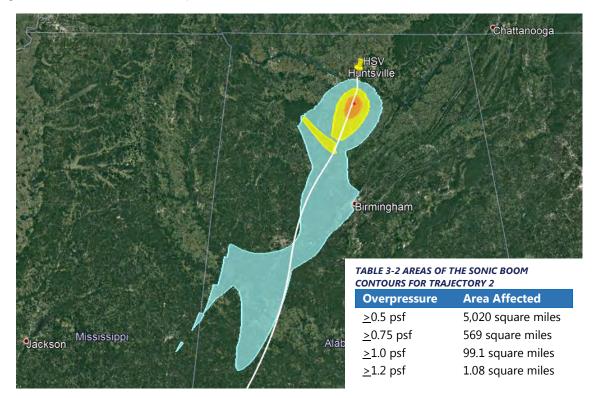


FIGURE 3-4 SONIC BOOM CONTOURS OF DRO-2 TRAJECTORY 2

The conversion of the maximum psf (1.18 psf) for 1 daytime landing in 2022 is 28.0 CDNL. The conversion of the maximum psf for 3 reentry/landings (2 daytime and 1 nighttime) in 2025 is 38.8 CDNL.

#### 3.1.2 Design Reference Orbit Two

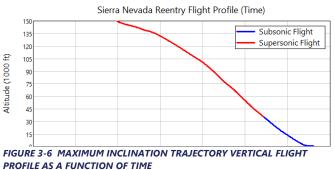
Design Reference Orbit Two (DRO-2) considers reentry trajectories originating from 28.5° orbital inclination and landing at Huntsville International Airport. The trajectories shown in Figure 3-5 and described below are three scenarios of maximum and minimum return inclination and the nominal trajectory. Also, all three of these flight paths fall within the boundaries set by the DRO-1 trajectory reentries.



FIGURE 3-5 DESIGN REFERENCE ORBIT TWO TRAJECTORIES

#### 3.1.2.1 DRO-2 Maximum Inclination Trajectory

For the first trajectory, the sonic boom analysis began at 150,000 feet. Figure 3-6 shows the flight profile for maximum inclination trajectory of the Dream Chaser, demonstrating its supersonic and subsonic vertical flight path as a function of time. It demonstrates that Dream Chaser becomes subsonic at about 38,000 feet.



The sonic boom contours of this trajectory are shown in

Figure 3-7. This shows the range of area that would be affected by the  $\geq$ 0.5 psf and greater shockwave of the Dream Chaser overhead, all of which is over land and spreading across three states. The area of  $\geq$ 0.5 psf overpressure exist through shown length of the flight path and increase in size as the vehicle approaches the end of its trajectory. The overpressure focuses on a smaller area when the vehicle finishes its final energy reduction maneuver, reaching up to 0.9 psf. The maximum overpressure reaches 1.1 psf as it approaches its final descent to subsonic speeds. The vehicle becomes subsonic before it makes its final turn towards the runway.

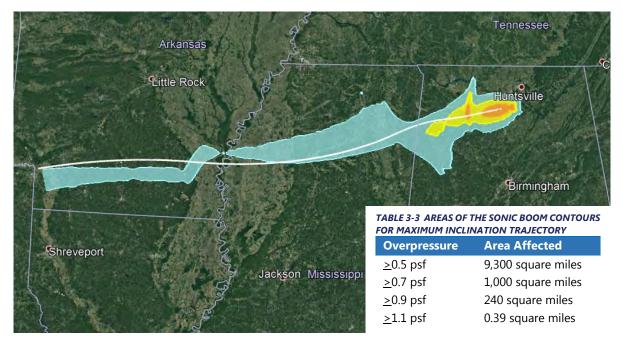
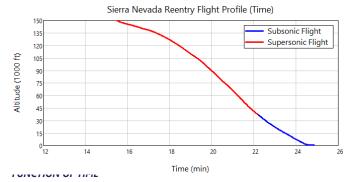


FIGURE 3-7 ≥ 0.5 PSF SONIC BOOM CONTOURS OF THE DRO-2 MAXIMUM INCLINATION TRAJECTORY

The conversion of the maximum psf for 1 daytime landing in 2022 is 27.4 CDNL. The conversion of the maximum psf for 3 reentry/landings (2 daytime and 1 nighttime) in 2025 is 38.2 CDNL.

#### 3.1.2.2 DRO-2 Minimum Inclination Trajectory

The sonic boom analysis of the minimum inclination trajectory began at 150,000 feet. Figure 3-8 shows the vertical flight profile, demonstrating its supersonic and subsonic vertical flight path as a function of time. It shows that Dream Chaser becomes subsonic at about 40,000 feet.



The sonic boom contours and the flight path of the minimum trajectory are shown in Figure 3-9.

As the vehicle passes into Alabama, regions of  $\geq$ 0.5 psf overpressure surface. The overpressure as the craft approaches the final turn to the runway reaches 0.9 psf. The final sonic boom contour reaches the maximum overpressure of 1.1 psf as the vehicle's velocity approaches the speed of sound. The vehicle becomes subsonic before it makes its final turn towards the runway.

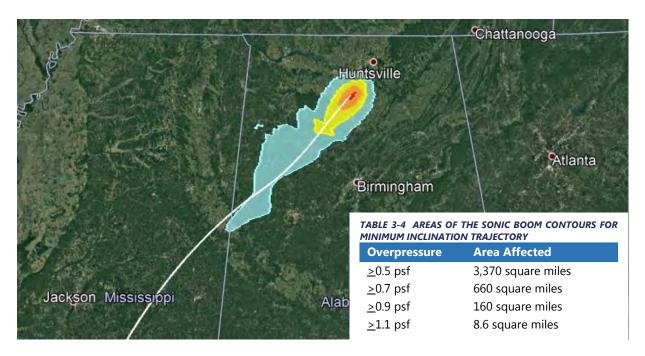


FIGURE 3-9 ≥ 0.5 SONIC BOOM CONTOURS OF THE DRO-2 MINIMUM INCLINATION TRAJECTORY

The conversion of the maximum psf (1.1 psf) for 1 daytime landing in 2022 is 27.4 CDNL. The conversion of the maximum psf for 3 reentry/landings (2 daytime and 1 nighttime) in 2025 is 38.2 CDNL.

#### 3.1.2.3 DRO-2 Nominal Trajectory

The nominal trajectory lies between the maximum and minimum inclination trajectories discussed above, and its analysis began at 150,000 feet. Figure 3-10 shows the vertical flight profile for the ideal case of the Dream Chaser, demonstrating its supersonic and subsonic flight paths as functions of time. It demonstrates that Dream Chaser becomes subsonic at about 36,000 feet.



Figure 3-11 shows the range of area that would be affected by the shockwave of the Dream Chaser overhead, all of which is over land and spreading across three states. The  $\geq$ 0.9 psf area occurs as the vehicle approaches the final turn to the runway. The final sonic boom contour reaches the maximum overpressure of 1.22 psf as the vehicle's velocity approaches the speed of sound. The vehicle becomes subsonic before it makes its final turn towards the runway.

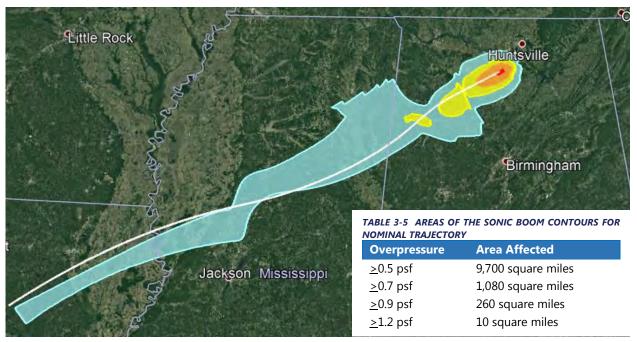


FIGURE 3-11  $\geq$  0.5 PSF SONIC BOOM CONTOURS OF THE DRO-2 NOMINAL TRAJECTORY

The conversion of the maximum psf (1.22 psf) for 1 daytime landing in 2022 is 28.3 CDNL. The conversion of the maximum psf for 3 reentry/landings (2 daytime and 1 nighttime) in 2025 is 39.1 CDNL

### 3.2 CONCLUSION

A sonic boom is the sound associated with the shock waves created by a vehicle traveling through the air faster than the speed of sound. The presence and location of sonic boom area is highly dependent on the trajectory and atmospheric conditions at the time of flight. According to FAA Order 1050.1, Desk Reference (Draft Update – May 2018), the psf metric is used to determine potential structural damage to buildings, while CDNL is applied during the assessment of potential human annoyance. According to 1050.1F, Desk Reference, Exhibit 11-3, *Land-Use Compatibility with Yearly Day-Night Average Sound Levels*, DNL less than 65 is compatible with all land use types.

Table 3-6 summarizes the results for each DRO and trajectory. The peak overpressure levels  $\geq$  1.0 psf are primarily over the State of Alabama, south of HSV. A sonic boom of  $\geq$  1.0 psf reentry of the SNC Dream Chaser would affect a maximum area 134 square miles of the southern U.S. Buildings and structures, depending on their condition, could be affected. In 2022, one daytime reentry to HSV would result in a maximum 1.25 psf equaling 28.5 CDNL. In 2025, two daytime and one nighttime reentries to HSV would result in a maximum 39.3 CDNL.

| TABLE 3-6 > 1.0 PSF SQUARE MILES AND CDNL |                    |         |           |           |  |  |  |
|---|--------------------|---------|-----------|-----------|--|--|--|
|   | > 1.0 psf sq miles | Max psf | 2022 CDNL | 2025 CDNL |  |  |  |
| DRO - 1 Trajectory 1                      | 130                | 1.25    | 28.5      | 39.3      |  |  |  |
| DRO - 1 Trajectory 2                      | 99                 | 1.18    | 28.0      | 38.8      |  |  |  |
| DRO - 2 Max Trajectory                    | 77.8               | 1.10    | 27.4      | 38.2      |  |  |  |
| DRO - 2 Min Trajectory                    | 69.9               | 1.10    | 27.4      | 38.2      |  |  |  |
| DRO - 2 Nominal                           | 134                | 1.22    | 28.3      | 39.1      |  |  |  |

The potential for structural damage is unlikely for the modeled sonic boom overpressure levels less than 1.0 psf.

The potential for hearing damage (with regards to humans) is insignificant, as the modeled sonic boom overpressure levels over land are substantially lower than the approximate 4 psf impulsive hearing conservation noise criteria.

Based on the FAA's draft guidance, the CDNL of the proposed reentries of the SNC Dream Chaser to HSV in 2022 and 2025 would not significantly result in human annoyance.

| From:        | <u>Stacey.Zee@faa.gov</u>   |
|--------------|---|
| To:          | Rogers, Rick  |
| Cc:          | Alberts, David; Daniel.Murray@faa.gov; Pam.Underwood@faa.gov; katherine.branham@faa.gov; leslie.grey@faa.gov; emily.sisneros@faa.gov; |
|              | Howard.Searight@faa.gov; Anna.Cushman@faa.gov   |
| Subject:     | RE: HSV Sonic Boom Analysis Shape Factor for Discussion   |
| Date:        | Monday, November 26, 2018 1:34:35 PM  |
| Attachments: | jmage001.gif  |
|              | jmage002.png  |
|              | jmage003.png  |
|              | jmage005.png  |

Rick and Dave -

We concur with your sonic boom methodology and shape factor calculations.

I understand you will be using the sonic boom analysis to determine a region of influence for the Environmental Assessment. We plan to implement Stakeholder Engagement for this project – to conduct outreach before the EA public meeting. We are developing the project approach and will be in touch within the next few weeks.

-Stacey Zee

From: Rogers, Rick <Rick.Rogers@rsandh.com>
Sent: Monday, November 26, 2018 12:05 PM
To: Zee, Stacey (FAA) <Stacey.Zee@faa.gov>
Cc: Alberts, David <David.Alberts@rsandh.com>
Subject: RE: HSV Sonic Boom Analysis Shape Factor for Discussion
Hi Stacey!

It was nice talking to you this morning about your concurrence with the sonic boom methodology and shape factor calculations. I look forward to receiving a confirmation email about our discussion this morning. Thanks, Rick

#### **Richard M. Rogers, PE**

Spaceport Leader 115 Alma Blvd, Suite 101, Merritt Island, FL 32953 O 321-454-6156 | M 352-397-7362 rick.rogers@rsandh.com

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From: <u>Stacey.Zee@faa.gov</u> <<u>Stacey.Zee@faa.gov</u>>

Sent: Monday, November 26, 2018 9:09 AM

To: Rogers, Rick <<u>Rick.Rogers@rsandh.com</u>>

Subject: RE: HSV Sonic Boom Analysis Shape Factor for Discussion

Hey Rick – let's discuss sometime today or tomorrow

From: Rogers, Rick <<u>Rick.Rogers@rsandh.com</u>>

Sent: Thursday, August 16, 2018 2:06 PM

To: Zee, Stacey (FAA) <<u>Stacey.Zee@faa.gov</u>>

**Cc:** Alberts, David <<u>David.Alberts@rsandh.com</u>>; Naber, Alexander <<u>Alexander.Naber@rsandh.com</u>>; Christopher Allison (<u>christopher.allison@sncorp.com</u>) <<u>christopher.allison@sncorp.com</u>>; <u>Lee.Jankowski@Teledyne.com</u>

Subject: HSV Sonic Boom Analysis Shape Factor for Discussion

#### Stacey,

We did originally calculate the SNC UDC shape factor using NASA 1122 as our source reference. We validated our calculations against the shape factor for the Concorde. We do not believe shape factor 2 to be of the best fit but are willing to discuss why you believe that to be the case. In PCBoom, we set the aircraft type as Shape Factor 8 with modified length and weight for UDC. Alex provided a summary of our calculations below. We can provide the detailed MathCAD calculation file if required.

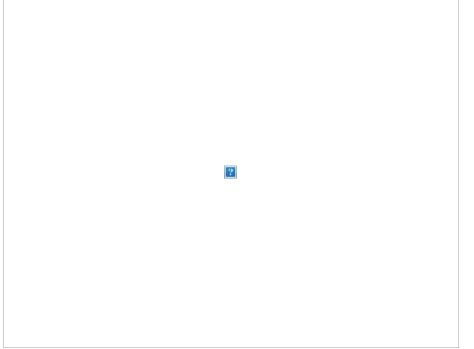
Using the information on the NASA 1122 Technical Paper, the following process was used to calculate the UDC shape factor graph. Additionally, the Concorde was used as a reference model to verify the method used. All equations below were pulled directly form the NASA 1122 Technical Paper

1. Using model data provided by SNC for the UDC and the reference information of the Concorde (below), the cross sectional area and the span of the vehicle at each foot of length was measured.

- 2. The span (b(x)) was then integrated as per the equation in 1122.
- 3. Recognizing the similarity of the B(x) coefficient and the Lift Factor (KL), the equation was manipulated to be in terms of KL, thus providing a way to correlate effective area and the lift factor.
- 4. The cross sectional area (A(x)) and the equivalent area due to lift (B(x)) were than summed to find the effective area while iterating on KL. The max effective area of each iteration of KL was then used to calculate shape factor using the equation in 1122.
- 5. Finally, the results of shape factor (KS) vs lift factor (KL) were plotted for the UDC, Concorde, Shuttle Orbiter, and F-104 (shape factor 2).

The shape factor plot of the Concorde, generated using the method above, looks nearly identical to the plot provided in NASA 1122, thus validating the methodology and calculations.

\*Note that the F-104 data shown below was created using discrete points from the NASA 1122 graph and not calculated.



Below is the second graph provided in NASA 1122, which shows the small fighter (F-104) which is categorized in PCBoom4 as a shape factor of 2.

Concorde sizing reference: Cross Sectional Area: <u>https://www.researchgate.net/figure/Concorde-Mach-plane-cross-sectional-area-distributions-B-Lift-Distribution-The-lift\_fig1\_325963982</u> Span Over Length Estimation: <u>http://www.concordesst.com/dimentions.html</u>

Richard M. Rogers, PE Spaceport Leader 115 Alma Blvd, Suite 101, Merritt Island, FL 32953 321-454-6156 rick.rogers@rsandh.com rsandh.com | Facebook | Twitter | LinkedIn | Blog

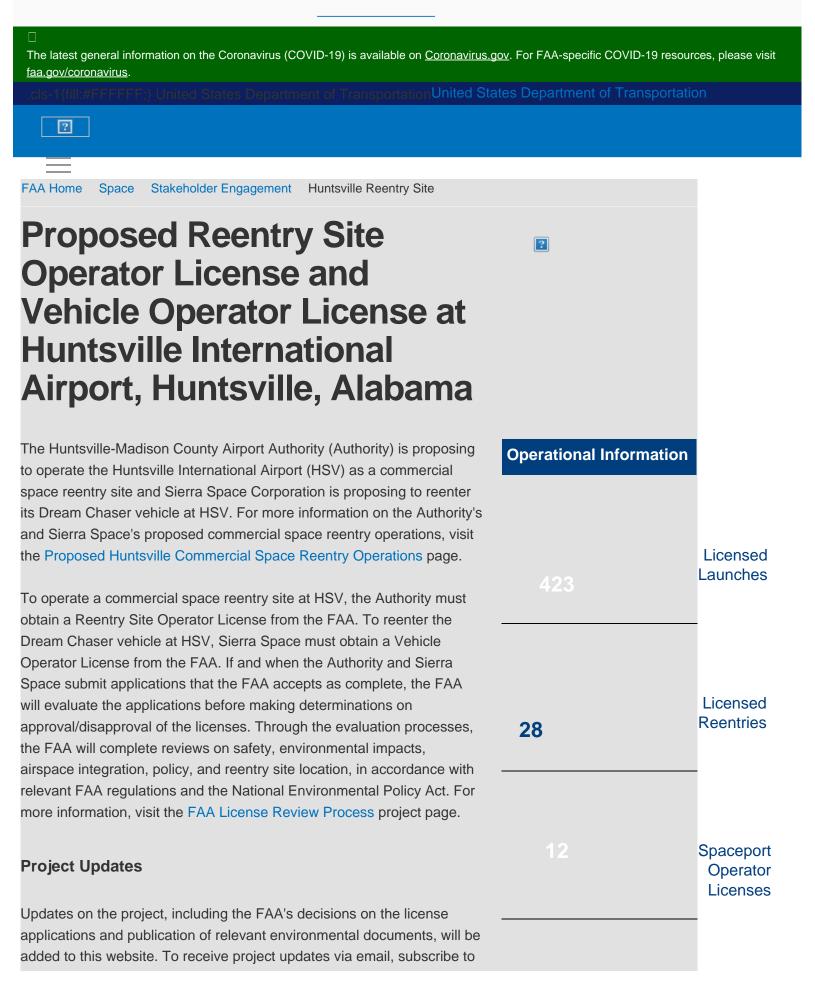
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APPENDIX E: DRAFT EA PUBLIC ENGAGEMENT

#### **APPENDIX E -1: DRAFT EA PUBLIC MEETING MATERIALS**

Proposed Reentry Site Operator License and Vehicle Operator License at Huntsville International Airport, Huntsville, Alabama



Proposed Reentry Site Operator License and Vehicle Operator License at Huntsville International Airport, Huntsville, Alabama

#### the project mailing list. Permitted (Experimental) Draft Environmental Assessment Launches The FAA is announcing the availability of the *Draft Environmental* Assessment for the Huntsville International Airport Reentry Site Operator License and Sierra Space Vehicle Operator License (Draft EA). The electronic version of the Draft EA is available on this website for Active download. Safety Approvals Draft Environmental Assessment for the Huntsville International Airport Reentry Site Operator License and Sierra Space Corporation Vehicle Operator License (Draft EA) (PDF, 27.6 MB) • Draft EA Appendices (PDF, 41.6 MB) Active Under the Proposed Action in the Draft EA, the FAA would: Launch Licenses Issue a Reentry Site Operator License to the Huntsville-Madison County Airport Authority to operate a commercial reentry site at Huntsville International Airport and to offer Huntsville International **Contact Commercial** Airport as a reentry site to Sierra Space for its Dream Chaser **Space** vehicle, and About our Office Issue a Vehicle Operator License to Sierra Space to land its Dream Chaser vehicle at Huntsville International Airport. 800 Independence Avenue SW Washington, DC 20591 **Public Involvement Opportunities** 202-267-7793 202-267-5450 (fax) Thank you for your interest in engaging in the licensing review process. For media inquiries Opportunities for stakeholder engagement, including participation in the please contact: environmental review process, will be posted here as they are available. pressoffice@faa.gov To receive notifications of public involvement opportunities, subscribe to For non-media inquiries the project mailing list. please contact: Commercial **Space Inquiries** Draft EA Public Review and Comment Period The FAA released the Draft EA for public review and comment on November 12, 2021. The FAA encourages all interested parties to provide comments concerning the scope and content of the Draft EA on or before December 22, 2021. Comments or questions on the Draft EA can be addressed to Ms. Stacey Zee, Huntsville Reentry, c/o ICF, 9300 Lee Highway, Fairfax,

VA 22031.

 Comments may also be submitted by email to huntsvillereentry@icf.com

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, be advised that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so. All comments received during the comment period will be given equal weight and be taken into consideration in the preparation of the Final EA.

#### Draft EA Public Meeting

The FAA will hold a virtual public meeting to solicit comments concerning the scope and content of the Draft PEA. The public meeting will be on Thursday, December 9, 2021 **at 5:00 p.m. Central Time**. The FAA invites all interested parties to attend the meeting. Register to attend here.

At the start of the hearing, the FAA, Huntsville International Airport, and Sierra Space will provide a Power Point presentation in English.

The presentation materials are available in English here (PDF).

The presentation materials are available in Spanish here (PDF).

After the presentation, members of the public may provide up to a threeminute comment. If you cannot attend the public meeting, you can still provide a comment at huntsvillereentry@icf.com by December 22, 2021.

A court reporter will transcribe the meeting. A translator will be available to translate comments into Spanish.

Page last modified: December 08, 2021 3:48:26 PM EST

#### Space

Streamlined Licensing Process

**Commercial Space Transportation Licenses** 

Search Resources

Legislation & Policies, Regulations & Guidance

Proposed Reentry Site Operator License and Vehicle Operator License at Huntsville International Airport, Huntsville, Alabama

| nvironmental                    |
|---------------------------------|
| paceports by State              |
| rspace Integration              |
| akeholder Engagement            |
| Boca Chica Launch Site          |
| Huntsville Reentry Site         |
| Commercial Space Operations     |
| License Review Process          |
| Shuttle Landing Facility        |
| ompliance, Enforcement & Mishap |
| dditional Information           |

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Budget and Performance

**Civil Rights** 

FOIA

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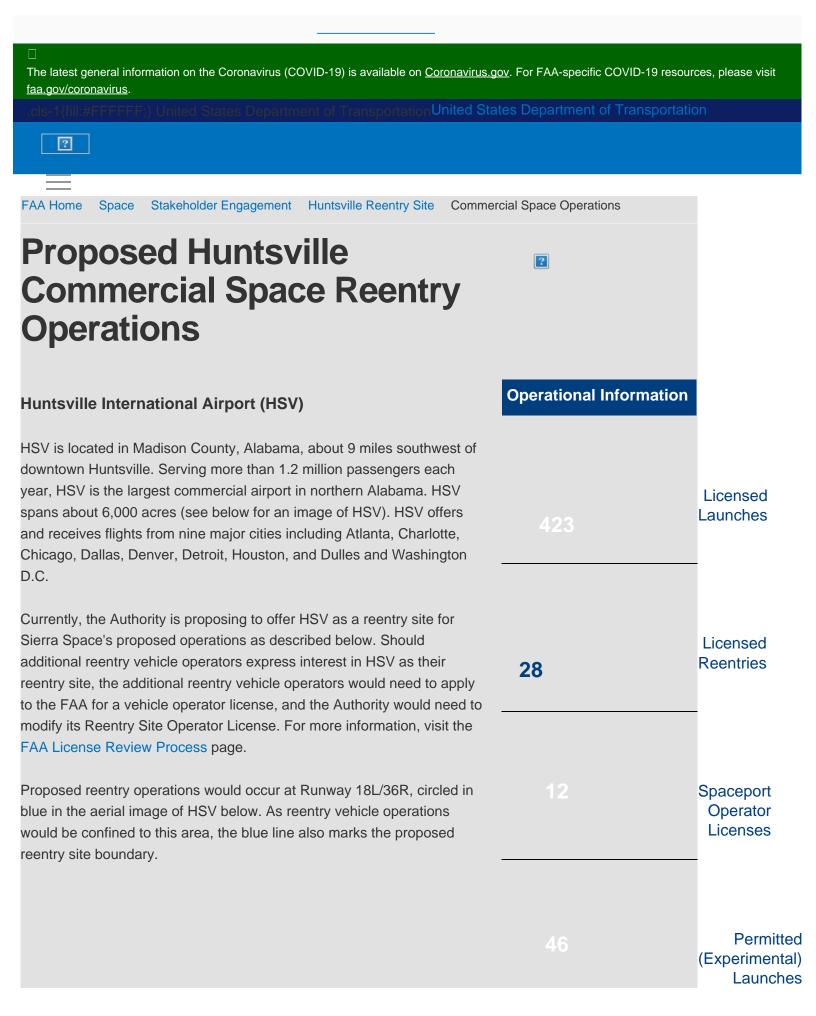
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Web Policies and Notices

Web Standards

https://www.faa.gov/space/stakeholder\_engagement/huntsville\_reentry/[12/10/2021 10:00:37 AM]



Proposed Huntsville Commercial Space Reentry Operations



Huntsville International Airport and proposed reentry site

#### Sierra Space Proposed Operations of the Dream Chaser

Sierra Space is developing the Dream Chaser, a reusable reentry vehicle capable of carrying payloads to and from low Earth orbit, including delivering supplies to the International Space Station under the Commercial Resupply Services 2 (CRS-2) contract with the National Aeronautics and Space Administration.

The below image shows Sierra Space's proposed operations. The Dream Chaser vehicle would be carried as payload on a vertically-launched United Launch Alliance Atlas 5. HSV does not support vertical launches of space vehicles; therefore, launch activities would occur at another site, such as Cape Canaveral. Sierra Space proposes that the Dream Chaser vehicle would deliver up to 5,500 kilograms of pressurized and unpressurized cargo to the International Space Station. Sierra Space would also offer disposal services over the open ocean via a transport vehicle that could separate from Dream Chaser and burn up safely in the Earth's atmosphere.

The Dream Chaser vehicle's reentry trajectories from orbit would be dependent on the specific mission being flown and would be defined prior to launch. During the reentry sequence, Dream Chaser would have set reentry windows, or timeframes, to begin descent into the Earth's atmosphere to meet the designated reentry trajectory. If No-Go criteria are met, the Dream Chaser vehicle would remain in orbit until the specific reentry trajectory could be received or a contingency trajectory is called upon.

The reentry vehicle would reenter from the south on an ascending trajectory, with high atmospheric overflight of the southwestern U.S. or

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Active Safety Approvals

> Active Launch

Licenses

#### About our Office

800 Independence Avenue SW Washington, DC 20591 202-267-7793 202-267-5450 (fax)

For media inquiries please contact: pressoffice@faa.gov

For non-media inquiries please contact: Commercial Space Inquiries Proposed Huntsville Commercial Space Reentry Operations

Central American countries, before landing at HSV. The reentry vehicle would remain above 60,000 feet altitude above mean sea level for the majority of the overflight of Texas, Arkansas, Louisiana, Mississippi, and Alabama. The reentry vehicle would descend below 60,000 feet altitude above mean sea level approximately 10 to 20 miles from HSV prior to landing and would operate below 60,000 mean sea level for about three to four minutes.



A complete proposed mission of Sierra Space's Dream Chaser vehicle

Page last modified: June 09, 2021 2:49:12 PM EDT

#### Space

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**Commercial Space Transportation Licenses** 

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Boca Chica Launch Site

Huntsville Reentry Site

**Commercial Space Operations** 

License Review Process

Shuttle Landing Facility

Compliance, Enforcement & Mishap

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#### Additional Information

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Proposed Huntsville Commercial Space Reentry Operations

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# **Commercial Space Transportation**

Public Meeting for the Draft Environmental Assessment For the Huntsville International Airport Reentry Site Operator License and Sierra Space Corporation Vehicle Operator License, Madison County, Huntsville, Alabama

December 9, 2021

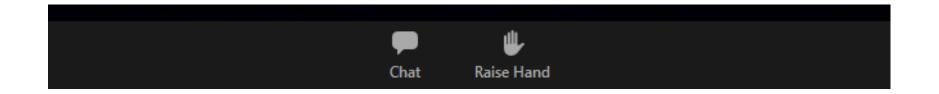
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# **Meeting Assistance**

 If you need assistance, send the host a chat message or raise your hand using the raise hand icon next to your name



- If you experience technical difficulties during the meeting, you can call in to listen to the meeting
  - o **1-833-548-0276**
  - Meeting ID: 850 3217 5874
  - Meeting Password: 8695227



# Meeting Agenda

- Logistics
- Introductions
- AST, Authority, and Sierra Space Presentations
- Comment Session



# **How to Submit Comments**

- Provide an oral comment at tonight's public meeting
  - Those who pre-registered will be called on first
  - Send host a chat message or raise your hand to be added to the speaker's list
- Email: <u>huntsvillereentry@icf.com</u>
- Mail:

Ms. Stacey Zee, HSV Draft EA c/o ICF 9300 Lee Highway Fairfax, VA 22031

### Comment period closes on December 22, 2021

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, be advised that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

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# **Ground Rules**

- Please do not use inappropriate language
- Pre-registered commenters will be called on in the order in which they registered
- Commenters will be given 3 minutes to speak. Please respect everyone's time
- Remember that all comments are weighted equally regardless of whether they are oral, electronic or written



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# **Commercial Space Transportation**

Public Hearing for the Draft Environmental Assessment For the Huntsville International Airport Reentry Site Operator License and Sierra Space Corporation Vehicle Operator License, Madison County, Huntsville, Alabama

December 9, 2021

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# Why Are We Here?

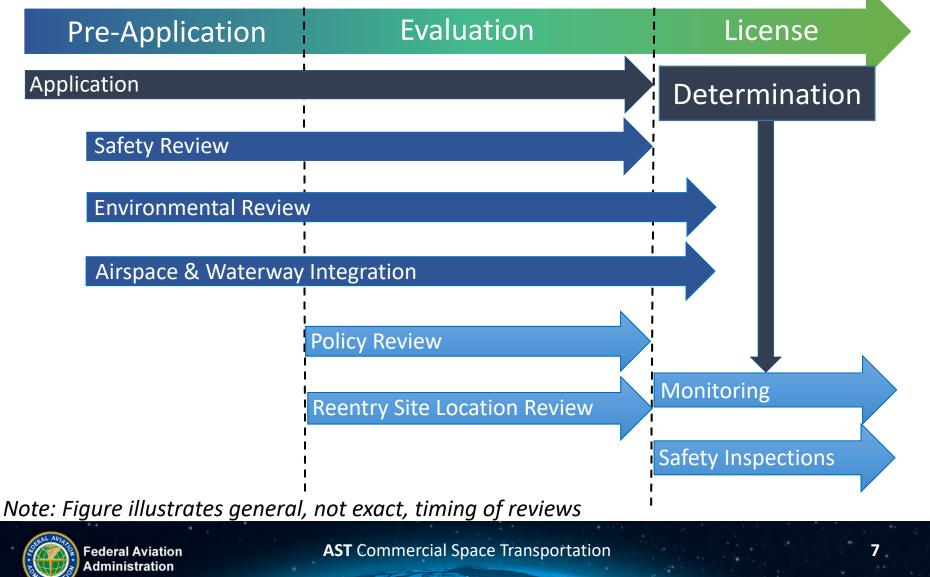
- The FAA is evaluating the Huntsville Madison County Airport's (Authority) and Sierra Space Corporation's (Sierra Space) proposed commercial space reentry operations at Huntsville International Airport (HSV)
- Reentry site and vehicle operations require a license from the FAA
- The FAA is analyzing the potential environmental impacts in an Environmental Assessment (EA) and is collecting comments on the Draft EA



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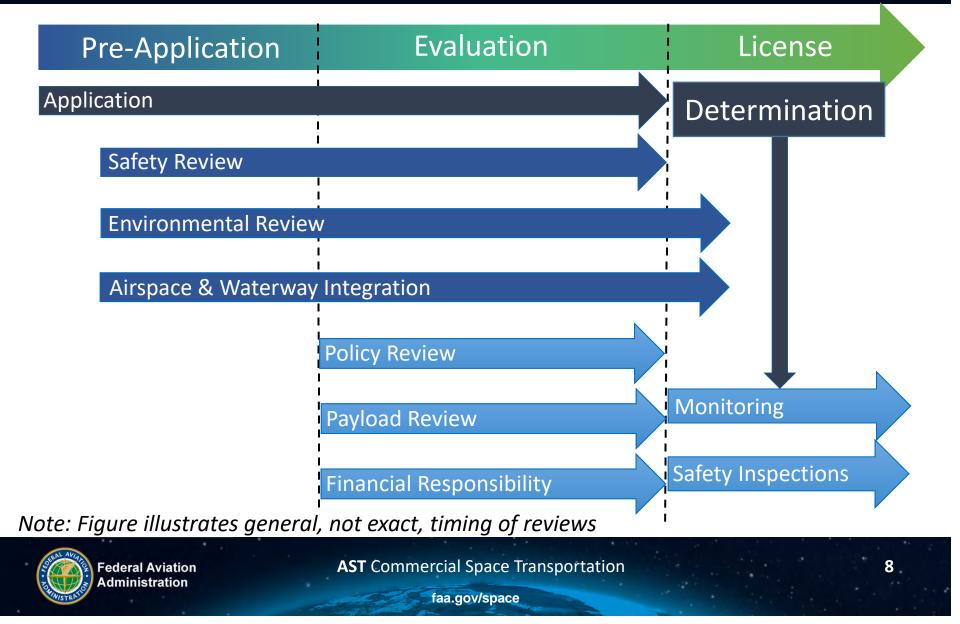
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## FAA Licensing Process Reentry Site Operator License



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# FAA Licensing Process Vehicle Operator License



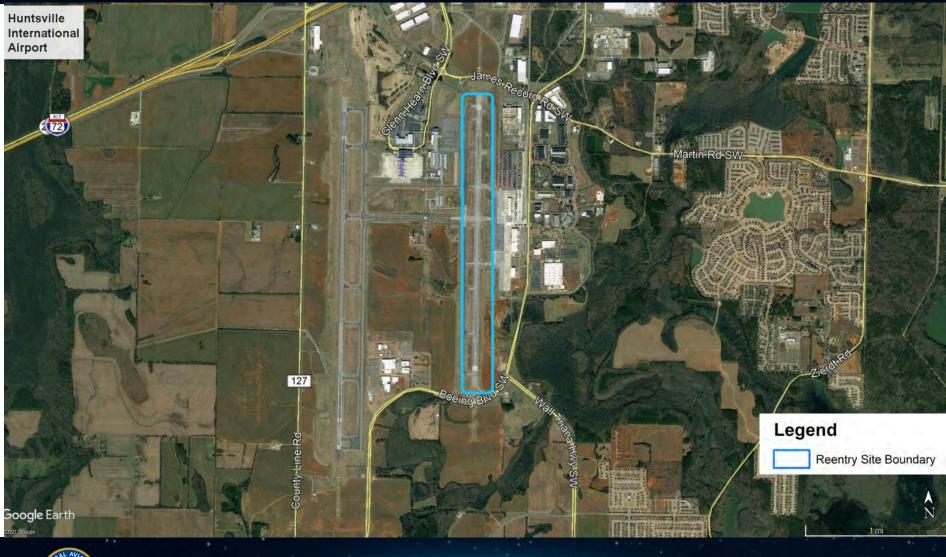
# **Project Overview**

- The Authority is proposing to operate a commercial space reentry site at HSV under an FAA Reentry Site Operator License
- Sierra Space is proposing to conduct reentries of its Dream Chaser vehicle at HSV under an FAA Vehicle Operator License
- Maximum number of proposed reentries, annually (could be daytime or nighttime)

| 2023 | 2024 | 2025 | 2026 | 2027 |
|------|------|------|------|------|
| 1    | 1    | 1    | 2    | 3    |



# **Proposed Project at HSV**



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# **Dream Chaser Vehicle**

- Runway-landing commercial Orbital Space Vehicle in development
- Uncrewed transportation from Low Earth Orbit (LEO)
- Non-toxic propulsion for orbital translations, attitude control, deorbit
- < 1.5g re-entry profile and >1000 mile total cross-range capability
- Designed to launch on a variety of launch vehicles
- Contract for Cargo Resupply Services 2 (CRS2) Program with National Aeronautics and Space Administration (NASA)



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### NASA Commercial Resupply Services 2 (CRS2) Program Mission Overview

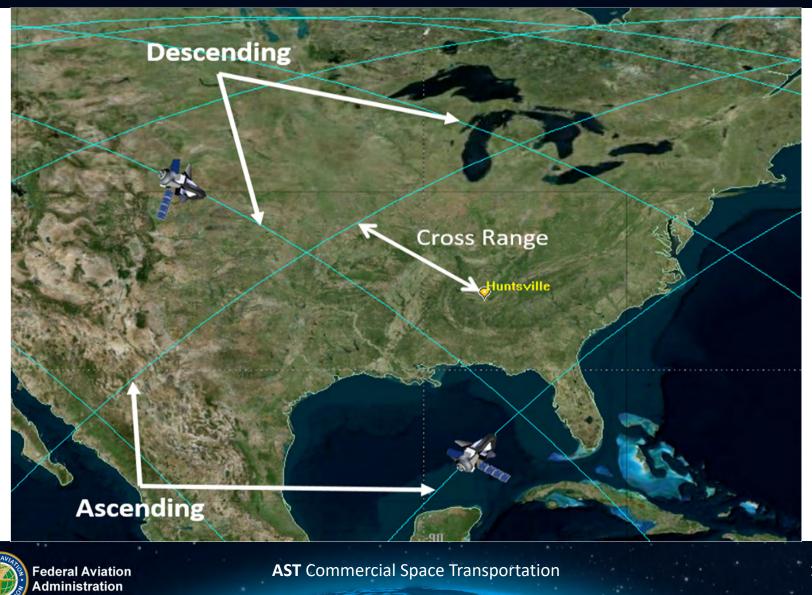


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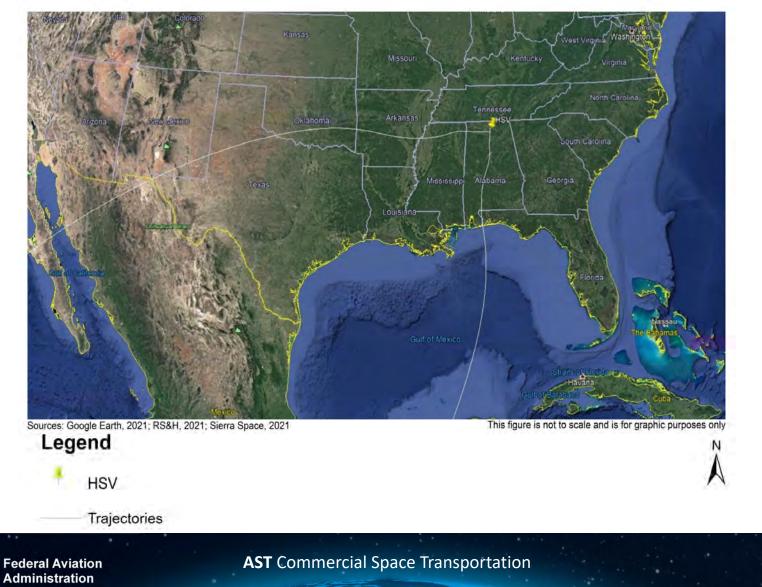
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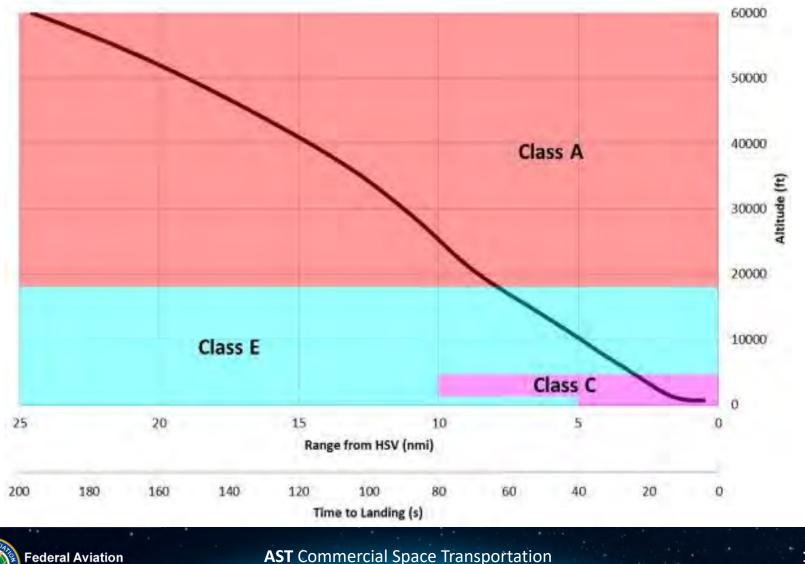
#### Ascending/Descending Trajectory and Cross Range



#### **Ground Track – HSV Reentry**



#### **Representative Flight Path**



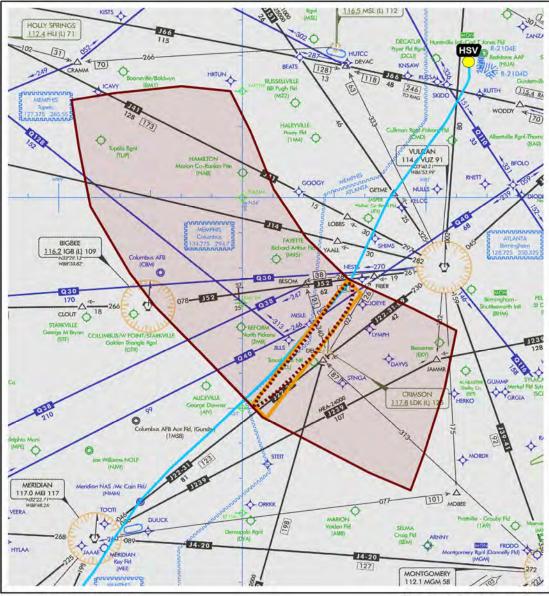
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# Airspace Closures due to Reentry at HSV

- Sierra Space would coordinate airspace closures for reentry operations with:
  - FAA Office of Commercial Space Transportation
  - FAA Air Traffic Organization
  - FAA Office of Airports
  - HSV
  - impacted Air Traffic Control facilities
  - any affected military organizations
  - U.S. Coast Guard
  - impacted foreign Air Navigation Service Providers
- The FAA does not anticipate altering the dimensions of airspace
- A NOTAM will be issued for each reentry opportunity; aircraft would be rerouted around the airspace closure area



#### Airspace Closures



Sources: ESRI, 2021; RS&H, 2021

#### Legend

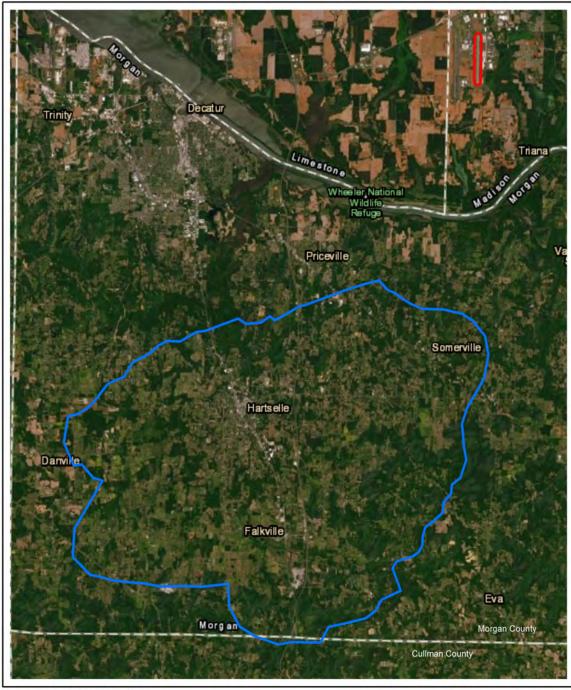
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# Sonic Boom

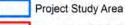


Sources: ESRI, 2020; RS&H, 2020

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

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Legend



Reentry Site Boundary at HSV

Federal Aviation Administration Ν

County Boundaries

# **Runway Closures**

- Temporary Flight Restrictions (TFRs) would be issued by the FAA at HSV per request by Sierra Space
- Runway 18R-36L (not within the reentry site boundary) would be closed during reentry, but would open after Dream Chaser has landed
- Runway 18L-36R
  - would remain closed for up to 10 hours or until the Dream Chaser is unloaded and in safe condition
  - prior to reopening, Airport Operations would inspect the runway before returning to normal aircraft operations



# **Impact Categories Analyzed in Detail**

- Noise and Noise-Compatible Land Use
- Biological Resources
- Department of Transportation Act Section 4(f)
- Hazardous Materials, Solid Waste, and Pollution Prevention

- Historical, Architectural, Archaeological and Cultural Resources
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

# Refer to the Draft EA for a full discussion of potential environmental consequences



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### **Noise Impacts**

- Sonic boom would be produced during Dream Chaser reentry operations
- Predicted sonic boom overpressure levels for populated areas near HSV: 1.25 pounds per square foot (or psf)
- Overpressure levels of 1.25 psf are similar to a clap of thunder
- Noise in surrounding communities would be below levels that the FAA has determined could adversely impact land use, occupational health and safety, and building structures



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# **Biological Resource Impacts**

• FAA consulting with the U.S. Fish and Wildlife Service per Section 7 of the Endangered Species Act

| Common Name<br>(Scientific Name)                 | Federal Status | State Status |
|--|----------------|--------------|
| Grey Bat (Myotis grisescens)                     | Endangered     | Endangered   |
| Indiana Bat ( <i>Myotis sodalis</i> )            | 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   |

- May affect, but would not significantly affect federally threatened and endangered species (proposed determination sent to USFWS on October 22, 2021)
  - Sonic booms infrequent and similar to thunder
  - Low probability of wildlife strikes



# **Cultural Resource Impacts**

- No anticipated adverse effects to characteristics of historic properties from noise
- No anticipated structural effects on historic properties
- Under National Historic Preservation Act, consulting with
  - Alabama State Historic
     Preservation Officer
  - Native American Tribes
  - Other consulting parties



Source: National Park Service



#### **Department of Transportation Section 4(f) Impacts**

- Increased sound levels during reentry operations
  - Proposed reentries modeled at 1.25 psf for sonic boom
- Proposed Action not expected to result in a significant impact on Section 4(f) resources
- FAA is consulting with
  - Tennessee Valley Authority
  - U.S. Fish and Wildlife Service
  - State Historic Preservation Officer



Source: U.S. Fish and Wildlife Service



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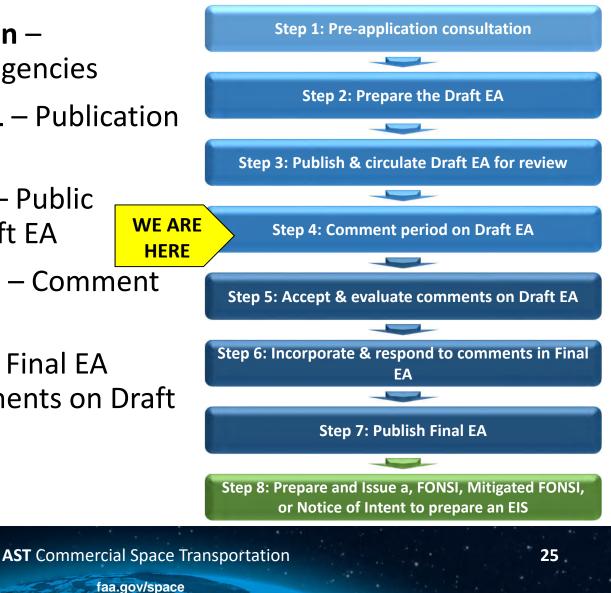
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# EA and Stakeholder Engagement Schedule

- **Draft EA Preparation** Coordination with agencies
- November 12, 2021 Publication of Draft EA
- **December 9, 2021** Public meeting on the Draft EA

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- December 22, 2021 Comment period closes
- Next Step Publish Final EA (incorporates comments on Draft EA)



#### **Comments on the Draft EA**

- Submit comments on the Draft EA:
  - Email: <u>huntsvillereentry@icf.com</u>
  - **By Mail**: Stacey Zee, HSV DEA, c/o ICF, 9300 Lee Highway, Fairfax, VA 22031
- Comment period closes on December 22, 2021
- Draft EA and public comment form available at: <u>https://www.faa.gov/space/stakeholder\_engagement/Huntsville\_ree\_ntry</u>
- To subscribe to the project mailing list, visit: <u>https://www.faa.gov/space/stakeholder\_engagement/Huntsville\_ree\_ntry</u>

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, be advised that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.



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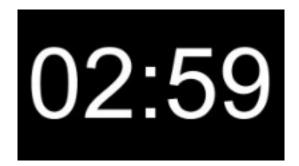


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#### **Oral Public Comments**





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# **How to Submit Comments**

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- Mailed:

Ms. Stacey Zee, HSV EA c/o ICF 9300 Lee Highway Fairfax, VA 22031

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#### Transporte espacial comercial

Reunión pública sobre la Evaluación Ambiental Preliminar (EA) para la licencia de operador del sitio de reentrada en el Aeropuerto Internacional de Huntsville y la licencia para el Operador del vehículo Sierra Space Corporation (Sierra Space) en Huntsville, Alabama

9 de diciembre de 2021

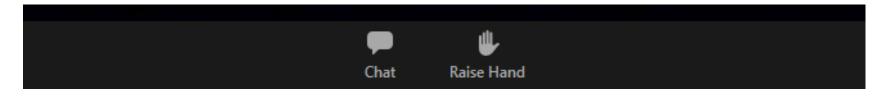
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# Asistencia durante la reunión

 Si necesita asistencia, envíe un mensaje de chat al anfitrión o levante la mano usando el icono de la mano levantada junto a su nombre.



- En caso de presentar dificultades técnicas durante la reunión, puede llamar por teléfono para escuchar la reunión.
  - o **1-833-548-0276**
  - o Número de identificación de la reunión: 850 3217 5874
  - o Contraseña de la reunión: 8695227



# Agenda de la reunión

- Logística
- Presentaciones
- Presentaciones de AST, Autoridad y Sierra Space
- Sesión de comentarios



### Presentación de comentarios

- Proporcione un comentario oral en la reunión pública de esta noche.
  - Se dará la palabra primero a los que se inscribieron previamente.
  - Envíe un mensaje de chat al anfitrión o levante la mano para que se lo agregue a la lista de oradores.
- Correo electrónico: <u>huntsvillereentry@icf.com</u>
- Dirección postal:

Ms. Stacey Zee, HSV Draft EA c/o ICF 9300 Lee Highway Fairfax, VA 22031

#### El período para formular comentarios concluye el 22 de diciembre de 2021.

Antes de incluir su dirección postal, número de teléfono, dirección de correo electrónico u otra información de identificación personal en su comentarios, tenga en cuenta que todo su comentario –incluida su información de identificación personal– podría publicarse en algún momento. Si bien puede solicitarnos en su comentario que obviemos del examen público su información personal, no estamos en condiciones de garantizar que podremos hacerlo.



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# **Reglas básicas**

- No utilice lenguaje inapropiado.
- Las personas que deseen formular comentarios y que se hayan inscrito antes serán llamadas siguiendo el orden de inscripción.
- Contarán con 3 minutos para hablar. Respete el tiempo de cada persona.
- Recuerde que todos los comentarios reciben la misma consideración independientemente de si son presentados en formato oral, electrónico o escrito.



AST Commercial Space Transportation

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#### Transporte espacial comercial

Audiencia pública para la Evaluación Ambiental Preliminar (EA) para la licencia de operador del sitio de reentrada en el Aeropuerto Internacional de Huntsville y la licencia para el Operador del vehículo Sierra Space Corporation (Sierra Space) en Huntsville, Alabama

9 de diciembre de 2021

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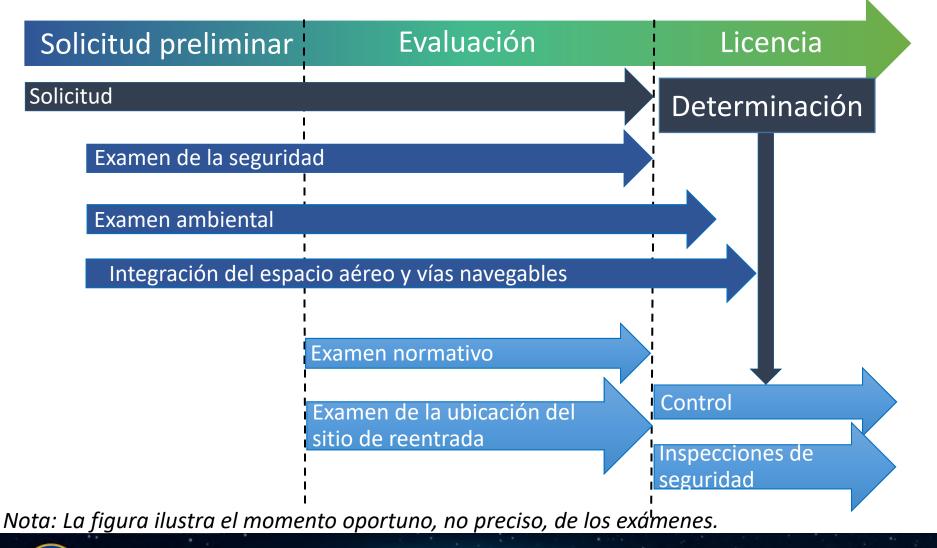
# ¿Por qué estamos aquí?

- La FAA está evaluando la propuesta para las operaciones de reentrada en el espacio comercial de la Autoridad del Aeropuerto de Huntsville en el Condado de Madison (la Autoridad) y Sierra Space Corporation (Sierra Space) en el Aeropuerto Internacional de Huntsville (HSV).
- El sitio de reentrada y las operaciones del vehículo requieren de una licencia de la FAA.
- La FAA está analizando los posibles efectos ambientales en su Evaluación Ambiental (EA) y está recabando comentarios en la EA preliminar.



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#### Proceso de la FAA para el otorgamiento de licencia Licencia de Operador del sitio de reentrada

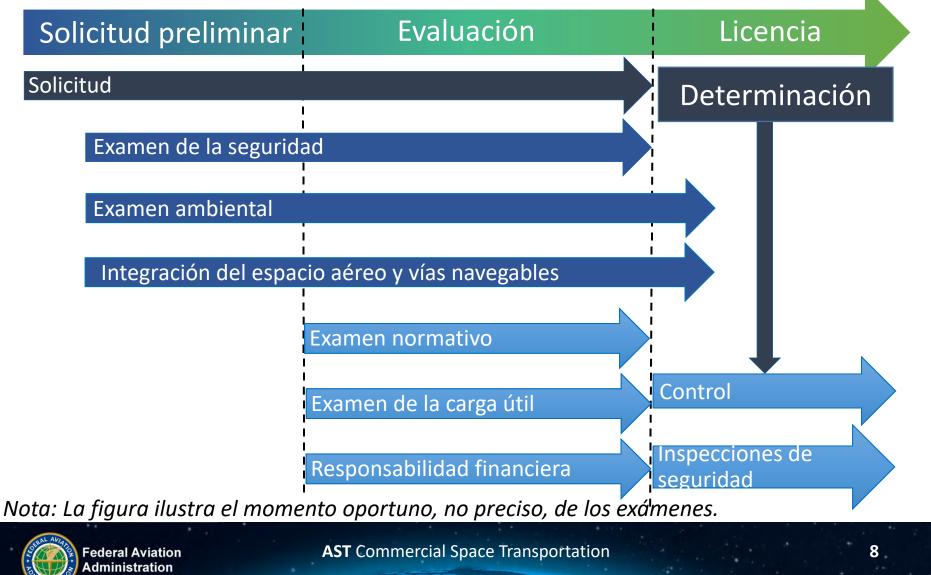


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7 .

#### Proceso de la FAA para el otorgamiento de licencia Licencia de Operador del vehículo



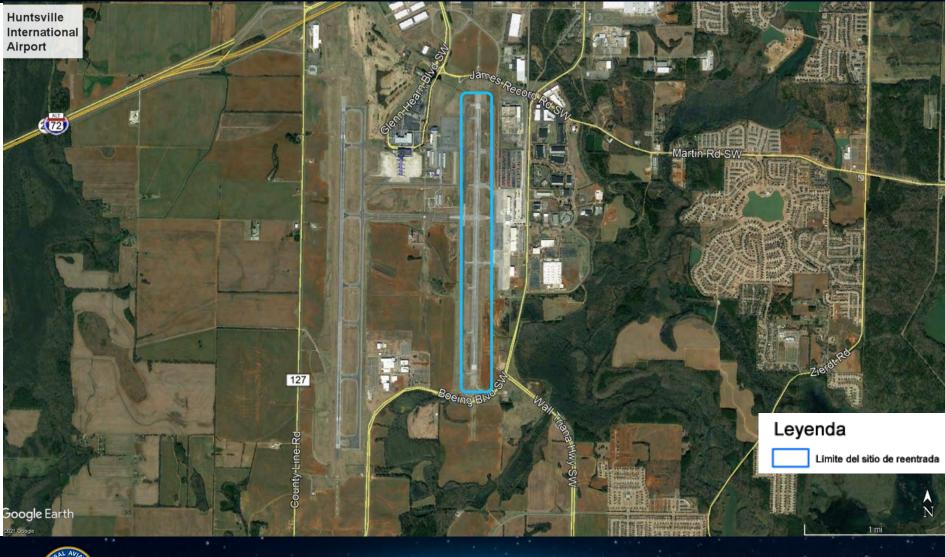
#### Aspectos generales del proyecto

- La Autoridad propone operar un sitio para el reentrada al espacio comercial en HSV bajo una licencia de operador de sitio de reentrada
- Sierra Space propone realizar reentradas de su vehículo Dream Chaser en HSV bajo una Licencia de la FAA de operador de vehículo.
- Número máximo de reentradas propuestas, anualmente (podría ser de día o de noche)

| 2023 | 2024 | 2025 | 2026 | 2027 |
|------|------|------|------|------|
| 1    | 1    | 1    | 2    | 3    |



#### Proyecto propuesto en HSV



Federal Aviation Administration AST Commercial Space Transportation

# Vehículo Dream Chaser

- Vehículo espacial orbital comercial para aterrizaje en pista en fabricación
- Transporte sin tripulación desde órbita terrestre baja
- Propulsión no tóxica para traslaciones orbitales, control de la actitud, desorbitación
- Perfil de reentrada < 1,5g y capacidad total de carrera transversal >1000 millas
- Diseñado para lanzarse en una variedad de vehículos de lanzamiento
- Contrato para el Programa de Servicios de suministro de carga 2 (CRS2) con la Administración Nacional de Aeronáutica y del Espacio (NASA)





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# Aspectos generales de la misión del programa de Servicios de suministro de carga 2 (CRS2) de la NASA

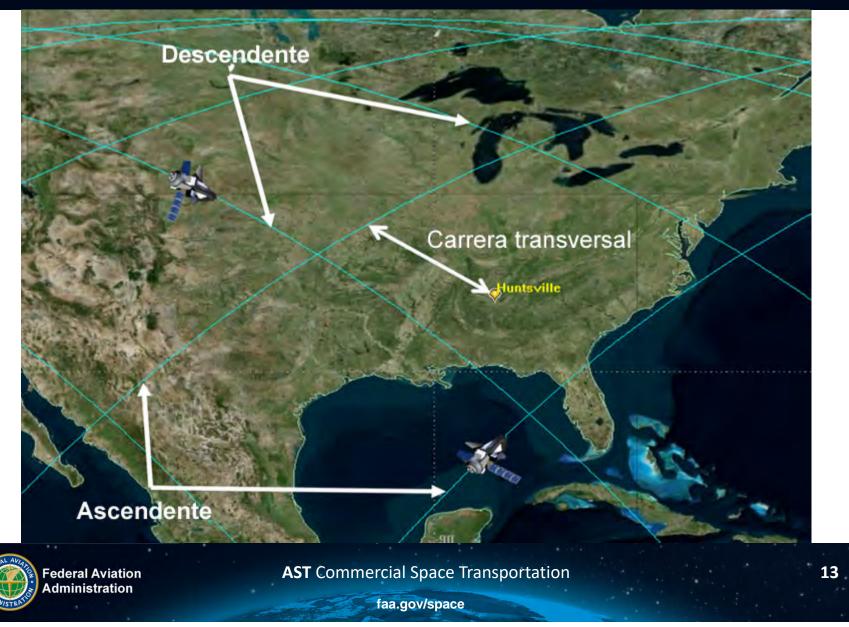


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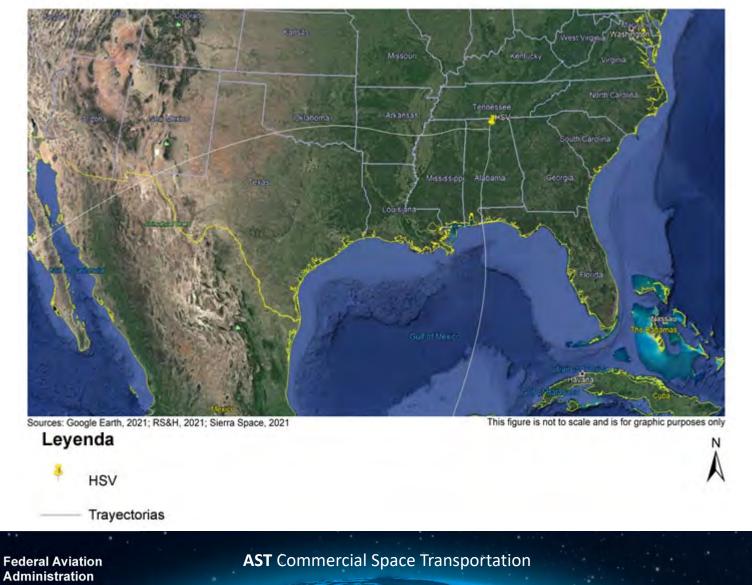
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#### Trayectoria ascendente y descendente y carrera transversal



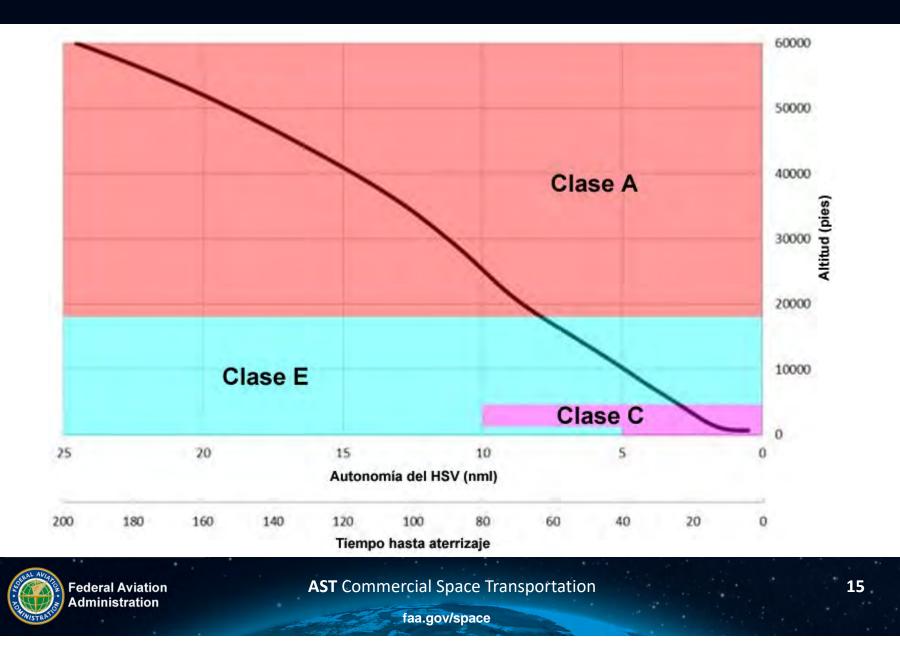
#### Derrota – reentrada del HSV



faa.gov/space

14.

#### Trayectoria de vuelo representativa

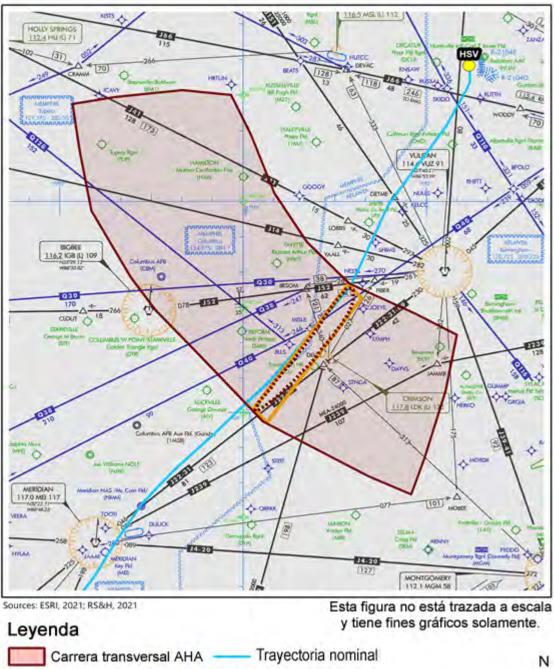


# Cierres del espacio aéreo debido a reentrada en HSV

- Sierra Space coordinará los cierres del espacio aéreo para las operaciones de reentrada con:
  - Oficina de Transporte Espacial Comercial de la FAA
  - Organización de Tránsito Aéreo de la FAA
  - Oficina de Aeropuertos de la FAA
  - HSV
  - instalaciones de control de tránsito aéreo impactadas
  - toda organización militar afectada
  - Guardia Costera de los EE. UU.
  - prestadores de servicios de aeronavegación extranjeros afectados
- La FAA no prevé modificar las dimensiones del espacio aéreo.
- Se expedirá un NOTAM para cada instancia de reentrada; la aeronave se redireccionará en torno del área de cierre del espacio aéreo.



# Cierres del espacio aéreo



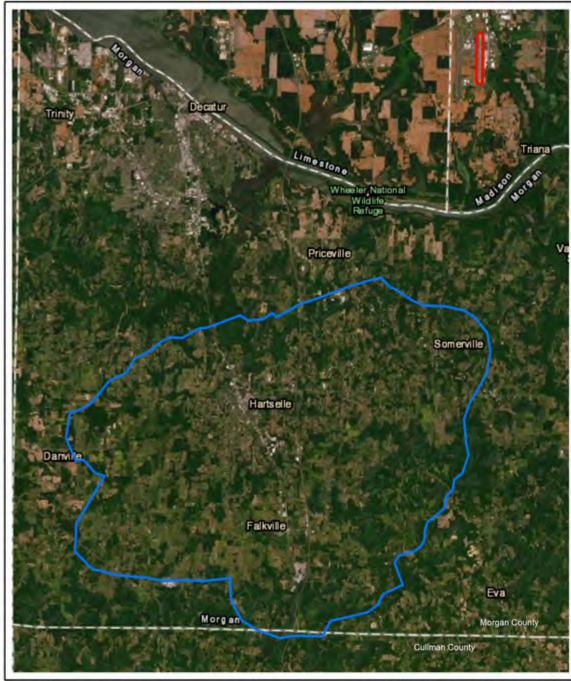
Pista 18L-36R

----- AHA nominal





# Estampido sónico



Sources: ESRI, 2020; RS&H, 2020

Esta figura no está trazada a escala y tiene fines gráficos solamente.



#### Leyenda



Área de estudio del proyecto

Federal Aviation Administration

Límite del sitio de reentrada en HSV

Ν

Límites del condado

## **Cierres de pistas**

- LA FAA expedirá restricciones temporales de vuelos (TFR, por sus siglas en inglés) en HSV a pedido de Sierra Space.
- La Pista 18R-36L (fuera del límite del sitio de reentrada) se cerrará durante la reentrada, pero abrirá después del aterrizaje del Dream Chaser.
- La Pista 18L-36R
  - permanecería cerrada por un máximo de 10 horas o hasta que el Dream Chaser sea descargado y se encuentre en situación segura
  - antes de la reapertura, Operaciones del Aeropuerto inspeccionaría la pista antes de retomar las operaciones normales con aeronaves



## Categorías de impacto analizadas en detalle

- Uso del terreno para actividades de ruido o compatibles con el ruido
- Recursos biológicos
- Sección 4(f) de la Ley del Departamento de Transporte
- Materiales peligrosos, desechos sólidos y prevención de la contaminación

- Recursos históricos, arquitectónicos arqueológicos y culturales
- Riesgos socioeconómicos, ambientales, paral a justicia y para la salud y seguridad ambiental de los niños

Remitirse al análisis completo de las consecuencias ambientales potenciales en la EA preliminar



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### Impactos de ruidos

- El estampido sónico se produciría durante las operaciones de reentrada del Dream Chaser.
- Los niveles de sobrepresión del estampido sónico previstos para zonas pobladas se aproximarían a HSV: 1,25 libras por pie cuadrado (o psf).
- Los niveles de sobrepresión de 1,25 psf son similares a un trueno.
- El ruido en las comunidades circundantes estaría por debajo de los niveles que la FAA ha establecido que afectarían en forma adversa el uso de terrenos, la salud y seguridad ocupacionales y las estructuras edilicias.



#### Impactos en recursos biológicos

 La FAA mantiene consultas con el Servicio de Pesca y Fauna y Flora Silvestres de los EE. UU. conforme a la sección 7 de la Ley relativa a las especies en peligro de extinción.

| Nombre común<br>(nombre científico)                   | Situación<br>federal    | Situación<br>estadual   |
|---|-------------------------|-------------------------|
| Murciélago gris (Myotis grisescens)                   | En peligro de extinción | En peligro de extinción |
| Murciélago de Indiana (Myotis sodalis)                | En peligro de extinción | En peligro de extinción |
| Murciélago orejudo del norte (Myotis septentrionalis) | Amenzado                | Amenzado                |
| Dark Pigtoe (Pleurobema furvum)                       | En peligro de extinción | En peligro de extinción |
| Pink Mucket (pearlymussel) (Lampsilis abrupta)        | En peligro de extinción | En peligro de extinción |
| Rough Pigtoe (Pleurobema plenum)                      | En peligro de extinción | En peligro de extinción |
| Sheepnose Mussel (Plethobasus cyphyus)                | En peligro de extinción | En peligro de extinción |
| Snuffbox Mussel (Epioblasma triquetra)                | En peligro de extinción | En peligro de extinción |
| Caracol de río Anthony (Atheamia anthonyi)            | En peligro de extinción | En peligro de extinción |

- Puede afectar, pero no afectaría profundamente, especies amenazadas y en peligro de extinción a nivel federal (determinación propuesta enviada a USFWS el 22 de octubre de 2021)
  - Los estampidos sónicos son infrecuentes y similares a truenos.
  - Baja probabilidad de afectar la vida silvestre



#### Impactos en recursos culturales

- No se prevén efectos adversos a características de propiedades históricas a raíz del ruido.
- No hay efectos estructurales previstos en propiedades históricas.
- Bajo la Ley nacional para la preservación histórica, consulta con
  - el Oficial de Preservación Histórica del Estado de Alabama
  - Tribus norteamericanas
  - Otras partes consultoras



Fuente: Servicio Nacional de Parques



#### Sección 4(f) del Departamento de Transporte Impactos

- Aumento de los niveles sonoros durante las operaciones de reentrada
  - Reentradas propuestas según el modelo de 1,25 psf para el estampido sónico
- Acción propuesta no se prevé que llevará a un impacto marcado en los recursos de la sección 4(f)
- La FAA está consultando con
  - Autoridad del Valle de Tennessee



Fuente: Servicio de Pesca y Fauna y Flora Silvestres de los EE. UU.

- Servicio de Pesca y Fauna y Flora Silvestres de los EE. UU.
- Oficial de Preservación Histórica del Estado de Alabama



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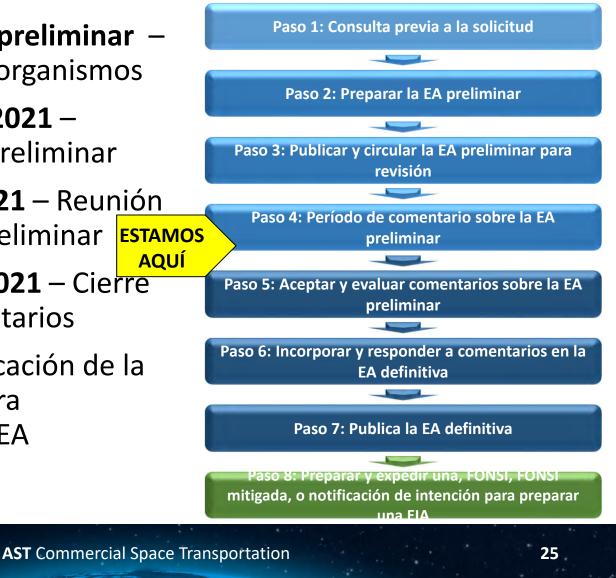
### Cronograma de la EA e interacción con las partes interesadas

faa.gov/space

- Preparación de la EA preliminar Coordinación con los organismos
- 12 de noviembre de 2021 –
   Publicación de la EA preliminar
- 22 de diciembre de 2021 Cierre del período de comentarios
- Próximo paso Publicación de la EA definitiva (incorpora comentarios sobre la EA preliminar)

**Federal Aviation** 

Administration



## **Comentarios sobre la EA preliminar**

- Presentar comentarios sobre la EA preliminar:
  - Correo electrónico: <u>huntsvillereentry@icf.com</u>
  - Por correo: Stacey Zee, HSV DEA, c/o ICF, 9300 Lee Highway, Fairfax, VA 22031
- El período para formular comentarios concluye el 22 de diciembre de 2021.
- EA preliminar y formulario para comentarios del público disponible en: <u>https://www.faa.gov/space/stakeholder\_engagement/Huntsville\_reentry</u>
- Para inscribirse en la lista para recibir comunicaciones, consulte: <u>https://www.faa.gov/space/stakeholder\_engagement/Huntsville\_reentry</u>

Antes de incluir su dirección postal, número de teléfono, dirección de correo electrónico u otra información de identificación personal en su comentarios, tenga en cuenta que todo su comentario –incluida su información de identificación personal– podría publicarse en algún momento. Si bien puede solicitarnos en su comentario que obviemos del examen público su información personal, no estamos en condiciones de garantizar que podremos hacerlo.



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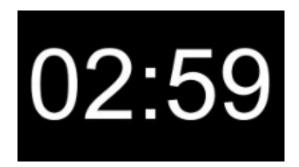


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Federal Aviation Administration

#### **Comentarios públicos orales**





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### Presentación de comentarios

- Proporcione un comentario oral en la reunión pública de esta noche.
  - Se dará la palabra primero a los que se inscribieron previamente.
  - Envíe un mensaje de chat al anfitrión o levante la mano para que se lo agregue a la lista de oradores.
- Correo electrónico: <u>huntsvillereentry@icf.com</u>
- Dirección postal:

Ms. Stacey Zee, HSV Draft EA

c/o ICF

9300 Lee Highway

Fairfax, VA 22031

#### El período para formular comentarios concluye el 22 de diciembre de 2021.

Antes de incluir su dirección postal, número de teléfono, dirección de correo electrónico u otra información de identificación personal en su comentarios, tenga en cuenta que todo su comentario –incluida su información de identificación personal– podría publicarse en algún momento. Si bien puede solicitarnos en su comentario que obviemos del examen público su información personal, no estamos en condiciones de garantizar que podremos hacerlo.



Federal Aviation Administration **AST** Commercial Space Transportation



faa.gov/space



Federal Aviation Administration

#### **APPENDIX E -2: DRAFT EA COMMENTS**

#### Hello FAA,

We're excited to nurture this important capability of landing Dream Chaser in Huntsville as a great opportunity.

The potential environmental impact of Sonic booms, and only semi-annual, is a regular effect from local Redstone Test Center activities.

Thank you for your consideration. Mark

Mark Becnel President

RadioBro Corporation +1 256 469 8249 Direct / Office / International mark@radiobro.com http://www.radiobro.com

| From:    | jamesdimmock.jd@gmail.com              |
|----------|--|
| То:      | Huntsville Reentry Project             |
| Subject: | From www.faa.gov: project mailing list |
| Date:    | Friday, November 12, 2021 4:27:44 PM   |

This email was sent through the Federal Aviation Administration's public website. You have been contacted via an email link on the following page: https://www.faa.gov/space/stakeholder\_engagement/huntsville\_reentry/

Message

It is a good idea if the proposal meets all environmental and safety standards. One must assess for air space occupancy to make certain that one carrier does not impose itself on the other. Access to And from the airport, namely roads and bridges must be able to accommodate the extra burden of traffic I am sure will happen once the system is up and running. Runway infrastructure is of prime concern and we must make certain that both landing and routes for liftoff meet every standard set forth by governing bodies and other conducting agencies. It has great promise.

| From:    | Rocket Cello                          |
|----------|---------------------------------------|
| To:      | Huntsville Reentry Project            |
| Subject: | Dreamchaser at Huntsville IA          |
| Date:    | Monday, November 15, 2021 11:26:29 AM |

Hello, in my personal opinion, this is a good idea, as it allows for a wider variety of de-orbit paths in case of an emergency (flood at KSC, or an issue with Dreamchaser that needs to brought back to ground quickly), but only once the EDL systems are confirmed to be functional without any issues, and Dreamchaser has about 2 successful flights under its belt. This might also cause a PR boost, and an increased interest in spaceflight, as seeing an orbit-capable vehicle (or a vehicle that's just come back) land on the same runway you're taking off from later is rather inspiring.

Best of luck with the rest of the comments! Yours Sincerely A random space nerd that loves dreamchaser.

(if this message is sent to the wrong person, please mention it)

| From:    | Patrick Dougherty                    |
|----------|--------------------------------------|
| To:      | Huntsville Reentry Project           |
| Subject: | Huntsville Reentry EA Public Comment |
| Date:    | Friday, November 12, 2021 6:21:37 PM |

Sounds' great. Space is our future.

Sent from Mail for Windows

| From:    | supha dumeen                         |
|----------|--------------------------------------|
| To:      | Huntsville Reentry Project           |
| Subject: | Huntsville Reentry EA Public Comment |
| Date:    | Friday, November 12, 2021 3:05:11 PM |

testing complete for homeland security and national guard supha dumeen

Tracey Y. Christmas

| <u>Owner</u>                          |
|---------------------------------------|
| Huntsville Reentry Project            |
| ffoulks@yahoo.com                     |
| Dream Chaser Huntsville, AL           |
| Friday, November 12, 2021 10:14:47 PM |
| High                                  |
|                                       |

Why does the Dream Chaser not have landing gear wheels on the front instead of a skid?

Seems to me this would alleviate closing HSV'S Primary for up to an hour.

My suggestion is to replace the skid with front landing gear Wheels so that it will allow for quick recovery and allow for consistent runway operations.

| From:    | Steven Goyette                       |
|----------|--------------------------------------|
| To:      | Huntsville Reentry Project           |
| Subject: | Huntsville Reentry EA Public Comment |
| Date:    | Friday, November 12, 2021 7:06:33 PM |

FAA,

Please allow the Dreamchaser spacecraft to return to the Alabama space port. I can't imagine it having any environmental impact at all. It will be returning wall gliding and have barely any fuel on board. Thank you!

Sent from my iPhone

| From:    | pradoxic Internaut                   |
|----------|--------------------------------------|
| To:      | Huntsville Reentry Project           |
| Subject: | Huntsville Reentry EA Public Comment |
| Date:    | Friday, November 12, 2021 8:18:05 PM |

I support this sounds awsome

| From:    | Dale Larsson                          |
|----------|---------------------------------------|
| To:      | Huntsville Reentry Project            |
| Subject: | DreamChaser licencing                 |
| Date:    | Monday, November 15, 2021 11:26:30 AM |

As per the requested input on the following decisions:

•Huntsville-Madison Airport Authority is seeking a Reentry Site Operator License. &

•Sierra Space is seeking a Vehicle Operator License.

I say let it fly.. and land!

Which matches my prior reply.

| From:    | Matthew Ward                          |
|----------|---------------------------------------|
| То:      | Huntsville Reentry Project            |
| Subject: | Dream Chaser Landing                  |
| Date:    | Monday, November 15, 2021 11:25:04 AM |

I am supporting the landing of this re-entry vehicle.

| From:    | Gisela Fletcher                        |
|----------|--|
| То:      | Huntsville Reentry Project             |
| Subject: | Dream Chaser Landing                   |
| Date:    | Saturday, November 13, 2021 4:54:11 AM |

I find it very important to be considered being part of the Dream Chaser Program. After all Huntsville is the Rocket City and it should live up to its name. I am not worried about any Sonic booms. We already hear the noise coming from the arsenal and we live with it just well. Including one or two more thunder like sounds a year shouldn't have any impact on anyone or anything at all. Therefore I'm all for it and can't wait to see the first landing of the Dream Chaser.

Sent from my iPad

| From:    | peter grove                           |
|----------|---------------------------------------|
| To:      | Huntsville Reentry Project            |
| Subject: | Landing                               |
| Date:    | Monday, November 15, 2021 11:26:32 AM |

It seems that the landing of the spacecraft in Huntsville is fairly benign compared to the historical prestige it will bring Huntsville Alabama. Thank You.

| From:    | Raymond Kamus                          |
|----------|--|
| То:      | Huntsville Reentry Project             |
| Subject: | Re entry                               |
| Date:    | Saturday, November 13, 2021 8:07:39 AM |

I think that would be cool that Huntsville have the opportunity to have those re entries happen here.We do alot of work for NASA and the space station...

Sent from Yahoo Mail on Android

The Dream Chaser landing in Huntsville needs to be approved.

Regards, Ron Sisulak

Sent from my iPhone

| From:    | PABLOFASHION SILVAINDUSTRIAL           |
|----------|--|
| То:      | Huntsville Reentry Project             |
| Subject: | Huntsville Reentry EA Public Comment   |
| Date:    | Saturday, November 13, 2021 9:57:53 AM |

Hola soy will-sun-kin@hotmail.com y estoy muy interesado en tener en cuenta esta recomendacion y asi mismo solicitar el estudio de este tipo de aeropuertos para suramérica y latinoamérica ya q es muy importante para el desarrollo sociológico y dinámico del planeta y de sus habitantes y sus implicaciones y directrices... En el medio ambiente... Gracias.... phablo7775weellstree@hotmail.com... Espero tengan en cuenta este texto para el borrador del documento público que se plasmara... finalmente apartir del 9 de diciembre y hasta el 22 de diciembre del 2021 ok un abrazo a los chiiipK@S\$... que están en esta tarea tan espectacular para todas las generaciones... De este y de otros planetas... will.sun.li@gmail.com....wilsun3@hotmail.com....

Get Outlook para Android

#### Translation

<u>Hello</u> I am will-sun-kin@hotmail.com and I am very interested in considering this recommendation and likewise request the study of this type of airports for South America and Latin America since it is very important for the sociological and dynamic development of the planet and of its inhabitants and its implications and guidelines... In the environment... Thank you....phablo7775weellstree@hotmail.com... I hope you take this text into account for the draft of the public document that will take shape... finally from December 9 and until December 22 December 2021 ok a hug to the chiipK@S\$... who are in this spectacular task for all generations... From this and other planets...will.sun.li@gmail.com.... wilsun3@hotmail.com....

Hello,

I am in support of Huntsville International Airport becoming a Dream Chaser landing site. This would reconnect North Alabama to one of our most important foundations: space flight. Space flight is a growing industry and refusing to seize this opportunity would be unwise.

Best, Kate Ambrose Resident of Morgan County, AL

| From:    | Tom Cash                             |
|----------|--------------------------------------|
| To:      | Huntsville Reentry Project           |
| Subject: | Sonic Booms                          |
| Date:    | Sunday, November 14, 2021 7:46:46 AM |

When I was 10 to 13 years old (1961 – 1964) my family lived in the Columbus, Ohio area about a mile south of the main airport. On the south side of the airfield was an aircraft manufacturing plant (see <a href="https://www.globalsecurity.org/military/facility/afp-85.htm">https://www.globalsecurity.org/military/facility/afp-85.htm</a>) and they manufactured several aircraft, one of which (the Vigilante <a href="https://en.wikipedia.org/wiki/North\_American\_A-5\_Vigilante">https://en.wikipedia.org/wiki/North\_American\_A-5\_Vigilante</a>) was supersonic capable. We experienced multiple sonic booms pretty much every day of the week as they test flew aircraft. Everyone was used to it and it had no impact I was aware of to anyone or anything. Given the amount of "booms" we already hear from Redstone Arsenal and the probably infrequent number of times the Dream Chaser may be landing at the Huntsville Jetport, I see this as a moot point – no big (or even little) deal.

Thomas Cash 2203 Poincianna St, HSV, AL 35801

| From:    | LINDA CLARK                            |
|----------|--|
| To:      | Huntsville Reentry Project             |
| Subject: | Huntsville Reentry EA Public Comment   |
| Date:    | Tuesday, November 16, 2021 11:34:35 AM |

Blessed is he who comes in the name of the Lord. FaithHunt

| From:    | Daniel Saturn                         |
|----------|---------------------------------------|
| To:      | Huntsville Reentry Project            |
| Subject: | environmental review                  |
| Date:    | Tuesday, November 16, 2021 8:38:08 PM |

I am **FOR** allowing huntsville to be used for a landing site, based on spaceX's proven ability to safely land its rockets on any given spot.

I believe anyone against, has based their decision on politics; or, enigmatic, arbitrary, capricious, uncertain, opinionated, etc. "science".

Dan Saturn

| From:    | Mark Spencer                           |
|----------|--|
| To:      | Huntsville Reentry Project             |
| Subject: | Huntsville Runways during Re-entry     |
| Date:    | Tuesday, November 16, 2021 11:43:48 AM |

I am very excited to see that Huntsville may be able to land the Dream chaser and feel that is an exciting use of this resource and a natural expansion of Huntsville International Airport's mission and capabilities! My only suggestion is that since the landing closes a runway for some amount of time when it is complete (even if the landing is successful), Huntsville should only be permitted to land the craft when both runways are expected to be available for use. Over approximately the last twelve years, Huntsville has managed to keep both runways simultaneously operational for less than 50% of days according to an analysis of publicly available NOTAM history -- and that statistic is currently moving in the wrong direction. Having the only a single operational runway at the time of the space craft landing increases the likelihood of unintended impact to other traffic.

| From:    | Mark F.                                  |
|----------|--|
| To:      | Huntsville Reentry Project               |
| Subject: | Public comment                           |
| Date:    | Wednesday, November 17, 2021 10:06:22 PM |

A more comprehensive environmental study needs to be done because the potential impact upon the proposed the landing zone area.

| From:    | Klinker777@yahoo.com                   |
|----------|--|
| To:      | Huntsville Reentry Project             |
| Subject: | From www.faa.gov: project mailing list |
| Date:    | Tuesday, December 7, 2021 12:05:46 PM  |

This email was sent through the Federal Aviation Administration's public website. You have been contacted via an email link on the following page: https://www.faa.gov/space/stakeholder\_engagement/huntsville\_reentry/

Message

I believe that Huntsville airport would be a good fit for this project.

| From:    | Ben Pearson                           |
|----------|---------------------------------------|
| То:      | Huntsville Reentry Project            |
| Subject: | Dream Chaser landing EA               |
| Date:    | Thursday, December 9, 2021 6:33:01 PM |

I just watched the review of the explanation of the EA, and as a person who lives in the Huntsville area, I can say that I appreciate the level of detail, and it sounds like an excellent use of the Huntsville Airport and the industry in the Huntsville area.

--Ben Pearson http://www.kd7uiy.com Ms. Stacey Zee,

Given all the risks and negative effects (sonic boom, etc) associated with getting approval for space vehicles to land at HSV, has the airport authority or Sierra or any of the applicants submitted a summary of the economic impact or any other benefit that this can bring to the area? If we are just taking all the risks and getting no benefits whatsoever, I would vote against it.

Thanks in advance for your time.

Jorge Castillo Madison, AL Resident

| From:    | Jim Keith                            |
|----------|--------------------------------------|
| To:      | Huntsville Reentry Project           |
| Subject: | Dream Chaser landing site            |
| Date:    | Friday, December 10, 2021 1:51:47 PM |

It would be awesome to have the Dream Chaser aircraft landing at HSV. I think the benefits would far outweigh any negative impacts.

I'd come out to watch the landings!

James Keith Hartselle, AL

| michaelmoore1966@bellsouth.net       |
|--------------------------------------|
| Huntsville Reentry Project           |
| Dream Chaser                         |
| Friday, December 10, 2021 9:40:00 AM |
|                                      |

I am in full support of bringing the Dream Chaser opportunities to Huntsville. I live in the flight path of the Huntsville airport on the north direction and have no issues with excessive noise or problems. Adding a Dream Chaser flight a few times a year would have no impact on me and the community. It would highlight the community as a space oriented city and bring untold benefits long term to support this community.

Bring on the Dream Chaser!

| From:    | <u>GC</u>                              |
|----------|--|
| To:      | Huntsville Reentry Project             |
| Subject: | Dream Chaser                           |
| Date:    | Saturday, December 11, 2021 8:43:47 PM |

I/we are NOT in support of this project for this area.

We are already having way too much fast growth and not enough infrastructure or living accommodations to support it!

The awful noise that this would bring, the danger to area residents, unwanted pharmaceutical and other businesses, and endangering native animals—but 'not too many' or 'too bad'?? Really? Wow.

Take your future dreams elsewhere, please. Like out into the desert! Not here!!

An exasperated citizen with the fast-track, mind blowing 'growth' in this area, which is actually quite terrible. No more!!

Gina Madison, AL

| From:    | Roger Cloud                          |
|----------|--------------------------------------|
| To:      | Huntsville Reentry Project           |
| Subject: | Go, Dream Chaser!                    |
| Date:    | Monday, December 13, 2021 4:35:04 PM |

I am writing to enthusiastically endorse the prospect of the Dream Chaser having landing privileges at Huntsville Airport. Certain sacrifices must be made for the sake of progress, even on a community-wide basis. The annoyance that the DC will cause is minor and only occasional. As a retired high tech/IP attorney (Calif.), I am aware of the risk v. benefit analysis that attends such decisions. The squeaky wheel of complainers will be heard, of course, but please trust that there are many of us "out here" who appreciate that this is a development that will yield many profound benefits in fields such as medicine, high tech, manufacturing, and more. I trust that you will bear in mind us more silent (but numerous) supporters. Sincerely, Roger Wilcox Cloud (Madison)

Sent from my iPhone

| From:    |   |
|----------|---|
| To:      | Huntsville Reentry Project              |
| Subject: | Dreamchaser landing public comment      |
| Date:    | Thursday, December 16, 2021 11:05:07 AM |

I am writing to support the proposal to land Sierra Space vehicles at Huntsville International Airport. Although I have no ties to the aerospace industry, I reside in Limestone County and work in Morgan County near the proposed landing path. I have studied the proposal and I believe that while the negative impacts of these landings would be extremely minimal, the economic and educational benefits would be substantial. I think it would be a wonderful experience for the children of this community to be able to witness such an event in their own community, and many would no doubt be encouraged to pursue STEM education by this exposure.

I do request that the FAA withholding my personal information from public release, if possible.

Best,

Gregory Forsythe

| From:    | Austin Nichols                         |
|----------|--|
| To:      | Huntsville Reentry Project             |
| Subject: | Huntsville Reentry EA Public Comment   |
| Date:    | Saturday, December 18, 2021 8:26:04 PM |

As A Huntsville native I grew up around the Spaceflight industry. It was a major part of my life and this amazing opportunity to have the Dreamchaser land at the Huntsville airport would be one of the most significant aerospace events for Huntsville since the Apollo program. The sonic boom would not be a problem as it would be no louder than a clap of thunder. This combined with the book only happening once every few months should be more than enough to rule out any negative effects. I hope the FAA will consider the historical and logistical reasons to have the dreamchaser land here and how great of an opportunity it would be for the rocket city.

| From:        | Bradley, Veronica   |
|--------------|---|
| To:          | Huntsville Reentry Project  |
| Subject:     | Draft Environmental Assessment for the Huntsville International Airport Reentry Site Operator License and Sierra Space Corporation Vehicle Operator License |
| Date:        | Monday, December 20, 2021 3:36:05 PM  |
| Attachments: | A4A Comments on HSV Rentry Ops Draft EA_FINAL.pdf   |

Dear Ms. Zee:

Please find attached comments submitted on behalf of Airlines for America regarding the Draft Environmental Assessment for the Huntsville International Airport Reentry Site Operator License and Sierra Space Corporation Vehicle Operator License. Please do not hesitate to contact us should you have any questions or would like to discuss our comments further. Thank you and happy holidays.

Best, Veronica

Veronica Bradley Director, Environmental Affairs (pronouns: she/her/hers) Airlines for America We Connect the World 1275 Pennsylvania Ave. NW, Suite 1300 Washington, DC 20004 (p) 202.626.4152 | (e) vbradley@airlines.org airlines.org | Facebook | Twitter | Instagram | LinkedIn



# **Airlines for America**

We Connect the World

December 20, 2021

Office of Commercial Space Transportation Federal Aviation Administration Stacey Zee, Environmental Protection Specialist 800 Independence Avenue, SW, Suite 325 Washington, DC 20591

#### Submitted Electronically via HuntsvilleReentry@icf.com

Re: Comments on Draft Environmental Assessment for Huntsville International Airport Reentry Site Operator License and Sierra Space Corporation Vehicle Operator License

Dear Ms. Zee:

Airlines for America (A4A),<sup>1</sup> the principal trade and service organization of the U.S. airline industry, appreciates the opportunity to provide comments on FAA's Draft Environmental Assessment (EA) for Huntsville International Airport (HSV) Reentry Site Operator License and Sierra Space Corporation Vehicle Operator License. While appreciating the work FAA put into the Draft EA, the Draft EA is deficient because it does not properly assess the integration of the proposed and potential reentries in the existing National Airspace System (NAS). This assessment should be a condition precedent to proceeding with and necessary to properly conducting the EA.

While the Draft EA purports to account for the emissions impacts of the Proposed Action, it does not adequately assess the attendant environmental impacts or consequences from the need to hold and re-route aircraft around the restricted airspace during reentry operations. The Draft EA notes that Notices to Air Missions (NOTAMs) would necessarily be issued to accommodate the reentry operations in the NAS. It states that the proposed reentry operations may affect aviation traffic from nearby commercial service airports, including ATL, BNA, BHM, and MSL, in addition to airspace and ground closures at HSV and explains that 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."<sup>2</sup> Moreover, it notes that any reentry mission could require two deorbit opportunities, necessitating two one-hour NOTAMs effective approximately 90 minutes apart.<sup>3</sup>

However, FAA has not included an assessment of the clear environmental impacts that would come from having to hold and re-route aircraft during the time of the temporary flight restrictions

<sup>3</sup> Id. at 2-8

<sup>&</sup>lt;sup>1</sup> A4A's members are: Alaska Airlines, Inc.; American Airlines Group; Atlas Air, Inc.; Delta Air Lines, Inc.; Federal Express Corporation; Hawaiian Airlines; JetBlue Airways Corp.; Southwest Airlines Co.; United Continental Holdings, Inc.; and United Parcel Service Co. Air Canada is an associate member.

<sup>&</sup>lt;sup>2</sup> Draft EA at 2-8, 13.

December 20, 2021 Page 2

issued through the NOTAMs; it simply states that "resulting greenhouse gas emissions are anticipated to be small" because of the low number and short-term nature of rerouting aircraft.<sup>4</sup> Holding aircraft at HSV will result in aircraft circling nearby airports and grounded aircraft enduring tarmac delays, each of which would increase emissions. Moreover, re-routing aircraft will result in longer flight paths that will increase emissions. These impacts could have significant environmental consequences, particularly given the list of potentially impacted airports, including ATL—the busiest—and BNA—the 27<sup>th</sup> busiest—airports in the country.

Furthermore, FAA states that the emissions impact will not be significant yet admits that it does not know the extent of the NOTAMs in terms of geographical area, which necessarily will impact how aircraft from these major airports will be rerouted during the temporary flight restrictions. And, if the reentry mission requires a second deorbit opportunity it is unclear whether the duration of the NOTAM may need to extend from one to three and a half hours to accommodate the 90-minute orbit on top of the two one-hour NOTAMs, considering "[m]ore specific time ranges of the AHA and NOTAM is subject to change after further FAA refinement."<sup>5</sup> A 3.5-hour flight restriction would certainly have a very real effect on NAS operations that could potentially significantly impact the environment.

Considering these acknowledged effects of the reentry operations on aircraft operations and their attendant environmental impacts, the Draft EA should be revised to include a credible analysis of the environmental impacts associated with these effects. Because the Draft EA does not properly assess the attendant emissions impacts of the Proposed Action due to its effects on NAS operations, FAA cannot proceed until it takes appropriate actions to correct this error. In any event, FAA should clarify that HSV's or Sierra Space Corporation's licenses (the RSOL and VOL, respectively) are both limited to five years and to authorize no more than two reentries per year per the description of the Proposed Action.

Beyond FAA's lack of environmental review of the Proposed Action's impact on the NAS, A4A is even more concerned that FAA has proceeded with this environmental analysis and approval process for the Proposed Action without answering critical questions about the Proposed Action's integration with existing NAS operations. The assessment of the Proposed Action in the Draft EA appears to be devoid of any consideration of airspace efficiency, which is critical to minimize adverse operational and financial impacts resulting from closures of airspace necessary for commercial space launches. In addition to adverse environmental impacts, commercial space operations impose substantial costs on airlines, their passengers, cargo shippers, the public, and the U.S. economy, including:

- Additional operating costs for increased flight distances and times resulting from rerouting aircraft, including additional airline resources to plan/manage events, flight crew, and maintenance.
- Denied boarding compensation for passengers that are denied boarding as a result of aircraft weight restrictions when additional fuel is required for longer routes.
- Passenger and airline costs resulting from impacts to flights and passengers that are not re-routed around the commercial space operation but are otherwise impacted by the resulting NAS congestion—e.g., flight delays, flow controls, gate and slot availability, and reduced on-time performance.

<sup>&</sup>lt;sup>4</sup> *Id.* at 3-3.

<sup>&</sup>lt;sup>5</sup> *Id*. at 2-8.

- Increased employment costs resulting from crew scheduling changes, including from limitations on flight and duty times.
- Increased passenger costs as a result of impacted passenger travel, including time lost from delayed flights, flight cancellations, and missed connections
- Lost revenue from decreased demand due to passengers avoiding air travel as a result of longer flights, lack of predictability, delays, cancellations, and missed connections.
- Costs from delayed cargo and package delivery for the public and businesses.
- Lost productivity for business travelers and increased costs of doing business for other sectors.

The FAA should address these identified issues, omissions, and concerns before finalizing the NEPA documentation. A4A further suggests that it should undertake a number of actions before proceeding with any licensing decision on the Proposed Action. This includes maturing the Space Data Integrator (SDI) and the Hazard Risk Assessment Management (HRAM) system or other technologies that improve existing procedures, the development of new procedures, and automated depictions of hazardous areas to improve the FAA's ability to more efficiently manage traffic in response to increases in commercial space activity as suggested by the Proposed Action.

A4A also recommends FAA move forward with programs to ensure safe commercial space integration with the NAS including the improvement of existing procedures; the development of new procedures to improve commercial space operations planning; the creation of air traffic control surveillance and tracking capabilities to include automated depictions of hazard areas and launch vehicles; improved and uniform hazard mitigation policies; and two-way communications. These tools will help the FAA achieve the sought-after integration of commercial space with the NAS while minimizing environmental impacts.

\* \* \*

Thank you in advance for your consideration of these comments on FAA's Draft EA. We would be pleased to provide any additional information or answer any questions FAA may have as it proceeds on this matter.

Sincerely,

Tim Pohle Vice President, Environmental Affairs

alur V Kille

Andy Cebula Vice President, NextGen and New Entrants

| 1  | FAA - COMMERCIAL SPACE TRANSPORTATION            |
|----|--|
| 2  | Public Meeting for the Draft Environmental       |
| 3  | Assessment for the Huntsville International      |
| 4  | Airport Reentry Site Operator License and Sierra |
| 5  | Space Corporation Vehicle Operator License,      |
| 6  | Madison County, Huntsville, Alabama              |
| 7  |  |
| 8  |  |
| 9  |  |
| 10 |  |
| 11 | Virtual Public Meeting                           |
| 12 | Thursday, December 9, 2021                       |
| 13 | 6:00 p.m.  |
| 14 |  |
| 15 |  |
| 16 |  |
| 17 |  |
| 18 |  |
| 19 |  |
| 20 | Job #42434                                       |
| 21 | Page 1 - 43                                      |
| 22 | Reported by Gary Euell                           |
|    |  |

# FAA - COMMERCIAL SPACE TRANSPORTATION

1 PANELISTS IN ATTENDANCE VIA ZOOM:

- 2 Amy Hanson
- 3 Butch Roberts
- 4 Christopher Allison
- 5 David Alberts
- 6 Emily Afifi
- 7 Emily Sisneros
- 8 Jennifer Fownes
- 9 Jennifer Piggott
- 10 Lee Jankowski
- 11 Lisa Bullard
- 12 Mary Swanstrom
- 13 Richard Tucker
- 14 Robert Greene
- 15 Ryan Gardner
- 16 Silvia Colla
- 17 Stacey Zee
- 18
- 19
- 20

22

- 21

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| 3  | Virtual Public Meeting | 4    |
| 4  | Comment Period         | 30   |
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1

PROCEEDINGS

MS. PIGGOTT: Good evening, ladies and 2 The time is 5 p.m. local time and we 3 gentlemen. will now start the Federal Aviation Administration 4 Office of Commercial Space Transportation or AST 5 Virtual Public Meeting for the Environmental 6 Assessment or EA for the Huntsville International 7 Airport Reentry Site Operator License and Sierra 8 Space Corporation Vehicle Operator License in 9 Huntsville, Alabama. Thank you everyone for 10 participating tonight. 11

My name is Jennifer Piggott, and I will 12 serve as your neutral facilitator this evening. 13 I'm with ICF, who is supporting the FAA as an 14 independent third party contractor. This virtual 15 public meeting is being recorded, transcribed, and 16 translated. I would like to call your attention 17 to the global icon at the bottom right of your 18 Zoom screen. If you click on this icon, you can 19 choose English or Spanish to ensure you are 20 listening to the meeting in your desired language. 21 Once you move to the Spanish room, we recommend 22

muting the original audio so you only hear the
meeting in your desired language. I will now
pause for our translator to come out of the
Spanish room into the English room to make this
announcement.

Thank you. If you need assistance with 6 Zoom during the meeting, you can use the chat 7 feature located at the bottom of your screen to 8 message the meeting host. We appreciate your 9 participation in this virtual public meeting. 10 We would much rather be with you in person, but with 11 the current conditions we want to provide all the 12 information we can while protecting everyone's 13 health. We're going to conduct this as closely as 14 possible to a typical in person public meeting. 15 Please make a note of the phone number for this 16 meeting. The phone number is 833-548-0276, 17 meeting ID 85032175874, password 8695227. If you 18 experience difficulty with your internet 19 connection at any point during this meeting, you 20 can call this number to listen to the meeting. 21 Additionally, individual internet connections and 22

bandwidth may impact your viewing experience this
evening. We recommend closing all apps and
programs and limiting other streaming or downloads
during this meeting.

5 Finally, we're running this meeting using 6 Zoom webinar, which mutes all participants and 7 restricts video feeds. Only the meeting host can 8 unmute you.

We will conduct the virtual public 9 meeting in two parts. First AST will provide a 10 presentation in English, which will be translated 11 simultaneously in the Spanish room. A copy of the 12 Spanish presentation can be found on the project 13 websites, and I will put that website right now 14 into the chat feed. So, a copy of that 15 presentation can be found on the project website 16 and that link is now in the chat feed. Then we 17 will conduct a facilitated comment session where 18 interested parties can provide oral comments for 19 the record. We will not host a question and 20 answer session during the meeting. Please submit 21 comments by the close of the comment period, which 22

|                            | ia Desembers 22 2021 We invite you to submit   |
|----------------------------|--|
| 1                          | is December 22, 2021. We invite you to submit  |
| 2                          | comments orally at tonight's meeting   |
| 3                          | electronically via the project E-mail address,   |
| 4                          | which is <u>Huntsvillereentry@ICF.com</u> . I will also  |
| 5                          | paste that in the chat feed so you have it, or you   |
| 6                          | can mail your comments to Miss Stacey Zee, HSV   |
| 7                          | Draft EA, care of ICF, 9300 Lee Highway, Fairfax,  |
| 8                          | Virginia 22031.  |
| 9                          | Additionally, tonight's presentation is  |
| 10                         | already available in both English and Spanish on   |
| 11                         | the project website. And again, that link is on  |
| 12                         | your screen and it's also in the chat feed.  |
| 13                         | I would now like to go over a few ground   |
|                            |  |
| 14                         | rules for tonight's meeting. Please remember this  |
| 14<br>15                   | rules for tonight's meeting. Please remember this meeting is being recorded, so please no  |
|                            |  |
| 15                         | meeting is being recorded, so please no  |
| 15<br>16                   | meeting is being recorded, so please no inappropriate language or comments. When we get  |
| 15<br>16<br>17             | meeting is being recorded, so please no<br>inappropriate language or comments. When we get<br>to the comment section of tonight's meeting, I   |
| 15<br>16<br>17<br>18       | meeting is being recorded, so please no<br>inappropriate language or comments. When we get<br>to the comment section of tonight's meeting, I<br>will call on pre-registered commenters first in  |
| 15<br>16<br>17<br>18<br>19 | meeting is being recorded, so please no<br>inappropriate language or comments. When we get<br>to the comment section of tonight's meeting, I<br>will call on pre-registered commenters first in<br>the order in which they registered, followed by |

| 1  | to provide an oral comment today, you may provide  |
|----|--|
| 2  | your comment electronically or in writing. All     |
| 3  | comments, regardless of how they are received, are |
| 4  | weighted equally. Again, we will make every        |
| 5  | effort to receive as many oral comments as         |
| 6  | possible during tonight's meeting.                 |
| 7  | We appreciate the chance to share the              |
| 8  | proposed project and environmental process with    |
| 9  | all of you. We wish we could be together in        |
| 10 | person but we're glad to come together virtually.  |
| 11 | Again, the purpose of this virtual public meeting  |
| 12 | is to share information about the Draft            |
| 13 | Environmental Assessment, provide information on   |
| 14 | how to provide comments, and to receive oral       |
| 15 | comments.  |
| 16 | I would now like to introduce Miss Stacey          |
| 17 | Zee with AST, and Stacey will introduce other FAA, |
| 18 | Sierra Space, and Huntsville team members with us  |
| 19 | this evening. Stacey.                              |
| 20 | MS. ZEE: Thank you, Jennifer. As                   |
| 21 | Jennifer noted, I'm Stacey Zee. I am the           |
| 22 | stakeholder engagement lead for the FAA office of  |
|    |  |

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| 1  | Commercial Space Transportation. Thanks all for    |
|----|--|
| 2  | participating tonight and we are very excited to   |
| 3  | share the information with you tonight. With us    |
| 4  | tonight from AST, we have Amy Hanson, Emily        |
| 5  | Sisneros and Emily Afifi. From Sierra Space, we    |
| 6  | have Christopher Allison. And then from            |
| 7  | Huntsville, we have Mary Swanstrom, Butch Roberts, |
| 8  | Lee Jankowski, Lisa Bullard, Dave Alberts, and     |
| 9  | Richard Tucker.                                    |
| 10 | Again, thank you for being with us this            |
| 11 | evening. And Jennifer, back to you.                |
| 12 | MS. PIGGOTT: Thanks, Stacey. Okay,                 |
| 13 | ladies and gentlemen, without further ado, we will |
| 14 | go ahead and transition into our presentation.     |
| 15 | The presentation this evening is about 20 to 25    |
| 16 | minutes long.                                      |
| 17 | Hi, my name is Stacy Zee, and I'm an               |
| 18 | environmental protection specialist and the        |
| 19 | stakeholder engagement lead with the FAA's office  |
| 20 | of Commercial Space Transportation. I, along with  |
| 21 | Emily Afifi, Emily Sisneros, and Amy Hanson, will  |
| 22 | explain the FAA's licensing process and the Draft  |

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| 1  | Environmental Assessment referred to as the draft  |
|----|--|
| 2  | EA for the Proposed Reentry Operations at the      |
| 3  | Huntsville International Airport in Madison        |
| 4  | County, Alabama. Huntsville International Airport  |
| 5  | and Sierra Space will also present materials.      |
| 6  | After the presentation, you will have the          |
| 7  | opportunity to provide oral comments on the        |
| 8  | potential environmental issues outlined in the     |
| 9  | Draft EA.  |
| 10 | Now I'm going to hand over the                     |
| 11 | presentation to Amy Hanson to describe why we are  |
| 12 | holding the public meeting today.                  |
| 13 | MS. HANSON: We are holding this public             |
| 14 | meeting because the Huntsville Madison County      |
| 15 | Airport Authority, or Authority, and Sierra Space  |
| 16 | Corporation or Sierra Space, are proposing to      |
| 17 | conduct Commercial Space Reentry Operations at     |
| 18 | Huntsville International Airport or HSV.           |
| 19 | Huntsville Madison County Airport                  |
| 20 | Authority is applying to the FAA for a Reentry     |
| 21 | Site Operator License and Sierra Space is applying |
| 22 | for a Vehicle Operator License to Reenter to the   |

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The National Environmental Policy Act or airport. 1 NEPA, requires the FAA to analyze the potential 2 environmental impacts of our proposed licensing 3 action. The FAA is the lead Federal Agency for 4 the EA. There are two cooperating agencies who 5 are included due to special expertise and or 6 jurisdictions. NASA has space launch special 7 expertise, and the US Coast Guard provides 8 maritime safety and security expertise during 9 launch operations. As part of the licensing 10 process, the FAA is analyzing the potential 11 environmental impacts under NEPA for this proposed 12 action and is collecting comments on the 13 The environmental process is only one Draft EA. 14 part of the licensing process. 15 Now, I'm going to hand over the 16 presentation to Emily Afifi to describe the FAA 17 licensing process for Reentry Site Operators and 18 Reentry Vehicle Operators. 19 This and the next slide show MS. AFIFI: 20

22 Operator License Application and a Vehicle

21

the FAA's process for reviewing a Reentry Site

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Operator License Application. The process can occur over a period of months or years, depending on the applicant's proposed operation and it begins with preapplication consultation.

Preapplication consultation is the part 5 of the process where the FAA starts coordination 6 with the applicant on the proposed operation. 7 Once the FAA has accepted a license application, 8 the formal evaluation period begins. During this 9 part of the process, the FAA conducts reviews on 10 safety, environmental, airspace, and waterway 11 integration, policy, and flight location aspects 12 of the application. The environmental review will 13 be discussed in more detail shortly. 14

Upon completion of the evaluation, if the 15 FAA makes a positive determination and grants an 16 authorization, the next part of the process is an 17 operational phase, which includes compliance 18 monitoring and safety inspection of the operator's 19 licensed activities. An authorization for a 20 Reentry Site Operator License is valid for five 21 years from the issuance date. A licensee can 22

renew the license by submitting an application to
 the FAA.

3 The authority's application for the 4 proposed operations at Huntsville International 5 Airport is currently in the evaluation phase of 6 the licensing process with the FAA.

The FAA's process for reviewing a Vehicle 7 Operator License Application is very similar to 8 the process for reviewing a Reentry Site Operator 9 License Application. There are a few additional 10 items required during the evaluation period for a 11 Vehicle Operator, including the payload review and 12 financial responsibility. An authorization for a 13 Vehicle Operator License is valid for the length 14 of time of the licensed activity but may not 15 exceed five years from the issuance date. А 16 licensee can renew the license by submitting an 17 application to the FAA. 18

Sierra Space's application for the
proposed operations at Huntsville International
Airport is currently in the preapplication phase
of the licensing process with FAA.

Now, I'm going to hand over the
 presentation to Amy Hanson to give the proposed
 project overview.

MS. HANSON: The Authority is proposing 4 to operate a Commercial Space Reentry Site at the 5 Huntsville International Airport. And Sierra 6 Space is proposing to conduct reentries using its 7 Dream Chaser vehicle at HSV. Sierra Space and the 8 Authority anticipate up to one reentry operation 9 at HSV per year in 2023, 2024, and 2025, up to two 10 reentries in 2026, and up to three reentries in 11 Reentry of the Dream Chaser would occur 12 2027. during the daytime or nighttime, depending on the 13 mission. 14

Now, I'm going to hand over the
presentation to Mary Swanstrom with Huntsville
International Airport Authority to describe their
proposed operations.

MS. SWANSTROM: Proposed reentry operations would occur at runway 18036R, circled in blue in the aerial image of HSV. As Reentry Vehicle Operations would be confined to this area,

the blue line also marks the proposed reentry site 1 boundary. During the reentry operation, both 2 runways could be closed for a temporary flight 3 restriction window of forty-five minutes. The 4 vehicle would remain on the runway for up to ten 5 hours while cargo and residual propellants are 6 removed. There is no construction proposed to 7 support the reentry operations and no permanent 8 storage or propellants on site. 9

Now, I'm going to hand over the 10 presentation to Christopher Allison of Sierra 11 Space to provide information on the Dream Chaser 12 vehicle, NASA Commercial Resupply Services 2 13 Program, reentry trajectories, and flight path. 14 MR. ALLISON: Sierra Space is 15 developing the Dream Chaser, a reusable reentry 16 vehicle capable of carrying payloads to and from 17 low earth orbit, including delivering supplies to 18 the International Space Station under the 19 Commercial Resupply Services to CRS2 contract with 20 the National Aeronautics and Space Administration 21 also known as NASA. The Dream Chaser is currently 22

the only runway landing commercial orbital space
vehicle in development. It will use nontoxic
propulsion for orbital translations, attitude
control, and deorbit. It is designed to launch in
a variety of launch vehicles and is on contract
for the NASA Cargo Supply Services to CRS2
Program.

The image shows Sierra Space's proposed 8 The Dream Chaser vehicle would be operations. 9 carried as a payload on a vertically launched 10 United Launch Alliance Vulcan rocket from Cape 11 Canaveral in Florida. Note, the launch will not 12 occur in Huntsville and will be licensed separate 13 from the action being proposed in this meeting. 14 Sierra Space proposes that the Dream Chaser 15 vehicle would deliver up to 5,500 kilograms of 16 pressurized and unpressurized cargo to the 17 International Space Station. Sierra Space would 18 dispose of materials from the International Space 19 Station over the broad open ocean via a cargo 20 module that will separate from Dream Chaser and 21 burn up safely in the Earth's atmosphere upon 22

reentry. Any surviving debris would be
intentionally placed in the remote part of the
Pacific Ocean. The Dream Chaser portion of the
system will return to a runway, where cargo and
other items returned will be offloaded.

Some key terms used when describing the 6 reentry of Dream Chaser are defined on this chart. 7 Reentries can either be considered on ascending or 8 descending trajectories as described in the image. 9 Ascending is when the relative motion of the 10 ground track projected by the orbiting vehicle is 11 moving in an upward direction relative to the 12 landing site. Descending is a downward motion 13 relative to the landing site. For the proposed 14 reentry to Huntsville, this action only considers 15 ascending trajectories. Further, the distance 16 between the ground track of the orbiting vehicle 17 and the landing site when perpendicular to the 18 landing site is referred to as cross range. Dream 19 Chaser has a greater than 1,000 nautical mile 20 cross range capability, meaning the vehicle does 21 not have to be perfectly aligned to cross over the 22

landing site to successfully perform a reentry and 1 This results in an increased number of landing. 2 reentry opportunities on a given mission. 3 The Dream Chaser vehicle's reentry trajectory from 4 orbit would be dependent on the specific mission 5 being flown and would be defined prior to reentry. 6 During the reentry sequence, Dream Chaser would 7 have set reentry windows or timeframes to begin 8 descent into the Earth's atmosphere to meet the 9 designated reentry trajectory. Assuming no-go 10 criteria are met, the Dream Chaser vehicle would 11 remain in orbit until the specific reentry 12 trajectory could be achieved or an alternate 13 trajectory is called upon. 14

The reentry vehicle would reenter from 15 the south on an ascending trajectory with high 16 atmospheric overflight of the southwestern US or 17 Central American countries before landing at 18 Huntsville. The two trajectories shown on this 19 chart show the bounding cross range trajectories 20 the Dream Chaser can fly to successfully land at 21 Huntsville. Additional trajectories could exist 22

between the two depicted here given mission
 specific parameters.

The reentry vehicle would remain above 3 60,000 feet altitude above mean sea level for the 4 majority of the overflight of Texas, Arkansas, 5 Louisiana, Mississippi, and Alabama. The reentry 6 vehicle would descend below 60,000 feet altitude 7 above mean sea level approximately 10 to 20 miles 8 from Huntsville prior to landing and would operate 9 below 60,000 feet above mean sea level for about 10 three to four minutes. 11

12 Now, I'm going to hand over the 13 presentation to Emily Sisneros to describe the 14 airspace closures process.

MS. SISNEROS: Airspace Closures. 15 Sierra Space will coordinate airspace closures for each 16 reentry operation with the FAA Air Traffic 17 Organization, the FAA Office of Airports, 18 Huntsville, any affected military organizations 19 including the United States Coast Guard and 20 impacted foreign air navigation service providers. 21 All notification and coordination procedures will 22

be outlined in letters of agreement. Operation 1 activities coordination by the same parties would 2 occur on a weekly and daily basis closer to the 3 reentry and landing at the airport. The FAA does 4 not anticipate altering the dimensions of the 5 airspace. The FAA would issue temporary flight 6 restrictions via a notice to air mission, also 7 referred to as a NOTAM for the reentry vehicles 8 operation and the controlled airspace or an 9 altitude reservation from the central altitude 10 reservation function, as described in Sierra 11 Space's letter of agreement with the FAA Air 12 Traffic Organization. 13

Airspace jurisdiction of the proposed 14 Dream Chaser flight path is controlled by both 15 Memphis and Atlanta Air Route Traffic Control 16 Centers. The extent of the airspace needed for 17 each reentry will depend on the trajectory and 18 associated aircraft hazard area, which will be 19 determined in the flight safety analysis. 20 Α nominal reentry to Huntsville is anticipated to 21 require a NOTAM lasting one hour. Aircraft would 22

be rerouted around the NOTAM airspace closure. 1 Aircraft traveling on existing routes and flight 2 paths that are used daily are often routinely 3 rerouted to account for weather and other 4 temporary restrictions. Also, not all proposed 5 reentry operations would affect the same aircraft 6 routes or the same airports, and rerouting 7 associated with the proposed reentry related 8 closures represents an extremely small fraction of 9 the total amount of rerouting that occurs from all 10 of the reasons in a given year. 11

This image shows the representative 12 aircraft Hazard Area generated for the plus or 13 minus 570 nautical mile cross range aircraft 14 hazard area and a potential NOTAM. Seasonal 15 considerations such as wind or operational 16 changes, such as changes in the payloads being 17 carried back from orbit, could further result in 18 slight alterations of the nominal deorbit 19 opportunity trajectory to the airport. 20 Now I'm going to hand over the 21 presentation to Amy Hanson to describe the sonic 22

1 boom for reentry operations.

| 2  | MS. HANSON: During reentry, the Dream              |
|----|--|
| 3  | Chaser vehicle would generate a sonic boom. This   |
| 4  | slide shows the area that would be potentially     |
| 5  | affected by the sonic boom with the blue line      |
| 6  | circling the area with Sonic Boom overpressure     |
| 7  | levels of one pound per square foot or PSF. The    |
| 8  | maximum peak sonic boom overpressure would be 1.25 |
| 9  | PSF, a magnitude similar to a clap of thunder.     |
| 10 | The study area defined by the sonic boom, as shown |
| 11 | in this slide, encompasses about 170 square miles  |
| 12 | and includes portions of Morgan and Coleman        |
| 13 | counties and the cities or towns of Hartsell,      |
| 14 | Falkville, and Somerville, Alabama. The red line   |
| 15 | in the upper right hand corner shows the reentry   |
| 16 | site boundary at Huntsville International Airport. |
| 17 | Now I'm going to hand over the                     |
| 18 | presentation to Mary Swanstrom with Huntsville     |
| 19 | International Airport Authority to describe runway |
| 20 | closures at the airport.                           |
| 21 | MS. SWANSTROM: A temporary flight                  |
| 22 | restriction issued by the FAA would temporarily    |

close both runways at HSV, runway 18L36R and 1 runway 18R36L to aircraft and vehicle ground 2 movements prior to landing. After Dream Chaser's 3 wheel stop, all traffic would be accommodated on 4 the airport's primary runway, runway 18R36L. 5 Runway 18L36R would remain unavailable for use by 6 other correct aircraft for landing and departures 7 until it is removed from the runway. This period 8 of time would vary given the operational 9 characteristics of each individual mission. While 10 Dream Chaser is on runway 18L36R and propellant-11 saving activities are occurring, aircraft and 12 vehicle movements would be restricted until the 13 vehicle is in a safe condition and removed from 14 15 the runway.

16 The Dream Chaser's licensed operation 17 would end when the vehicle is in a safe condition 18 as defined in Sierra Spaces Vehicle Operators 19 License. Runway 18L36R would be returned to 20 service at R plus eight hours. Airport operations 21 would conduct inspections for each runway to 22 ensure they are safe for the resumption of

traffic, including verifying that the runways are 1 free from foreign objects and debris or damage. 2 Now I'm going to hand over the 3 presentation to Amy Hanson to describe the 4 environmental impacts analyzed in in the 5 Environmental Assessment Process. 6 This slide lists the MS. HANSON: 7 environmental impact categories that are analyzed 8 in detail in the Draft EA. The following slides 9 present a high-level summary of some of the impact 10 Please refer to the Draft EA for a categories. 11 full discussion of environmental consequences 12 determinations. 13 Noise impacts include increased sound 14 levels from reentry operations in the form of 15 sonic booms. Predicted overpressure levels for 16 reentry remodeled to be 1.25 pounds per square 17 foot, or PSF. The study area for potential 18 impacts to environmental resources was defined as 19 the area experiencing 1 PSF or greater sonic boom 20 overpressures. Overpressure from each sonic boom 21 resulting from proposed Dream Chaser reentry 22

operations would be similar to the overpressure 1 from a clap of thunder. Data from the National 2 Oceanic and Atmospheric Administration or NOAA 3 show their residents in Morgan County experience 4 on average, about 8,000 thunder events caused by 5 lightning. So, the sonic booms would not be 6 unusual noise levels. Cumulative noise in the 7 surrounding communities from one to three reentry 8 operations annually is estimated to be below 9 levels associated with adverse noise exposure in 10 the FAA regulations. 11

The proposed action would not include 12 construction, and therefore no ground disturbing 13 activities that could impact biological resources 14 would occur. Sonic Booms resulting from proposed 15 reentry have the potential to affect species. 16 There are a number of federally and/or state 17 listed threatened and endangered species within 18 the sonic boom study area. But no critical 19 habitat is designated for wildlife species in the 20 study area. Animals generally do not experience 21 lasting adverse effects to sonic booms with low 22

overpressures such as would occur as a result from 1 the proposed reentry operations. While there is 2 the potential for reentry operations to result in 3 wildlife strikes, the very small number of 4 proposed reentry operations per year would not 5 significantly increase the chance of a wildlife 6 strike at HSV. As a result, the FAA has 7 determined the proposed action may affect, but 8 would not significantly affect, species listed 9 under and critical habitat designated under the 10 Federal Endangered Species Act. The FAA is 11 consulting with the US Fish and Wildlife Service 12 on this finding. 13

There is the potential for the sonic 14 booms produced during reentry to alter the visual 15 or audible characteristics or settings of historic 16 properties. However, given the low number and low 17 overpressure levels of the sonic booms, reentry 18 operations are not anticipated to alter the 19 characteristics of the historic properties found 20 in the sonic boom study area. Sonic Booms also 21 have the potential to cause structural damage to 22

historic properties but generally at higher 1 overpressure levels, 2 PSF and above, than those 2 that would result from the proposed reentry 3 operations. Therefore, the proposed action is not 4 expected to have adverse effects on historic 5 properties. The FAA has made a finding of no 6 adverse effect for historic properties and is 7 currently conducting National Historic 8 Preservation Act, Section 106 consultation with 9 the State Historic Preservation Officer and other 10 consulting parties. The FAA is also conducting 11 government to government and Section 106 12 consultation with Native American tribes. 13 Section 4(f) of the US DOT Act of 1966 14 protects significant publicly owned parks, 15 recreational areas, wildlife and waterfowl 16 refuges, and public and private historic sites. 17 Section 4(f) provides that the Secretary of 18 Transportation may not approve a transportation 19 program or project requiring the use of publicly 20 owned land of a public park, recreation area, or 21 wildlife or waterfowl refuge of national, state, 22

or local significance, or land of a historic site 1 of national, state, or local significance unless 2 there is no feasible and prudent alternative to 3 the use of that land and the program or project 4 includes all possible planning to minimize harm 5 resulting from the use. Properties potentially 6 eligible for protection under Section 4(f) in the 7 sonic boom study area include the Tennessee Valley 8 Authority Wheeler Reservoir, the Wheeler National 9 Wildlife Refuge, and the federally listed historic 10 properties discussed on the previous slide. 11

Reentry operations would not result in a 12 permanent incorporation or physical use of any 13 Section 4(f) property. There is the potential for 14 noise impacts of sonic booms to result in the 15 constructive use of Section 4(f) properties in the 16 study area, but only if a property's intended use 17 or attributes are significantly impaired. While 18 some properties in the sonic boom study area could 19 be sensitive to new sources of noise, the low 20 frequency and magnitude of the sonic booms would 21 not significantly impair those resources. 22 As a

| 1                    | result, the FAA has made a preliminary   |
|----------------------|--|
| 2                    | determination that the proposed action would not   |
| 3                    | result in a constructive use of Section 4(f)   |
| 4                    | properties and is currently consulting with the  |
| 5                    | Tennessee Valley Authority, US Fish and Wildlife   |
| 6                    | Service, and the Alabama State Historic  |
| 7                    | Preservation Officer.  |
| 8                    | Now I'm going to hand over the   |
| 9                    | presentation to Stacey Zee to provide information  |
| 10                   | on the EA and Stakeholder Engagement Schedule and  |
| 11                   | comments on the Draft EA.  |
| 12                   | MS. ZEE: This slide outlines the EA  |
| 13                   | schedule and how you can remain involved in the  |
| 14                   | NEPA process. The FAA carried out coordination   |
| 15                   |  |
|                      | with state and federal agencies throughout   |
| 16                   | with state and federal agencies throughout preparation of the Draft EA. The FAA also   |
|                      |  |
| 16                   | preparation of the Draft EA. The FAA also  |
| 16<br>17             | preparation of the Draft EA. The FAA also<br>initiated agency consultation with federal and  |
| 16<br>17<br>18       | preparation of the Draft EA. The FAA also<br>initiated agency consultation with federal and<br>state resource agencies, such as the US Fish and  |
| 16<br>17<br>18<br>19 | preparation of the Draft EA. The FAA also<br>initiated agency consultation with federal and<br>state resource agencies, such as the US Fish and<br>Wildlife Service and Alabama State Historic |

1 12th with a forty-day comment period. Today is
 2 the Draft EA public meeting, and the comment
 3 period closes on December 22nd.

The next step is for the FAA to publish 4 the final EA, which will incorporate public 5 comments received on the Draft EA. It will also 6 include a finding on the proposed action, either a 7 finding of no significant impact, a mitigated 8 finding of no significant impact, or a notice of 9 intent to prepare an environmental impact 10 Comments on the Draft EA can be statement. 11 submitted either by E-mail or mail to the 12 addresses on the slide. We ask the comments be 13 submitted by Wednesday, December 22nd to ensure 14 that they are considered in the development of the 15 final EA. Before including personal identifying 16 information in your comment, be advised that your 17 entire comment may be made publicly available at 18 any time. While you can ask us in your comment to 19 withhold from public review your personal 20 identifying information, we cannot guarantee that 21 we will be able to do so. 22

The Draft EAA is available on the FAA's 1 website at the link provided on the slide. The 2 FAA's website also includes a place to sign up for 3 the project mailing list. Members of that mailing 4 list will receive project updates, including 5 notification of the FAA publishing the final EA 6 and the FAA's finding. The remaining portion of 7 tonight's meeting is reserved for providing oral 8 comments. Jennifer will explain the process. 9 Okay. Thank you for that 10 MS. PIGGOTT: presentation and information. 11 We've now reached the second part of the 12 virtual public meeting, a facilitated comment 13 If you would like to make an oral session. 14 comment, please send a chat message to the meeting 15 host or raise your hand using the hand raise icon 16 if you're on Zoom or for call-in only users, press 17 \*9 to raise your hand and I will add you to the 18

commentor list. I will call on you in the order
in which you raise your hand with preregistered
speakers being called on first. I will now paste
the names of the first three speakers in the chat

1 box.

Please raise your hand to indicate you're 2 ready to make your comment if your name has been 3 placed in the chat box. The first three speakers 4 are Liz Hurley, Ben Harrison, and Paul Mamakos. Ι 5 apologize if I mispronounce anyone's name this 6 evening. Each commoner will have three minutes to 7 make their comments. At the start of your 8 comments, please state your full name for the 9 Again, we are not hosting a question and record. 10 answer session this evening. 11 Again, our first speaker is Liz Hurley, 12 and I am not seeing Liz on the Zoom feed this 13 evening. Liz, if you're a call-in only user, 14 please press \*9 to raise your hand. 15 Our next speaker -- okay. I see your 16 note. He has just let me know that they will not 17 be providing a comment tonight. Our third speaker 18 is Paul Mamakos. Paul, I'm also not seeing you on 19 the Zoom feed this evening. If you're a call-in 20 only user, please press \*9 to raise your hand. 21 Okay with that, I'll post the names of 22

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| 1  | our next three speakers in the chat feed, which   |
|----|---|
| 2  | are Mark Spencer, Raymond Wesley, and Rob Martin. |
| 3  | If you would please raise your hand to indicate   |
| 4  | that you're ready to provide your comments. Mark  |
| 5  | Spencer, Raymond Wesley, and Rob Martin. Mark, I  |
| 6  | see your hand is raised. I'm going to ask you to  |
| 7  | unmute.   |
| 8  | MR. SPENCER: My name is Mark Spencer.             |
| 9  | I'm the founder of Evolution.                     |
| 10 | MS. PIGGOTT: So, Mark, can you hear me?           |
| 11 | I'm going to pause you there. If you could turn   |
| 12 | maybe your volume down a little bit. We're        |
| 13 | getting a lot of echo.                            |
| 14 | MR. SPENCER: Okay, is that better?                |
| 15 | MS. PIGGOTT: Yeah, much better. Go                |
| 16 | ahead. You have three minutes.                    |
| 17 | MR. SPENCER: Okay. My name is Mark                |
| 18 | Spencer. I'm the founder of Evolution, an         |
| 19 | avionics technology company based at the          |
| 20 | Huntsville International Airport. I use the       |
| 21 | airport both in operating my own aircraft as well |
| 22 | as flying commercially. I live in Madison, about  |
|    |   |

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| 1  | a 15 minute drive from the airport. My comments    |
|----|--|
| 2  | represent my own views and not necessarily those   |
| 3  | of any company. I wish to speak today in support   |
| 4  | of the effort to support landing of space vehicles |
| 5  | and specifically in support of providing           |
| 6  | Huntsville International Airport a Reentry Site    |
| 7  | Operator License and Sierra Space Corporation a    |
| 8  | Vehicle Operator License in order to allow the     |
| 9  | Dream Chaser Dream Chaser to land at HSV.          |
| 10 | The Huntsville community, of course, has           |
| 11 | a long history of supporting advanced spaceflight  |
| 12 | and other aerospace technologies and is fortunate  |
| 13 | to have an airport with two long runways and       |
| 14 | advanced safety resources, including crash fire    |
| 15 | response, and all that within a vast physical      |
| 16 | airfield area. I believe that the unique traits    |
| 17 | of the Huntsville Airport, which include a balance |
| 18 | of fantastic airfield resources, a level of        |
| 19 | traffic that can accommodate the expected          |
| 20 | disruption of having a spacecraft landing, plus a  |
| 21 | population that is disproportionately supportive   |
| 22 | of space endeavors and tolerant of the occasional  |

loud noise compared to other cities, makes it
 especially well-suited to this venture.

With all the support, however, I do 3 request that the FAA use caution when issuing 4 limitations for both Huntsville International 5 Airport and Sierra Space Corporation's respective 6 operator licenses to ensure their operations are 7 only permitted when taxiways Foxtrot and Juliet 8 and both runways are fully operational at HSV. 9 The landing of a spacecraft will shut down a 10 runway for an extended period of time, even in the 11 case of a nominal landing, and potentially can 12 shut it down for much longer in the case of an off 13 nominal landing. And then also some historical 14 NOTAM data shows that the Huntsville International 15 Airport has only had both its runways operational 16 for less than half the days of the last 12 years. 17 Permitting the airport to land the spacecraft when 18 only one runway is operational is likely to change 19 the balance of impact for the airport's other 20 users, including commercial passengers, air 21 ambulance flights, and military and general 22

aviation aircraft and should not be permitted 1 under the operator licenses. 2 Thank you for the opportunity to provide 3 comments and I look forward to the opportunity to 4 see Dream Chaser land at Huntsville. 5 Thank you for your MS. PIGGOTT: 6 comments. Okay, our next speaker is Rob Martin. 7 If you're ready to make your comments, please 8 raise your hand. 9 Okay, with that I'll post the names of 10 our final two preregistered speakers in the chat 11 Our final two speakers -- hold on one 12 feed. Rob, I see your hand is raised. I'm 13 second. going to ask you to unmute. 14 15 MR. MARTIN: Can you hear me okay? MS. PIGGOTT: Yes, go ahead. You have 16 three minutes. 17 MR. MARTIN: Very well. I'm Rob Martin. 18 I'm a retired aerospace engineer living in Muscle 19 Shoals, Alabama, have used Huntsville 20 International Airport many times, and it's a 21 terrific facility, and we love going in and out of 22

the airport on trips or whatever. My concern, not 1 really a concern, but just a question about the 2 propellants that are going to be used on Dream 3 Chaser. Normally those propellants on orbit are 4 highly toxic and need lots of unstowing and safety 5 procedures to safely unload those propellants once 6 the spacecraft has landed. And I noticed in the 7 beginning of the briefing that no facilities are 8 planned to be built, nor is there any safety on 9 offloads of any of these propellants, it's 10 supposedly nontoxic. I was just a little 11 surprised at that and wondered what type of 12 propellant they're going to be using and also if 13 they're bringing spacecraft back from orbit, 14 ensuring that those propellants are nontoxic as 15 well. So that concludes my comments. 16 MS. PIGGOTT: Thank you for your 17 comments. 18 Okay, our next two speakers I posted in 19 the chat feed Melba Ochoa and Caroline Klapp. Ιf 20 you would please raise your hand or if you're a 21 call-in only user, press \*9 to raise your hand so 22

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| 1  | I can ask you unmute and you can provide your      |
|----|--|
| 2  | comment. Melba Ochoa and Caroline Klapp. Okay, I   |
| 3  | see your note in the chat feed, that you will not  |
| 4  | be providing a comment this evening.               |
| 5  | Okay, ladies and gentlemen, those are all          |
| 6  | of the folks that preregistered to provide an oral |
| 7  | comment this evening. So, I'll now open the floor  |
| 8  | to anyone who is in attendance tonight who would   |
| 9  | like to provide an oral comment. Again, you can    |
| 10 | raise your hand or you can if you're a call-in     |
| 11 | only user, you can press *9 to raise your hand and |
| 12 | I'll ask you to unmute. Would anyone like to       |
| 13 | provide an oral comment this evening? Okay.        |
| 14 | Robert Kendall, I see your hand is raised. I'm     |
| 15 | going to ask you to unmute.                        |
| 16 | MR. KENDALL: Hi. Good evening. My name             |
| 17 | is Robert Kendall. I'm currently a resident in     |
| 18 | the Huntsville area. I live right next to the      |
| 19 | airport. I would like to give my comments not to   |
| 20 | support the approval of this license. The          |

22 lack of conversation, out of control. There does

21

Huntsville area is growing. The housing is, for

not seem to be any stopping it. The housing is
going to surround this airport over time and is
going to open up opportunities for more damage
from not only the sonic booms, but from our
current air flights to the elderly and our retired
military.

7 The second point is our wildlife. 8 Wildlife studies do not accurately test for proper 9 side effects to sonic booms. But the toxic 10 propellants are an obvious problem. If anything 11 were to go wrong with this vehicle in reentry, 12 it's breaking up or landing in any area would 13 cause irreparable damage to the wildlife.

My third comment is on sonic boom damage. 14 Studies have been conducted on sonic booms, and 15 the damage that they found has limited the use of 16 such aircraft such as the France Airways aircraft, 17 and now the new aircrafts that are being created 18 are being limited to specific cities and runways 19 where their damage can be minimized. Currently, 20 General Electric is working on aircraft that has a 21 lower sonic boom and its sole reason for design is 22

because of the known damage that sonic booms can
 cause.

Lastly, in Huntsville we -- we build 3 rockets. We have a NASA engineering type of 4 community, and we love what we do. But we do not 5 launch the rockets from here, nor do we land them 6 There's reasons for that. There's reasons here. 7 why we do this in Texas and in Florida, and most 8 aircraft used to land in the ocean. I implore the 9 employees of the FAA and the companies to look at 10 the many numerous remote areas that are available 11 throughout the United States and its surrounding 12 territories. There's other places that this can 13 be done that are safer to humans, our structure, 14 our wildlife, and our peace of mind. Thank you. 15 That ends my comments. 16

MS. PIGGOTT: Thank you for your
comments.
Again, ladies and gentlemen, we have
plenty of time. So, if you'd like to provide an

21 oral comment this evening, please raise your hand 22 by using the raise hand feature in Zoom if you've

not already provided an oral comment and would 1 like to provide one tonight. For our call-in only 2 users, please press \*9 if you'd like to provide an 3 oral comment. Would anyone else like to make an 4 oral comment this evening? Again, just use the 5 raise hand feature or you can send a message to me 6 using the chat letting me know that you want to be 7 unmuted, or if you're a call-in only user, you can 8 press \*9. 9

Okay folks, seeing none, thank you for participating in this virtual public meeting. All comments, whether submitted orally, electronically, or in writing through the US Mail will receive equal consideration. Please submit your comments electronically via the project email

at <u>huntsvillereentry@icf.com</u> or you can mail
comments to Miss Stacy Zee, HSV Draft EA, care of
ICF, 9300 Lee Highway, Fairfax, Virginia 22031.
I'll put that E-mail address again in the chat

20 feed for everybody so that you have it. Before

21 including your address, phone number, E-mail

22 address, or other personal identifying information

| 1  | in your comment, please be advised that your       |
|----|--|
| 2  | entire comment, including your personal            |
| 3  | identifying information, may be publicly available |
| 4  | at any time. To ensure the FAA has sufficient      |
| 5  | time to consider public input, comments must be    |
| 6  | submitted by December 22, 2021.                    |
| 7  | Again, ladies and gentlemen, thank you             |
| 8  | for your interest and your participation this      |
| 9  | evening. This meeting is adjourned.                |
| 10 | [Whereupon the virtual public meeting was          |
| 11 | concluded.]  |
| 12 | [Off the record at 6:45 p.m.]                      |
| 13 |  |
| 14 |  |
| 15 |  |
| 16 |  |
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| 1  |  |
|----|--|
| 2  | CERTIFICATE OF REPORTER                            |
| 3  |  |
| 4  | I, GARY EUELL, do hereby certify that the          |
| 5  | foregoing proceeding was attended by me and        |
| 6  | thereafter transcribed from my digital audio       |
| 7  | recording of the proceeding and thereafter was     |
| 8  | reduced to typewriting by me.                      |
| 9  |  |
| 10 | I further certify that I am not related to any     |
| 11 | of the parties in this matter, and this transcript |
| 12 | is a true and accurate record of said audio        |
| 13 | recording to the best of my ability. The above     |
| 14 | information has been transcribed by me with a      |
| 15 | pledge of confidence, and I do hereby certify that |
| 16 | I will not discuss or release the content, or any  |
| 17 | information contained herein.                      |
| 18 |  |
| 19 |  |
| 20 | Gary Cuell   |
| 21 | GARY EUELL, Court Reporter                         |
| 22 |  |

Olender Reporting, Inc. (866) 420-4020 | schedule@olenderreporting.com APPENDIX E-2: SUMMARY OF COMMENTS RECEIVED ON THE DRAFT EA AND FAA RESPONSES

# **E.1 Introduction**

This appendix includes a summary of comments received on the FAA's December 2021 Draft Environmental Assessment for Huntsville International Airport Reentry Site Operator License, Huntsville Reentry Site (Draft EA) and the FAA's responses to those comments. The Draft EA was released on November 12, 2021, for public review and comment through 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 an advertisement in the Huntsville Times. The FAA also held a virtual public meeting on December 9, 2021.

In total, 40 commenters, including one trade association and 39 private individuals, provided comments on the Draft EA (see **Table 1**).

| #  | Name              | Individual or Organization | General Topic Provided    |
|----|-------------------|----------------------------|---------------------------|
| 01 | Mark Becnel       | Individual                 | General Support           |
| 02 | James Dimmock     | Individual                 | Roads Level of Service;   |
|    |                   |                            | Infrastructure            |
| 03 | Rocket Cello      | Individual                 | General Support           |
| 04 | Patrick Dougherty | Individual                 | General Support           |
| 05 | Supha Dumeen      | Individual                 | No comment/Not Applicable |
| 06 | F. Foulks         | Individual                 | Spacecraft Design         |
| 07 | Steven Goyette    | Individual                 | General Support           |
| 08 | Stefan Kratky     | Individual                 | General Support           |
| 09 | Dale Larsson      | Individual                 | General Support           |
| 10 | Matthew Ward      | Individual                 | General Support           |
| 11 | Gisela Fletcher   | Individual                 | General Support           |
| 12 | Peter Grove       | Individual                 | General Support           |
| 13 | Raymond Kamus     | Individual                 | General Support           |
| 14 | Ron Sisulak       | Individual                 | General Support           |
| 15 | Katherine Ambrose | Individual                 | General Support           |
| 16 | Tom Cash          | Individual                 | General Support           |
| 17 | Linda Clark       | Individual                 | No comment/Not Applicable |
| 18 | Daniel Saturn     | Individual                 | General Support           |
| 19 | Mark Spencer      | Individual                 | Runway Usage              |
| 20 | Mark F.           | Individual                 | More Comprehensive Study  |
| 21 | Pablo Silva       | Individual                 | General Support           |
| 22 | [Unknown] Klinker | Individual                 | General Support           |
| 23 | Ben Pearson       | Individual                 | General Support           |
| 24 | Jorge Castillo    | Individual                 | Economic Impact           |
| 25 | Jim Keith         | Individual                 | General Support           |
| 26 | Michael Moore     | Individual                 | General Support           |

## TABLE 1: LIST OF COMMENTORS

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

| #  | Name                 | Individual or Organization | General Topic Provided    |
|----|----------------------|----------------------------|---------------------------|
| 27 | Gina [Unknown]       | Individual                 | Various Topics            |
| 28 | Roger Cloud          | Individual                 | General Support           |
| 29 | Redacted per request | Individual                 | General Support           |
| 30 | Austin Nichols       | Individual                 | General Support           |
| 31 | Veronica Bradley     | Organization, Airlines for | Various Topics            |
|    |                      | America                    |                           |
| 32 | Liz Hurley           | Individual                 | No comment/Not Applicable |
| 33 | Ben Harrison         | Individual                 | No comment/Not Applicable |
| 34 | Paul Mamakos         | Individual                 | No comment/Not Applicable |
| 35 | Mark Spencer         | Individual                 | General Support           |
| 36 | Raymond Wesley       | Individual                 | No comment/Not Applicable |
| 37 | Rob Martin           | Individual                 | Hazardous Materials       |
| 38 | Melba Ochoa          | Individual                 | No comment/Not Applicable |
| 39 | Caroline Klapp       | Individual                 | No comment/Not Applicable |
| 40 | Robert Kendall       | Individual                 | Various Topics            |

# **E.2 General Comments**

The following are commentors who provided general comments regarding the EA. The FAA reviewed and considered each comment and provided a response(s).

**Commentors:** 01\_Mark Becnel, 03\_Rocket Cello, 04\_Patrick Dougherty, 07\_Steven Goyette, 08\_Stefan Kratky, 09\_Dale Larsson, 10\_Matthew Ward, 11\_Gisela Fletcher, 12\_Peter Grove, 13\_Raymond Kamus, 14\_Ron Sisulak, 15\_Katherine Ambrose, 16\_Tom Cash, 18\_Daniel Saturn, 22\_Unknown Klinker, 23\_Ben Pearson, 25\_Jim Keith, 26\_Michael Moore, 28\_Roger Cloud, 29\_Redacted per request, 30\_Austin Nichols.

**Comment Summary:** Commenters expressed general support regarding approval of the proposed reentry site operator license at Huntsville International Airport.

FAA Response: Comment noted.

**Commentors**: 05\_Supha Dumeen, 17\_Linda Clark, 32\_Liz Hurley, 33\_Ben Harrison, 34\_Paul Mamakos, 36\_Raymond Wesley, 38\_Melba Ochoa, 39\_Caroline Klapp

**Comment Summary:** No comment(s) provided, or comments were not applicable to the EA.

FAA Response: Comment noted.

# **E.3 Specific Comments**

The following are specific comments submitted regarding the Draft EA. The FAA reviewed and considered each comment and has provided responses.

### 02 - James Dimmock (Individual - Email)

**Comment:** Access to and from the airport, namely roads and bridges must be able to accommodate the extra burden traffic. I am sure will happen once the system is up and running. Runway infrastructure is prime concern, and we must make certain that both landing and routes for liftoff meet every standard set forth by governing bodies and other conducting agencies.

**FAA Response:** Section 3.2.6.2 of the EA discusses the potential impacts on transportation from the Proposed Action, which could see an increase to local traffic from potential spectators, up to 40 new employees, and one to three semi-trailer trucks used to transport the Dream Chaser and related ground transportation equipment. Given the small number of proposed launches per year (up to one reentry annually in 2023, 2024, and 2025; two reentries in 2026; and up to three reentries in 2027), the EA concludes that there would not be a significant impact to the service level of local roads.

The following text was added to footnote 11 to address the commenter's concerns regarding runway infrastructure: "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"

#### 06- F. Foulks (Individual - Email)

**Comment:** Why does the dream chaser not have landing gear wheels on the front instead of a skid? Seems to me this would alleviate closing HSV's Primary for up to an hour. My suggestion is to replace the skid with front landing gear wheels so that it will allow for quick recovery and allow for consistent runway operations.

**FAA Response:** Airspace and runway closures around HSV were determined based on the needed landing and post-flight handling procedures for the Dream Chaser vehicle as designed by Sierra Nevada and described in their license application, see Section 2.1.3.5 of the EA. Landing gear would not have an impact on runway closures for Dream Chaser vehicle landing operations.

#### 19 - Mark Spencer (Individual - Email)

**Comment**: Huntsville should only be permitted to land the craft when both runways are expected to be available for use.

**FAA Response**: Section 2.1.3.5 of the EA describes the landing and post-flight handling procedures, including runway closures and inspections. All efforts will be made by HSV, Sierra Space, and the FAA to pre-coordinate re-entries and runway use at HSV to minimize 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.

#### 20 - Mark F (Individual - Email)

**Comment**: A more comprehensive environmental study needs to be done because the potential impact upon the proposed the landing zone area.

**FAA Response**: The EA was prepared in compliance with 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), FAA Order 1050.1F, Environmental Impacts: Policies and Procedures, and FAA Order 5050.4B, NEPA Implementing Instructions for Airport Actions.

No construction would occur at HSV related to the Proposed Action. Impacts are considered in Chapter 3 of the EA for all environmental resource categories as required in FAA Order 1050.1F and FAA Order 5050.4B. After consideration of the FAA's significance thresholds for each respective environmental resource category, no significant adverse impacts are anticipated as a result of the Proposed Action.

In addition, 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.

### 21 – Pablo Silva (Individual - Email)

**Comment**: Hola soy will-sun-kin@hotmail.com y estoy muy interesado en tener en cuenta esta recomendacion y asi mismo solicitar el estudio de este tipo de aeropuertos para suramérica y latinoamérica ya q es muy importante para el desarrollo sociológico y dinámico del planeta y de sus habitantes y sus implicaciones y directrices... En el medio ambiente... Gracias.... phablo7775weellstree@hotmail.com... Espero tengan en cuenta este texto para el borrador del documento público que se plasmara... finalmente apartir del 9 de diciembre y hasta el 22 de diciembre del 2021 ok un abrazo a los chiiipK@S\$... que están en esta tarea tan espectacular para todas las generaciones... De este y de otros planetas... will.sun.li@gmail.com....wilsun3@hotmail.com....

**English Translation of Comment**: Hello, I am will-sun-kin@gmail.com and I am very interested in considering this recommendation and request the study of this type of airports for South America and Latin America since it is very important for the sociological and dynamic development of the planet and of its inhabitants and its implications and guidelines ... On the environment ... Thank you... phablo7775weellstree@hotmail.com....I hope you take this text into account for the draft of the public document that will be finalized as of December 9<sup>th</sup> through December 22, 2021. Sending hugs to those involved in this spectacular task for all generations from this one and of other planets... will.sun.li@gmail.com....wilsun3@hotmail.com....

**FAA Response**: The Authority is seeking a FAA Reentry Site Operator License (RSOL) to operate a commercial reentry site only at the Huntsville International Airport. Under the RSOL, the Authority could offer the Airport 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 at the Airport. Other airports within the US would be required to apply to the FAA for a commercial space site operator license before offering their facility to commercial space vehicle operators, who would also need to apply to the FAA for a vehicle operator license to conduct operations at the relevant location. The FAA only regulates commercial space operations and sites that are U.S. incorporated or operated in U.S. Territory.

**Spanish Translation of FAA Response**: La Autoridad está en busqueda de una Licencia de Operador de Sitio de Reingreso (RSOL) de la FAA para operar un sitio de reingreso comercial solo en el Aeropuerto Internacional de Huntsville. Bajo un RSOL, la Autoridad podría ofrecer el Aeropuerto a Sierra Space Corporation para la operación del vehículo de reingreso Dream Chaser. Al mismo tiempo, Sierra Space está solicitando a la FAA una licencia de operador de vehículos (VOL) para aterrizar el Dream Chaser en el aeropuerto. Otros aeropuertos dentro de los Estados Unidos (EE. UU tendrían que solicitar a la FAA una licencia de operador de sitio espacial comercial antes de ofrecer sus instalaciones a los operadores de vehículos espaciales comerciales, quienes también tendrían que solicitar a la FAA una licencia de operador de setaciones en el aeropuerto correspondiente. La FAA solo regula operaciones espaciales comerciales y sitios que están incorporados en los EE. UU. u operados en el territorio de los EE. UU.

#### 24 – Jorge Castillo (Individual - Email)

**Comment**: Has the airport authority or Sierra or any of the applicants submitted a summary of the economic impact or any other benefit that this can bring to the area?

**FAA Response**: As described in Section 3.2.6 of the EA, Sierra Space would employ 10 to 40 people, in a mix of both full- and part-time positions, for post-reentry procedures. 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. 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 region.

#### 27 – Gina [last name unknown] (Individual - Email)

**Comment**: I/we are NOT in support of this project for this area. We are already having way too much fast growth and not enough infrastructure or living accommodations to support it! The awful noise that this would bring, the danger to area residents, unwanted pharmaceutical and other businesses, and endangering native animals. Take your future dreams elsewhere, please.

**FAA Response**: As described in Section 3.6.2 of the EA, Sierra Space would employ 10 to 40 people, in a mix of both full- and part-time positions, for post-reentry procedures. 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.

No construction would occur at HSV related to the Proposed Action. The EA considers potential impacts from the sonic boom that would be produced by Dream Chaser reentry operations. As described in Section 3.2.1, the frequency and magnitude of sonic booms resulting from the Proposed Action would not exceed the FAA's significance thresholds for noise and noise-compatible land use. Therefore, the reentry vehicle operations would not pose a significant impact with regards to human annoyance or any disproportionate impact to environmental justice communities. In addition, the potential for hearing damage from sonic booms is negligible because the modeled sonic boom overpressure levels over land are substantially lower than the National Institute for Occupational Safety & Health (NIOSH) and Occupational Safety and Health Administration (OSHA) ~4 psf impulsive hearing conservation noise criterion.

Section 3.2.2 of the EA describes the potential impact of sonic booms on wildlife. The U.S. Fish and Wildlife Service agreed with the FAA's determination that the proposed reentry operations "may affect but would not significantly affect" threatened or endangered species in the study area.

## 31 - Veronica Bradley (Airlines for America - Letter)

**Comment 1**: The Draft EA is deficient because it does not properly assess the integration of the proposed and potential reentries in the existing National Airspace System (NAS). This assessment should be a condition precedent to proceeding with and necessary to properly conducting the EA.

**FAA Response**: The EA was prepared in compliance with 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), FAA Order 1050.1F, Environmental Impacts: Policies and Procedures, and FAA Order 5050.4B, NEPA Implementing Instructions for Airport Actions.

Chapter 3 of the EA considers the impact of airspace closures associated with Dream Chaser reentry operations, which could result in temporary re-routing of enroute flights on established alternate flight paths through the issuance of Notice to Air Missions (NOTAMs) (for more information, see Section 2.1.3.3, Reentry Vehicle Flight Paths). Impacts of airspace closures are evaluated in detail for Noise and Noise Compatible Land Use (Section 3.2.1) and summarized for the following resource categories that were not analyzed in detail: Air Quality, Climate, and Natural Resources and Energy Supply. Given the small number of proposed reentry operations (no more than 3 per year during the maximum frequency), and the duration of NOTAMs (a maximum of two hours per reentry from two separate 1-hour NOTAMs), if a back-to-back deorbit attempt is needed), impacts to all environmental resource categories are anticipated to be minor.

**Comment 2**: While the Draft EA purports to account for the emissions impacts of the Proposed Action, it does not adequately assess the attendant environmental impacts or consequences from the need to hold and re-route aircraft around the restricted airspace during reentry operations.

FAA has not included an assessment of the clear environmental impacts that would come from having to hold and re-route aircraft during the time of the temporary flight restrictions issued through the NOTAMs: Holding aircraft at HSV will result in aircraft circling nearby airports and grounded aircraft enduring tarmac delays, each of which would increase emissions. Moreover, re-routing aircraft will result in longer flight paths that will increase emissions. These impacts could have significant environmental consequences, particularly given the list of potentially impacted airports, including Hartsfield-Jackson Atlanta International Airport (ATL)—the busiest—and Nashville International Airport (BNA)—the 27th busiest—airports in the country.

**FAA Response**: Analysis in the EA was conducted in accordance with FAA Order 1050.1F, which outlines criteria for assessing the significance of identified potential impacts.

Re-routing associated with commercial space transportation-related closures represents a small fraction of the total amount of re-routing that occurs from all other reasons in any given year. For example, weather results in the greatest amount of re-routing in any given year. All aircraft re-routing in response to commercial space operations would occur along established alternative routes according to existing flight procedures that have already undergone environmental review. 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, 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. The duration of the closure also affects the number of necessary re-routes to ensure safety in the affected airspace. Reentries could affect only a fraction of the air traffic of longer duration windows at the same day and time, and any additional flight miles would occur at or above 3,000 feet AGL (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).

Chapter 3 of the EA describes the expected increase in emissions related to increased fuel burn from additional flight miles of diverted aircraft.

**Comment 3**: If the reentry mission requires a second deorbit opportunity it is unclear whether the duration of the NOTAM may need to extend from one to three and a half hours to accommodate the 90-minute orbit on top of the two one-hour NOTAMs.

**FAA Response**: Section 2.1.3 of the EA describes how NAS impacts would be coordinated with relevant parties, including pre-launch and pre-reentry activities. Letters of Agreements (LOAs) that would be in place with FAA Air Traffic Control, would describe the precoordinated reentries and minimize potential effects on the National Airspace System. In the event of a second deorbit opportunity, an additional one hour NOTAM would be issued that would be a different and separate time frame from the original NOTAM issued for the first deorbit. The NOTAMs would be specific to the reentry (reeentry = atmospheric reentry, desent and landing) and does not include the 90 minute orbit in preparation for reentry. In practice, the FAA attempts to divide airspace

closures into subsets that can be released incrementally in time, as well as geographically based on airspace boundaries. In doing so, the actual closure times are often smaller than the maximum value of one hour noted above.

**Comment 4**: Considering these acknowledged effects of the reentry operations on aircraft operations and their attendant environmental impacts, the Draft EA should be revised to include a credible analysis of the environmental impacts associated with these effects. Because the Draft EA does not properly assess the attendant emissions impacts of the Proposed Action due to its effects on NAS operations, FAA cannot proceed until it takes appropriate actions to correct this error.

**FAA Response**: Analysis in the EA was conducted in accordance with FAA Order 1050.1F, which outlines criteria for assessing the significance of identified potential environmental impacts. The analysis conducted as part of the EA determined that 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. The duration of the closure would also affect the number of necessary re-routes to ensure safety in the affected airspace. Reentries could affect only a fraction of the air traffic of longer duration windows at the same day and time. Any additional flight miles would occur at or above 3,000 feet AGL (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).

**Comment 5**: FAA should clarify that HSV's or Sierra Space Corporation's licenses (the RSOL and VOL, respectively) are both limited to five years and to authorize no more than two reentries per year per the description of the Proposed Action.

**FAA Response**: Section 2.1 of the EA has been revised to clarify that the VOL has a duration of 5 years, and any renewals or modifications to Sierra Space's license would require an appropriate environmental review be conducted.

The Proposed Action includes a maximum of one Sierra Space reentry operation per year in 2023, 2024, and 2025; a maximum of two reentry operations in 2026; and a maximum of three reentry operations in 2027 (Table 2-1 in Section 2.1).

**Comment 6**: FAA has proceeded with this environmental analysis and approval process for the Proposed Action without answering critical questions about the Proposed Action's integration with existing NAS operations. The assessment of the Proposed Action in the Draft EA appears to be devoid of any consideration of airspace efficiency, which is critical to minimize adverse operational and financial impacts resulting from closures of airspace necessary for commercial space launches.

**FAA Response**: Analysis in the EA was conducted in accordance with FAA Order 1050.1F, which outlines criteria for assessing the significance of identified potential impacts.

Note that this EA evaluates the environmental impacts associated with the operation of a commercial space reentry site at HSV and Dream Chaser's reentry operations at HSV. Impacts associated with the launch of Dream Chaser are considered elsewhere. As described in Section 1.1 of the EA, "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."

The FAA continues to explore ways to better manage airspace to increase the efficiency and capacity of the NAS for all users. The FAA's Air Traffic Organization is currently examining dynamic reentry windows to enable air traffic to move dynamically through airspace even when it is closed via a NOTAM. These procedures involve being in constant contact with the operator and knowing the status of a reentry so the airspace can be used by aircraft as long as possible prior to the moment a reentry vehicle reenters Earth's atmosphere.

**Comment 7**: In addition to adverse environmental impacts, commercial space operations impose substantial costs on airlines, their passengers, cargo shippers, the public, and the U.S. economy, including:

- Additional operating costs for increased flight distances and times resulting from rerouting aircraft, including additional airline resources to plan/manage events, flight crew, and maintenance.
- Denied boarding compensation for passengers that are denied boarding as a result of aircraft weight restrictions when additional fuel is required for longer routes.
- Passenger and airline costs resulting from impacts to flights and passengers that are not re-routed around the commercial space operation but are otherwise impacted by the resulting NAS congestion—e.g., flight delays, flow controls, gate and slot availability, and reduced on-time performance.
- Increased employment costs resulting from crew scheduling changes, including from limitations on flight and duty times.
- Increased passenger costs as a result of impacted passenger travel, including time lost from delayed flights, flight cancellations, and missed connections
- Lost revenue from decreased demand due to passengers avoiding air travel as a result of longer flights, lack of predictability, delays, cancellations, and missed connections.
- Costs from delayed cargo and package delivery for the public and businesses.
- Lost productivity for business travelers and increased costs of doing business for other sectors

**FAA Response**: Section 3.2.6.2 of the EA evaluates potential socioeconomic impacts of the Proposed Action, including those resulting from re-routing aircraft due to the Proposed Action: "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 the low frequency of proposed reentry operations and short duration of airspace closures, the FAA does not expect significant socioeconomic impacts to occur to airlines, their passengers, cargo shippers, the public, and the U.S. economy, especially when compared to other causes of re-routing aircraft (e.g., weather issues, runway closures, military exercises, and presidential flights). 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, thereby giving operators advanced notice to factor closures into their operations in the vicinity of the airport.

**Comment 8**: A4A further suggests that it should undertake a number of actions before proceeding with any licensing decision on the Proposed Action. This includes maturing the Space Data Integrator (SDI) and the Hazard Risk Assessment Management (HRAM) system or other technologies that improve existing procedures, the development of new procedures, and automated depictions of hazardous areas to improve the FAA's ability to more efficiently manage traffic in response to increases in commercial space activity as suggested by the Proposed Action.

FAA Response: Please see response to Comment #7 associated with this letter.

**Comment 9**: A4A also recommends FAA move forward with programs to ensure safe commercial space integration with the NAS including the improvement of existing procedures; the development of new procedures to improve commercial space operations planning; the creation of air traffic control surveillance and tracking capabilities to include automated depictions of hazard areas and launch vehicles; improved and uniform hazard mitigation policies; and two-way communications. These tools will help the FAA achieve the sought-after integration of commercial space with the NAS while minimizing environmental impacts.

FAA Response: Please see response to Comment #7 associated with this letter.

## 35 - Mark Spencer (Individual - Transcript)

**Comment:** I do request that the FAA use caution when issuing limitations for both Huntsville International Airport and Sierra Space Corporation's respective operator licenses to ensure their operations are only permitted when taxiways Foxtrot and Juliet and both runways are fully operational at HSV. The landing of a spacecraft will shut down a runway for an extended period of time, even in the case of a nominal landing, and potentially can shut it down for much longer in the case of an off-nominal landing. And then also some historical NOTAM data shows that the Huntsville International Airport has only had both its runways operational for less than half the days of the last 12 years. Permitting the airport to land the spacecraft when only one runway is operational is likely to change the balance of impact for the airport's other users, including commercial passengers, air ambulance flights, and military and general aviation aircraft and should not be permitted under the operator licenses.

**FAA Response**: 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. Sierra Space would coordinate with the Authority to coordinate airspace and runway closures at HSV and resolve potential conflicts for us. Both runways would be closed to other aircraft and vehicle movements for approximately one hour during the landing of Dream Chaser, and the runway on which Dream Chaser would land (Runway 18L/36R) would be closed for a total of 9.5 hours while Dream Chaser is safed and moved off the runway. For more information, please see Section 2.1.3.5 of the EA.

### 37 - Rob Martin (Individual - Transcript)

**Comment:** My concern, not really a concern, but just a question about the propellants that are going to be used on Dream Chaser. Normally those propellants on orbit are highly toxic and need lots of unstowing and safety procedures to safely unload those propellants once the spacecraft has landed. And I noticed in the beginning of the briefing that no facilities are planned to be built, nor is there any safety on offloads of any of these propellants, it's supposedly nontoxic. I was just a little surprised at that and wondered what type of propellant they're going to be using and also if they're bringing spacecraft back from orbit, ensuring that those propellants are nontoxic as well.

**FAA Response:** As described in Section 2.1.2 of the EA, only residual amounts of the Dream Chaser vehicle propellants (hydrogen peroxide and kerosene) would remain during reentry. 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. While on the runway, hydrogen peroxide would be flushed/diluted (as required), offloaded into approved storage containers, transported to off-Airport property, and disposed of in an approved method by local waste management. Residual kerosene would be stored at the existing kerosene storage area at the Airport.

### 40 - Robert Kendell (Individual - Transcript)

**Comment 1:** The housing is going to surround this airport over time and is going to open up opportunities for more damage from not only the sonic booms, but from our current air flights to the elderly and our retired military.

**FAA Response:** The location of the sonic boom resulting from the proposed reentry operations compared to the location of HSV is shown in Figure 3-1 of the EA. The Proposed Action's sonic boom overpressures would be lower than the FAA's significance threshold, and therefore, the Proposed Action would not result in significant noise impacts. See Section 3.2.1 of the EA for further information regarding the potential noise-related impacts of the Proposed Action.

**Comment 2:** The second point is our wildlife. Wildlife studies do not accurately test for proper side effects to sonic booms. But the toxic propellants are an obvious problem. If anything were to go wrong with this vehicle in reentry, it's breaking up or landing in any area would cause irreparable damage to the wildlife.

**FAA Response:** Section 3.2.2 of the EA describes the potential impact of sonic booms on wildlife. The USFWS agreed with the FAA's determination that the proposed reentry operations "may affect, but would not likely adversely affect" threatened or endangered species in the study area.

As described in Section 2.1.2 of the EA, only residual amounts of the Dream Chaser vehicle propellants (hydrogen peroxide and kerosene) would remain during reentry. The FAA also reviews the Proposed Action for all FAA safety and risk requirements under 14 CFR Part 400. No impacts to wildlife as a result of hazardous materials are expected as a result of the Proposed Action.

**Comment 3:** My third comment is on sonic boom damage. Studies have been conducted on sonic booms, and the damage that they found has limited the use of such aircraft such as the France Airways aircraft, and now the new aircrafts that are being created are being limited to specific cities and runways where their damage can be minimized. Currently, General Electric is working on aircraft that has a lower sonic boom and its sole reason for design is because of the known damage that sonic booms can cause.

**FAA Response:** As described in Section 3.2 of the EA, each reentry operation would cause a sonic boom with maximum peak overpressure of 1.25 psf, which is similar to a clap of thunder, which is an event commonly experienced by residents located within the affected sonic boom study area. Given the low sonic boom magnitude and the low frequency of the proposed reentry operations at HSV, the impacts from the Proposed Action would not exceed the FAA's significance thresholds for noise and noise-compatible land use. No damage is expected to occur to humans or structures in the sonic boom study area.

**Comment 4:** I implore the employees of the FAA and the companies to look at the many numerous remote areas that are available throughout the United States and its surrounding

territories. There [are] other places that this can be done that are safer to humans, our structure, our wildlife, and our peace of mind.

**FAA Response:** The FAA is evaluating the environmental impacts of the Proposed Action (issuing a VOL to Sierra Space and an RSOL to HSV). Chapter 2 of the EA provides a discussion of alternatives considered and explains why it is appropriate to 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. The EA was prepared in accordance with 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), FAA Order 1050.1F, Environmental Impacts: Policies and Procedures, and FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions.