APPENDIX A – AGENCY COORDINATION

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APPENDIX A-1 – EARLY COORDINATION LETTERS DISTRIBUTED AND RECEIVED

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RS&H

10748 Deerwood Park Boulevard S
Jacksonville, Florida 32256

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

September 13, 2019

NAME
TITLE
AGENCY
ADDRESS
CITY, STATE, ZIP

RE: National Environmental Policy Act (NEPA) Early Agency Coordination
Supplemental Environmental Assessment for Operation of Concept Reentry Vehicles to Shuttle Landing Facility, Cape Canaveral Spaceport, Florida

Dear [Mr./Ms. LAST NAME],

The purpose of this letter is to seek input regarding potential environmental impacts that may be associated with the operation of concept reentry vehicles landing at the Shuttle Landing Facility at Cape Canaveral Spaceport (SLF) (see **Attachment 1**).[1]

Space Florida, an independent Special District of the State of Florida, prepared a 2018 Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License (2018 EA) to operate the SLF as a launch location for horizontally launched and landed reusable vehicles. The Federal Aviation Administration (FAA) accepted the 2018 EA as a Federal document and issued a Finding of No Significant Impact (FONSI) on November 2, 2018. The FAA issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Since the FONSI, Space Florida proposes to add concept reentry vehicle operations with new flightpaths to the Proposed Action. As a result, and in compliance with NEPA, a Draft Supplemental EA (SEA) has recently kicked off to disclose the changes to the Proposed Action and the potential environmental effects.

Under the Proposed Action, the FAA would issue a Reentry Site Operator License (RSOL) to Space Florida for the operation of a commercial space reentry site at the SLF. The FAA would amend Space Florida's current LSOL for the site to include the RSOL. Commercial space operators may also use the SEA to support their application to acquire a reentry license to allow them to conduct horizontal landings of concept reentry vehicles at the SLF should their operations match those described and assessed within the SEA. However, should a prospective vehicle operator's reentry footprint fall outside that analyzed in the SEA, 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 a SEA 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.

[1] Cape Canaveral Spaceport is defined in Florida Statute 331.304

Due to jurisdiction and special expertise related to the Proposed Action, NASA, the U.S. Air Force, U.S. Fish and Wildlife Service, and National Park Service are again cooperating agencies in the development of the SEA.

Under the Proposed Action to be addressed in the SEA, the FAA would modify Space Florida's LSOL (LSO 18-018) for the landing of a concept reentry vehicle at the SLF. The FAA may use the SEA to support the issuance of licenses to prospective operators (when their operations match those described and assessed within the SEA) that would allow them to conduct concept reentry vehicle landings at the SLF.

Concept Reentry Vehicle

The concept reentry vehicle parameters considered in the SEA are summarized in the **Table 1**. The purpose of describing these parameters is to broadly assess the potential impacts of concept reentry vehicle operations at the SLF. This information does not necessarily reflect the exact concept reentry vehicle(s) that would operate at the SLF. However, if a prospective operator's concept reentry vehicle parameters fall outside the parameters analyzed in the SEA, 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 concept reentry vehicle parameters considered in the SEA is similar to, but not limited to, the Sierra Nevada Corporation (SNC) *Dream Chaser*® spacecraft. **Attachment 2** depicts a concept reentry vehicle.

Table 1: Concept Reentry Vehicle Parameters

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 nmi
Propellants	Hydrogen Peroxide (H2O2) and Kerosene (RP-1)
Pressurized/Unpressurized Cargo Capacity	5,500 kg, 30 ft^3
Return Payload Capacity	1,850 kg

Source: SNC, 2019

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

Table 2: Estimated Annual Number of Reentries

	2021	2022	2023	2024	2025
Concept Vehicle Reentries	1	2	3	5	6

Source: Space Florida, 2019.

The concept reentry vehicle would reenter from west/southwest on an ascending trajectory before landing at the SLF. Ascending trajectories include high atmospheric overflight of Central American countries as well as varying overflight of the southern half of Florida, south of 29° North latitude. The operation of concept reentry vehicles to the SLF would not require any closures of non-involved KSC property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

Orbital reentries would reenter the National Airspace System (NAS) at 60,000 feet above mean sea level (MSL) approximately 30-40 miles prior to landing (for approximately 25 – 40 seconds) and would enter restricted airspace approximately 25-30 miles (for approximately 2.5 - 3 minutes) prior to landing at the SLF. The concept reentry vehicle's trajectories in the NAS for landings on Runway 15 and Runway 33 are shown in **Attachment 3**.

The region of influence for the SEA is shown in **Attachment 4**.

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

- Advise your agency of the preparation of the SEA;
- Request any relevant information that your agency may have regarding the project site or environs; and
- Solicit early comments regarding potential environmental, social, and economic issues for consideration during the preparation of the SEA.

You may send any information and comments to Mr. Pete Eggert at peggert@spaceflorida.gov or to myself at the address provided at the top of this letter. We would appreciate your prompt response within 30 days.

On behalf of Space Florida, we would like to thank you for your interest in this project and we look forward to working with you as we prepare the SEA. If you have any questions or need additional information regarding the Proposed Action or SEA, please do not hesitate to contact Pete Eggert at (321) 730-5301 x123 or myself at (904) 256-2469.

Sincerely,

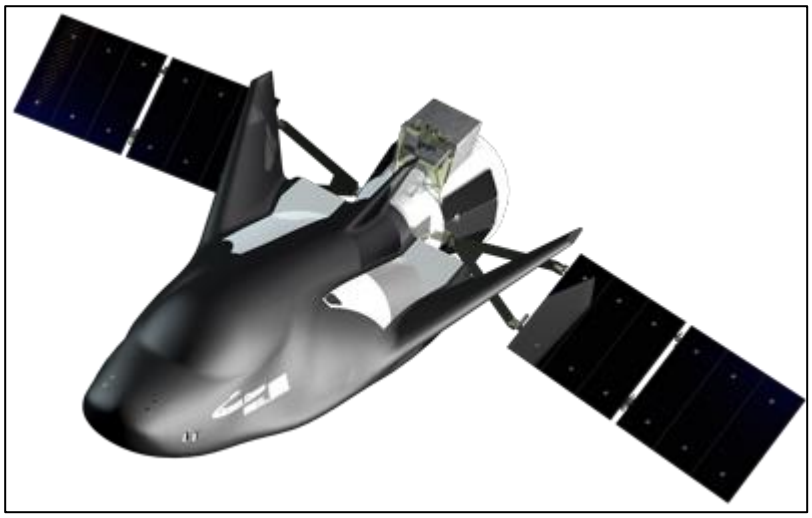
David Alberts
Project Manager
RS&H, Inc.

Attachments
cc: Pete Eggert, Space Florida
Stacey Zee, FAA
Rick Rogers, RS&H
Brian Gulliver, Kimley Horn
Project File

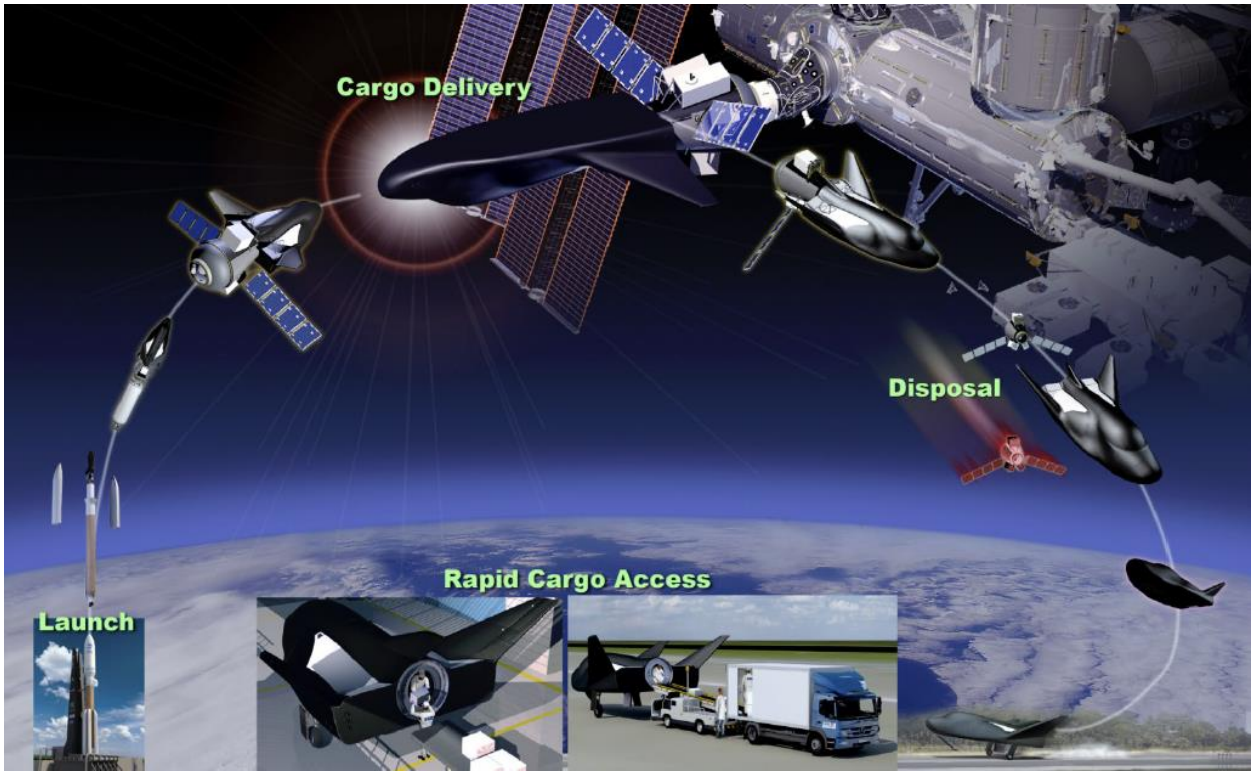
Attachment 1: Vicinity Map

Source: Space Florida, 2019, ESRI, 2019.

Attachment 2: Concept Reentry Vehicle Operation

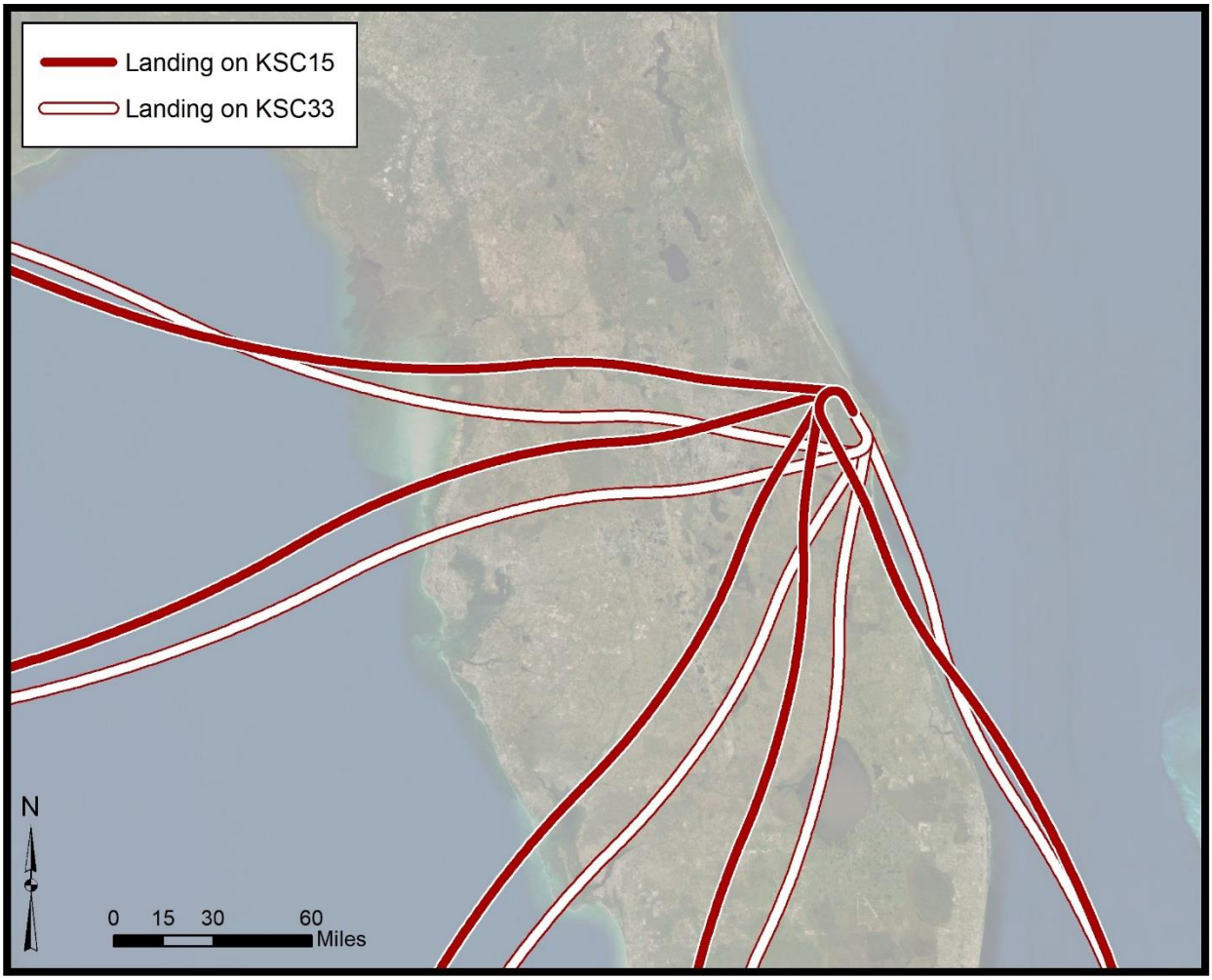


Source: SNC, 2019.



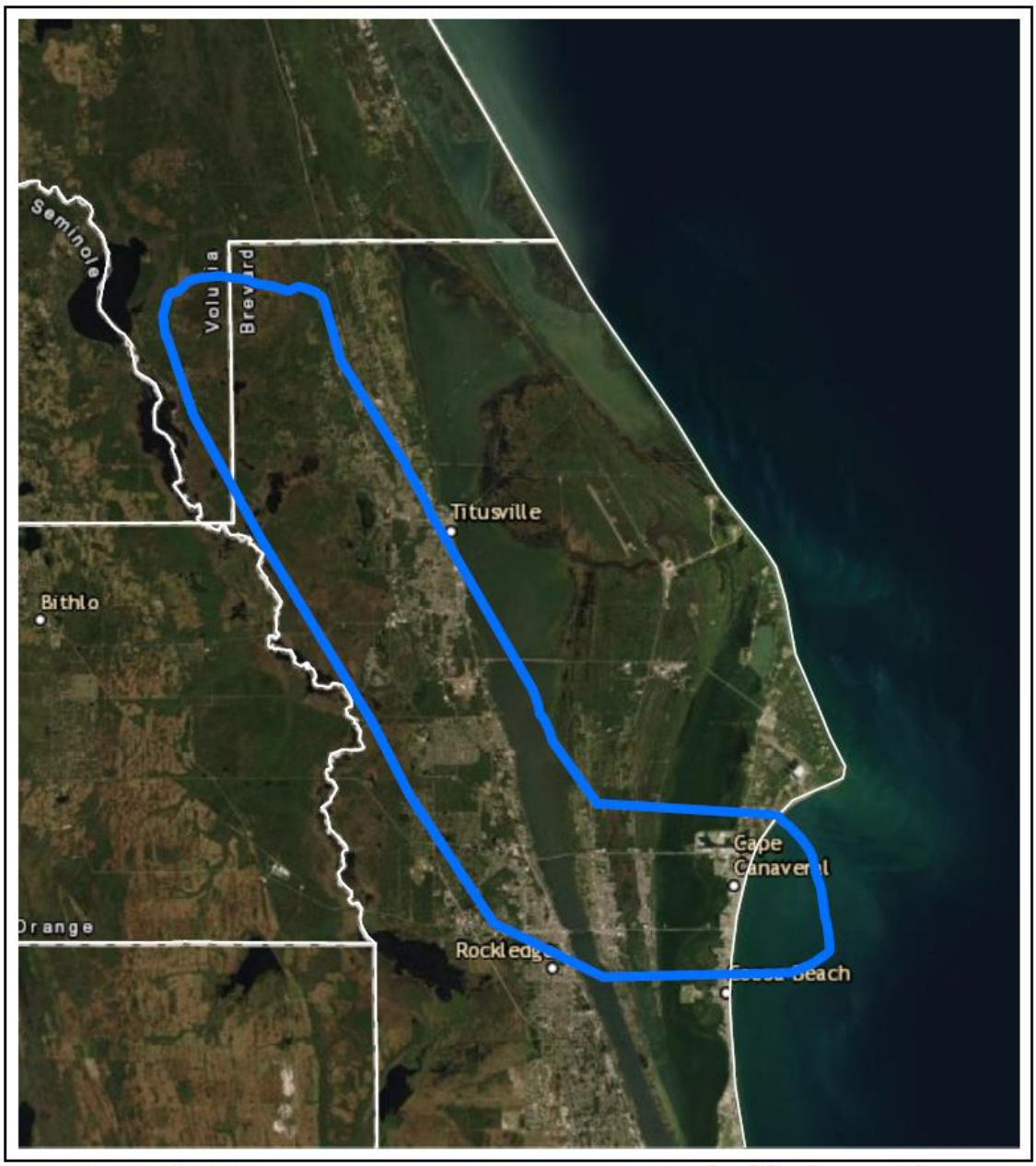
Source: SNC, 2019.

Attachment 3: Reentry Vehicle Flight Path Approaches



Source: SNC, 2019, Google, 2019.

Attachment 4: Region of Influence



Agency Coordination List
SLF Supplemental EA

Agency	Contact Type	Last Name	First Name	Title	Phone	Email	Address	City	State	Zipcode
Brevard County	Consulting Agency	Elmore	Amanda	Planning and Zoning	321-633-2070 (x 5-2660)	Amanda.elmore@brevardfl.gov	Viera Government Center 2725 Judge Fran Jamieson Way Building A	Viera	FL	32940
City of Titusville	Consulting Agency	Parrish	Brad	Planning and Growth Managment	321-567-3776	bradley.parrish@titusville.com	P.O. Box 2806 555 S. Washington Ave	Titusville	FL	32781-2803
EPA - Region 4	Consulting Agency	Militscher	Christopher	Region 4	404-562-9512	militscher.chris@epa.gov	Sam Nunn Atlanta Federal Cetner	Atlanta	GA	30303-8960
FAA (AST)	Lead Federal Agency	Zee	Stacey	Environmental Protection Specialist	202-267-9305	stacey.zee@faa.gov	800 Independence Ave SW	Washington	DC	20591
Florida Department of Environmental Protection Florida State Clearinghouse	Consulting Agency	Stahl	Chris	Clearinghouse Coordinator	850-717-9076	Chris.Stahl@dep.state.fl.us	2600 Blair Stone Road, MS 47	Tallahassee	FL	32399
Florida Division of Historical Resources	Consulting Agency	Parsons, PH.D., RPA	Timothy	State Historic Preservation Officer and Director of Historical Resources	850-245-6300	Timothy.Parsons@DOS.MyFlorida.com	Bureau of Historic Preservation R.A. Gray Building 500 South Bronough Street	Tallahassee	FL	32399
Metropolitian Planning Organization	Consulting Agency	Kraum	Sarah	Space Coast Transportation Planning Organization (TPO) - Multi-modal Program Specialist	(321) 690-6890	sarah.kraum@brevardfl.gov	2725 Judge Fran Jamieson Way; Bldg. B; Room 105, MS #82	Melbourne	FL	32940
NASA KSC	Cooperating Agency	Dankert	Don		321.861.1196	donald.j.dankert@nasa.gov		John F. Kennedy Space Center	FL	32899
National Parks Service - Canaveral National Seashore (CANA)	Cooperating Agency	Kneifl	Kristen	Resource Management Specialist	321-267-1110 x14	kristen_kneifl@nps.gov	Canaveral National Seashore 212 S. Washington Ave.	Titusville	FL	32796
Regional Planning Council	Consulting Agency	McCue, AICP	Tara	East Central Florida Regional Planning Council - Director or Planning and Community Development	407-245-0300	tara@ecfrpc.org	455 N. Garland Avenue, Fourth Floor	Orlando	FL	32801
U.S. Air Force's 45th Space Wing	Cooperating Agency	Long	Eva	NEPA Project Manager		eva.long@usaf.af.mil	45CES/CEIE1224 Jupiter St.	Patrick AFB	FL	32925
US Army Corps of Engineers	Consulting Agency	Collins	Jeff	Project Manager	321-504-3771 x13	Jeffrey.S.Collins@usace.army.mil	Department of the Army, Jacksonville District Corps of Engineers, Cocoa Permits Section, 400 High Point Drive, Suite 600	Cocoa	FL	32926
US Fish and Wildlife Service	Cooperating Agency	Ehrhardt	Cheri M.	Natural Resource Planner	321-593-2516 cell 321-861-2368 office	cheri_ehrhardt@fws.gov	PO Box 2683	Titusville	FL	32781
US Fish and Wildlife Service (Merritt Island NWR)	Cooperating Agency	Hamilton	Layne L.	Refuge Manager	321-861-2278 321-403-9213 (cell)	layne_hamilton@fws.gov	Merritt Island National Wildlife Refuge Complex US Fish and Wildlife Service PO Box 2683	Titusville	FL	32781

Agency Coordination List
SLF Supplemental EA

Agency	Contact Type	Last Name	First Name	Title	Phone	Email	Address	City	State	Zipcode
Catawba Indian Nation		Haire	Wenonah George	THPO	803-328-2427 x224	wenonahh@ccppcrafts.com	996 Avenue of the Nations	Rock Hill	SC	29730
Chitimacha Tribe of Louisiana		Walden	Kimberly S.	THPO	337-923-9923	THPO@chitimacha.gov	P.O. Box 661	Charenton	LA	70523
Coushatta Tribe of Louisiana		Langley	Linda	THPO	337-584-1560	llangley@coushattatribela.org	P.O. Box 10	Elton	LA	70532
Eastern Band of Cherokee Indians		Townsend	Russell	THPO	828-554-6851	russtown@nc-cherokee.com	P.O. Box 455	Cherokee	NC	28719
Jena Band of Choctaw Indians		Shively	Alina	THPO	318-992-1205	ashively@jenachoctaw.org	PO Box 14	Jena	LA	71342
Miccosukee Tribe of Indians of Florida		Dayhoff	Fred	Historical Preservation Officer	239-695-4360		HC61SR68 Old Loop Road	Ochopee	FL	34141
Muscogee (Creek) Nation		Butler	RaeLynn	THPO	918-732-7678	section106@mcn-nsn.gov	P.O. Box 580	Okmulgee	OK	74447
Poarch Band of Creek Indians		Haikey	Larry	THPO	251-368-9136, ext. 2067	THPO@pci-nsn.gov	5811 Jack Springs Road	Atmore	AL	36502
Seminole Nation of Oklahoma		Isham	Theodore	THPO	405-234-5218	isham.t@sno-nsn.gov	PO Box 1498	Wewoka	OK	74884
Seminole Tribe of Florida		Backhouse	Dr. Paul	THPO	863-983-6549	paulbackhouse@semtribe.com	30290 Josie Billie Highway, PMB 1004	Clewiston	FL	33440

yellow indicates correspondence was, or will be, sent via FAA (Stacey Zee email - 9/11/19 6:40 pm)

Alberts, David

From: Parrish, Bradley <Brad.Parrish@titusville.com>
Sent: Tuesday, September 17, 2019 9:05 AM
To: Alberts, David
Subject: RE: Shuttle Landing Facility - Supplemental EA - Early Agency Coordination

Thank you for the opportunity to comment on the NEPA letter. We reviewed the letter and do not have any comments.

Brad Parrish, AICP
Planning Manager
555 South Washington Avenue
City of Titusville, FL 32796
Direct 321.567.3776
Planner of the Day 321.567.3782
www.titusville.com

For the City's interactive zoning map, including updates on developments in Titusvillle please visit
http://titusville.maps.arcgis.com/home/index.html

We are interested in your opinion. The Community Development Customer Service Survey can be found at http://www.titusville.com/Page.asp?NavID=2118.

Titusville
Gateway to Nature & Space

Community Development
Planning Department

From: Alberts, David <David.Alberts@rsandh.com>
Sent: Friday, September 13, 2019 8:34 AM
To: Parrish, Bradley <Brad.Parrish@titusville.com>
Subject: Shuttle Landing Facility - Supplemental EA - Early Agency Coordination

Good Morning,

The attachment is an NEPA Early Coordination Letter associated with the *Supplemental Environmental Assessment for Operation of Concept Reentry Vehicles to Shuttle Landing Facility, Cape Canaveral Spaceport, Florida*.

Your agency's review and comments are appreciated.

Sincerely,

David Alberts

Project Manager

David E. Alberts
Aviation Senior Environmental Manager
10748 Deerwood Park Blvd South, Jacksonville, FL 32256
O 904-256-2469 | M 904-307-7049
david.alberts@rsandh.com
rsandh.com | Facebook | Twitter | LinkedIn | Blog

Stay up-to-date with our latest news and insights.

From: Pete Eggert
To: Alberts, David
Subject: Fwd: Supplemental EA for Reentry Vehicles at the Shuttle Landing Facility Cape Canaveral Florida
Date: Tuesday, October 22, 2019 10:54:05 AM

Begin forwarded message:

From: "Stahl, Chris" <Chris.Stahl@dep.state.fl.us>
Date: October 22, 2019 at 10:30:29 AM EDT
To: Pete Eggert <PEggert@spaceflorida.gov>
Subject: Supplemental EA for Reentry Vehicles at the Shuttle Landing Facility Cape Canaveral Florida

The Florida State Clearinghouse has co comments or concerns for the proposed EA.

Chris Stahl

Chris Stahl, Coordinator
Florida State Clearinghouse
Florida Department of Environmental Protection
3800 Commonwealth Blvd., M.S. 47
Tallahassee, FL 32399-2400
ph. (850) 717-9076
State.Clearinghouse@floridadep.gov

From:	Gissentanna, Larry
To:	Alberts, David
Cc:	Kajumba, Ntale; Buskey, Traci P.
Subject:	RE: Scoping Comments for Supplemental Environmental Assessment for Operation of Concept Reentry Vehicles to Shuttle Landing
Date:	Thursday, October 17, 2019 9:58:26 AM

RE: Scoping Comments for the Supplemental Environmental Assessment for Operation of Concept Reentry Vehicles to Shuttle Landing Facility, Cape Canaveral Spaceport, FL

Dear Mr. Alberts,

The U.S. Environmental Protection Agency Region 4 is in receipt of the scoping document on the proposed preparation of a Supplemental Environmental Assessment (SEA) to evaluate the potential impacts of the Operation of Concept Reentry Vehicles at the Shuttle Landing Facility, Cape Canaveral Spaceport (SLF), Florida. The EPA understands that the Federal Aviation Administration issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Since the 2018 Environmental Assessment/Finding of No Significant Impact (EA/FONSI), Space Florida proposes to add concept reentry vehicle operations with new flightpaths to the Proposed Action.

The EPA's preliminary concerns at this time can be summarized to include the following areas: The SEA should address the potential impacts to air quality, water, wetlands, noise, energy, climate change, environmental justice, and children's health related to the increase in air traffic. Please keep the local community informed and involved throughout the project process; by having community meetings and updating the community through local and social media outlets.

We look forward to reviewing the SEA when it becomes available. The EPA requests at least 1 hard copies of the Draft and Final SEA, with an electronic version, i.e. website or CD/DVD. Please forward all hard/electronic copies to the address below.

Thank you for the opportunity to comment. If you have any questions, please contact us via email or the information below.

Sincerely,

Larry O. Gissentanna
Project Manager, DoD & Federal Facilities

U.S. Environmental Protection Agency/ Region 4
Strategic Programs Office, NEPA Section
61 Forsyth Street, SW
Atlanta, GA 30303-8960
Office: 404-562-8248
gissentanna.larry@epa.gov

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APPENDIX A-2 – SECTION 106 CONSULTATION

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U.S. Department
of Transportation
Federal Aviation Administration

Office of Commercial Space Transportation

800 Independence Ave., SW
Washington, DC 20591

March 2, 2020

Dr. Timothy Parsons
State Historic Preservation Officer
Florida Division of Historical Resources
R.A. Gray Building
500 South Bronough Street
Tallahassee, Florida 32399-0250

Dear Dr. Parsons,

The FAA is initiating Section 106 consultation and soliciting concurrence on the proposed Area of Potential Effects (APE), described below. Space Florida is applying to the FAA for a Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport[1] in Brevard County, Florida. FAA issuance of an RSOL is considered a federal undertaking under the regulations of the Advisory Council for Historic Preservation (36 Code of Federal Regulations [CFR] § 800.16(y)) for Section 106 of the National Historic Preservation Act.

Background

In 2018, Space Florida prepared a 2018 *Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License* (2018 EA) to operate the SLF as a launch location for horizontally launch vehicles. The FAA issued a Finding of No Significant Impact (FONSI) based on the 2018 EA on November 2, 2018 and issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Space Florida now proposes to add reentry vehicle operations with new flightpaths to their site. The issuance of a RSOL and the associated reentries will be analyzed in a Supplemental Environmental Assessment (SEA).

Project Activities

Under the proposed project, the FAA would issue a RSOL to Space Florida for the operation of a commercial space reentry site at the SLF. Space Florida proposes to offer the site to vehicle operators for reentry operations. The reentry vehicle expected to operate at SLF and analyzed in the SEA is similar to the Sierra Nevada Corporation (SNC) *Dream Chaser*® spacecraft. Table 1 summarizes the reentry vehicle parameters. Figure 1 shows a reentry vehicle and proposed operation.

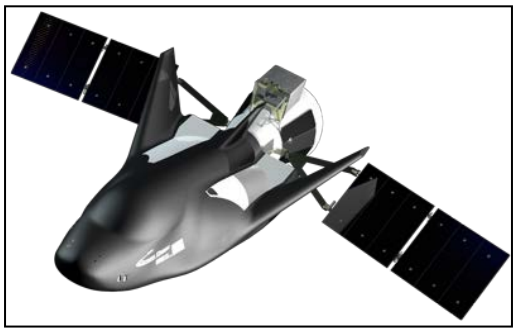
[1] According to FL Statute 331.304, the Cape Canaveral Air Force Station and John F. Kennedy Space Center may be referred to as the Cape Canaveral Spaceport.

Table 1: Reentry Vehicle Parameters

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 nmi
Propellants	Hydrogen Peroxide (H2O2) and Kerosene (RP-1)
Return Payload Capacity	1,850 kg

[1] Dream Chaser propellants ae used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground. Source: SNC, 2019.

Figure 1: Reentry Vehicle and Operation



Source: SNC, 2019.

Reentry vehicle operations would include up to 6 reentries annually over the five-year license term (see **Table 2**).

Table 2: Estimated Annual Number of Reentries

	2020	2021	2022	2023	2024
Vehicle Reentries	1	2	3	5	6

Source: Space Florida, 2019.

The reentry vehicle would reenter the atmosphere from west/southwest and overfly the Gulf of Mexico or Caribbean Sea, based on a mission dependent trajectory before landing at the SLF. The operation of reentry vehicles to the SLF would not require any closures of non-involved Kennedy Space Center property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

Reentry vehicles would pass below 60,000 feet above mean sea level (MSL) approximately 30-40 miles prior to landing at the SLF. The vehicle would generate a sonic boom during reentry. No construction activities are proposed as part of the proposed project.

Area of Potential Effects

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 encompasses about 280 square miles and includes portions of Brevard and Volusia counties. The APE also extends over a portion of the Atlantic Ocean. This APE is based on the footprint of the reentry vehicle's sonic boom noise contour and includes those areas of the Earth's surface that would experience a sonic boom of 1.0 pound per square foot or greater. (Attachment 1)

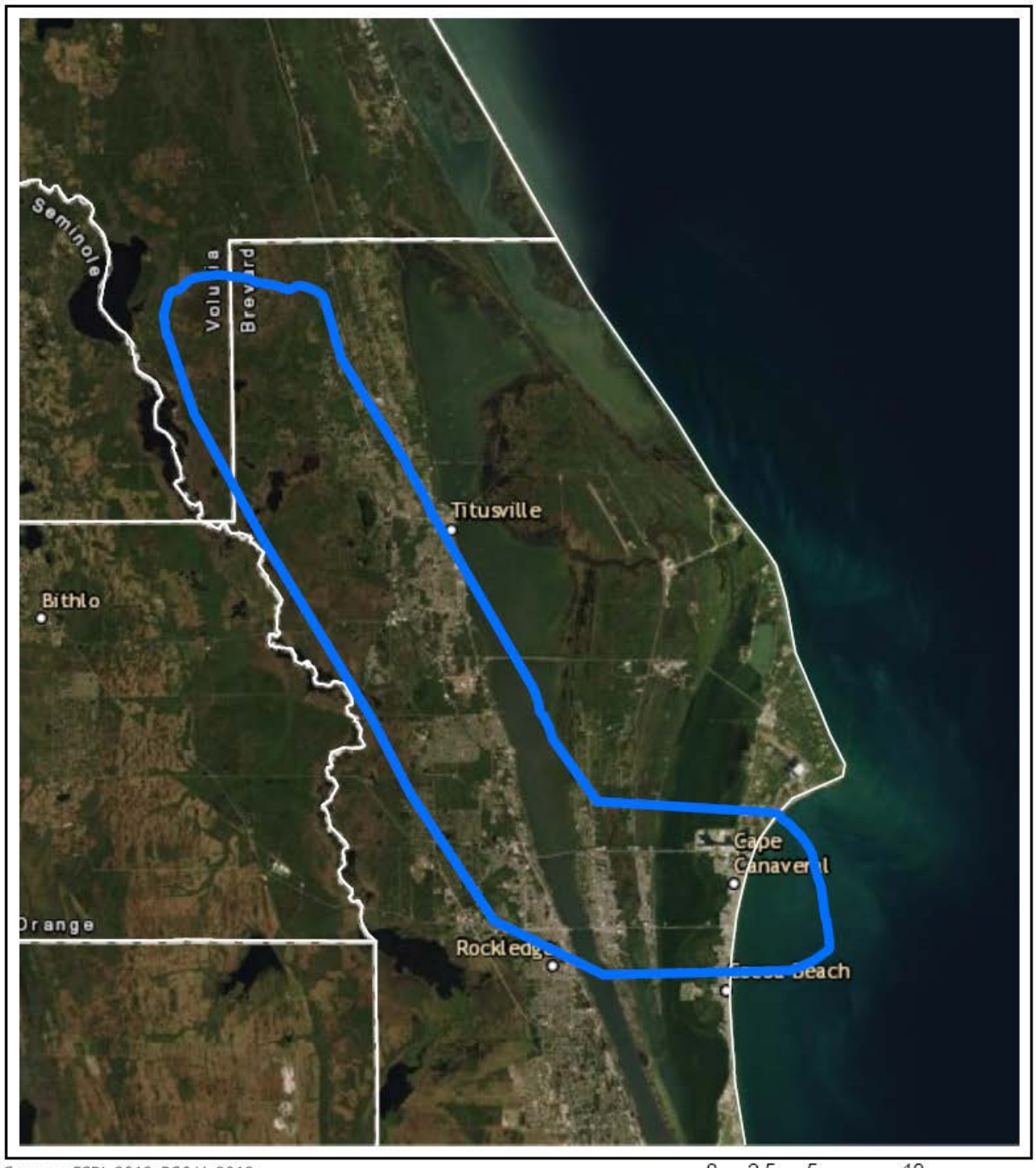
The FAA requests your concurrence on the determination of the APE within 30 days. If you have any questions or need additional information on the project, please contact Ms. Stacey Zee of my staff at (202) 267-9305 or at Stacey.Zee@faa.gov. Thank you in advance for your input on this project.

Sincerely,

Daniel Murray
Manager, Space Transportation Development Division

Enclosures:
Attachment 1 – Area of Potential Effects

Attachment 1 - Area of Potential Effects



FLORIDA DEPARTMENT of STATE

RON DESANTIS
Governor

LAUREL M. LEE
Secretary of State

Daniel Murray
Manager, Space Transportation Development Division
Office of Commercial Space Transportation
800 Independence Ave., SW
Washington, D.C. 20591

March 10, 2020

RE: DHR Project File No.: 2020-0991, Received by DHR: March 3, 2020
Area of Potential Effect Consultation - Space Florida, Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SFL) at the Cape Canaveral Spaceport, Brevard County, Florida

Dear Mr. Murray:

The Florida State Historic Preservation Officer reviewed the referenced project for possible effects on historic properties listed, or eligible for listing, in the *National Register of Historic Places (NRHP).* The review was conducted in accordance with Section 106 of the *National Historic Preservation Act of 1966*, as amended, and its implementing regulations in *36 CFR Part 800: Protection of Historic Properties.*

The FAA notes that the proposed undertaking consists of a Reentry Site Operator License (RSOL) for Space Florida to operate a commercial space reentry site at the Shuttle Launch Facility at the Cape Canaveral Spaceport. The FAA recommends an area of potential effect (APE) for the undertaking including a 280 square mile area. The FAA defined the APE in consideration of both potential direct and indirect effects associated with proposed reentry operations. The FAA based the APE footprint on the reentry vehicle's sonic boom and includes those areas that would experience a sonic boom of 1.0 pound per square foot or greater.

Based on the information provided, our office concurs with the proposed APE and we look forward to continuing consultation with the FAA for this undertaking. If you have any questions, please contact me by email at *Jason.Aldridge@dos.myflorida.com* or by telephone at 850-245-6344.

Sincerely,

Jason Aldridge
Deputy State Historic Preservation Officer
for Compliance and Review

U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of Commercial Space Transportation

800 Independence Ave., SW
Washington, DC 20591

March 26, 2020

Dr. Timothy Parsons
State Historic Preservation Officer
Florida Division of Historical Resources
R.A. Gray Building
500 South Bronough Street
Tallahassee, Florida 32399-0250

RE: Finding of No Adverse Effect for Space Florida, Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport, Brevard County, Florida

Dear Dr. Parsons,

As part of the Federal Aviation Administration's (FAA's) Section 106 review and pursuant to 36 CFR § 800.4, the FAA has undertaken identification efforts for the Space Florida RSOL for the SLF at the Cape Canaveral Spaceport. Based on the results of these efforts the FAA has determined a finding of No Adverse Effect is appropriate for this undertaking.

Tribal Consultation: The FAA initiated Section 106 consultation with the following Native American tribes: the Coushatta Tribe of Louisiana, the Miccosukee Tribe of Indians, and the Muscogee (Creek) Nation. All project documentation and this determination of effect letter has been provided to those tribes participating in the consultation.

Area of Potential Effects: The Area of Potential Effects (APE) for this undertaking is defined as an area encompassing 280 square miles, including portions of Brevard and Volusia counties and a portion of the Atlantic Ocean. This APE is based on the footprint of the reentry vehicle's sonic boom noise contour and includes those areas of the Earth's surface that would experience a sonic boom of 1.0 pound per square foot or greater. This APE was reviewed and concurred upon by the State Historic Preservation Office (SHPO) in a letter dated March 10, 2020.

Identification Efforts: Research information on historic properties within the APE was obtained from the National Park Service (NPS) National Register of Historic Places (NRHP) and the Florida Master Site File. The Proposed Action does not include construction activities and therefore no additional survey work was performed.

Historic Properties in the APE: Historic, architectural, and cultural resources are sites recorded by the Florida Division of Historical Resources as Florida historical markers or resources that are in or eligible for listing in the National Register of Historic Places (NRHP). Table 1 lists the NHRP-eligible sites in the APE and Attachment 1 shows the location of these sites in relation to the APE.

Table 1: NRHP Resources in the APE

Resource Name	Resource Type
Aladdin Theater	Listed in NRHP
Barton Ave Residential District	Listed in NRHP
Cape Canaveral Air Force Station	Listed in NRHP
City Point Community Church	Listed in NRHP
Cocoa Junior High	Eligible for NRHP
Cocoa Post Office	Eligible for NRHP
Dr. George E Hill House	Listed in NRHP
J.R. Field, Homestead	Listed in NRHP
La Grange Church and Cemetery	Listed in NRHP
Porcher House	Listed in NRHP
Rockledge Drive Residential District	Listed in NRHP
Valencia Subdivision Residential Historic	Listed in NRHP

Sources: (NPS, National Register of Historic Places, 2019) (DHR, 2019)

Finding of Effect: Twelve (12) historic properties were identified in the project APE (Table 1 and Attachment 1).

No ground disturbing activities will occur in the APE. Operation of the reentry vehicles would increase flight activity at the SLF. The Proposed Action would not result air quality or visual (light or viewshed) impacts but the descent of reentry vehicles would generate a sonic boom. The Proposed Action would result in one sonic boom in 2020 and up to six sonic booms in 2024.

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

- Destroy or damage a historic property;
- Alter the character of the property's use, or physical features within the setting if the setting contributes to the property's qualification for the NRHP;
- Introduce visual, audible, or atmospheric features that would diminish the integrity of the property's historic features, if the setting contributes to the property's NRHP-eligibility; and/or Cause neglect of the property resulting in the property's deterioration or destruction.

Overpressure caused by extreme sonic booms has been associated with the potential for structural damage, specifically for brittle materials such as glass and plaster. The probability of a window breaking when exposed to a sonic boom with a 1.0 psf overpressure ranges from one in a billion to one in a million, depending on the condition of the glass, while the threshold for damage from overpressure on well-maintained structures is greater than 2 psf (BRRC, 2019[1]). The results of the sonic boom analysis indicated that the maximum overpressure associated with operation of the Proposed Action would be 1.1 psf, which is below the 2 psf threshold for damage on well-maintained structures.

[1] BRRC. (2019). *Shuttle Landing Facility Reentry Site Licensing Sonic Boom Analysis.*

The potential for sonic boom impacts is also evaluated in relation to human annoyance and hearing conservation. The modeled maximum of 1.1 psf translates to an equivalent CDNL[2] of 41.2 dBC. Noise caused by the proposed reentry vehicle operations would be less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA).[3] The intensity of sonic booms associated with operation of the Proposed Action would be similar to thunder in intensity. It is estimated that, on average, each resident in the APE experiences the overpressure from a thunderstorm greater than 2.09 psf more than 20 times a year. Users of the historic properties located within the APE therefore likely experience similar levels of thunderstorm activity and noise impacts.

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 within the 30-day regulatory time frame.

The documentation provided herein meets the regulatory standard for documenting this effect determination in accordance with 36 CFR § 800.5 If you have questions or concerns regarding this finding or the sufficiency of documentation, please contact Ms. Stacey Zee of my staff at (202) 267-9305 or at Stacey.Zee@faa.gov.

Sincerely,

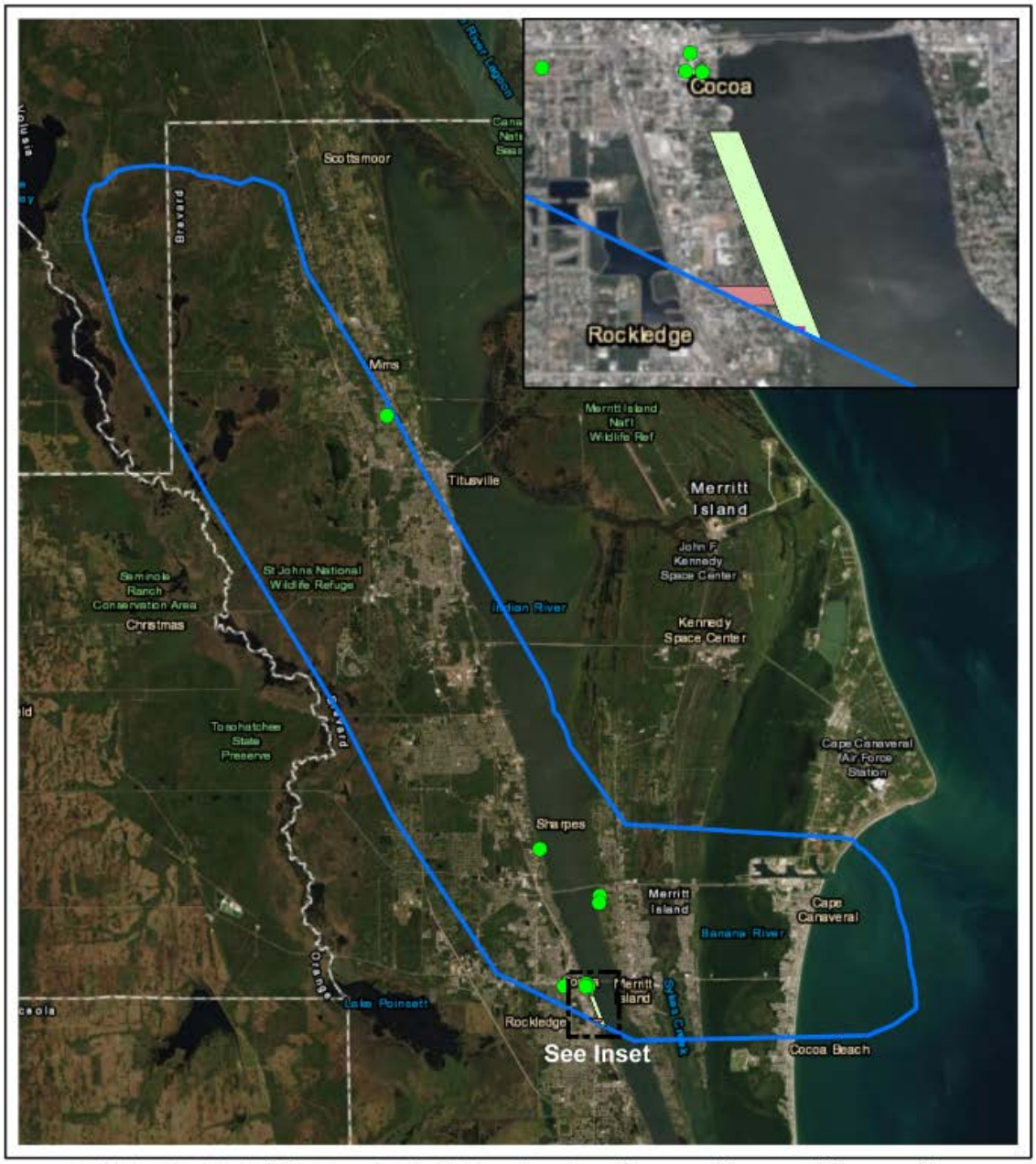
DANIEL P MURRAY Digitally signed by DANIEL P MURRAY
Date: 2020.03.26 08:15:31 -04'00'

Daniel Murray
Manager, Space Transportation Development Division

Enclosures:
Attachment 1 – Historic Properties in the Area of Potential Effects

[2] CDNL is the C-weighted Day-Night Level (DNL). C-weighting is preferred over A-weighting for impulsive noise sources with large low-frequency content such as sonic booms.
[3] Areas exposed to DNL 65 dBA or lower are compatible with all land uses.

Attachment 1 – Historic Properties in the Area of Potential Effects



Sources: Esri, 2019; RS&H, 2019; Florida Master Site File, 2019

0 2 4 8 12 16 Miles

N

Legend

- Historic Resource
- Barton Avenue Historic District
- Rockledge Drive Residential District
- Valencia Subdivision Residential Historic
- Area of Potential Effect

RS&H

FLORIDA DEPARTMENT of STATE

RON DESANTIS
Governor

LAUREL M. LEE
Secretary of State

Daniel Murray
Manager, Space Transportation Development Division
Office of Commercial Space Transportation
800 Independence Ave., SW
Washington, D.C. 20591

August 3, 2020

RE: DHR Project File No.: 2020-0991-B, Received by DHR: March 26, 2020
Finding of No Adverse Effect for Space Florida, Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SFL) at the Cape Canaveral Spaceport, Brevard County, Florida

Dear Mr. Murray:

The Florida State Historic Preservation Officer reviewed the referenced project for possible effects on historic properties listed, or eligible for listing, in the *National Register of Historic Places (NRHP).* The review was conducted in accordance with Section 106 of the *National Historic Preservation Act of 1966*, as amended, and its implementing regulations in *36 CFR Part 800: Protection of Historic Properties.*

The FAA identified twelve historic properties within the undertaking's area of potential effect (APE). The FAA assessed potential effects to these resources related to noise and vibration generated by the undertaking. The FAA determined that the sonic booms generated by the undertaking will have no adverse effect to the identified historic properties, or other historic properties listed, or eligible for listing, in the NRHP.

Based on the information provided, our office concurs with the FAA's determination of no adverse effect to historic properties.

If you have any questions, please contact me by email at *Jason.Aldridge@dos.myflorida.com* or by telephone at 850-245-6344.

Sincerely,

Jason Aldridge
Deputy State Historic Preservation Officer
for Compliance and Review

APPENDIX A-3 – USFWS SECTION 7 CONSULTATION

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U.S. Department
of Transportation
Federal Aviation Administration

Office of Commercial Space Transportation

800 Independence Ave., SW.
Washington, DC 20591

March 2, 2020

Ms. Annie Dziergowski
Chief, Project Review and Consultation
U.S. Fish and Wildlife Service
North Florida Ecological Services Office
7915 Baymeadows Way, Suite 200
Jacksonville, FL 32256-7517
Submitted to: jaxregs@fws.gov

SUBJECT: Endangered Species Act Consultation for Proposed Reentry Operations at the Shuttle Landing Facility, Cape Canaveral Spaceport, Brevard County, Florida

Dear Ms. Dziergowski,

The FAA is initiating Section 7 consultation and soliciting concurrence with our assessment and determination of the potential effects on ESA-listed species for the proposed reentry operations at the Shuttle Landing Facility (SLF). Space Florida is applying to the FAA for a Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport[1] in Brevard County, Florida (see **Figure 1** for project location).

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

[1] According to FL Statute 331.304, the Cape Canaveral Air Force Station and John F. Kennedy Space Center may be referred to as the Cape Canaveral Spaceport.

Figure 1. Project Location

Background

In 2018, Space Florida prepared a 2018 *Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License* (2018 EA) to operate the SLF as a launch location for horizontally launched and landed reusable vehicles. The FAA issued a Finding of No Significant Impact (FONSI) and Record of Decision based on the 2018 EA on November 2, 2018 and issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Space Florida now proposes to add reentry vehicle operations, including operations of the Sierra Nevada Corporation Dream Chaser vehicle, with new flightpaths to their site.[2] The issuance of a RSOL and the associated reentries will be analyzed in a Supplemental Environmental Assessment (SEA).

In 2017, the FAA conducted ESA section 7 consultation with the USFWS for the FAA's action of issuing Space Florida a launch site operator license (FWS Log No. 04EF1000-2018-I-771). The FAA determined that operation of the SLF as a launch site and associated construction would have no effect on ESA-listed

[2] "Reentry vehicle" means a vehicle designed to return from Earth orbit or outer space to Earth, or a reusable launch vehicle designed to return from Earth orbit or outer space to Earth, substantially intact. 51 U.S.C. § 50902 (19)

species except the eastern indigo snake (*Dymarchon corais couperi*). The FAA determined the action proposed in 2017 may affect, but would not adversely affect, the eastern indigo snake. The USFWS concurred with this determination. The 2017 consultation did not include reentry vehicle operations.

Project Description

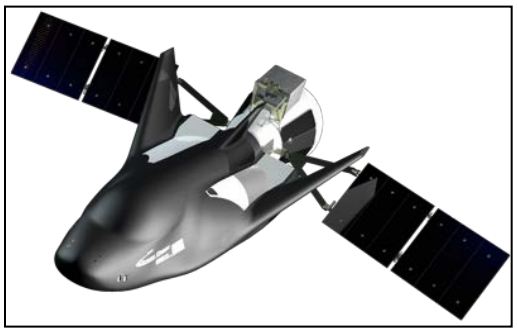
The FAA's Proposed Action is to issue a RSOL to Space Florida for the operation of a commercial space reentry site at the SLF. Space Florida proposes to offer the site to vehicle operators for reentry vehicle operations. Space Florida expects that the reentry vehicles that operate at SLF would be similar to Sierra Nevada Corporation's *Dream Chaser*® spacecraft. Table 1 summarizes the reentry vehicle parameters that will be evaluated in the SEA. Figure 1 shows a reentry vehicle and proposed operation.

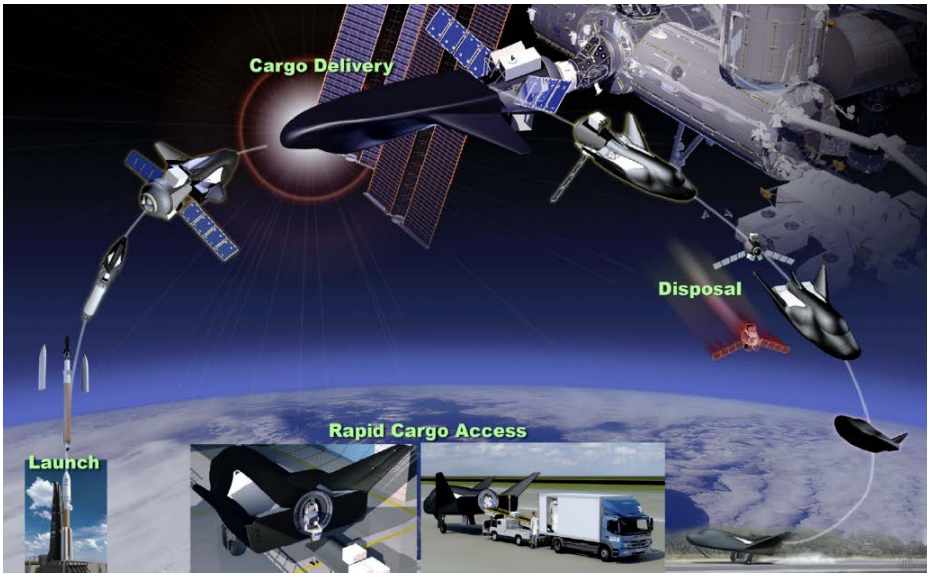
Table 1. Reentry Vehicle Parameters

Characteristic	Data
Vehicle Length	30 feet
Wingspan	27 feet
Gross Vehicle Weight	24,600 pounds
Landing Gear Configuration	Nose skid and two rear wheels
Runway Length Required for Landing	10,000 feet
Cross-Range Capability	± 700 nautical miles
Propellants[1]	Hydrogen peroxide (H_2O_2) and kerosene (RP-1)
Return Payload Capacity	1,850 kilograms

[1] Dream Chaser propellants ae used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground. Source: SNC, 2019.

Figure 1. Reentry Vehicle and Operation





Space Florida is proposing a maximum of 6 reentries annually over the five-year license term (see **Table 2**).

Table 2. Estimated Annual Number of Reentries

2020	2021	2022	2023	2024
1	2	3	5	6

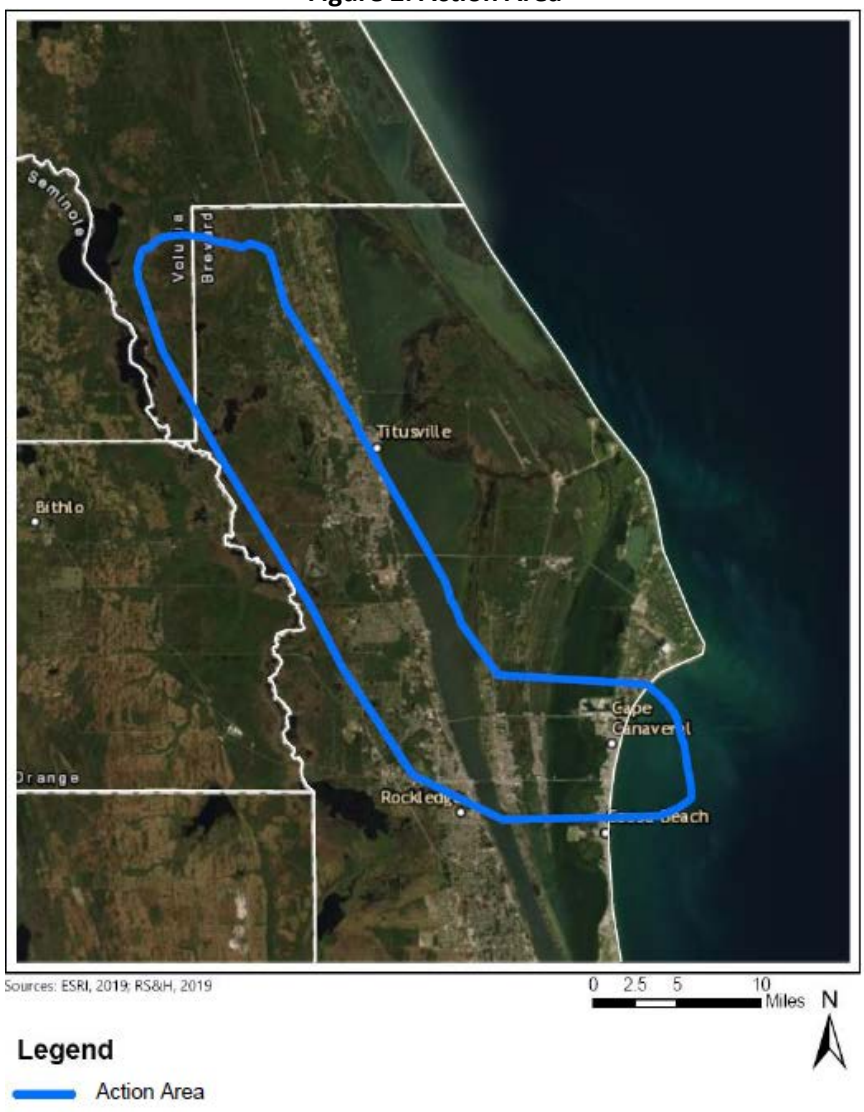
The reentry vehicle would reenter the atmosphere from the west/southwest and overfly the Gulf of Mexico or Caribbean Sea, based on a mission dependent trajectory before landing at the SLF. The operation of reentry vehicles to the SLF would not require any closures of non-involved Kennedy Space Center (KSC) property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

Reentry vehicles would pass below an altitude of 60,000 feet above mean sea level (MSL) approximately 30–40 miles prior to landing at the SLF. The vehicle would generate a sonic boom during reentry. No construction activities are proposed as part of the proposed project.

Action Area

The action area is defined as all areas directly or indirectly affected by the federal action. The action area is based on the footprint of the reentry vehicle's sonic boom noise contour and includes those areas of the Earth's surface that would experience a sonic boom of 1.0 pound per square foot (psf) or greater. This approximately 280-square mile area encompasses portions of Brevard and Volusia counties (see Figure 2).

Figure 2. Action Area



ESA-Listed Species and Critical Habitat

The FAA used the USFWS's Information for Planning and Consultation online system to generate a species list and identify critical habitat for the project. Table 3 includes ESA-listed species and critical habitat within the action area. Designated critical habitat for the West Indian manatee (*Trichechus manatus latirostris*) is present within the action area.

In 1977, the USFWS designated multiple waterways and parts of coastal Florida, from Jacksonville south to Miami and west around the peninsula to Tampa Bay, as critical habitat for manatees (42 FR 47840). The waters around KSC and Cape Canaveral Air Force Station (CCAFS) are critical habitat for the manatee. The Upper Banana River is an area of particular emphasis for cautious boat operations.

Table 3. ESA-Listed Species for the Action Area

Category	Species Common Name	Species Scientific Name	Status
Mammals	West Indian manatee	*Trichechus manatus latirostris*	E
	Southeastern beach mouse	*Peromyscus polionotus nineiventris*	T

Category	Species Common Name	Species Scientific Name	Status
Birds	Audubon's crested caracara	*Polyborus plancus audubinii*	T
	Eastern black rail	*Laterallus jamaicensis* ssp. *jamaicensis*	PT
	Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E
	Florida scrub-jay	*Aphelocoma coeruluscens*	T
	Piping plover	*Charadrius melodus*	T
	Wood stork	*Mycteria americana*	E
	Red knot	*Calidris canutus rufa*	T
	Red-cockaded woodpecker	*Picoides borealis*	E
Reptiles	Atlantic salt marsh snake	*Nerodia clarkii (fasciata)taeniata*	T
	Eastern indigo snake	*Dymarchon corais couperi*	T
	Gopher tortoise	*Gopherus polyphemus*	C
	Green sea turtle	*Chelonia mydas*	T
	Hawksbill sea turtle	*Eremochelys imbricata*	E
	Leatherback sea turtle	*Dermochelys coriacea*	E
	Loggerhead sea turtle	*Caretta caretta*	T
Plants	Carter's mustard	*Warea carteri*	E
	Lewton's polygala	*Polygala lewtonii*	E
	Okeechobee gourd	*Cucurbita okeechobeensis*	E
	Rugel's pawpaw	*Deeringhthamnus rugelii*	E

C = candidate; E = endangered; PT = proposed threatened; T = threatened
Source: USFWS 2019.

Potential Effects to ESA-listed Species and Critical Habitat

The Proposed Action would have no effect on the West Indian manatee's critical habitat because the action does not involve any activities within or near the critical habitat. Similarly, the Proposed Action would have no effect on ESA-listed plants in the action area because the action does involve activities with the potential to affect these plants.

Reentry operations have the potential to affect ESA-listed species in the action area, mainly from noise, including sonic booms. 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.

The entirety of the sonic boom footprint would be approximately 1 psf or less, which is less than a clap of thunder. Previous ESA consultation between the U.S. Air Force and USFWS in the vicinity of SLF have concluded that sonic booms would not adversely affect ESA-listed species.

Based on the lack of observed adverse effects to wildlife in the studies mentioned above and the lack of known adverse effects to ESA-listed over decades of launch operations at KSC and CCAFS, the FAA expects that sonic booms associated with the Proposed Action ***may affect, but would not likely to adversely affect***, ESA-listed wildlife species in the action area.

Conclusion

In summary, the FAA anticipates reentry operations (sonic booms) **may affect, but would not likely to adversely affect**, all of the ESA-listed wildlife species in Table 3. The FAA seeks your concurrence on our effect determination and welcomes any additional comments. Thank you for your assistance in this matter. Please provide your response to Stacey Zee via e-mail at Stacey.Zee@faa.gov.

Sincerely,

Daniel Murray
Manager, Space Transportation Development Division

From:	Zee, Stacey (FAA)
To:	Pete Eggert; Alberts, David
Cc:	Clarkson, Chelsea (FAA); Grey, Leslie (FAA)
Subject:	FW: USFWS receipt confirmation of project consultation request Re: [EXTERNAL] Shuttle Landing Facility - Section 7 letter
Date:	Tuesday, March 3, 2020 1:07:17 PM

Receipt of USFWS ltr

From: Jacksonville Regulatory, FW4 <jaxregs@fws.gov>
Sent: Tuesday, March 03, 2020 1:02 PM
To: Zee, Stacey (FAA) <Stacey.Zee@faa.gov>
Subject: USFWS receipt confirmation of project consultation request Re: [EXTERNAL] Shuttle Landing Facility - Section 7 letter

Thank you for contacting the project consultation section of the Service's North Florida Ecological Services Office in Jacksonville.

Do not reply to this automated response. This message simply confirms that we have received your e-mail.

Please allow a **minimum of 60-days** from date of project submission to our office before inquiring as to your project's review status. This allows time for your project submission to be received, complete intake processing, and staff assignment and initial review.

Requests are placed in different process tracks (technical assistance, informal consultations or formal consultations) and generally handled on a first-in, first-out basis within those tracks. Where statutory timelines apply every reasonable effort is made to comply with these timelines. However, these timelines assume all information required for us to complete our review/consultation is provided and no additional information is requested. Such requests for additional information, clarification or incomplete submissions can result in the temporary suspension of the timeline.

If you have not heard from us **after 60-days**, for quickest response submit a status request via e-mail to jaxregs@fws.gov, or you may call our Project Consultation Section at 904.731.3336.

Your understanding and cooperation is appreciated.

**** We recently updated our information for those applicants seeking FEMA CLOMR clearance. Also, many project review/consultation requests may already be covered by an existing clearance or authorization. Please take a look on our website at https://www.fws.gov/northflorida - click the "Consultant & Landowner Tools" button on the left. ****

***** Address and telephone contact information is available on our website at https://www.fws.gov/northflorida - click the "Contact Us" button on the left. *****

--

****

Project Consultation Section
North Florida Ecological Services Office
U.S. Fish & Wildlife Service
TEL: 904.731.3336
FAX: 904.731.3045
www.fws.gov/northflorida

U.S. Department of Transportation
Federal Aviation Administration

Office of Commercial Space Transportation

800 Independence Ave., SW.
Washington, DC 20591

March 2, 2020

Ms. Annie Dziergowski
Chief, Project Review and Consultation
U.S. Fish and Wildlife Service
North Florida Ecological Services Office
7915 Baymeadows Way, Suite 200
Jacksonville, FL 32256-7517
Submitted to: jaxregs@fws.gov

SUBJECT: **Endangered Species Act Consultation for Proposed Reentry Operations at the Shuttle Landing Facility, Cape Canaveral Spaceport, Brevard County, Florida**

Dear Ms. Dziergowski,

The FAA is initiating Section 7 consultation and soliciting concurrence with our assessment and determination of the potential effects on ESA-listed species for the proposed reentry operations at the Shuttle Landing Facility (SLF). Space Florida is applying to the FAA for a Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport[1] in Brevard County, Florida (see **Figure 1** for project location).

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

U.S. FISH & WILDLIFE SERVICE

FWS Log No 20-I-0690

The Service concurs with your effect determination(s) for resources protected by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). This finding fulfills the requirements of the Act.

For RICHARD RAUSCHENBERGER Digitally signed by RICHARD RAUSCHENBERGER Date: 2020.05.08 12:40:10 -04'00'

Jay B. Herrington
Field Supervisor

Date

[1] According to FL Statute 331.304, the Cape Canaveral Air Force Station and John F. Kennedy Space Center may be referred to as the Cape Canaveral Spaceport.

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APPENDIX A-4 – TRIBAL GOVERNMENT-TO-GOVERNMENT AND SECTION 106 CONSULTATION

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Tribal Government-to-Government and Section 106 consultation letters (see following pages for an example) were sent to the following Tribal Historic Preservation Officers (THPOs):

Native American Tribe	Name	Title	Email	Address	City	State	Zip Code
Catawba Indian Nation	Wenonah G. Haire	THPO	caitlinh@ccppcrafts.com	1536 Tom Steven Road	Rock Hill	SC	29730
Chitimacha Tribe of Louisiana	Kimberly Walden	THPO	kim@chitimacha.gov	P.O. Box 661	Charenton	LA	70523
Coushatta Tribe of Louisiana	Linda Langley, Ph.D	THPO	llangley@coushattatribela.org	PO Box 10	Elton	LA	70532
Eastern Band of Cherokee Indians	Russel Townsend	THPO	russtown@nc-cherokee.com	Qualla Boundary Reservation PO Box 455	Cherokee	NC	28719
Jena Band of Choctaw Indians	Alina Shively	THPO	ashively@jenachoctaw.org	P.O. Box 14	Jena	LA	71342
Muscogee (Creek) Nation	RaeLynn Butler	THPO	section106@mcn-nsn.gov	P.O. Box 580	Okmulgee	OK	74447
Poarch Band of Creek Indians	Robert Thrower	THPO	rthrower@pci-nsn.gov	5811 Jack Springs Road	Atmore	AL	36502
Seminole Tribe of Florida	Paul Backhouse, Ph.D	THPO	paulbackhouse@semtribe.com	30290 Josie Billie Hwy, PMB 1004	Clewiston	FL	33440

U.S. Department
of Transportation
**Federal Aviation
Administration**

Commercial Space Transportation

800 Independence Ave., SW.
Washington, DC 20591

March 12, 2020

Wenonah G. Haire, Tribal Historic Preservation Officer
Catawba Indian Nation
1536 Tom Steven Road, Rock Hill, SC, 29730

RE: Invitation for Government-to-Government Tribal Consultation for Section 106 review of Reentry Vehicle Operations at the Shuttle Landing Facility at Cape Canaveral Spaceport in Brevard County, Florida

The Federal Aviation Administration (FAA) has received an application from Space Florida to conduct reentry vehicle operations at the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport in Brevard County, Florida. FAA issuance of a Reentry Site Operator License (RSOL) is considered a federal undertaking under the regulations of the Advisory Council for Historic Preservation (36 Code of Federal Regulations [CFR] § 800.16(y)) for Section 106 of the National Historic Preservation Act.

For your reference, a project description and map of the area of potential effects are enclosed with this letter. The proposed project and its associated activities are also subject to the National Environmental Policy Act (NEPA) and the FAA has initiated preparation of a Supplemental Environmental Assessment to meet its regulatory obligations. The agency intends to complete Section 106 in conjunction with the NEPA process.

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*, FAA Order 1210.20 *American Indian and Alaska Native Tribal Consultation Policy and Procedures*, and 36 CFR § 800.2(c)(2)(B)(ii), the FAA is seeking input on properties of cultural or religious significance that may be affected by the undertaking, and inviting you to participate in government-to-government consultation in the Section 106 consultation process.

Please contact Stacey Zee at 202-267-9305, or via email at Stacey.Zee@faa.gov within 30 days of the receipt of this letter to confirm your intent to participate in this Section 106 consultation.

Sincerely,

DANIEL P MURRAY Digitally signed by DANIEL P MURRAY
Date: 2020.03.31 09:33:02 -04'00'

Daniel Murray
Manager, Space Transportation Development Division

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

Attachment 1 – Project Description

Background

In 2018, Space Florida prepared a 2018 *Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License* (2018 EA) to operate the SLF as a launch location for horizontally launched and landed reusable vehicles. The FAA issued a Finding of No Significant Impact (FONSI) based on the 2018 EA on November 2, 2018 and issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Space Florida now proposes to add reentry vehicle operations with new flightpaths to the Proposed Action, which will be analyzed in a Supplemental Environmental Assessment (SEA).[1]

Project Activities

Under the proposed project, the FAA would issue a RSOL to Space Florida for the operation of a commercial space reentry site at the SLF. Space Florida proposes to offer the site to vehicle operators for reentry operations. The reentry vehicle expected to operate at SLF and analyzed in the SEA is similar to the Sierra Nevada Corporation (SNC) *Dream Chaser®* spacecraft. **Table 1** summarizes the reentry vehicle parameters. **Figure 1** shows a reentry vehicle and proposed operation.

Table 1: Reentry Vehicle Parameters

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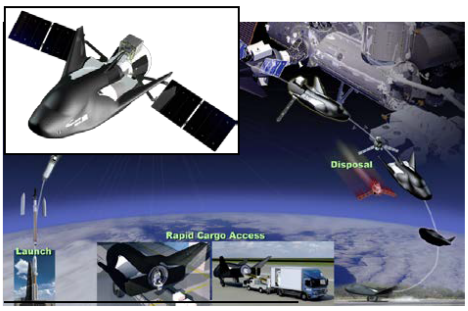
Gross Vehicle Weight	24,600 lbs
Landing Gear Configuration	Nose skid and two rear wheels
Runway Length Required for Landing	10,000 ft
Cross-Range Capability	± 700 nmi
Propellants	Hydrogen Peroxide (H2O2) and Kerosene (RP-1)
Return Payload Capacity	1,850 kg

[1] Dream Chaser propellants ae used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground. Source: SNC, 2019.

Figure 1: Reentry Vehicle and Operation



[1] "Reentry vehicle" means a vehicle designed to return from Earth orbit or outer space to Earth, or a reusable launch vehicle designed to return from Earth orbit or outer space to Earth, substantially intact. 51 U.S.C. § 50902 (19)

Source: SNC, 2019.

Reentry vehicle operations would include up to 6 reentries annually over the five-year license term (see **Table 2**).

Table 2: Estimated Annual Number of Reentries

	2020	2021	2022	2023	2024
Vehicle Reentries	1	2	3	5	6

Source: Space Florida, 2019.

The reentry vehicle would reenter the atmosphere from west/southwest and overfly the Gulf of Mexico or Caribbean Sea, based on a mission dependent trajectory before landing at the SLF. The operation of reentry vehicles to the SLF would not require any closures of non-involved Kennedy Space Center property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

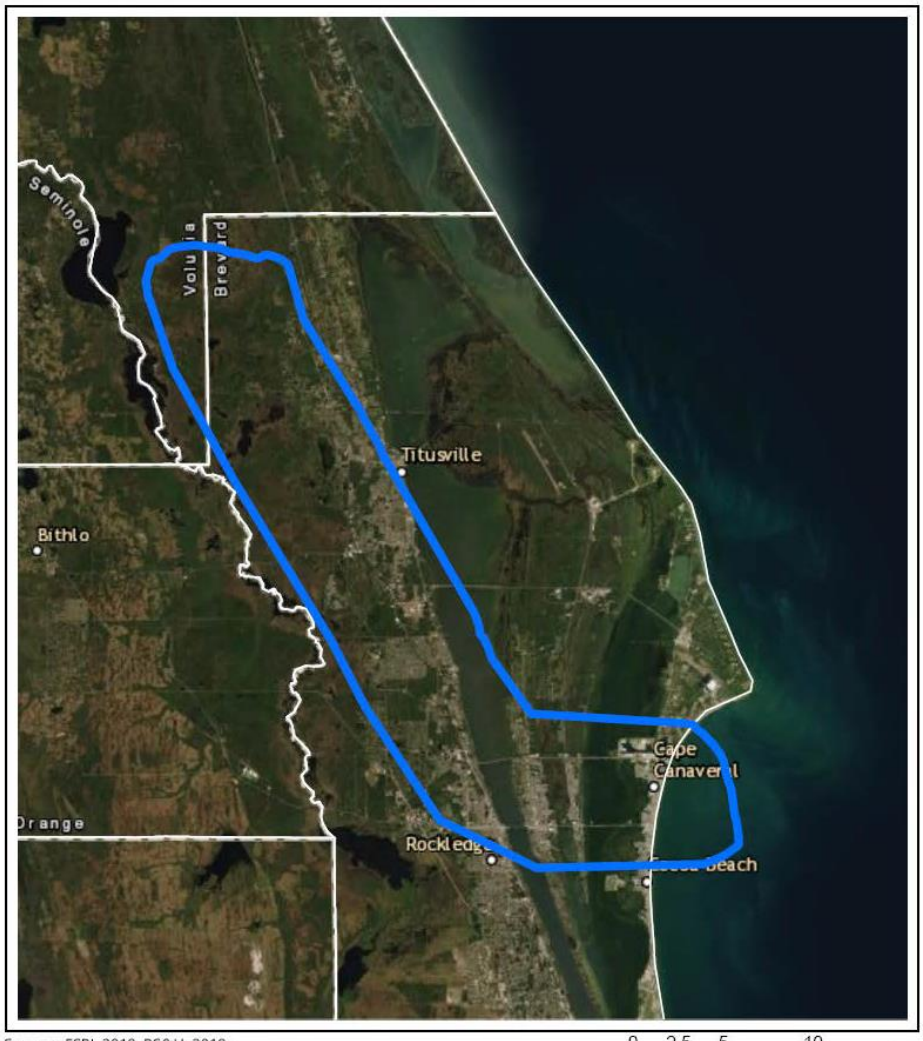
Reentry vehicles would pass below 60,000 feet above mean sea level (MSL) approximately 30-40 miles prior to landing at the SLF. The vehicle would generate a sonic boom during reentry. No construction activities are proposed as part of the proposed project.

Area of Potential Effects

The FAA has defined an APE in consideration of both potential direct and indirect effects associated with proposed reentry operations.

The proposed APE encompasses about 280 square miles and includes portions of Brevard and Volusia counties. The APE also extends over a portion of the Atlantic Ocean. This APE is based on the footprint of the reentry vehicle's sonic boom noise contour and includes those areas of the Earth's surface that would experience a sonic boom of 1.0 pound per square foot or greater. (Attachment 2)

Attachment 2 – Area of Potential Effects



Government-to-Government consultation letters (see following pages for an example) were sent to the following Native American Tribal leaders for tribes for which no THPO contact was available:

Native American Tribe	Name	Title	Email	Address	City	State	Zip Code
Miccosukee Tribe of Indians of Florida	Billie Colley	Chairman	HopeL@miccosukeetribe.com	P.O. Box 440021	Miami	FL	33144
Seminole Nation of Oklahoma	Leonard Harjo	Chief	chief.prin@sno-nsn.gov	PO Box 1498	Wewoka	OK	74884

U.S. Department
of Transportation
**Federal Aviation
Administration**

Commercial Space Transportation

800 Independence Ave., SW.
Washington, DC 20591

March 12, 2020

Billie Colley, Chairman
Miccosukee Tribe of Indians of Florida
P.O. Box 440021, Miami, FL, 33144

RE: Invitation for Government-to-Government Tribal Consultation for Reentry Vehicle Operations at the Shuttle Landing Facility at Cape Canaveral Spaceport in Brevard County, Florida

The Federal Aviation Administration (FAA) has received an application from Space Florida to conduct reentry vehicle operations at the Shuttle Landing Facility (SLF) at the Cape Canaveral Spaceport in Brevard County, Florida. In accordance with the National Environmental Policy Act (NEPA), the FAA issuance of a Reentry Site Operator License (RSOL) is considered a federal action. For your reference, a project description is enclosed with this letter. The FAA has initiated preparation of a Supplemental Environmental Assessment to meet its regulatory obligations.

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 contacting your tribal leaders to initiate 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 contact Stacey Zee at 202-267-9305, or via email at Stacey.Zee@faa.gov within 30 days of the receipt of this letter to confirm your intent to participate in this government-to-government consultation.

Sincerely,

DANIEL P MURRAY Digitally signed by DANIEL P MURRAY
Date: 2020.03.31 09:27:28 -04'00'

Daniel Murray
Manager, Space Transportation Development Division

Enclosures:
Attachment 1 – Project Description

Attachment 1 – Project Description

Background

In 2018, Space Florida prepared a 2018 *Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License* (2018 EA) to operate the SLF as a launch location for horizontally launched and landed reusable vehicles. The FAA issued a Finding of No Significant Impact (FONSI) based on the 2018 EA on November 2, 2018 and issued a Launch Site Operator License (LSOL) (License Number: LSO 18-018) to Space Florida to operate a launch site at the SLF. Space Florida now proposes to add reentry vehicle operations with new flightpaths to the Proposed Action, which will be analyzed in a Supplemental Environmental Assessment (SEA).[1]

Project Activities

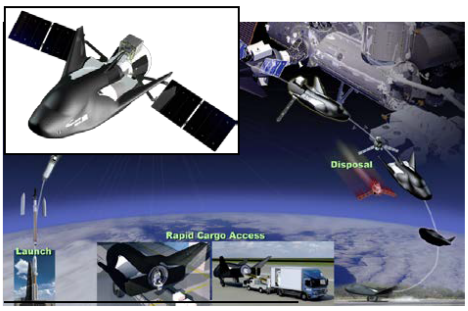
Under the proposed project, the FAA would issue a RSOL to Space Florida for the operation of a commercial space reentry site at the SLF. Space Florida proposes to offer the site to vehicle operators for reentry operations. The reentry vehicle expected to operate at SLF and analyzed in the SEA is similar to the Sierra Nevada Corporation (SNC) *Dream Chaser*® spacecraft. **Table 1** summarizes the reentry vehicle parameters. **Figure 1** shows a reentry vehicle and proposed operation.

Table 1: Reentry Vehicle Parameters

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 nmi
Propellants	Hydrogen Peroxide (H2O2) and Kerosene (RP-1)
Return Payload Capacity	1,850 kg

[1] Dream Chaser propellants ae used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground. Source: SNC, 2019.

Figure 1: Reentry Vehicle and Operation



[1] "Reentry vehicle" means a vehicle designed to return from Earth orbit or outer space to Earth, or a reusable launch vehicle designed to return from Earth orbit or outer space to Earth, substantially intact. 51 U.S.C. § 50902 (19)

Source: SNC, 2019.

Reentry vehicle operations would include up to 6 reentries annually over the five-year license term (see **Table 2**).

Table 2: Estimated Annual Number of Reentries

	2020	2021	2022	2023	2024
Vehicle Reentries	1	2	3	5	6

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The reentry vehicle would reenter the atmosphere from west/southwest and overfly the Gulf of Mexico or Caribbean Sea, based on a mission dependent trajectory before landing at the SLF. The operation of reentry vehicles to the SLF would not require any closures of non-involved Kennedy Space Center property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

Reentry vehicles would pass below 60,000 feet above mean sea level (MSL) approximately 30-40 miles prior to landing at the SLF. The vehicle would generate a sonic boom during reentry. No construction activities are proposed as part of the proposed project.

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APPENDIX A-5 – STAKEHOLDER MEETINGS

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Stakeholder Outreach

The Federal Aviation Administration's (FAA's) Office of Commercial Space Transportation (AST) is working to proactively engage stakeholders by initiating early and ongoing outreach efforts that span the life of the license application review process, including the pre-application consultation phase and prior to the associated environmental document's public review period.

June 2019

AST organized meetings with internal FAA contacts and with agencies located near the Shuttle Landing Facility (SLF). In the meetings, Space Florida described their plans for the proposed reentry site and potential reentry operations. AST provided an overview of the licensing process.

- Intra-agency coordination: June 3, 2019 meeting with the Airport Planning and Environmental Division, Orlando Airport District Office, Command Center, and the SLF Jacksonville Air Route Traffic Control Center.
- Interagency meeting (Cooperating Agencies): In June 2019, AST met with agencies located near the SLF. The agencies provided points of contact for the project.
- Four agencies asked to be Cooperating Agencies for the environmental process:
    - The National Aeronautics and Space Administration (Kennedy Space Center)
    - US Air Force (Cape Canaveral Air Force Station)
    - US Fish and Wildlife (Merritt Island National Wildlife Refuge)
    - National Park Service (Cape Canaveral National Seashore and Atlanta-based regional staff)

June 2020

AST met with Cooperating Agencies for the SLF Reentry Programmatic Environmental Assessment (EA). In this meeting, Space Florida and the Sierra Nevada Corporation (SNC) presented their proposed operations and proposed application timelines. AST described the planned stakeholder engagement approach for the project, the status of the environmental document, and the change in approach to a Programmatic EA.

September 2020

On September 25, 2020, the FAA hosted a virtual meeting to provide information on Space Florida's proposed reentry site operations and to collect feedback from interested aviation groups (Air Line Pilots Association, Airlines for America, Airports Council International – North America, and the American Association of Airport Executives).

At the meeting, Space Florida summarized the history of reentry operations at the SLF and Space Florida's role as a state-chartered spaceport authority. Space Florida provided an overview of their proposed reentry site operations and SNC described the representative reentry vehicle (SNC's Dream Chaser) used for the analyses in the PEA. While SNC plans to apply to the FAA for a reentry license to conduct reentry operations at the SLF, the application has not yet been submitted and was therefore not discussed during the call or in this PEA.

The FAA provided an overview of the FAA's licensing process, focusing on the Reentry Site Operator License for which Space Florida has applied. FAA staff described the FAA's safety review, airspace integration, and environmental review that are a part of the FAA's license review process.

Aviation stakeholder groups were provided an opportunity to ask questions and suggest additional groups for the FAA to include in future stakeholder engagement efforts for Space Florida's proposed reentry site operations. Meeting participants were encouraged to sign up for the project mailing list through the FAA's stakeholder engagement website for this project: https://www.faa.gov/space/stakeholder_engagement/shuttle_landing_facility/public_involvement_opportunities/.

APPENDIX A-6 – DRAFT EA COMMENTS

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DRAFT EA COMMENTS

The following commentors provided input during the agency and public review of the SLF Draft Programmatic Environmental Assessment.

- Commentor 1: Vinny [Last Name Unknown], General Public
- Commentor 2: Steven Wright, National Park Service
- Commentor 3: Kevin Thompson, Greater Orlando Aviation Authority

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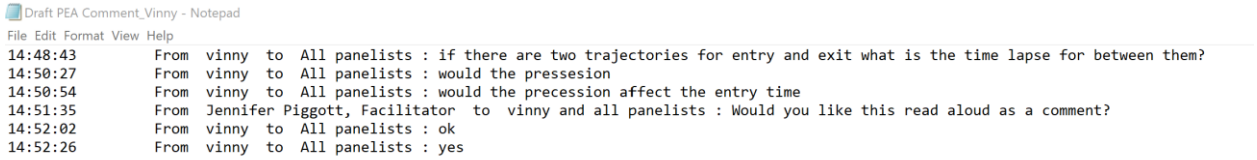
Commentor 1: Vinny [Last Name Unknown], General Public


Draft PEA Comment_Vinny - Notepad

File Edit Format View Help

14:48:43 From vinny to All panelists : if there are two trajectories for entry and exit what is the time lapse for between them?
14:50:27 From vinny to All panelists : would the pressesion
14:50:54 From vinny to All panelists : would the precession affect the entry time
14:51:35 From Jennifer Piggott, Facilitator to vinny and all panelists : Would you like this read aloud as a comment?
14:52:02 From vinny to All panelists : ok
14:52:26 From vinny to All panelists : yes

Response:

For a reentry vehicle coming from an International Space Station (ISS) orbit, the time traveling one orbit around the Earth is approximately 90 minutes. The precession of the specific orbit around the Earth dictates the reentry and landing time for the deorbit opportunity to land at the SLF.

Commentor 2: Steven Wright, U.S. Department of Interior, National Park Service

From: Zee, Stacey (FAA)
To: Alberts, David; Pete Eggert; Jimmy Moffitt (JMoffitt@spaceflorida.gov)
Cc: Clarkson, Chelsea (FAA); Fownes, Jennifer (Jennifer.Fownes@icf.com)
Subject: FW: [EXTERNAL] Notice of Availability for the Draft Programmatic EA for the Shuttle Landing Facility Reentry Site Operator License
Date: Monday, December 7, 2020 1:36:18 PM

FYI

From: Wright, Steven <Steven_M_Wright@nps.gov>
Sent: Monday, December 07, 2020 1:35 PM
To: slfproject@icf.com; Zee, Stacey (FAA) <Stacey.Zee@faa.gov>
Cc: Kneifl, Kristen R <Kristen_Kneifl@nps.gov>
Subject: Re: [EXTERNAL] Notice of Availability for the Draft Programmatic EA for the Shuttle Landing Facility Reentry Site Operator License

Stacey,

The National Park Service has no comments regarding the subject draft Programmatic Environmental Assessment for the Shuttle Landing Facility Reentry Site Operator License.

Steven M. Wright
National Park Service
Department of Interior Region 2
South Atlantic-Gulf Regional Office
Planning & Compliance Division
(404) 507-5710
(404) 507-5674 fax

nps.gov | FindYourPark.com

Response:

Comment noted.

Commentor 3: Kevin Thompson, Greater Orlando Aviation Authority

Fownes, Jennifer

From: Kevin Thompson <kevin.thompson@goaa.org>
Sent: Wednesday, December 2, 2020 7:49 PM
To: slfproject
Subject: SNC Dream Chaser SLC Questions

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Red Category

To whom it may concern,

I have a few questions regarding Space Florida's Part 433 license application and future Sierra Nevada Dream Chaser operations. I was unable to summit questions during the virtual workshop as only comments were allowed.

1. How does the SNC Dream Chaser compare to the Space Shuttle in terms of noise exposure levels (sonic boom) and noise contours?

2. Does the proposed action affect the Orlando class bravo airspace?

3. Do any contingency or emergency LOAs affect other Florida airports or FAA controlled airspace?

Thank you for your attention to these inquires. I look forward to hearing from you. Take care and stay healthy.

Best Regards,

Kevin Thompson, C.M., ACE
Aviation Noise Abatement Coordinator
Airport Operations – Airfield
Greater Orlando Aviation Authority
One Jeff Fuqua Blvd.
Orlando, FL 32827-4399
Phone: (407) 825-3828
kevin.thompson@goaa.org

GOAA GREEN
Greening The Orlando Experience®

Response:

1. The SNC Dream Chaser is significantly smaller and lighter than the Space Shuttle. The SNC Dream Chaser's maximum sonic boom was estimated by Blue Ridge Research and Consulting to be approximately 1.1 pounds per square foot (psf) in Brevard County with sonic booms less than 1.0 psf in the Central Florida region.

For comparison to the Space Shuttle, a 2011 NASA Contractor Report (NASA/CR-2011-217090 "A Compilation of Space Shuttle Sonic Boom Measurements") analyzed the sonic boom measurements for 23 Space Shuttle reentries and recorded a maximum sonic boom at 2.28 psf in Titusville and 1.75 psf in Orlando.[1]

See **Appendix B** of the Final PEA for further details on the Dream Chaser sonic boom calculations.

2. Please note that when a commercial vehicle operator applies to the FAA for a reentry license to reenter to the SLF, a separate environmental document, tiering off this PEA, would be developed to support the issuance of a reentry license to the prospective operator. The environmental document will disclose any closures or restrictions of airspace.

[1] NASA/CR-2011-217090 Source: https://ntrs.nasa.gov/citations/20110011322

The FAA and Space Florida will use the SLF PEA distribution list and project website to provide updates on subsequent environmental analyses.

3. Any commercial reentry operators would be required to obtain a reentry license from the FAA. The operators would need to develop a Letter of Agreement (LOA) as a part of the license. LOAs, in part, describe contingency scenarios and how those would be managed in real-time if they occur. The operator would coordinate the LOAs with any FAA stakeholders who manage airspace that would be used during reentry operations to the SLF.

APPENDIX B: SLF REENTRY SITE LICENSING SONIC BOOM ANALYSIS

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Blue Ridge Research and Consulting, LLC

Technical Report

Shuttle Landing Facility Reentry Site Licensing Sonic Boom Analysis

May 2, 2019 (FINAL)

Prepared for:
Brian Gulliver
Kimley-Horn
4582 South Ulster St, Suite 1500
Denver, CO 80237

Prepared by:
Michael James, M.S.
Alexandria Salton, M.S.

Kimley-Horn Project Number:
096627003.3 - Order #2
SLF LSOL and RSOL

BRRC Report Number:
BRRC 19-01

Blue Ridge Research and Consulting, LLC
29 N. Market St, Suite 700
Asheville, NC 28801
(p) 828-252-2209
(f) 831-603-8321
www.BlueRidgeResearch.com

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Acronyms and Abbreviations

The following acronyms and abbreviations are used in the report:

BRRC	Blue Ridge Research and Consulting, LLC
CDNL	C-weighted DNL
dB	decibel
dBA	A-weighted decibel level
dbC	C-weighted decibel level
DNL	Day-Night Average Sound Level
FAA	Federal Aviation Administration
ft	foot/feet
KSC	Kennedy Space Center
NASA	National Aeronautics and Space Administration
NIHL	noise-induced hearing loss
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
psf	pounds per square foot
RSOL	Reentry Site Operator License
SEL	Sound Exposure Level in decibels
SLF	Shuttle Landing Facility
SNC	Sierra Nevada Corporation

1 Introduction

This report documents the sonic boom analysis performed as part of Space Florida's effort to obtain a Reentry Site Operator License (RSOL) at the Shuttle Landing Facility (SLF).The SLF is managed by Space Florida and is part of the John F. Kennedy Space Center (KSC), located on Merritt Island in Brevard County, Florida (Figure 1). Sierra Nevada Corporation (SNC) is proposing to conduct reentry operations of the Dream Chaser spacecraft (Figure 1) at the SLF. In addition to the Dream Chaser, the SLF could support other types of reentry vehicles, for a total of six reentry operations annually. For the purposes of the RSOL application, the Dream Chaser is utilized as a representative reentry vehicle for noise and sonic boom analysis. Sonic boom modeling was conducted for ten representative reentry azimuths to evaluate the potential for sonic boom impacts across the range of possible reentry trajectories.

The representative reentry vehicle will create sonic booms during its supersonic reentry. The potential for the boom to intercept the ground depends on the trajectory and speed of the vehicle as well as the atmospheric profile. The sonic boom is shaped by the physical characteristics of the vehicle and the atmospheric conditions through which it propagates. These factors affect the perception of a sonic boom. The noise is perceived as a deep double boom, with most of its energy concentrated in the low frequency range. Although sonic booms generally last less than one second, their potential for impact may be considerable.

This noise study describes the potential for sonic boom impacts associated with the representative reentry vehicle during reentry events. Section 2 summarizes the noise metrics discussed throughout this report; Section 3 describes the general methodology of the sonic boom modeling; Section 4 describes the modeling input parameters; and Section 5 presents the sonic boom modeling results. A summary is provided in Section 6 to document the notable findings of this noise study.

Figure 1. Aerial view of the SLF and SNC's Dream Chaser spacecraft

2 Noise Metrics and Criteria

2.1 Noise Metrics

Any unwanted sound that interferes with normal activities or the natural environment can be defined as noise. Noise metrics are used to describe noise events and to identify 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. Noise sources can be continuous (constant) or transient (short-duration) and contain a wide range of frequency (pitch) content. Determining the character and level of sound aids in predicting the way it is perceived.

Sonic booms are classified as transient noise events and sonic boom levels are described in units of peak overpressure in pounds per square foot (psf). Sonic boom peak overpressures are used to assess single event noise impacts. Cumulative noise impacts are assessed using the Day-Night Average Sound Level (DNL) that accounts for the Sound Exposure Level (SEL) of all noise events in a 24-hour period. The SEL represents the cumulative noise exposure of a transient noise event and includes both its magnitude and its duration. Typically, 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 adjustment 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.

2.2 Noise Criteria

Noise criteria have been developed to protect the public health and welfare of the surrounding communities. The impacts of sonic booms are evaluated on a cumulative basis in terms of human annoyance. In addition, the sonic boom impacts are evaluated on a single-event basis in relation to hearing conservation and structural damage criteria. Although Federal Aviation Administration (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.

2.2.1 Human Annoyance

A significant noise impact would occur if the "action would increase noise by DNL 1.5 dB[A] or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB[A] 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" [1]. A-weighted DNL is based on long-term cumulative noise exposure and has been found to correlate well with community annoyance for regularly occurring events including aircraft, rail, and road noise [2, 3]. For impulsive noise sources with significant low-frequency content such as sonic booms, C-weighted DNL (CDNL) is preferred over A-weighted DNL [4]. In terms of percent highly annoyed, DNL 65 dBA is equivalent to CDNL 60 dBC [5]. Additionally, it has been noted that DNL "threshold does not adequately address the effects of noise on visitors to areas within a national park or national wildlife refuge where other noise is very low and a quiet setting is a generally recognized purpose and attribute" [1]. DNL contours are provided as the most widely accepted metric to estimate the potential changes in long-term community annoyance.

2.2.2 Hearing Conservation

Multiple federal government agencies have provided guidelines on permissible noise exposure limits on impulsive noise such as sonic booms. 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 (NIHL). In terms of upper limits on impulsive or impact noise levels, National Institute for Occupational Safety and Health (NIOSH) [6] and Occupational Safety and Health Administration (OSHA) [7] have stated that levels should not exceed 140 dB peak sound pressure level, which equates to a sonic boom level of approximately 4 psf. KSC's Hearing Loss Prevention Program states that impact or impulse noise exposure levels should not exceed 130 dB peak sound pressure level, which equates to a sonic boom level of approximately 1.3 psf.

2.2.3 Structural Damage

Sonic booms can be associated with structural damage. Most damage claims are for brittle objects, such as glass and plaster. Table 1 summarizes the threshold of damage that may be expected at various overpressures [8]. Additionally, Table 1 describes example impulsive events for each level range. A large degree of variability exists in damage experience, and much of the damage depends on the pre-existing condition of a structure. Breakage data for glass, for example, spans a range of two to three orders of magnitude at a given overpressure. The probability of a window breaking at 1 psf ranges from one in a billion [9] to one in a million [10]. These damage rates are associated with a combination of boom load and glass condition. At 10 psf, the probability of breakage is between one in 100 and one in 1,000. Laboratory tests involving glass [11] have shown that properly installed window glass will not break at overpressures below 10 psf, even when subjected to repeated booms. However, in the real world, glass is not always in pristine condition.

Damage to plaster occurs at similar ranges to glass damage. Plaster has a compounding issue in that it will often crack due to shrinkage while curing or from stresses as a structure settles, even in the absence of outside loads. Sonic boom damage to plaster often occurs when internal stresses are high as a result of these factors. In general, for well-maintained structures, the threshold for damage from sonic booms is 2 psf [8], below which damage is unlikely.

Table 1. Possible damage to structures from sonic booms [8]

Nominal level and comparative events	Damage Type	Item Affected
0.5 – 2 psf *Compares to piledriver at construction site*	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.
	Damage to outside 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 psf *Compares to cap gun or firecracker near ear*	Glass, plaster, roofs, ceilings	Failures show that would have been difficult to forecast in terms of their existing localized condition. Nominally in good condition.
4 – 10 psf *Compares to handgun at shooter's ear*	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.
	Roofs	High probability rate of failure in nominally good state, slurry-wash; some chance of failures in tiles on modern 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.
> 10 psf *Compares to fireworks display from viewing stand*	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.
	Ceilings	Plasterboards displaced by nail popping.
	Roofs	Most slate/slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gale-end and will-plate cracks; domestic chimneys dislodged if not in good condition.
	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
	Bric-a-brac	Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.

3 Sonic Boom Modeling

When a vehicle moves through the air, it pushes the air out of its way. At subsonic speeds, the displaced air forms a pressure wave that disperses rapidly. At supersonic speeds, the vehicle is moving too quickly for the wave to disperse, so it remains as a coherent wave. This wave is a sonic boom. When heard at ground level, a sonic boom consists of two shock waves (one associated with the forward part of the vehicle, the other with the rear part) of approximately equal strength and separated by 100 to 200 milliseconds. When plotted, this pair of shock waves and the expanding flow between them has the appearance of a capital letter “N,” so a sonic boom pressure wave is usually called an “N-wave.” An N-wave has a characteristic "bang-bang" sound that can be startling. Figure 2 shows the generation and evolution of a sonic boom N-wave under the vehicle.

Figure 3 shows the sonic boom pattern for a vehicle in steady, level supersonic flight. The boom forms a cone that is said to sweep out a “carpet” under the flight track. The boom levels vary along the lateral extent of the “carpet” with the highest levels directly underneath the flight track and decreasing as the lateral distance increases to the cut-off edge of the “carpet.” When the vehicle is maneuvering, the sonic boom energy can be focused in highly localized areas on the ground. The complete ground pattern of a sonic boom depends on the size, weight, shape, speed, and trajectory of the vehicle.

Sonic boom modeling and analysis utilize PCBoom software [12]. PCBoom calculates the magnitude and location of sonic boom overpressures on the ground from a vehicle in supersonic flight.

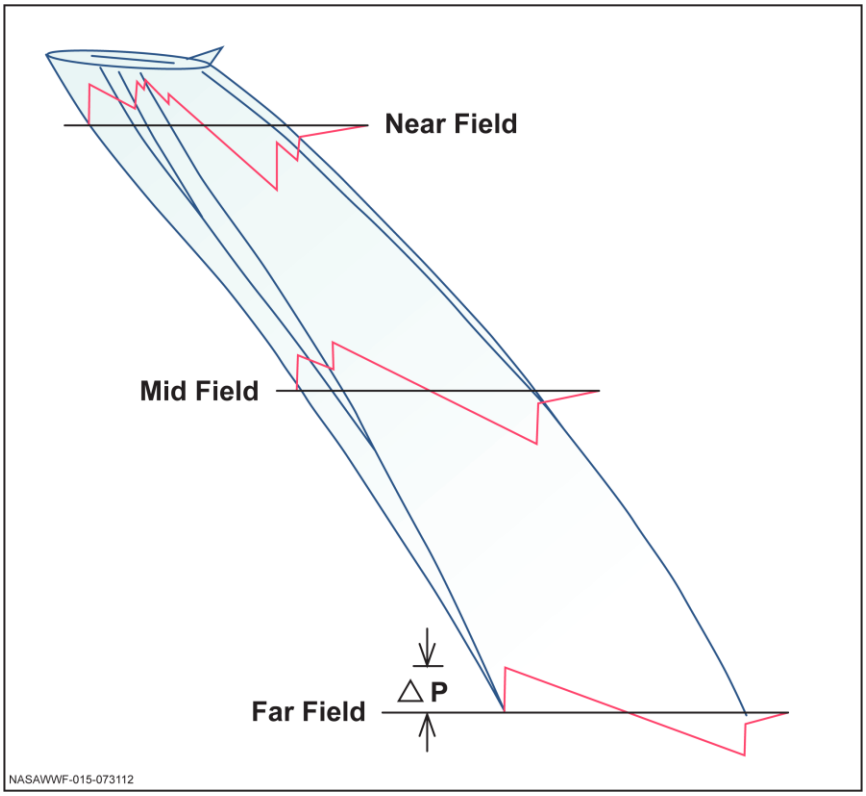

Figure 2. Sonic boom generation and evolution to N-wave [13]

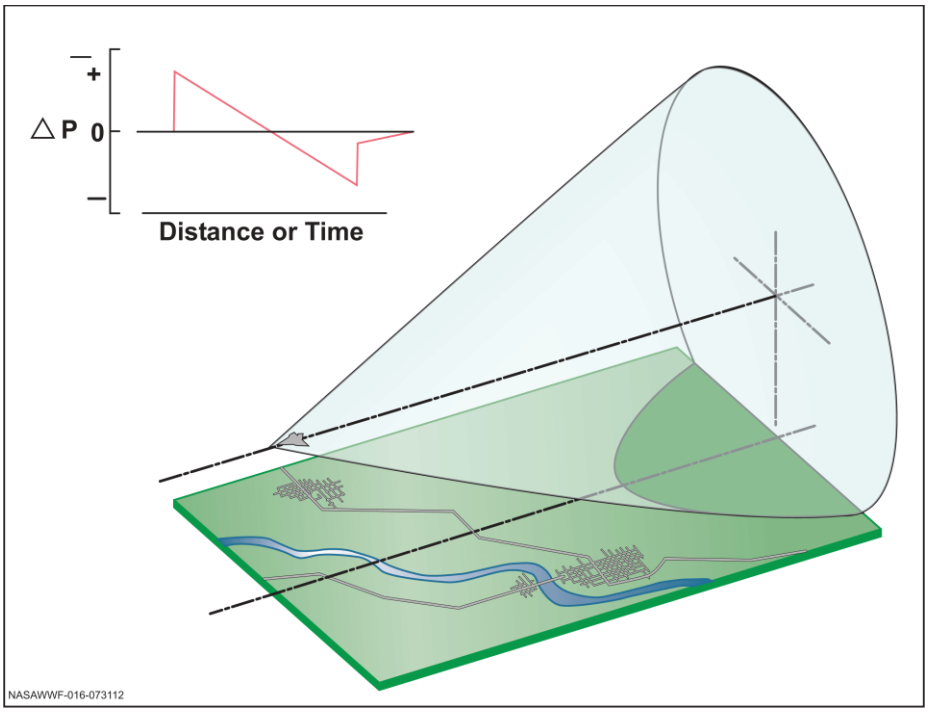

Figure 3. Sonic boom carpet for a vehicle in steady flight [14]

4 Shuttle Landing Facility Modeling Input

4.1 Reentry Site Description

The SLF is an airport and spaceport located on Merritt Island in Brevard County, Florida and is part of NASA's KSC as shown in Figure 4. The SLF was designed and constructed in the 1970s to serve as the primary landing and recovery site for the Space Shuttle Orbiter. In 2013, NASA's KSC officially signed over management of the SLF to Space Florida. The runway's coordinates are provided in Table 2. The reentry site's atmospheric profile was developed from standard atmospheric data sources [15, 16, 17] to create a composite atmospheric profile for altitudes up to 62 miles.

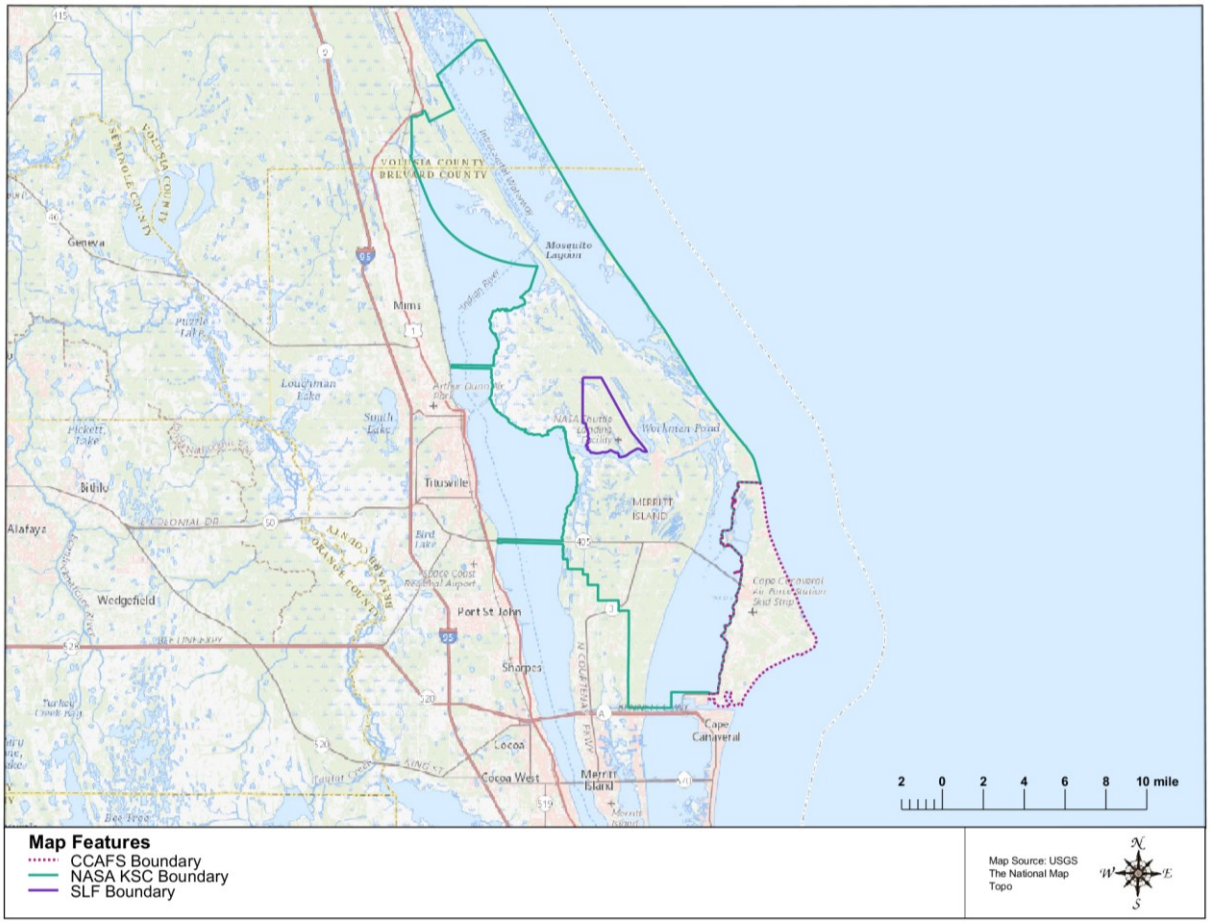

Figure 4. Site boundaries of Cape Canaveral Air Force Station (CCAFS), KSC, and SLF

Table 2. SLF runway coordinates

Runway	Start		End	
ID	Latitude	Longitude	Latitude	Longitude
Runway 15	28.632758° N	80.706064° W	28.597031° N	80.682683° W
Runway 33	28.597031° N	80.682683° W	28.632758° N	80.706064° W

4.2 Modeling Parameters

4.2.1 Vehicle Description

PCBoom requires specific vehicle input parameters to determine the sonic booms resulting from proposed reentry operations. For this analysis the Dream Chase spacecraft was chosen as the representative reentry vehicle and its parameters are presented in Table 3.

Table 3. Vehicle parameters used in acoustic modeling

Parameters	Values
Vehicle Description	SNC's Dream Chaser spacecraft
Vehicle Length	30 feet
Gross Vehicle Weight	24,600 lbs

4.2.2 Operational Data

The SLF is expected to support up to six reentries annually. Of the six total annual operations, two operations are projected to occur during acoustic nighttime hours (2200 – 0700).

4.2.3 Flight Trajectory Data

Reentry trajectories arriving to SLF will be unique to each mission and the environmental conditions. The proposed reentry operations span a range of possible reentry trajectories. For the purpose of assessing potential sonic boom impacts from vehicle reentries, a total of ten trajectories (five for each runway) have been provided by SNC to represent the range of reentry trajectories. The ten reentry trajectories are described in Table 4 and shown in Figure 5, where Runway 15 and Runway 33 trajectories are displayed in red and blue, respectively.

Table 4. Trajectory descriptions

Description
Runway 15 - Northern boundary of reentry trajectories
Runway 15 - Northern reentry trajectory
Runway 15 - Nominal reentry trajectory
Runway 15 - Southern reentry trajectory
Runway 15 - Southern boundary of reentry trajectories
Runway 33 - Northern boundary of reentry trajectories
Runway 33 - Northern reentry trajectory
Runway 33 - Nominal reentry trajectory
Runway 33 - Southern reentry trajectory
Runway 33 - Southern boundary of reentry trajectories

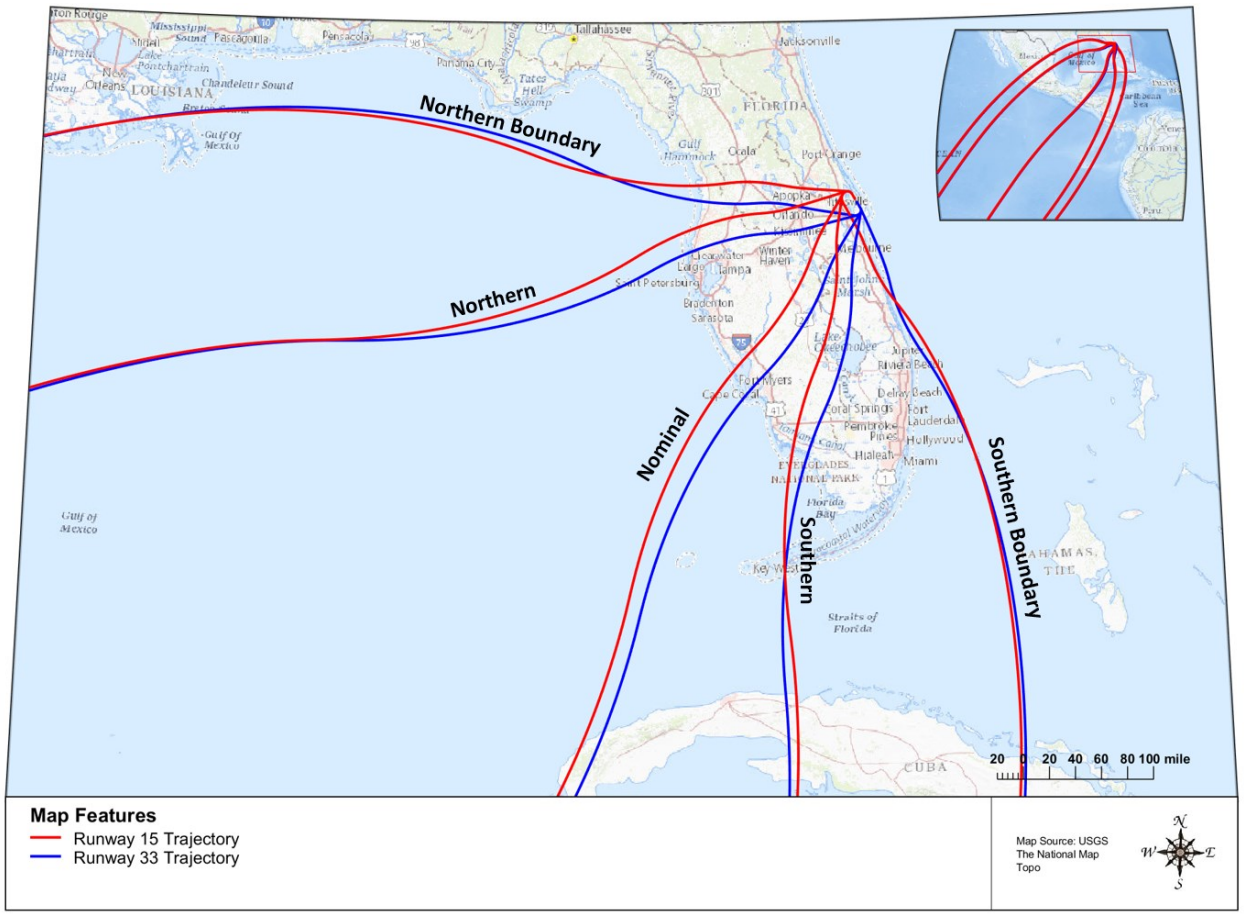

Figure 5. Modeled supersonic flight path of SNC's Dream Chaser spacecraft reentries

5 Results

The following section presents the noise study results of the sonic boom impacts associated with the representative reentry vehicle operations to the SLF. 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/or location of sonic boom regions is highly dependent on the actual trajectory and atmospheric conditions at the time of flight.

The modeled sonic boom contours for the northern bounding trajectory, northern trajectory, nominal trajectory, southern trajectory, and southern bounding trajectory to Runway 15 are presented in Figure 6 through Figure 10, respectively. Similarly, the sonic boom contours for the five reentry trajectories to Runway 33 are presented in Figure 11 through Figure 15. Each figure presents the sonic boom contours for levels above 0.5 psf across Florida and Cuba along with an inset map that displays the entire extent of the 0.25 psf sonic boom contour over the Pacific Ocean. The modeled sonic boom contours are presented for contours levels between 0.25 psf and 1 psf. In addition to the contours, the black ground path in the figures show the portion of supersonic flight during each event that generate sonic boom footprints that intercept the ground. Note, the Dream Chaser spacecraft is subsonic before it turns to its final approach.

The potential for sonic boom impacts over the entire range of reentry trajectories is represented by 'envelope' contours as presented in Figure 16. The 'envelope' contours represent the maximum peak overpressure predicted for any trajectory flown within the range of potential reentry azimuths. The area impacted by a single trajectory will be much smaller as shown in Figure 6 through Figure 15. A summary of the modeled 'envelope' sonic boom peak overpressure results presented in Figure 16 is detailed below.

- Land areas within the 'envelope' sonic boom contours include central/southern Florida, the Louisiana coast, southeast Texas, Mexico, Central America, the Galapagos Islands, western Cuba, and the islands of Bimini and the Cay Sal Bank in the Bahamas. The predicted overpressure levels for a vast majority of this area are between 0.25 and 0.5 psf, comparable to distant thunder.
- Land area in portions of Florida and Northwestern Cuba may experience levels greater than 0.5 psf. Sonic boom peak overpressures between 1.0 and 1.1 psf may be experienced by communities along the Florida Space Coast, including Cape Canaveral, Merritt Island, Cocoa, Port St John, and Titusville.

The modeled maximum peak overpressure is approximately 1.1 psf over all trajectories. A modeled maximum of 1.1 psf translates to an equivalent CDNL of 41 dBC for the maximum projected reentry operation tempo. Therefore, the proposed reentry vehicle operations do not pose a significant impact with regards to human annoyance as the noise exposure is less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA). The potential for hearing damage (with regards to humans) is negligible, as the modeled sonic boom overpressure levels over land are substantially lower than the ~4 psf impulsive hearing conservation noise criteria. The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf.

Although the proposed reentry operations do not pose significant impacts in relation to human annoyance, hearing conservations, or structural damage; the unexpected, loud impulsive noise of sonic

booms tend to cause a startle effect in people. However, when humans are exposed to impulse noises with similar characteristics on a regular basis, they tend to become conditioned to the stimulus and the resulting startle reaction is generally not displayed. The physiological effects of single sonic booms on humans [18] for the levels produced by the representative reentry vehicle can be grouped as presented in Table 5.

Table 5. Physiological effects of single sonic booms on humans [18]

Sonic boom overpressure	Behavioral effects
0.3 psf	Orienting, but no startle response; eyeblink response in 10% of subjects; no arm/hand movement.
0.6 – 2.3 psf	Mixed pattern of orienting and startle responses; eyeblink in about half of subjects; arm/hand movements in about a fourth of subjects, but not gross bodily movements.

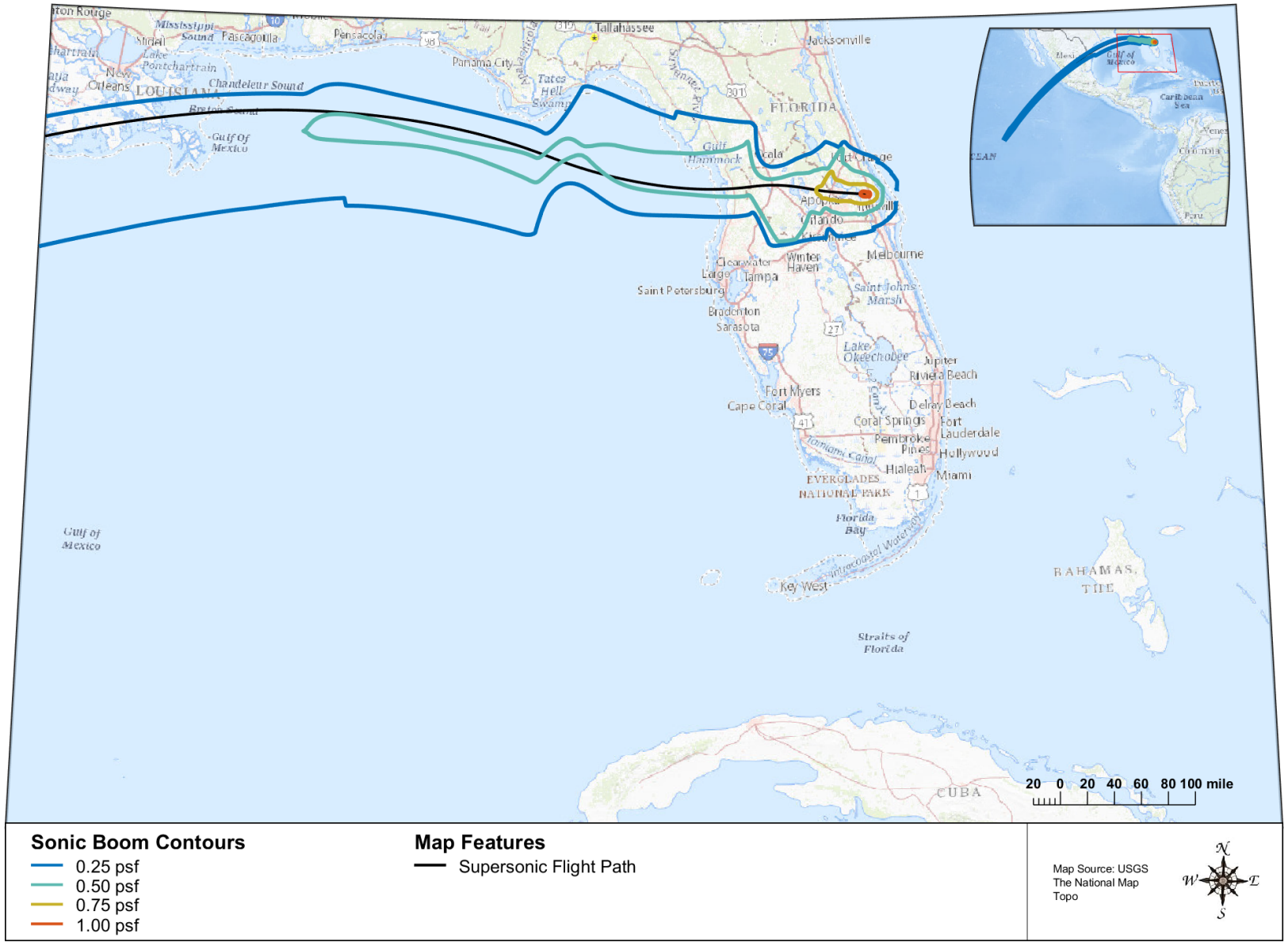

Figure 6. Sonic boom contours for the northern boundary of reentry trajectories to Runway 15

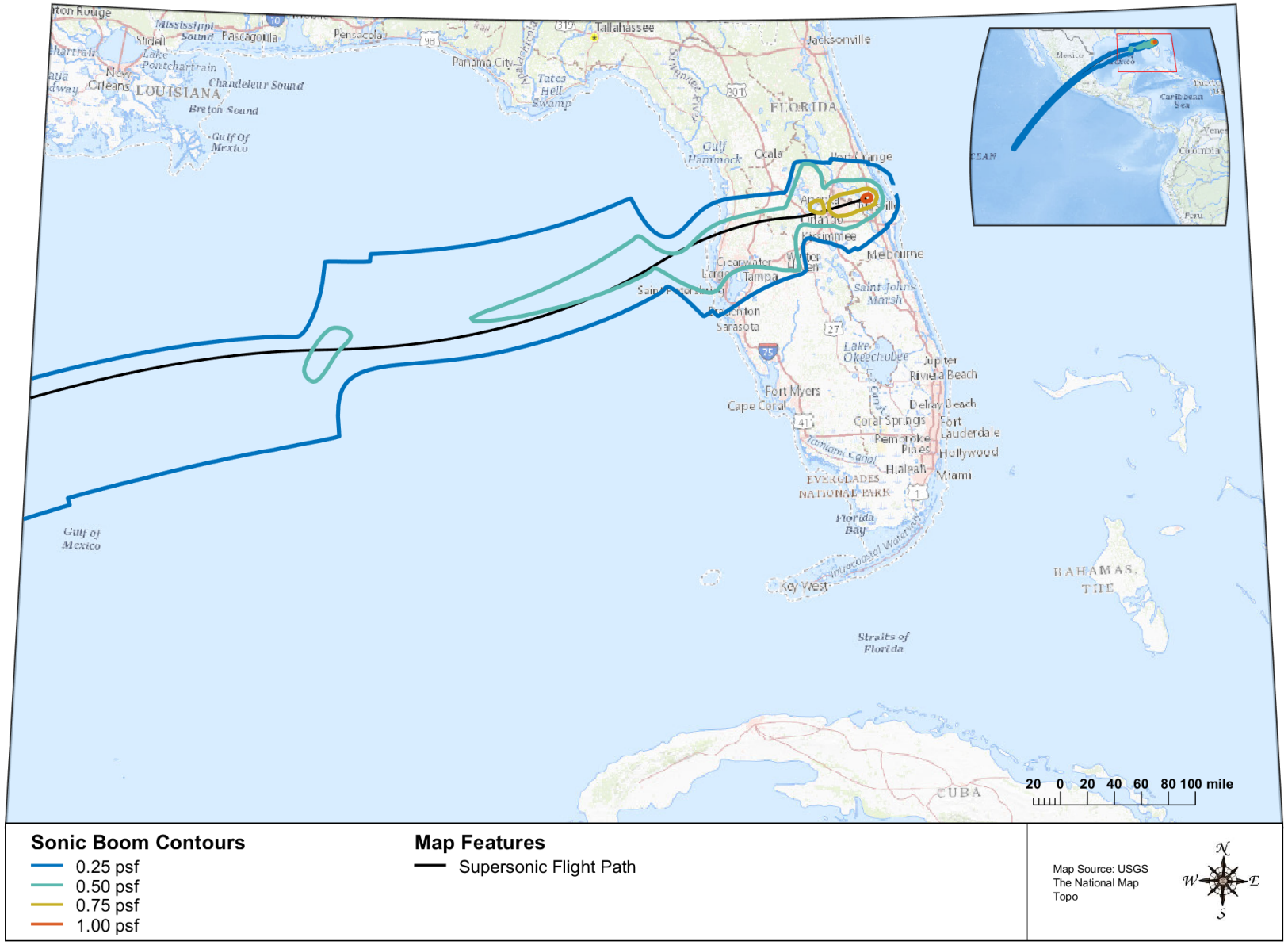

Figure 7. Sonic boom contours for the northern reentry trajectory to Runway 15

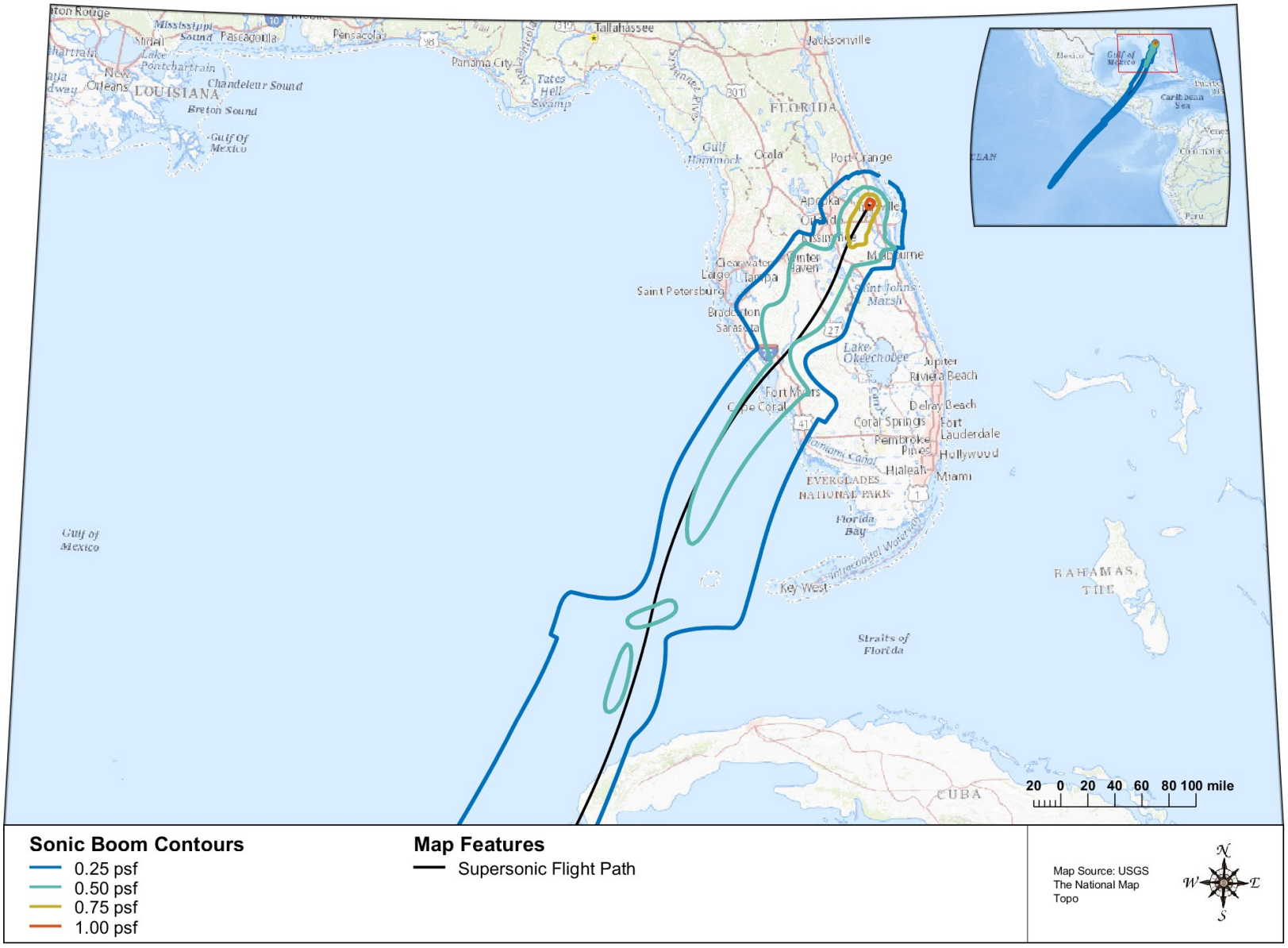

Figure 8. Sonic boom contours for the nominal trajectory to Runway 15

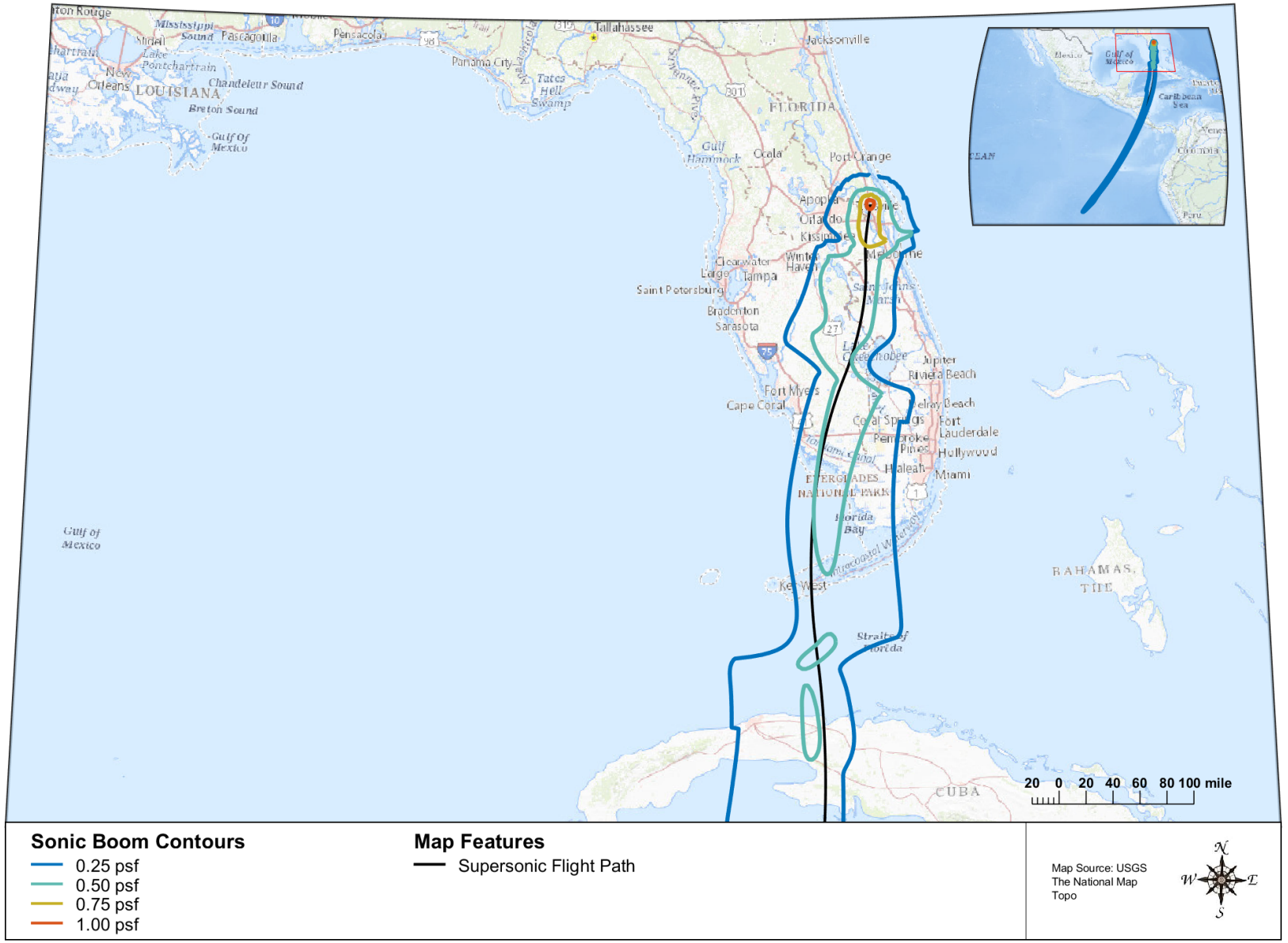

Figure 9. Sonic boom contours for the <u>southern</u> reentry trajectory to <u>Runway 15</u>

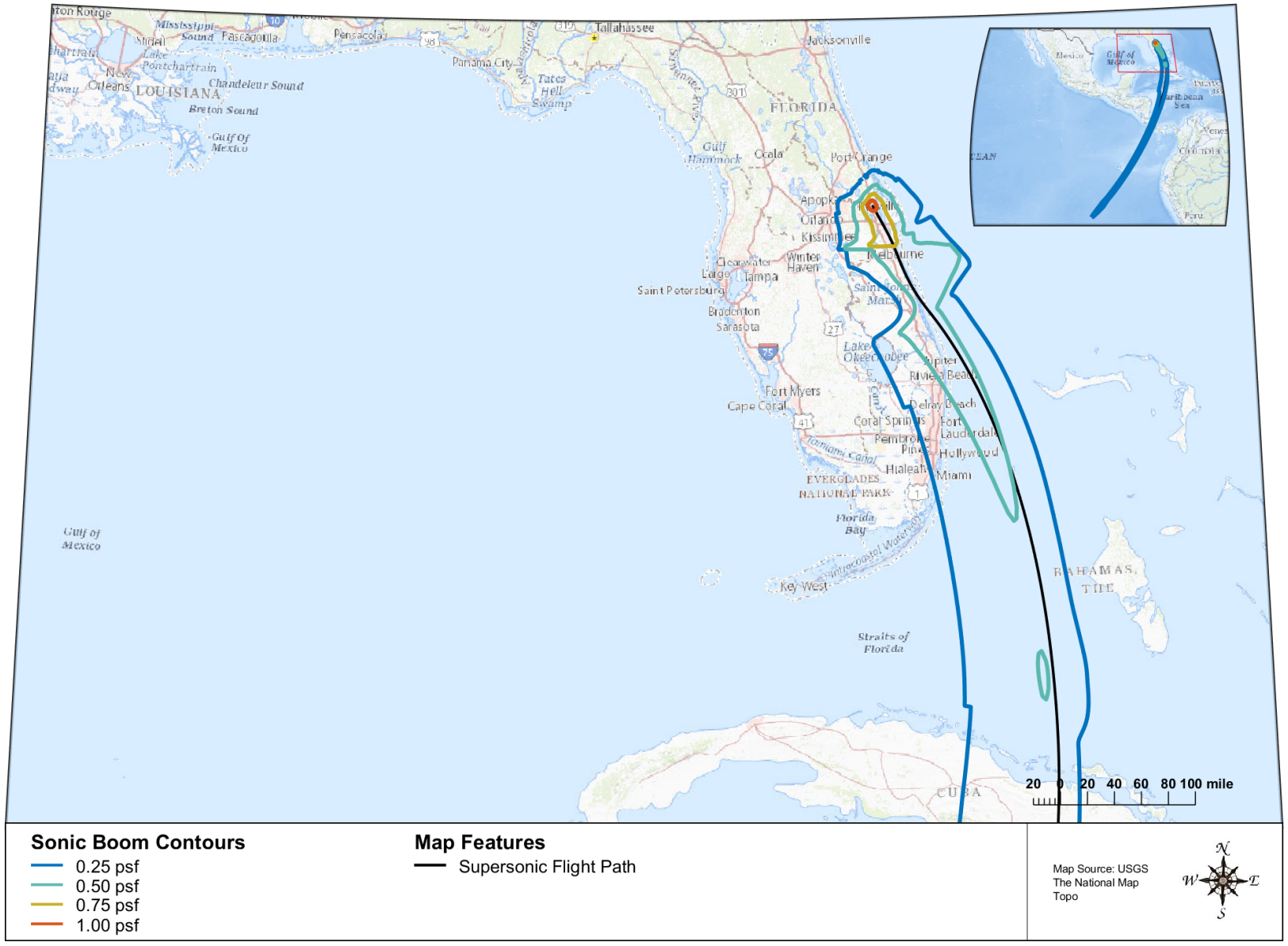

Figure 10. Sonic boom contours for the southern boundary of reentry trajectories to Runway 15

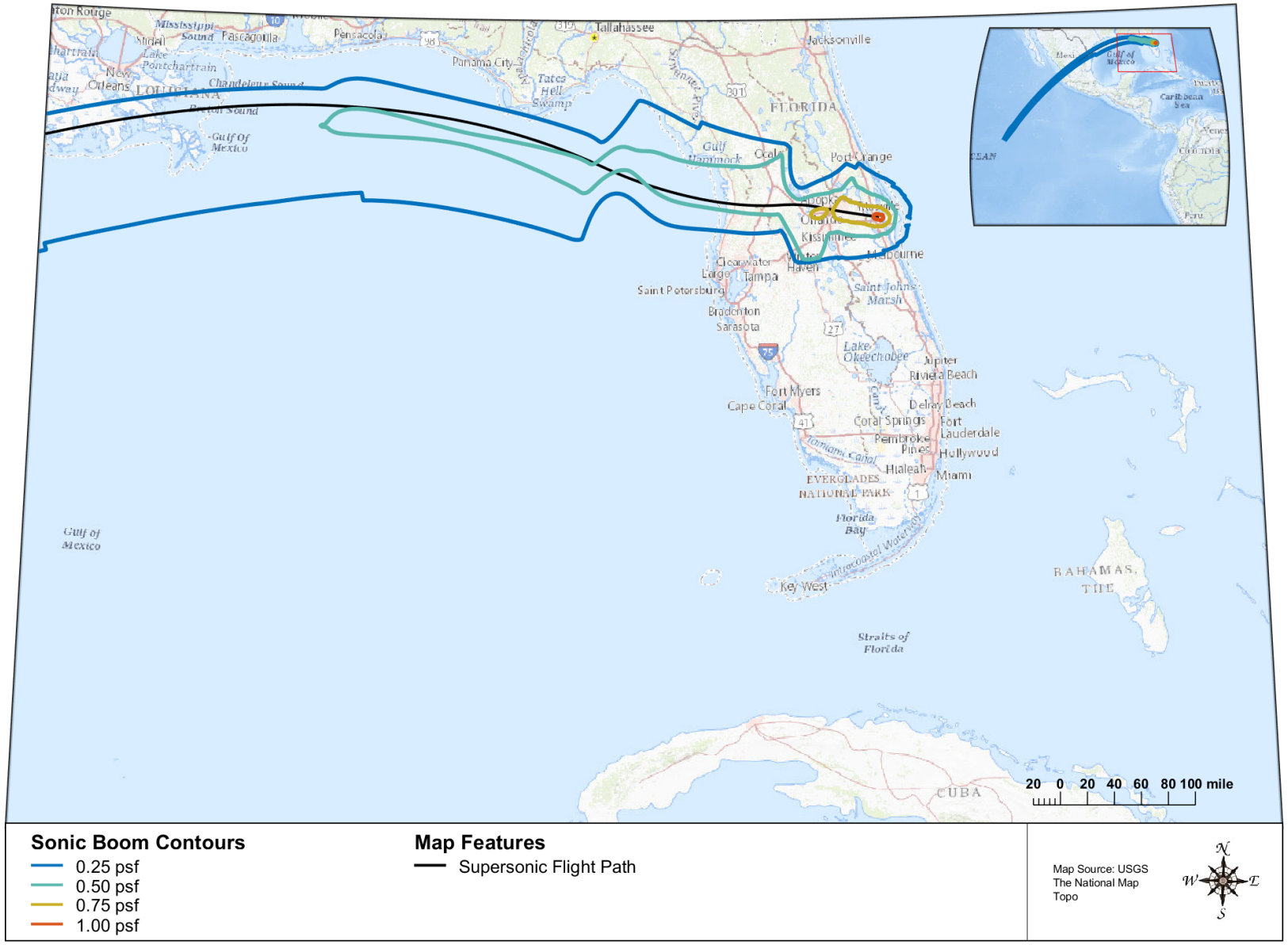

Figure 11. Sonic boom contours for the <u>northern boundary</u> of reentry trajectories to <u>Runway 33</u>

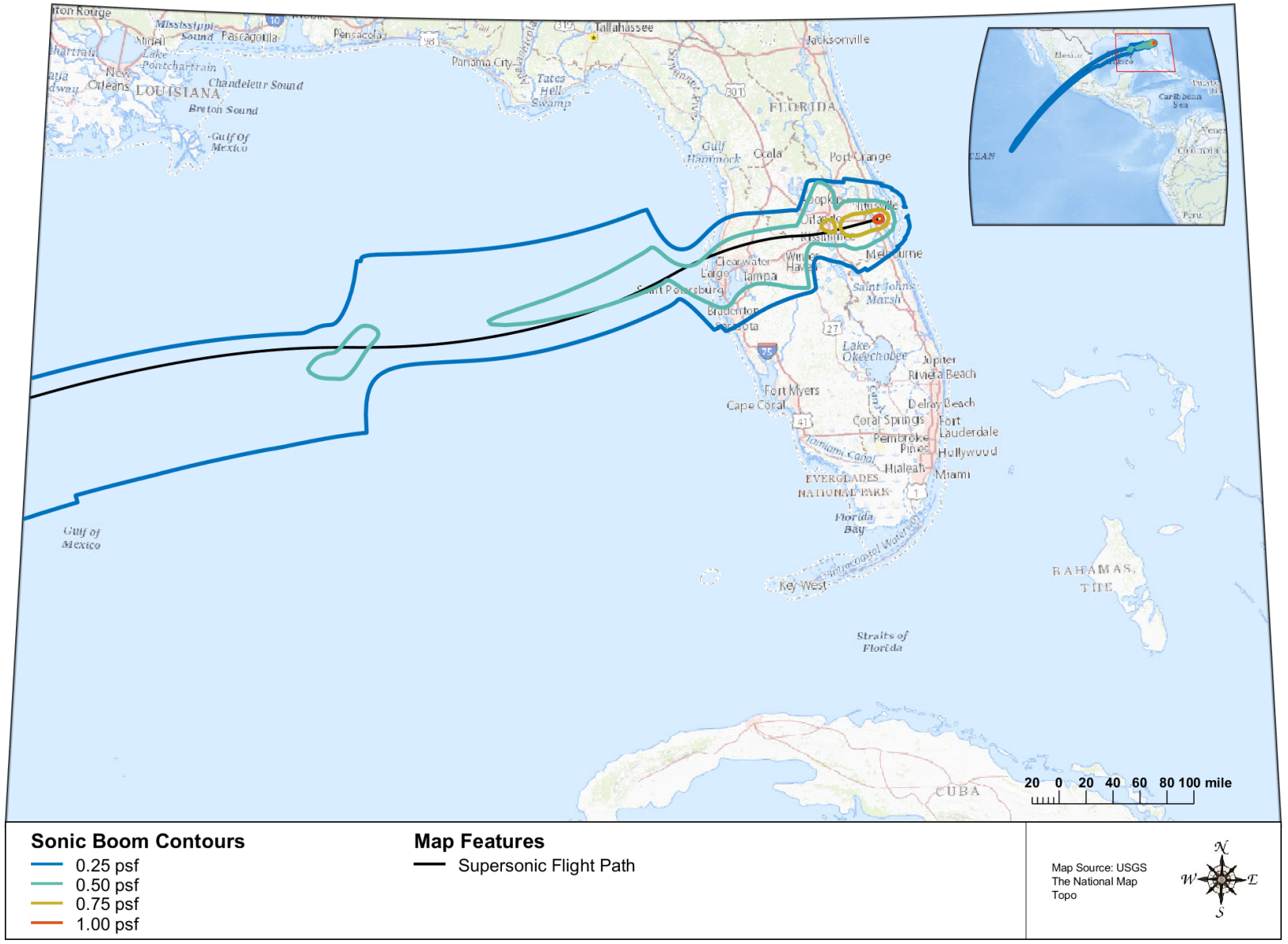

Figure 12. Sonic boom contours for the <u>northern</u> reentry trajectory to <u>Runway 33</u>

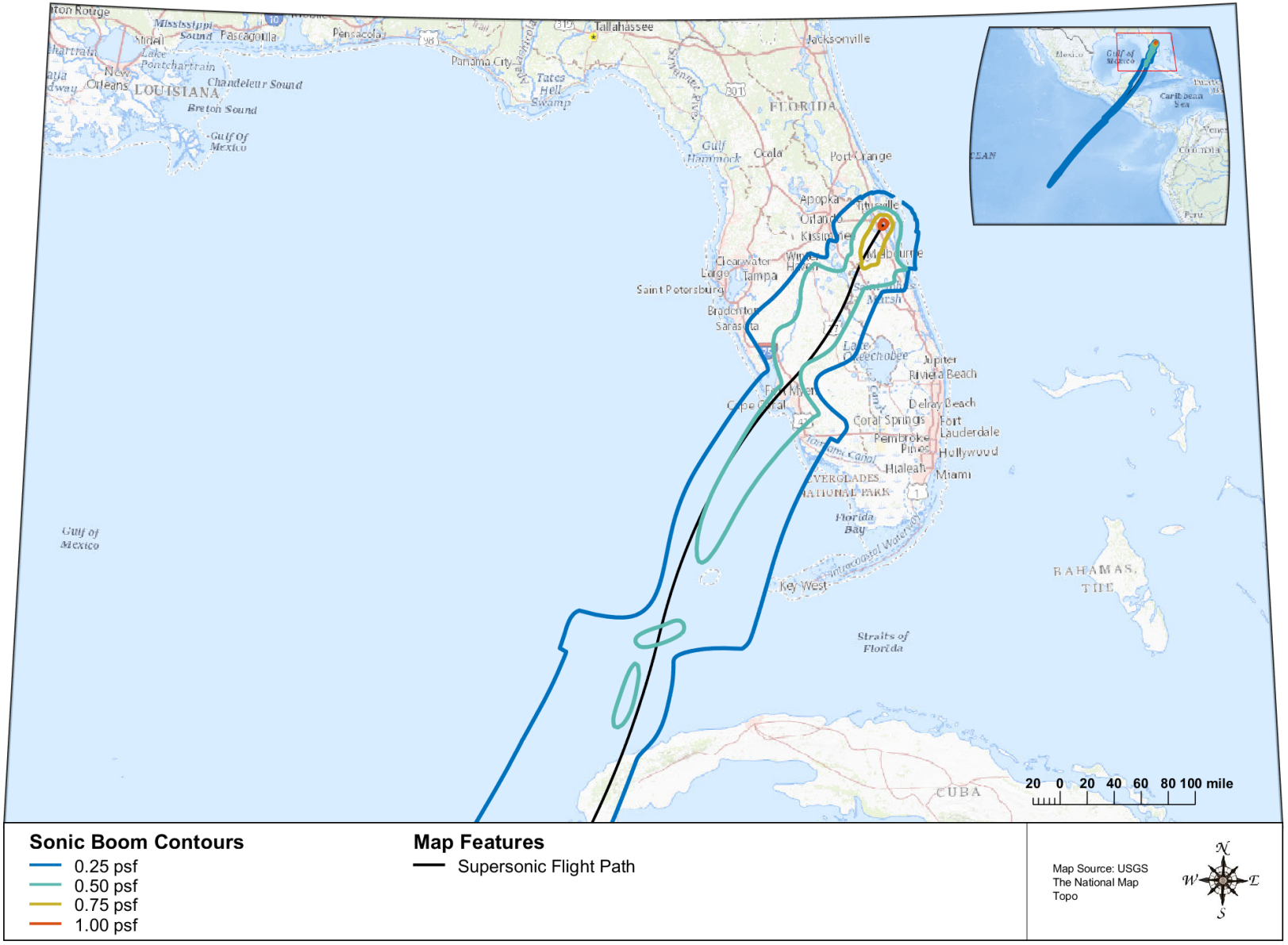

Figure 13. Sonic boom contours for the nominal trajectory to Runway 33

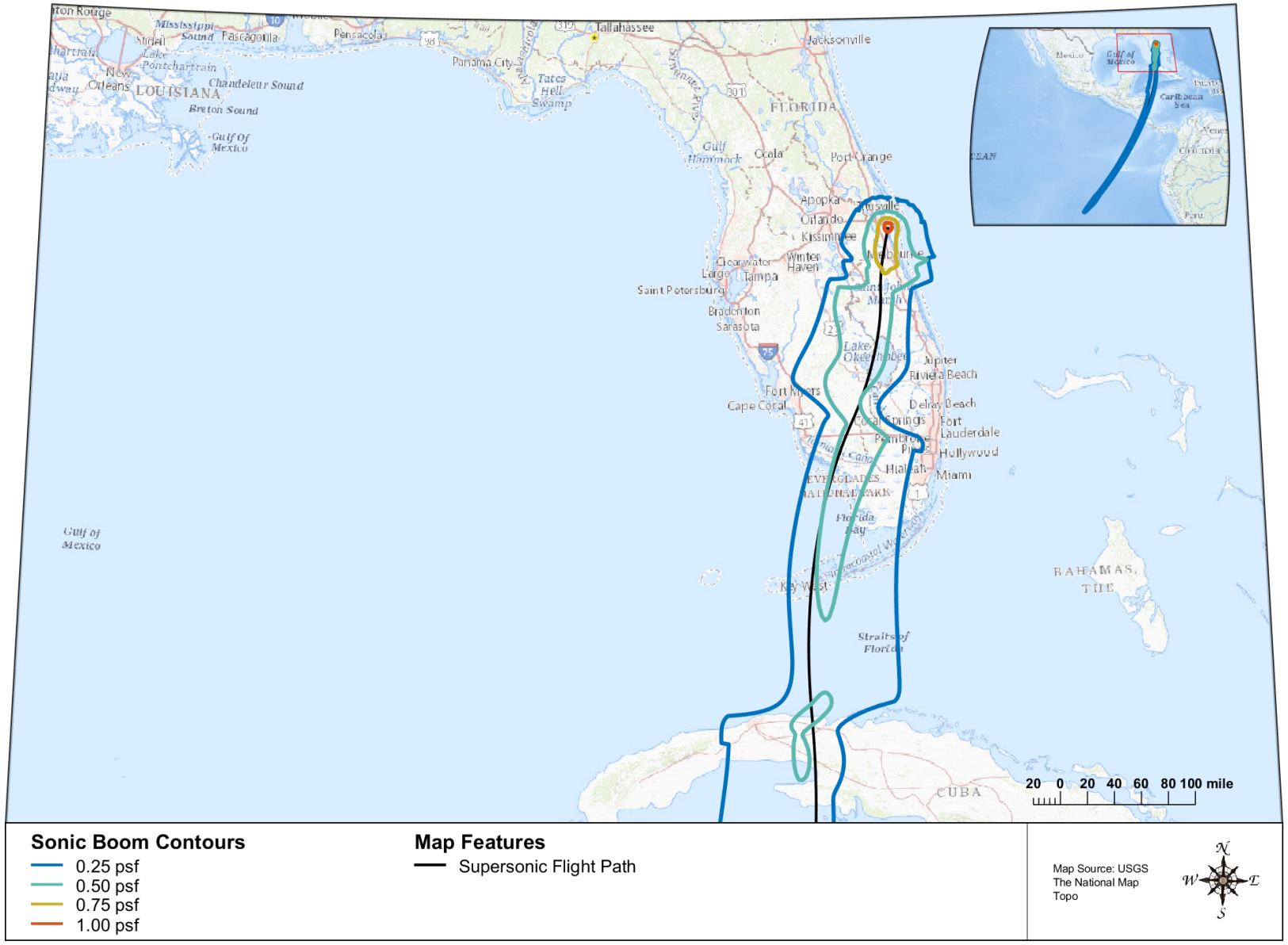

Figure 14. Sonic boom contours for the <u>southern</u> reentry trajectory to <u>Runway 33</u>

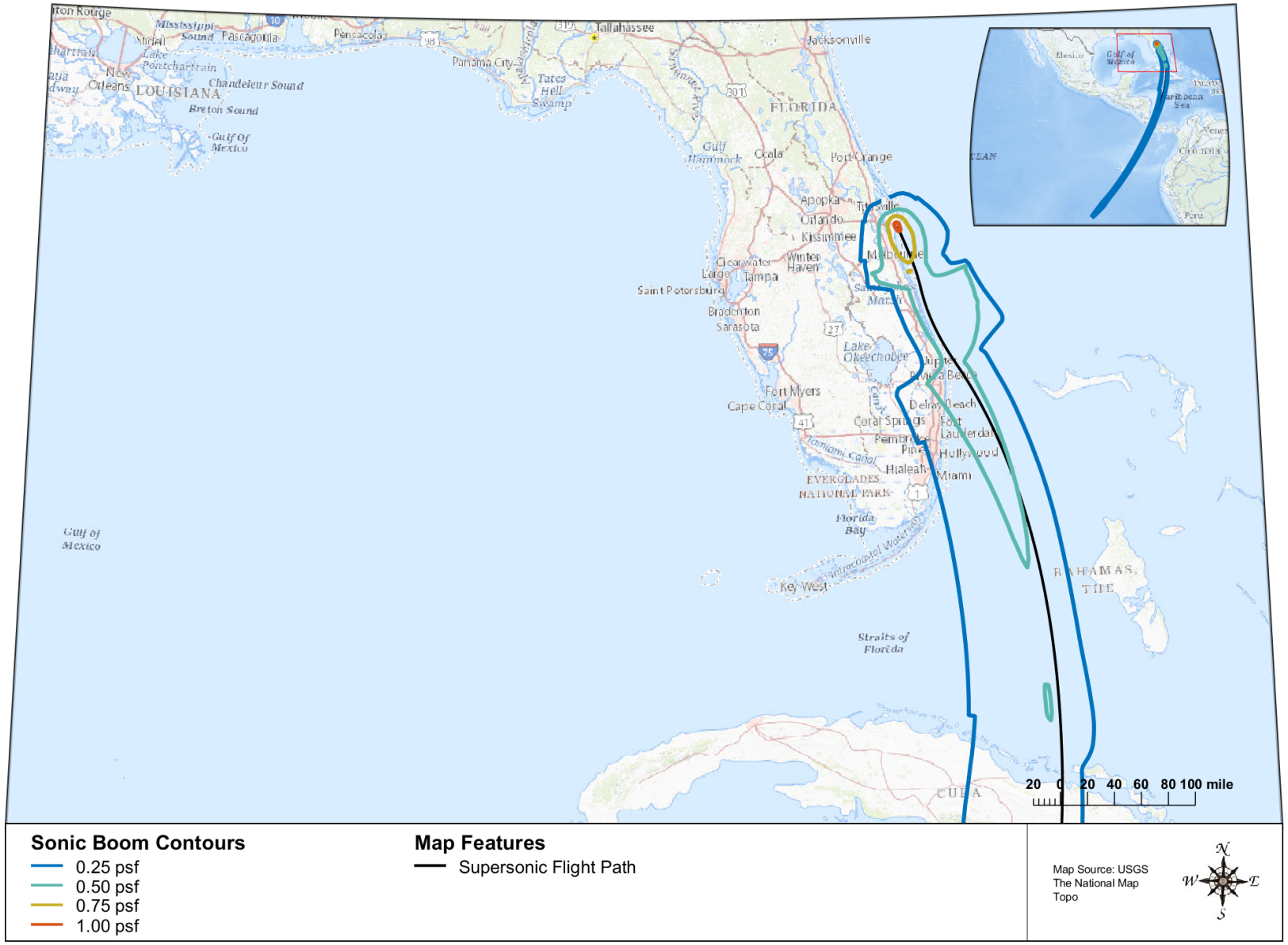

Figure 15. Sonic boom contours for the southern boundary of reentry trajectories to Runway 33

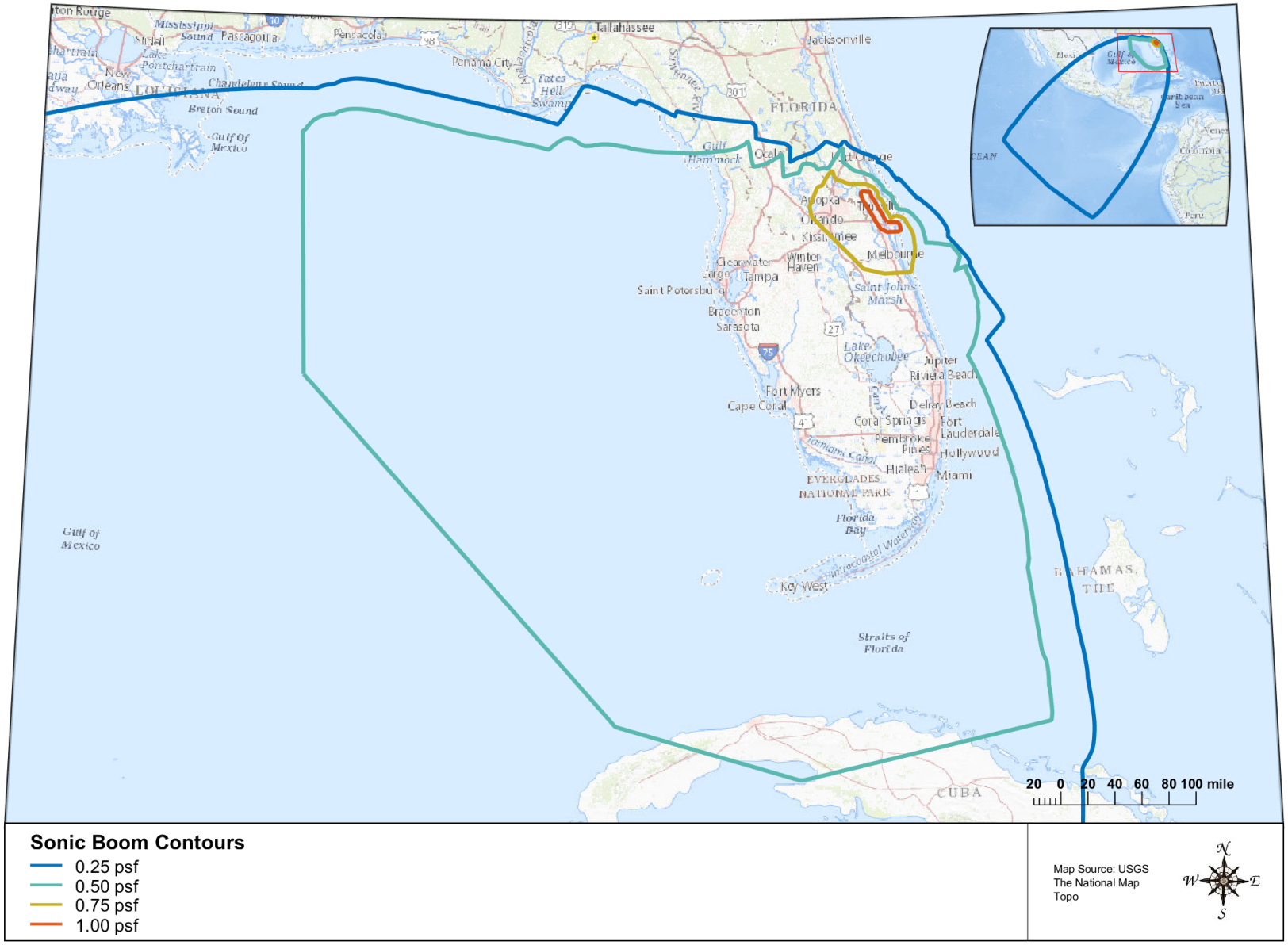

Figure 16. Sonic boom contours for the envelope of reentry trajectories

6 Summary

This report documents the sonic boom analysis performed as part of Space Florida's efforts to obtain an RSOL for the SLF. Space Florida is proposing to offer the SLF to potential commercial reentry operators for orbital reentries and landings up to six times annually. Sierra Nevada Corporation's Dream Chaser spacecraft was utilized as the representative reentry vehicle for this analysis. Sonic boom modeling was conducted for ten representative trajectories to evaluate the potential for sonic boom impacts across the range of possible reentry azimuths.

The potential for sonic boom impacts is evaluated on a single-event and cumulative basis in relation to human annoyance, hearing conservation and structural damage criteria. The modeled maximum peak overpressure is approximately 1.1 psf. A modeled maximum of 1.1 psf translates to an equivalent CDNL of 41 dBC for the maximum projected reentry operation tempo. Therefore, the proposed reentry vehicle operations do not pose a significant impact with regards to human annoyance as the noise exposure is less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA). The potential for hearing damage (with regards to humans) is negligible, as the modeled sonic boom overpressure levels over land are substantially lower than the ~4 psf impulsive hearing conservation noise criteria. The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf.

7 References

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APPENDIX C: USING THIS PROGRAMMATIC EA TO TIER FUTURE NEPA REVIEWS

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C.1 Using this Programmatic EA to Tier Future NEPA Reviews

C.1.1 What Is A Programmatic NEPA Document?

A programmatic document is a type of NEPA document (either an EA or EIS) from which future EAs and EISs can be tiered. Programmatic EAs and EISs are prepared for broad federal actions. Programmatic documents are useful in providing the basis for subsequent project-level specific environmental reviews. Programmatic NEPA reviews are subject to the same process and procedural requirements as other EAs and EISs.[1]

C.1.2 How Are Programmatic NEPA Documents Different from Project-Specific NEPA Documents?

Programmatic and project-specific NEPA documents differ in the scope of their analyses. Project-specific EAs and EISs tend to focus on specific actions at specific locations. In contrast, programmatic EAs and EISs tend to be broader in scope and tend to be less specific. A programmatic document should consider the potential environmental impacts of the future implementation of policy, projects, or actions, even if they are not fully known. In contrast, a project-specific NEPA document analyzes the impacts of an action within known and clearly defined parameters.

C.1.3 What Is Tiering?

Tiering refers to the coverage of general matters in broad NEPA reviews (such as programmatic EAs or EISs prepared for policies, programs, or broad groups of related actions) with subsequent narrower statements or analyses (such as project-level or site-specific EAs or EISs) that are tiered from the broader programmatic documents (see 40 CFR § 1508.28). Tiering allows for more efficient and focused analyses. Instead of restating material, information from a programmatic NEPA review can be incorporated into subsequent tiered reviews by reference (see 40 CFR § 1502.21). The advantage of tiering is that it reduces and eliminates a redundant or duplicative analysis that has already been considered at the programmatic level, thereby expediting the preparation of future site- or project-specific NEPA reviews. Tiering can also be used to sequence environmental documents from the early stage of a proposed action (e.g., need for the action and site selection) to a subsequent stage (e.g., proposed construction) to help focus on issues that are ripe for decision and exclude from consideration issues not yet ripe or already decided (see Paragraph 3-2 of FAA Order 1050.1F).

C.1.4 Why Is This Proposed Action Being Analyzed in a Programmatic NEPA Document?

Under the FAA licensing process, separate licenses must be obtained for operation of a commercial space launch or reentry site[2] and operation of a commercial space vehicle.[3] Space Florida's proposal is to obtain a Reentry Site Operator License (RSOL) to allow for the operation of commercial space reentry vehicles at

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[1] FAA Order 1050.1F, Paragraph 3-2 outlines the FAA's procedures for programmatic documents and tiering.

[2] 14 CFR § 420.15(b) discusses environmental review requirements for licenses to operate a launch site; 14 CFR §§ 433.7 and 433.9 discuss environmental review requirements for licenses to operate a reentry site.

[3] 14 CFR §§ 415.201 and 415.203 discusses environmental review requirements for launch licenses for expendable launch vehicles; 14 CFR §§ 431.91 and 431.93 discusses environmental review requirements for launch and reentry of reusable launch vehicles.

the Shuttle Landing Facility (SLF). The new capabilities would include establishing reentry corridors and recovery and post-reentry processing of reentry vehicles landing at the site.

The Proposed Action analyzed in this programmatic NEPA document does not include the issuance of reentry licenses to commercial space vehicle operators. When a reentry vehicle operator applies to the FAA for a license to conduct reentry operators at the SLF, a separate environmental document would be required to provide a more detailed analysis based on vehicle-specific parameters and operations.

The FAA has determined that analyzing the issuance of an RSOL to Space Florida in a programmatic document is an effective way to sequence environmental documents between Space Florida's RSOL and subsequent stages when a vehicle operator applied for a reentry license for the site. The FAA will tier subsequent documents from this Programmatic EA (PEA) to focus on environmental impacts specific to a vehicle applicant's proposed operations under a reentry license.

C.1.5 What is Addressed in This PEA and How Will Future Reviews be Tiered?

At present, the only FAA decision under consideration is FAA issuance of an RSOL to Space Florida. This PEA uses the Sierra Nevada Corporation's Dream Chaser vehicle as the basis of analyses for conceptual reentry operations. This PEA analysis reflects the broad and general environmental impacts that may be expected to result from these type of reentry operations.

For any commercial reentry vehicle operator that approaches the FAA with a proposal to conduct reentry operations at the SLF (including Sierra Nevada Corporation), the FAA will assess the particular aspects of the operator's proposal in a subsequent NEPA review that will tier from this PEA. Table C-1 outlines the analyses that will be deferred until an operator proposes to conduct reentry operations at the SLF and that therefore will be covered in the tiered NEPA document. Table C-1 also describes the aspects of reentry operations which, if aligned exactly with the conceptual operations analyzed in this EA, may be incorporated by reference into the tiered document instead of being analyzed separately. However, all proposed reentry operators will require some level of tiered NEPA documentation, regardless of whether operations are aligned exactly with the conceptual reentry operations in this PEA.

Table C-1
PEA Components to be Analyzed in Future Environmental Reviews

FAA ACTION	PROJECT COMPONENTS AND ASSUMPTIONS ANALYZED IN PEA	COMPONENTS TO BE ANALYZED IN FUTURE TIERED REVIEWS	COMPONENTS TO BE INCORPORATED BY REFERENCE IN FUTURE TIERED REVIEWS
Issuance of an RSOL for reentries of a commercial vehicle at the SLF	Operation of a commercial reentry vehicle	Specific details of operator's proposed reentry vehicle, including vehicle type, flight profiles, propellant type and quantity, and reentry trajectory.	Where the operator's proposal aligns with conceptual reentry vehicle operations, the tiered EA will incorporate the PEA analysis by reference. Where the operator's proposal deviates, the tiered EA will present a detailed analysis of the potential for environmental impacts not presented in the PEA.
	Up to six reentry operations annually and up to 17 over five years	Number of annual reentry operations in the operator's proposal.	If annual operations are less than the number analyzed in this PEA, the tiered EA will incorporate the relevant components of this PEA by reference. If the operator proposes a greater reentry frequency (for example, if an operator proposes one reentry operation a month for a total of twelve reentry operations annually), the tiered document will present a detailed analysis of the potential for environmental impacts likely to result from this reentry frequency.
	Up to four daytime reentries and up to two nighttime reentries	Timeframe for reentry operations in the operator's proposal.	If all reentries are proposed to be conducted during the hours analyzed in this PEA, the tiered EA will incorporate the relevant components of this PEA by reference. If the operator proposes a different timeframe for reentry operations (for example, four nighttime reentries and two daytime reentries), the tiered document will present a detailed analysis of the potential for environmental impacts likely to result from the new proposed timing.

FAA ACTION	PROJECT COMPONENTS AND ASSUMPTIONS ANALYZED IN PEA	COMPONENTS TO BE ANALYZED IN FUTURE TIERED REVIEWS	COMPONENTS TO BE INCORPORATED BY REFERENCE IN FUTURE TIERED REVIEWS
	40 new permanent full-time employees to support proposed operations at the SLF	Number of new employees needed based on the operator's proposal.	If the number of new employees needed is less than the 40 analyzed in this PEA, the tiered EA will incorporate the relevant components of this PEA by reference. If the operator proposes reentry operations requiring greater staff levels, the tiered document will present a detailed analysis of the potential for environmental impacts likely to result from a significant influx of new personnel at the SLF.
Airspace modifications to accommodate operation of the reentry vehicle	Airspace procedural changes, coordination, and notifications based on proposed operations of the described reentry vehicle	Designation of reentry vehicle operating areas. The tiered EA will include an evaluation and designation of a new reentry vehicle operating area. While the vehicle will be required to operate within the parameters established in this PEA, a new reentry vehicle operating area may be designated based on the needs of the vehicle proposed for operation.	To the extent that the proposed reentry vehicle operating area aligns with that analyzed in this PEA, the tiered EA will incorporate the PEA analysis by reference. Where the proposed reentry vehicle operating area deviates from that analyzed in this PEA, the tiered EA will present a detailed analysis of the potential for environmental impacts.

APPENDIX D: AIRFIELDS AND AIRSPACE

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D.1 Airfield and Airspace Impacts

D.1.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a reentry site operator license to Space Florida and the commercial reentry operations associated with the Proposed Action would not occur. There would be no impacts on airfields or airspace associated with the No Action Alternative and current airspace designations in the vicinity of KTTS would remain in place. National airspace initiatives including the Next Generation Air Transportation System and Space and Air Traffic Management System would continue to be implemented under the No Action Alternative.

D.1.2 Proposed Action

Reentry Site Operator License and Future Reentry Operator Licensing Process

This PEA evaluates the potential impacts of the FAA issuing a reentry site operator license to Space Florida to offer the National Aeronautics and Space Administration's (NASA's) Shuttle Landing Facility (SLF) as a location to conduct commercial reentry operations based on the conceptual reentry operations analyzed for the Sierra Nevada Corporation (SNC) Dream Chaser reentry vehicle. However, prior to any reentry operations, each separate reentry vehicle operator would need to obtain a specific reentry license from the FAA for their vehicle type and trajectory. The licensing of specific reentry operators is a detailed and specific process that would occur beyond the publication date of this PEA. An environmental analysis that tiers from this PEA would be prepared to analyze the impacts of a vehicle operator proposing to conduct reentries at the SLF (see Appendix C for more information).

In 2018 an airspace letter of agreement, for both launch and reentry operations, was signed and included in the approved Part 420 Launch Site Operator License for the SLF. This agreement established the framework for developing "procedures for the issuance of Notices to Airmen, Altitude Reservation Special Activity Airspace access." Given Space Florida's use of hypothetical launch and reentry vehicle operations, it was not possible for ATC and Space Florida to include specific measures in the agreement at the time it was developed. Rather, the parties worked to establish a commitment to collaboratively develop an outline for the necessary plans and procedures to be developed at a later time.

Prior to reentry operations, designated Space Florida personnel would notify the reentry operator of other activities at the SLF and resolve potential conflicts for use. Space Florida would also work with the Kennedy Space Center Spaceport Integration Office to ensure that planned reentries would not interfere with NASA, U.S. Fish and Wildlife Service, U.S. Space Force, National Park Service, National Security Agency, National Geospatial-Intelligence Agency, National Oceanic and Atmospheric Administration, or other commercial operations.

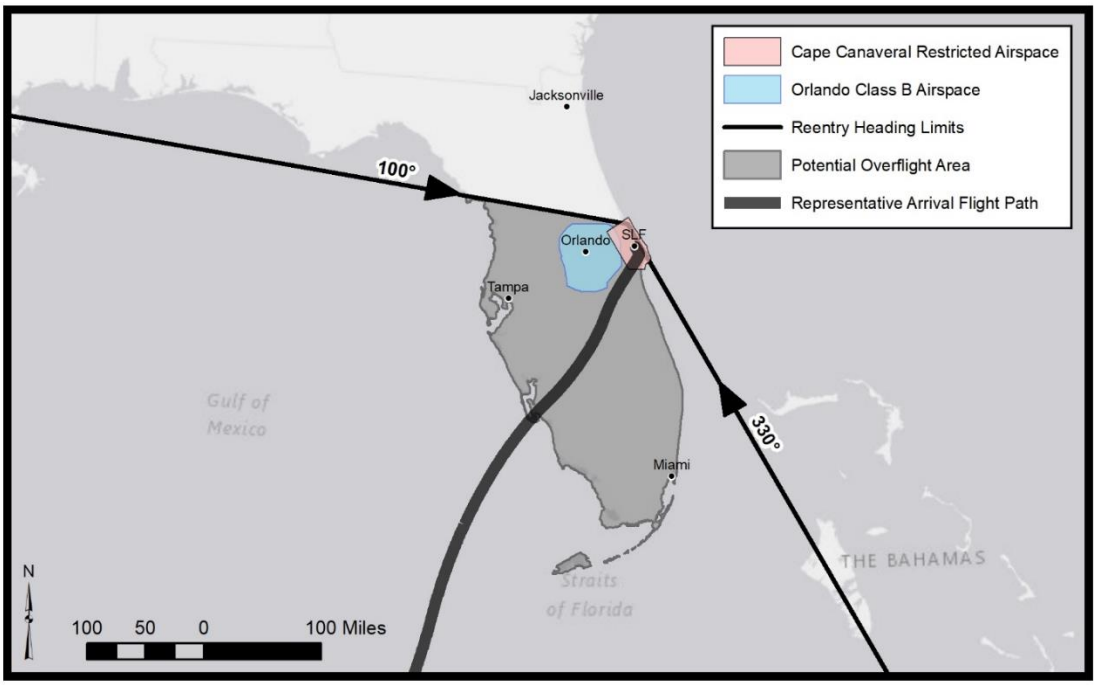
Future reentry operators would be required to apply for a Part 435 reentry vehicle license and to obtain their own letter of agreement with ATC. At that time, the operator would be able to provide specific data describing its vehicle and missions that the FAA could use to identify specific safety measures and the effect of implementing those measures on the airspace. The reentry vehicle license process would work with ATC to schedule its missions according to the process outlined in the agreement. Mission planning would include collaboration between the reentry vehicle operator and ATC to identify the reentry flight path to

the SLF, as well as the location and timing of the airspace closure associated with the reentry flight path that considers its effect on other users of the National Airspace System. FAA ATC would ensure reentry operations are safely and efficiently integrated into the NAS by approving, modifying, or denying all airspace decisions associated with reentry operations.

Reentry Operations

Operations of the commercial reentry vehicles at SLF include an un-powered, gliding horizontal landing. The reentry vehicle would reenter from west/southwest on an ascending reentry trajectory before landing at the SLF (see Figure D-1). Ascending reentry trajectories include high atmospheric overflight of Central American countries as well as overflight of the southern half of Florida, south of 29° North latitude. The reentry vehicle would descend below 60,000 feet altitude above mean sea level (MSL) approximately 30-40 miles from the SLF prior to landing and would be operating below 60,000 MSL for less than 30 seconds before entering Cape Canaveral Restricted Airspace. The reentry vehicle would remain in the Cape Canaveral Restricted Airspace for the remainder of its reentry and landing at the SLF (for approximately 2.5 – 3 minutes).

FIGURE D-1: PROPOSED REENTRY VEHICLE FLIGHT PATH APPROACHES



Source: (Sierra Nevada Corporation, 2019)

Summary of Potential Impacts of the Proposed Action

Prior to the issuance of any reentry vehicle operator licenses, the FAA, the reentry vehicle operator, and Space Florida would apply specific vehicle and operational parameters to the development of the letter of agreement required in part 435. During the licensing process, the FAA would identify potential effects on the airspace associated with the operations and address those effects in greater detail in the environmental review, where more detailed information is available.

The Proposed Action would result in no physical changes to the airfield as there are no construction activities associated with the proposed action. Immediately prior to a reentry and landing of a reentry vehicle, air traffic control would ensure that the runway at KTTS is clear of other aircraft.

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