

The National FAA Safety Team Presents-



Federal Aviation
Administration

Flight Planning in the Vicinity of Launch or Reentry Activities – What Pilots Need to Know

Presented to: <Audience>
By: <Presenter>
Date: < >

Produced by AFS-850
The National FAA Safety Team (FAASTeam)



Desired Outcome

Increase Pilots' Awareness of their responsibilities related to flights in the “proximity” of space launch/reentry-operations by:

- **Have pilots be aware of the increasing operational cadence of the Commercial Space Transportation Launch and Reentry activities, in expanding geographical areas**
- **Discussion of the increased need for pilots to investigate upcoming launch/reentries activities as part of routine preflight planning to ensure safety-of-flight and to avoid “fouling” a range**
- **The consequences of fouling a “range” to the pilot, the launch operator, and supporting entities**
- **Information available to pilots supporting preflight planning**
- **Technologies being developed to minimize space launch/reentry impacts to the NAS**



What Pilots Need to Know....

PART 91 GENERAL OPERATING AND FLIGHT RULES

91.143 Flight limitation in the proximity of space flight operations.

When a Notice to Airmen (NOTAM) is issued in accordance with this section, no person may operate any aircraft of U.S. registry, or pilot any aircraft under the authority of an airman certificate issued by the Federal Aviation Administration, within areas designated in a NOTAM for space flight operation except when authorized by ATC.



U.S. Space Program Background

- **The United States Space Program has three components:**
 - Civil, NASA
 - Military, DOD
 - Commercial, DOT/FAA

FAA's Office of Commercial Space Transportation (AST) Licenses Launch and Reentry operations as well as Launch and Reentry Sites, a.k.a. spaceports.



Over the Decades...

- From the 1970s, as the Apollo Moon Program ended, thru Skylab and subsequently the Space Shuttle Program (1981-2011), Civil and DOD launches dominated the Space Program. The Federal Ranges were known to pilots.... Wallops, the “Cape”, Vandenberg, White Sands, etc.
- Pilots knew the Shuttle launches would begin from Pad 39A at the Cape, and reentries would begin over the Indian Ocean with the Shuttle arriving high over the Shuttle Landing Facility (SLF) at the Cape, or high over Edwards AFB in CA...launching and landing in TFR’d airspace.
- Pilots flying in CA were aware Vandenberg AFB routinely conducted “polar” launches, launching to the South to an orbit above or nearly above the North/South poles while conducting Earth-mapping or reconnaissance missions.
- Pilots developed a “familiarity” with launch areas and how to avoid launch and reentry activities.



A Paradigm Shift Begins

- On February 24, 1984, Executive Order 12465 designated DOT as the lead agency for licensing commercial expendable launch vehicles (ELV) activities. The Commercial Space Launch Act was enacted later that year.
- The U.S.-licensed commercial space industry made its first suborbital and orbital launches in 1989.
- 2004 was a pivotal year. On October 4th the \$10M Ansari X-Prize was won by Scaled Composites. It's White Knight/SpaceShipOne (shown) had flown to space twice in two weeks from the Mojave Air and Spaceport in Mojave, CA.
- Following soon thereafter was the announcement of the construction of WhiteKnightTwo and SpaceShipTwo. SS2 would be a six passenger, two-crewed vehicle, opening the way for routine sub-orbital space tourism.
- The permanent facility (spaceport) would be constructed in New Mexico.
- The enthusiasm from the X-Prize infused the space tourism industry!



Commercial Space accelerates...

- Orbital activities- SpaceX had designed and flew its Falcon 1 (F-1), at the remote Regan Test Site on the Kwajalein Atoll in the Pacific from 2006-2009. SpaceX then moved to the development of it's F-9 vehicle .. first flown in 2010.
- Following the Columbia accident and recognizing the Shuttle Program could not be sustained financially after ISS construction was completed, NASA contracted for Commercial Resupply Services (CRS) for the ISS.
- SpaceX and Orbital/ATK (now Northrup Grumman) won awards. ISS resupply missions would launch from the Cape on SpaceX Falcon 9s, and from the Mid-Atlantic Regional Spaceport, at the Wallops Flight Facility in VA, on Antares rockets.



Commercial Space Accelerates continued-

- **Other launch and reentry activities were occurring. Blue Origin developed its New Shepard suborbital vehicle and began conducting suborbital flights at Van Horn, its West Texas “exclusive-use” site.**



Commercial Space Accelerates continued-

- **SpaceX begins testing “Fly-Back” landings at its exclusive-use site in McGregor, TX. Today “Return to Launch Site” (RTLS) and/or barge landings are routinely conducted from the Cape and Vandenberg.**



Commercial Space - New Entrants and Seasoned Professionals

- Rocket Lab's Electron has conducted orbital FAA licensed launches from the Mahia Peninsula in NZ, as well as from Wallops/ the Mid-Atlantic Regional Spaceport
- Boeing Space's Starliner, plans for inland landings.



**Sierra Space - Dream Chaser/Orbital Reef
And many more!**



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The Industry takes flight

- Today, human-rated SpaceX Dragon capsules carry Government and Private Astronauts to and from the ISS.



- Commercially procured, Orbital tourism has been realized with an all-private astronaut compliment on-board Space X Inspiration 4.



- Axiom Space, using the ISS as its host is in development and construction of “Axiom Station” intended to be the world’s first commercial space station.



Regulatory Guidance

- **When the Commercial Space Launch Act was enacted into law in 1984, The Office of Commercial Space Transportation was placed in the Office of the Secretary of Transportation.**
- **It wasn't until 1995 that the Office moved to be a Line of Business (LOB) in the FAA.**
- **Because the Office was originally placed in the DOT, its regulations were developed in 14 CFR, Chapter III, Part 400.**
- **Traditional Aviation Safety regulations are in 14 CFR Chapter I, Parts 1-199.**



FAA/AST Authority

- **Statutory Authority - United States Code (USC):**
- **Aviation regulations:** U.S. Code: Title 49 – Transportation
- **Space regulations:** U.S. Code: Title 51 – National & Commercial Space Programs
- **Code of Federal Regulations (CFR):**

<i>CFR Title</i>	<i>Volume</i>	<i>Chapter</i>	<i>Part</i>	<i>Regulatory Entity</i>
14: Aeronautics and Space	1	I	1-59	Federal Aviation Administration, Department of Transportation (Aviation Safety Regulations)
	2		60-139	
	3		140-199	
	4	II	200-399	Office of the Secretary, Department of Transportation (Aviation Proceedings)
		III	400-1199	Commercial Space Transportation, Federal Aviation Administration, Department of Transportation
	5	V	1200-1299	National Aeronautics and Space Administration
		VI	1300-1399	Air Transportation System Stabilization



Regulatory Guidance ... to Risk to Aircraft

Commercial Space Launch and Reentries are regulated in 14 CFR part 400. Specifically-

PART 450 - LAUNCH AND REENTRY LICENSE REQUIREMENTS

Subpart C - Safety Requirements

450.101 Safety Criteria

(a) Launch risk criteria. For any launch, an operator may initiate the flight of a launch vehicle only if all risks to the public satisfy the criteria in this paragraph...

(3) Aircraft risk. A launch operator must establish any aircraft hazard areas necessary to ensure the probability of impact with debris capable of causing a casualty for aircraft does not exceed 1×10^{-6} .



Aircraft Hazard Area ... defined

From the Aeronautical Information Manual (AIM)

AIRCRAFT HAZARD AREA (AHA)– Used by ATC to segregate air traffic from a launch vehicle, reentry vehicle, amateur rocket, jettisoned stages, hardware, or falling debris generated by failures associated with any of these activities. An AHA is designated via NOTAM as either a TFR or stationary ALTRV. Unless otherwise specified, the vertical limits of an AHA are from the surface to unlimited.

ALTITUDE RESERVATION (ALTRV)– Airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished. ALTRVs are approved by the appropriate FAA facility. ALTRVs must be classified as either “moving” or “stationary.”



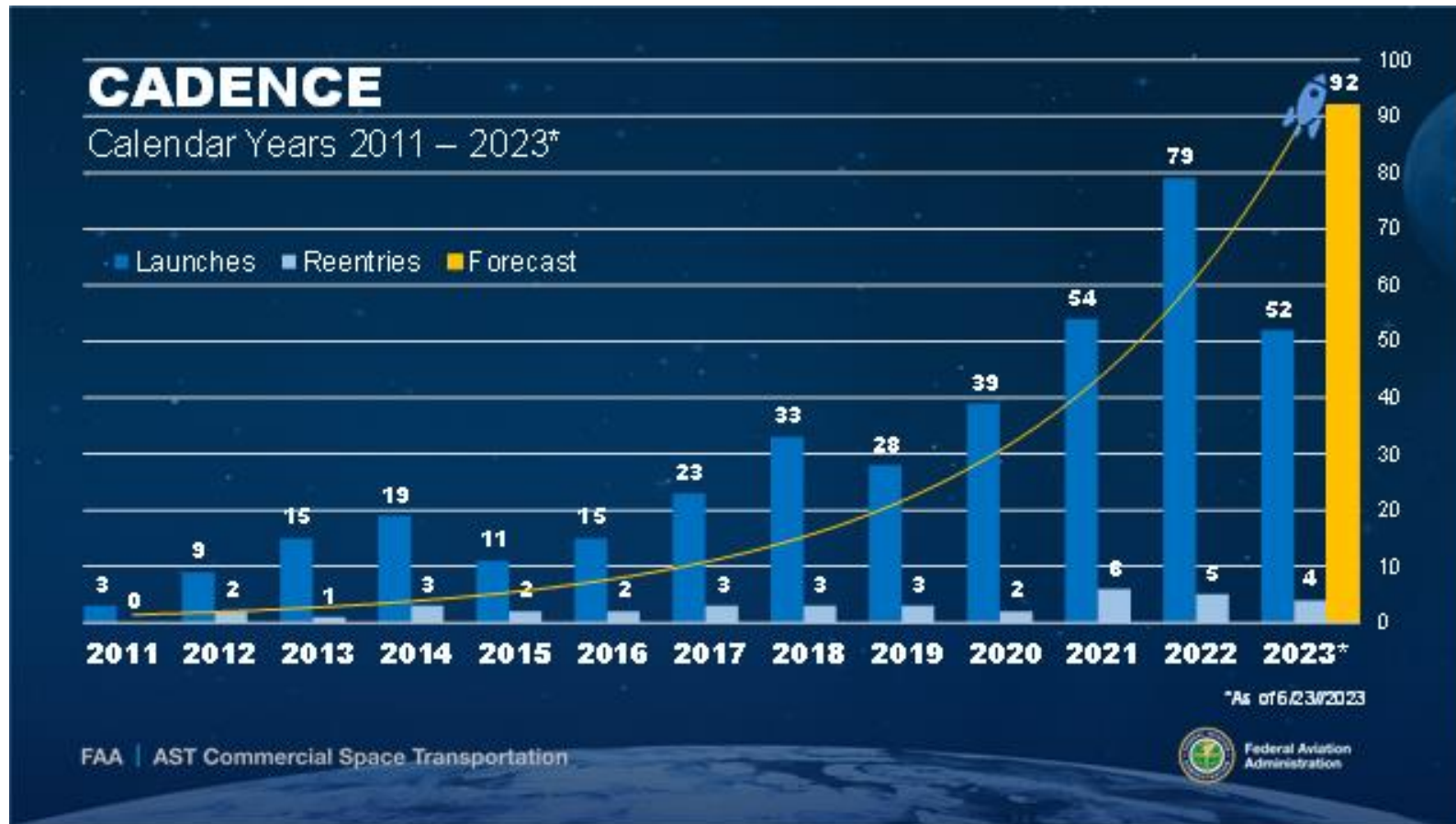
STATIONARY ALTRV... defined

From the Pilot/Controller Glossary

- STATIONARY ALTITUDE RESERVATION – An altitude reservation which encompasses activities in a fixed volume of airspace to be occupied for a specified time period. Stationary ALTRVs may include activities such as special tests of weapons systems or equipment; certain U.S. Navy carrier, fleet, and anti-submarine operations; rocket, missile, and drone operations; and certain aerial refueling or similar operations.



Increasing Cadence of Commercial Launch and Reentry Activities



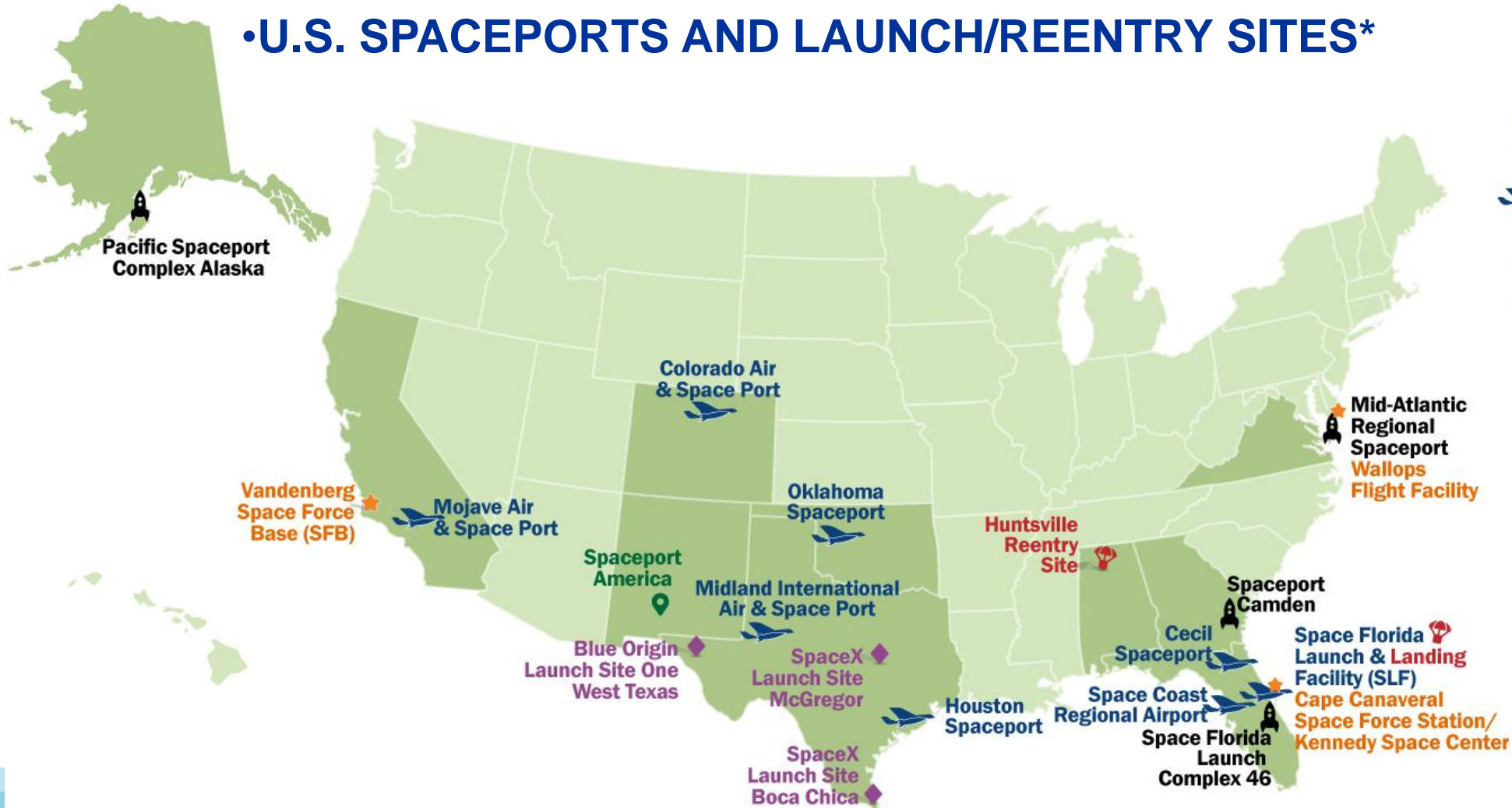
Federal Aviation
Administration

14 Licensed U.S. Launch & Reentry Sites—“Spaceports”

COMMERCIAL
SPACE
TRANSPORTATION



•U.S. SPACEPORTS AND LAUNCH/REENTRY SITES*



MAP LEGEND

- States with Current Spaceports
- ✈ FAA-Licensed Horizontal Launch Site
- 🚀 FAA-Licensed Vertical Launch Site
- 📍 FAA-Licensed Horizontal and Vertical Launch Site
- 🚀 FAA-Licensed Reentry Site
- ★ U.S. Federal Site
- ◆ Exclusive Use Site (Non-FAA Licensed)

*Locations licensed by the FAA or currently hosting FAA-licensed activity.

•FAA/AST October 2022



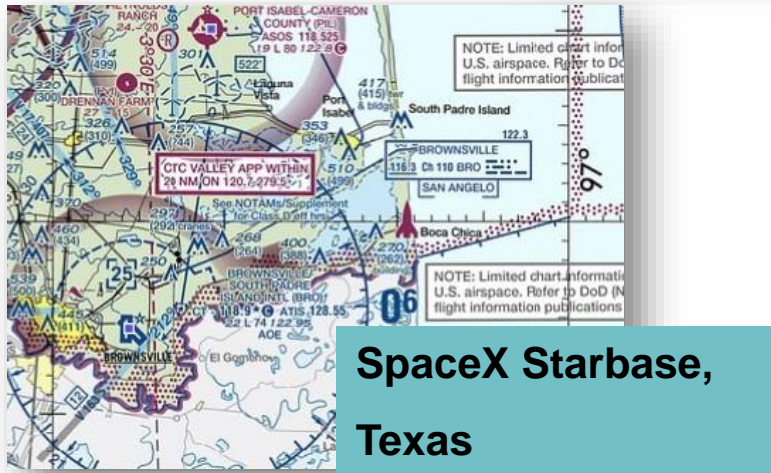
VFR Charting Examples



Vandenberg Space Force Base, California



Wallops Flight Facility, Virginia



SpaceX Starbase, Texas



Space Florida Launch & Landing Facility and Launch Complex 46, Florida

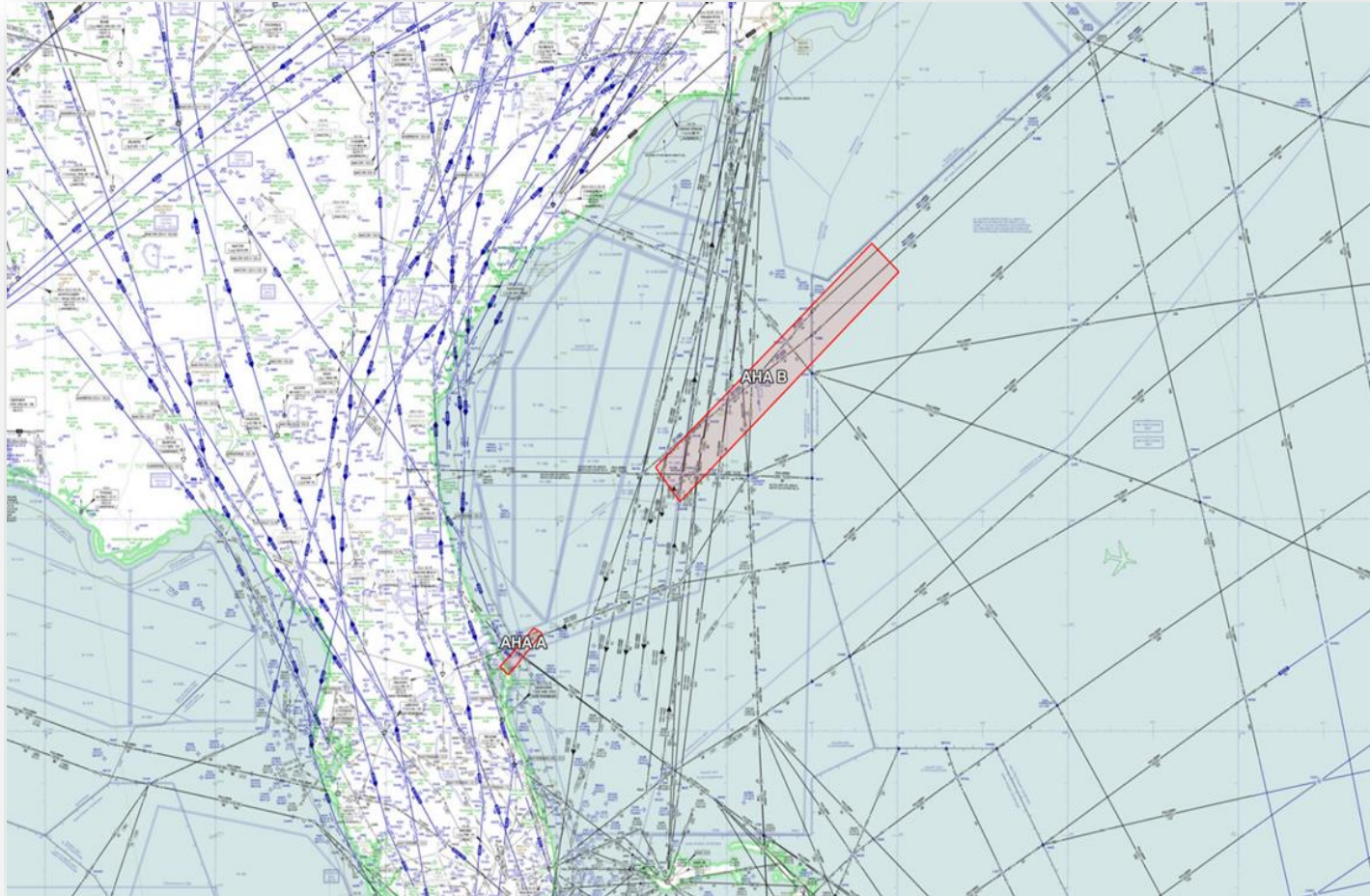


Amateur rocket operations



Federal Aviation
Administration

CCSFS/KSC CRS-26 Launch



THE REFERENCE DATE TIME GROUP OF THIS MESSAGE IS 231203

SUBJ: ALTRV APVL EROP X1403 FLCN9 CRS-26 /1

1. (AREA A)

STATIONARY RESERVATION SURFACE TO UNLIMITED (WHILE IN CONTROLLED AIRSPACE) WITHIN AN AREA BNDD BY 2837N 08040W 2859N 08016W 2856N 08010W 2832N 08034W (TO POINT OF ORIGIN)

FROM 301742 NOV 2022 TO 301813 NOV 2022

(AREA B)

STATIONARY RESERVATION SURFACE TO UNLIMITED (WHILE IN CONTROLLED AIRSPACE) WITHIN AN AREA BNDD BY 3029N 07850W 3233N 07618W 3217N 07559W 3010N 07833W (TO POINT OF ORIGIN)

FROM 301742 NOV 2022 TO 301815 NOV 2022

2. PROJECT OFFICER: 1ROPS/DOS DSN 467-5941 COM 321-853-5941

ALTERNATE PROJECT OFFICER:

ARTCCS CONCERNED: ZMA ZJX ZWY

ADDITIONAL INFO: MARSA ALL X1403 EROPS & ALL 'OTHER' EROPS SCHEDULED AFTER THIS DATE IF RESCHEDULE IS REQUIRED.

PARTICIPATING SUPPORT AIRCRAFT WILL OPERATE IAW MARSA.

AUTHORITY DELEGATED TO MIAMI TO CANCEL THE ALTRVS REQUESTED BY 1ROPS POST LAUNCH

FAA CARF

COM: 540 422 4211/4213

DSN: 510 422 4211/4213

COM FAX: 540 422 4291

DSN FAX: 510 422 4291

After Hours:

COM: 540 422 4100

Hours of operation:

0600-2200 ET



Federal Aviation
Administration

CRS 26 First-stage Booster landing



Vandenberg Starlink 2-6

THE REFERENCE DATE TIME GROUP OF THIS MESSAGE IS 251657

SUBJ: ALTRV APVL 2ROPS AIROP DO-2307 /1

1. STATIONARY RESERVATION SURFACE TO UNLIMITED (WHILE IN CONTROLLED AIRSPACE) WITHIN AN AREA BNDD BY 3438N 12039W 3440N 12035W 3430N 12027W 3256N 11938W 3253N 11944W 3431N 12038W (TO POINT OF ORIGIN)

FROM 291612 JAN 2023 TO 292145 JAN 2023
FROM 301559 JAN 2023 TO 302131 JAN 2023
FROM 311545 JAN 2023 TO 312117 JAN 2023
FROM 011531 FEB 2023 TO 012103 FEB 2023
FROM 021517 FEB 2023 TO 022049 FEB 2023

2. PROJECT OFFICER: 2 ROPS/DOS DSN 276-8825; COMMERCIAL (805) 606-8825

ALTERNATE PROJECT OFFICER:

ARTCCS CONCERNED: ZLA

ADDITIONAL INFO: MARSALA ALL 2ROPS AIROP DO-2307/1. ALL INTERNATIONAL AIRSPACE REQUESTS FOR COORDINATION WILL BE COORDINATED BY THE COMMERCIAL LAUNCH AGENCY. COORDINATION FOR USE OF WARNING AND RESTRICTED AREAS HAS BEEN ACCOMPLISHED IAW FAA ORDER 7610.4 (SERIES).

FAA CARF

COM: 540 422 4211/4213

DSN: 510 422 4211/4213

COM FAX: 540 422 4291

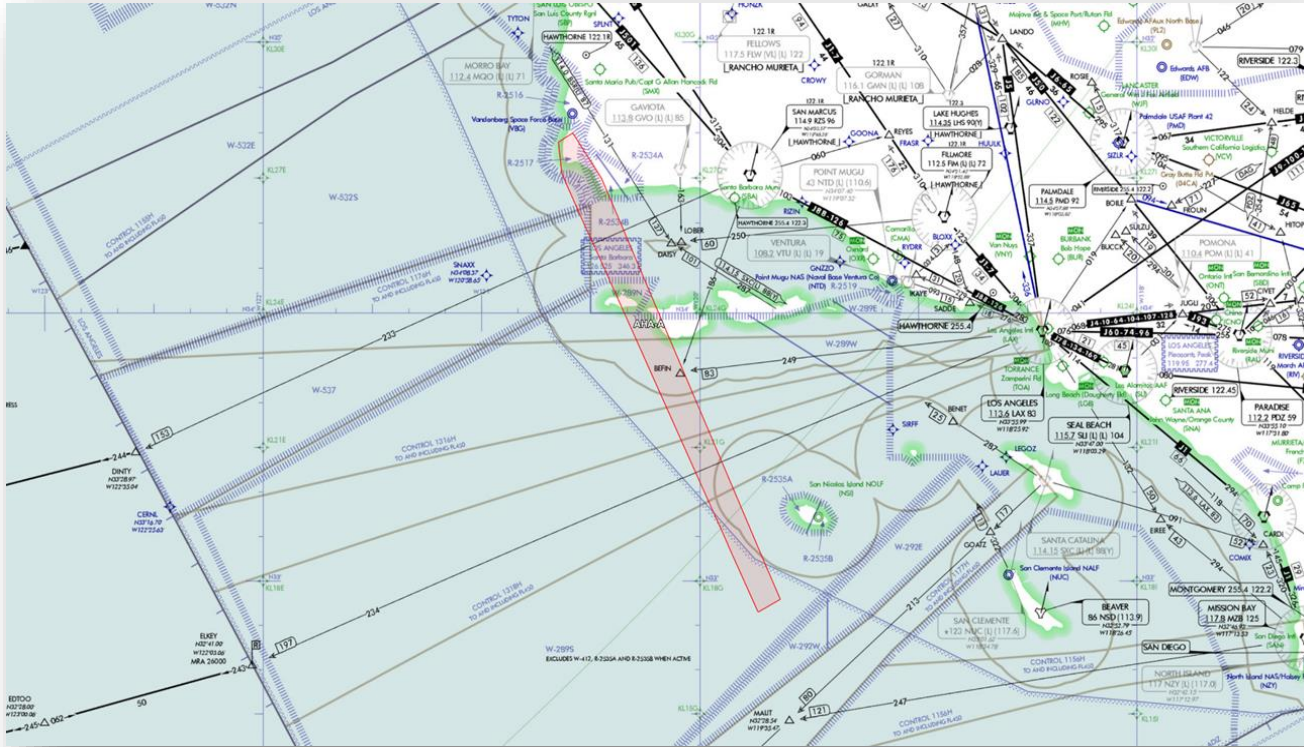
DSN FAX: 510 422 4291

After Hours:

COM: 540 422 4100

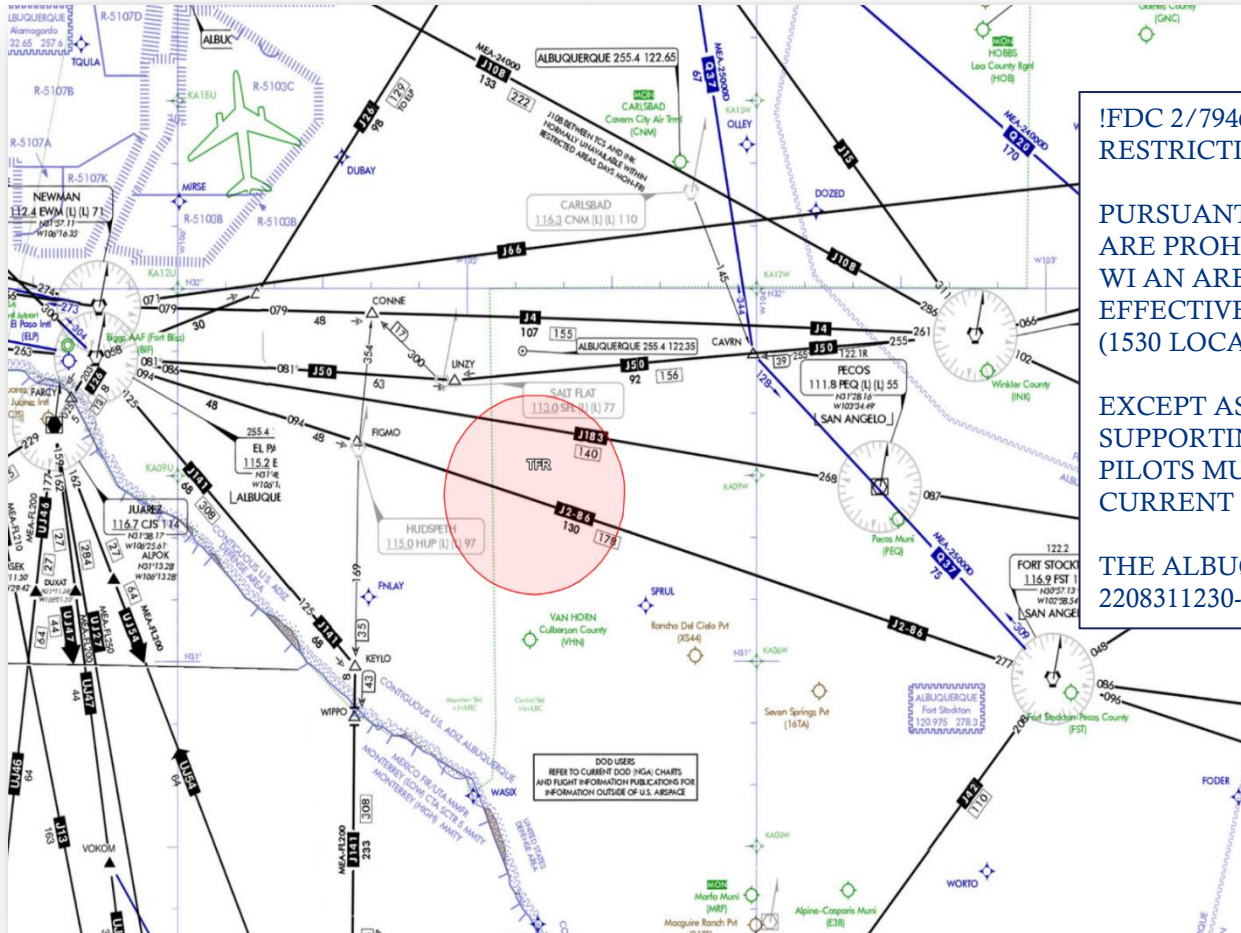
Hours of operation:

0600-2200 ET



Federal Aviation
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Blue Origin – New Shepard Sub-orbital launch



IFDC 2/7946 ZAB TX..AIRSPACE VAN HORN, TX..TEMPORARY FLIGHT RESTRICTIONS.

PURSUANT TO 14 CFR SECTION 91.143, SPACE OPS AREA, ACFT OPS ARE PROHIBITED WI AN AREA DEFINED AS 16NM RADIUS OF 312700N1044600W (SFL125024.2) SFC-UNL EFFECTIVE 2208311230 UTC (0730 LOCAL 08/31/22) UNTIL 2208312030 UTC (1530 LOCAL 08/31/22).

EXCEPT AS SPECIFIED BELOW AND/OR UNLESS AUTHORIZED BY ATC: A. AIRCRAFT SUPPORTING THE RECOVERY OF THE SPACE VEHICLE ARE EXEMPT FROM THIS TFR. B. PILOTS MUST CONSULT ALL NOTAMS REGARDING THIS OPS AND MAY CONTACT ZAB FOR CURRENT AIRSPACE STATUS.

THE ALBUQUERQUE /ZAB/ ARTCC, TEL 505-856-4500, IS THE CDN FAC. 2208311230-2208312030



Federal Aviation Administration

Wallops Rocket Lab, RL-33

THE REFERENCE DATE TIME GROUP OF THIS MESSAGE IS 201855

SUBJ: ALTRV APVL ROCKET LAB /1

1. (ALPHA)

STATIONARY RESERVATION SURFACE TO UNLIMITED (WHILE IN CONTROLLED AIRSPACE) WITHIN AN AREA BNDD BY 3805N 7508W 3758N 7527W 3748N 7534W 3739N 7531W 3740N 7531W 3749N 7525W 3748N 7521W 3751N 7517W (TO POINT OF ORIGIN)

FROM 232230 JAN 2023 TO 240200 JAN 2023

FROM 242230 JAN 2023 TO 250200 JAN 2023

FROM 252230 JAN 2023 TO 260200 JAN 2023

FROM 262230 JAN 2023 TO 270200 JAN 2023

FROM 272230 JAN 2023 TO 280200 JAN 2023

(BRAVO)

STATIONARY RESERVATION SURFACE TO UNLIMITED (WHILE IN CONTROLLED AIRSPACE) WITHIN AN AREA BNDD BY 3602N 6652W 3731N 7124W 3735N 7152W 3741N 7253W 3713N 7240W 3632N 7240W 3622N 7225W 3611N 7157W 3456N 6722W (TO POINT OF ORIGIN)

FROM 232230 JAN 2023 TO 240200 JAN 2023

FROM 242230 JAN 2023 TO 250200 JAN 2023

FROM 252230 JAN 2023 TO 260200 JAN 2023

FROM 262230 JAN 2023 TO 270200 JAN 2023

FROM 272230 JAN 2023 TO 280200 JAN 2023

(CHARLIE)

STATIONARY RESERVATION SURFACE TO UNLIMITED (WHILE IN CONTROLLED AIRSPACE) WITHIN AN AREA BNDD BY 3030N 5516W 2809N 5102W 2745N 5124W 2957N 5539W (TO POINT OF ORIGIN)

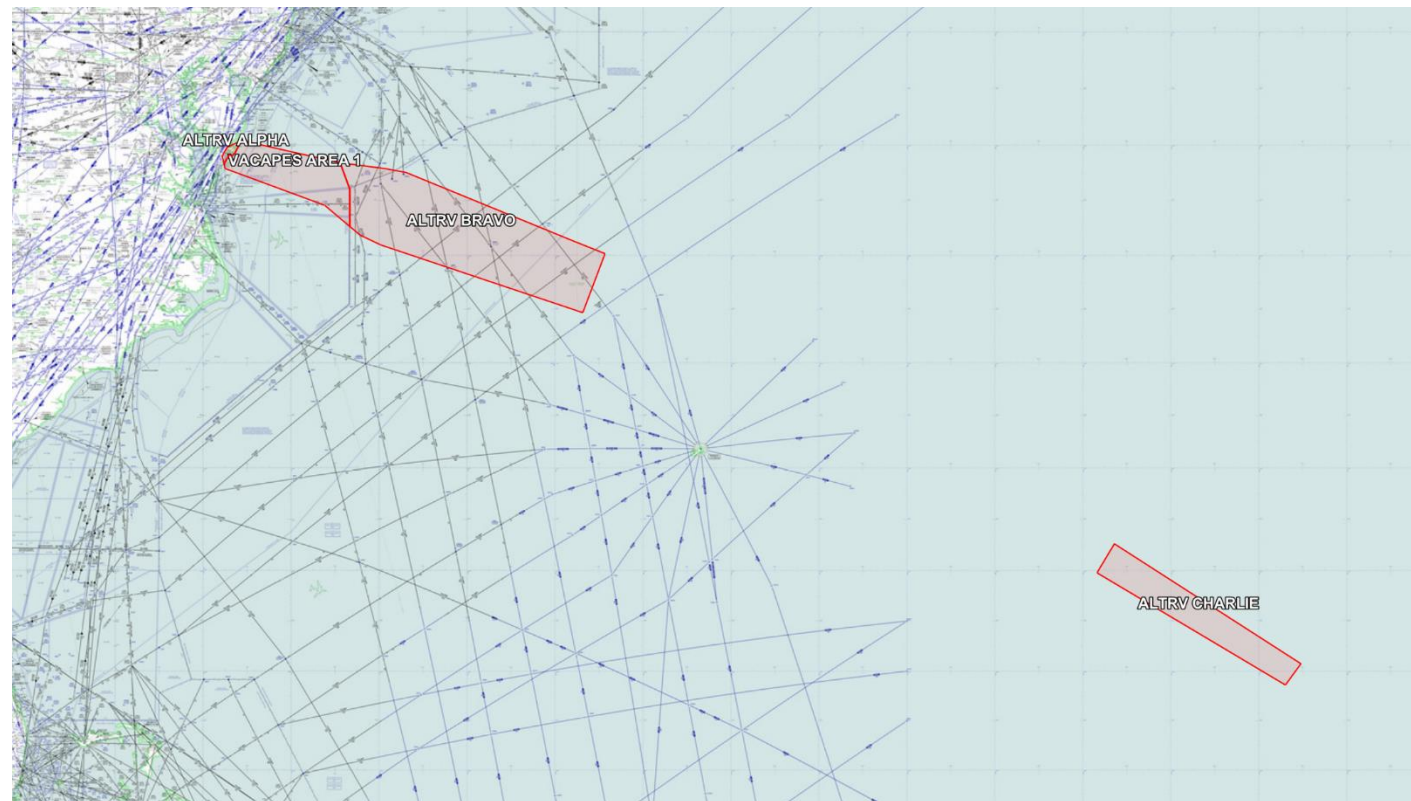
FROM 232230 JAN 2023 TO 240200 JAN 2023

FROM 242230 JAN 2023 TO 250200 JAN 2023

FROM 252230 JAN 2023 TO 260200 JAN 2023

FROM 262230 JAN 2023 TO 270200 JAN 2023

FROM 272230 JAN 2023 TO 280200 JAN 2023



AUTOMATICALLY GENERATED



Federal Aviation
Administration

SpaceX Dragon Capsule Reentry

FDC X/XXXX ZMA FL..AIRSPACE TAMPA, FL..TEMPORARY FLIGHT RESTRICTIONS.

PURSUANT TO 14 CFR SECTION 91.143, SPACE OPERATIONS AREA, AIRCRAFT OPERATIONS ARE PROHIBITED

WITHIN AN AREA DEFINED AS 8.5NM RADIUS OF 280600N0835400W SFC-UNL

EFFECTIVE 2301120940 UTC UNTIL 2301121010 UTC.

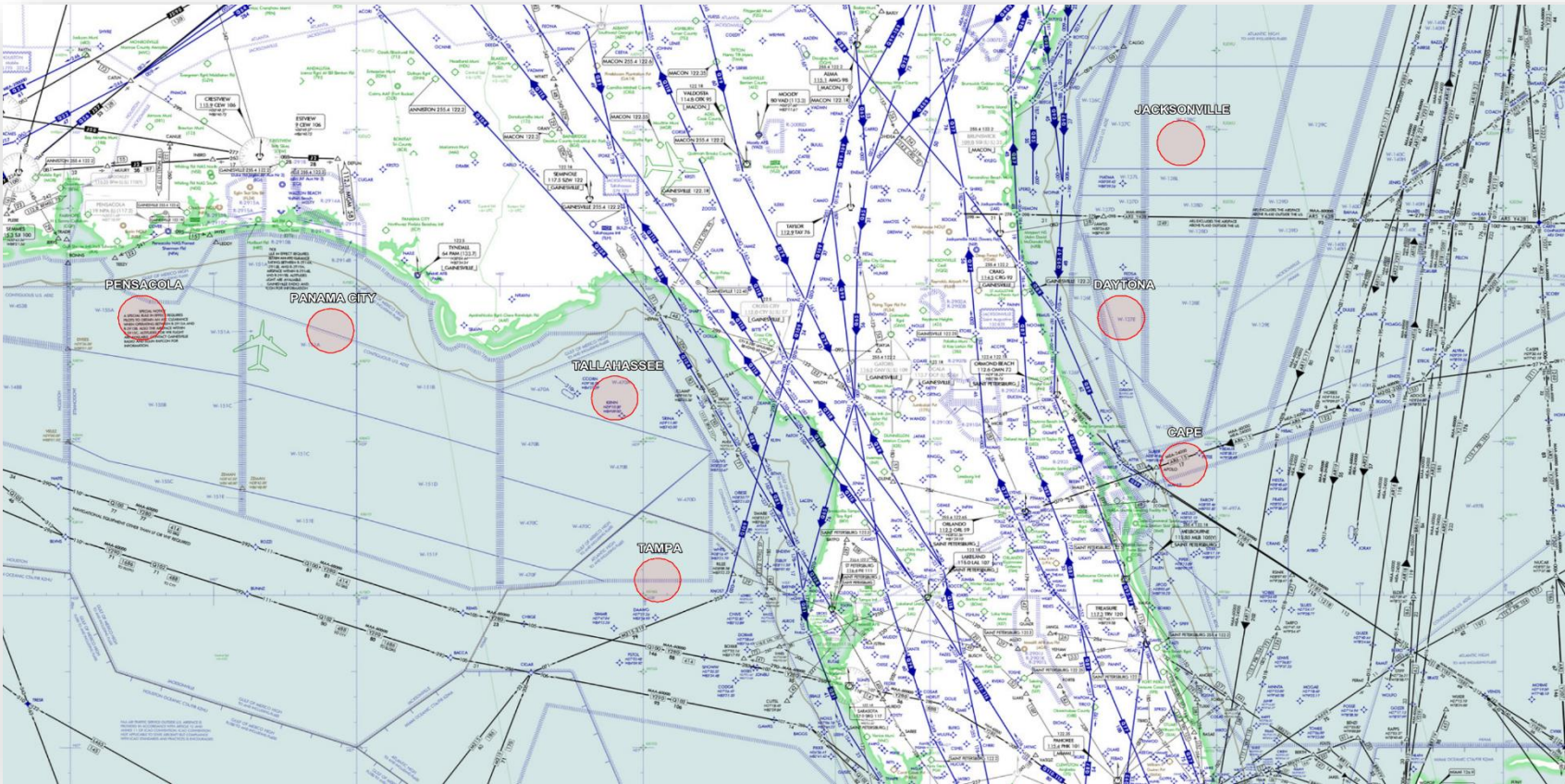
WITHIN AN AREA DEFINED AS 8.5NM RADIUS OF 280600N0835400W SFC-5000FT MSL
EFFECTIVE 2301121010 UTC UNTIL 2301121210 UTC

A. FLIGHT LIMITATION IN THE PROXIMITY OF SPACE FLIGHT OPS, OPS BY FAA CERT PILOTS OR U.S. REG ACFT ARE PROHIBITED WITHIN THE DEFINED AIRSPACE THAT INCLUDES THE AIRSPACE OUTSIDE OF U.S. TERRITORY.

B. AIRCRAFT SUPPORTING THE RECOVERY OF THE SPACE VEHICLE ARE EXEMPT FROM THIS TFR.

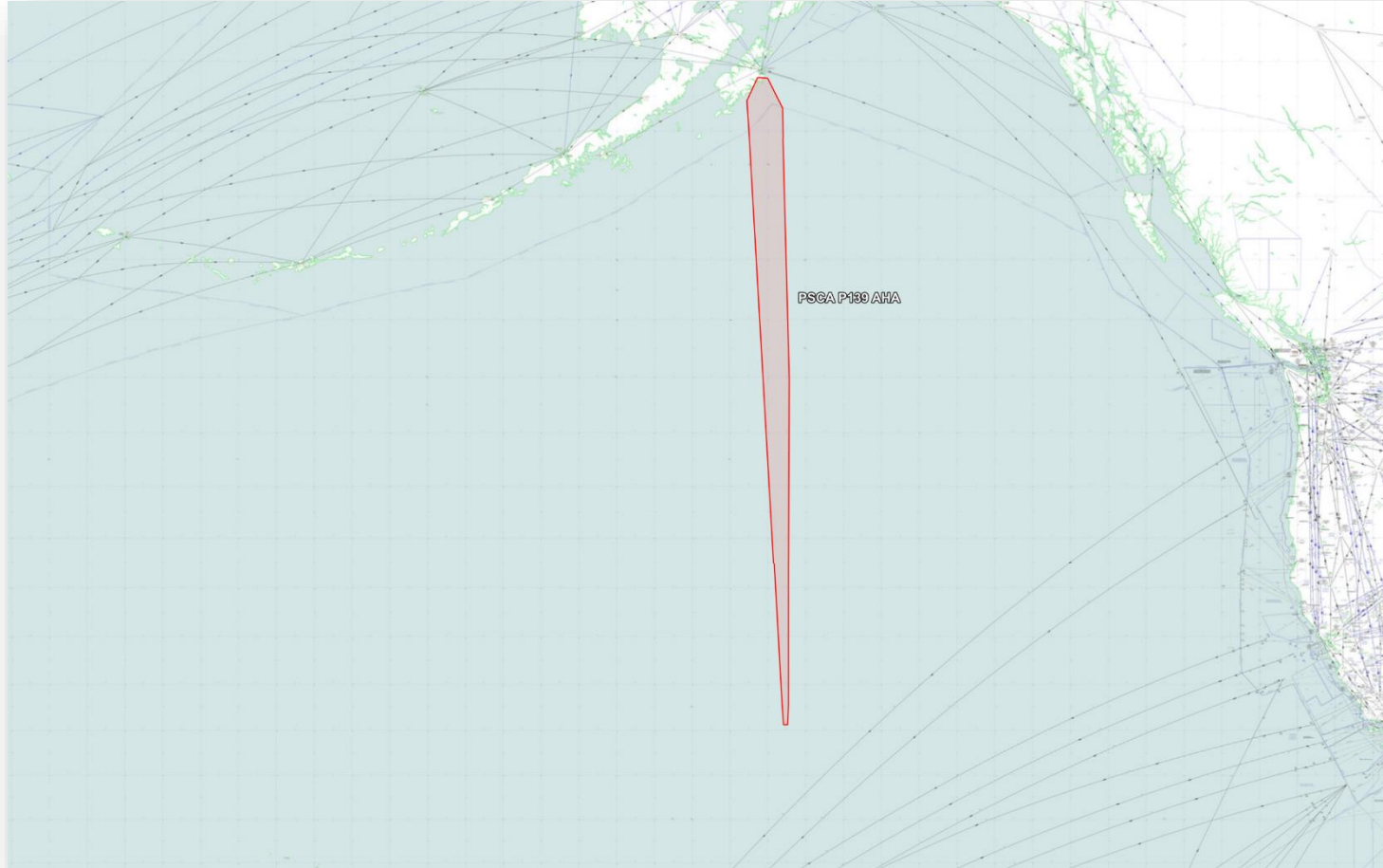
C. PILOTS MUST CONSULT ALL NOTAMS REGARDING THIS OPS AND MAY CONTACT ZJX FOR CURRENT AIRSPACE STATUS.

THE MIAMI /ZMA/ ARTCC, PHONE 305-716-1589, IS THE COORDINATION FACILITY.



Federal Aviation
Administration

PSCA Launch – ABL Space Systems



THE REFERENCE DATE TIME GROUP OF THIS MESSAGE IS
061429

SUBJ: ALTRV APVL PSCA LAUNCH P139 /1

1. STATIONARY RESERVATION SURFACE TO UNLIMITED
(WHILE IN CONTROLLED AIRSPACE) WITHIN AN AREA
BNDD BY 5652N 15306W 5733N 15231W 5731N 15201W 5640N
15112W 4755N 15052W 3507N 15055W 3413N 15057W 3413N
15109W 3522N 15116W (TO POINT OF ORIGIN)

FROM 072200 DEC 2022 TO 080130 DEC 2022
FROM 082200 DEC 2022 TO 090130 DEC 2022
FROM 092200 DEC 2022 TO 100130 DEC 2022
FROM 102200 DEC 2022 TO 110130 DEC 2022
FROM 112200 DEC 2022 TO 120130 DEC 2022
FROM 122200 DEC 2022 TO 130130 DEC 2022
FROM 132200 DEC 2022 TO 140130 DEC 2022
FROM 142200 DEC 2022 TO 150130 DEC 2022

2. PROJECT OFFICER: SHANNON EDWARDS, CELL: 509-713-
4368, OFFICE: 907-771-8036
ALTERNATE PROJECT OFFICER: PAUL PENA, CELL: 907-942-
4485, OFFICE: 907-743-3525
ARTCCS CONCERNED: ZAN ZAK
ADDITIONAL INFO: ALASKA AEROSPACE'S PACIFIC
SPACEPORT COMPLEX ALASKA (PSCA).

FAA CARF

COM: 540 422 4211/4213

DSN: 510 422 4211/4213

COM FAX: 540 422 4291

DSN FAX: 510 422 4291

After Hours:

COM: 540 422 4100

Hours of operation:

0600-2200 ET



Federal Aviation
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Flight planning apps can help

- **Don't fly on the line**
 - Fly at least a mile from the airspace you're trying to avoid
- **IFR Flights**
 - Expect routing that will avoid AHAs
- **VFR Flight following**
 - Recommended
 - Air Traffic will warn and issue avoidance instructions



“Fouling” a Range

Obviously, errant entry into an Aircraft Hazard Areas can place an aircraft in harm’s way, but there are other consequences as well-

- To the aircraft and its occupants, there exists the risk of being hit by debris, as well as a possible violation for entering restricted airspace.
- To the launch operator, the launch cannot proceed per Part 450 Safety Requirements. The Range is “fouled” and the launch scrubbed. The costs can be significant... between \$500,000 to \$1,000,000
- To the airlines and all operators in the NAS is the reality that they will have to again route around restricted airspace, possibly tankering additional fuels, delaying departures, and impacting domestic and international air travel.



ATO - Managing Space Operations

- The Space Operations group is the Air Traffic Organization's (ATO) office of primary responsibility for launch and reentry of space operations and oversees the ATO effort to integrate space operations into the NAS.
- While a space operation is in progress, the FAA uses technology and procedural measures to manage when to close and reopen the airspace and which aircraft to reroute.
- In the event of a space vehicle malfunction or mishap, the FAA can quickly identify the affected airspace and take actions necessary to ensure the safety of aircraft from falling debris.



ATO - Managing Space Operations

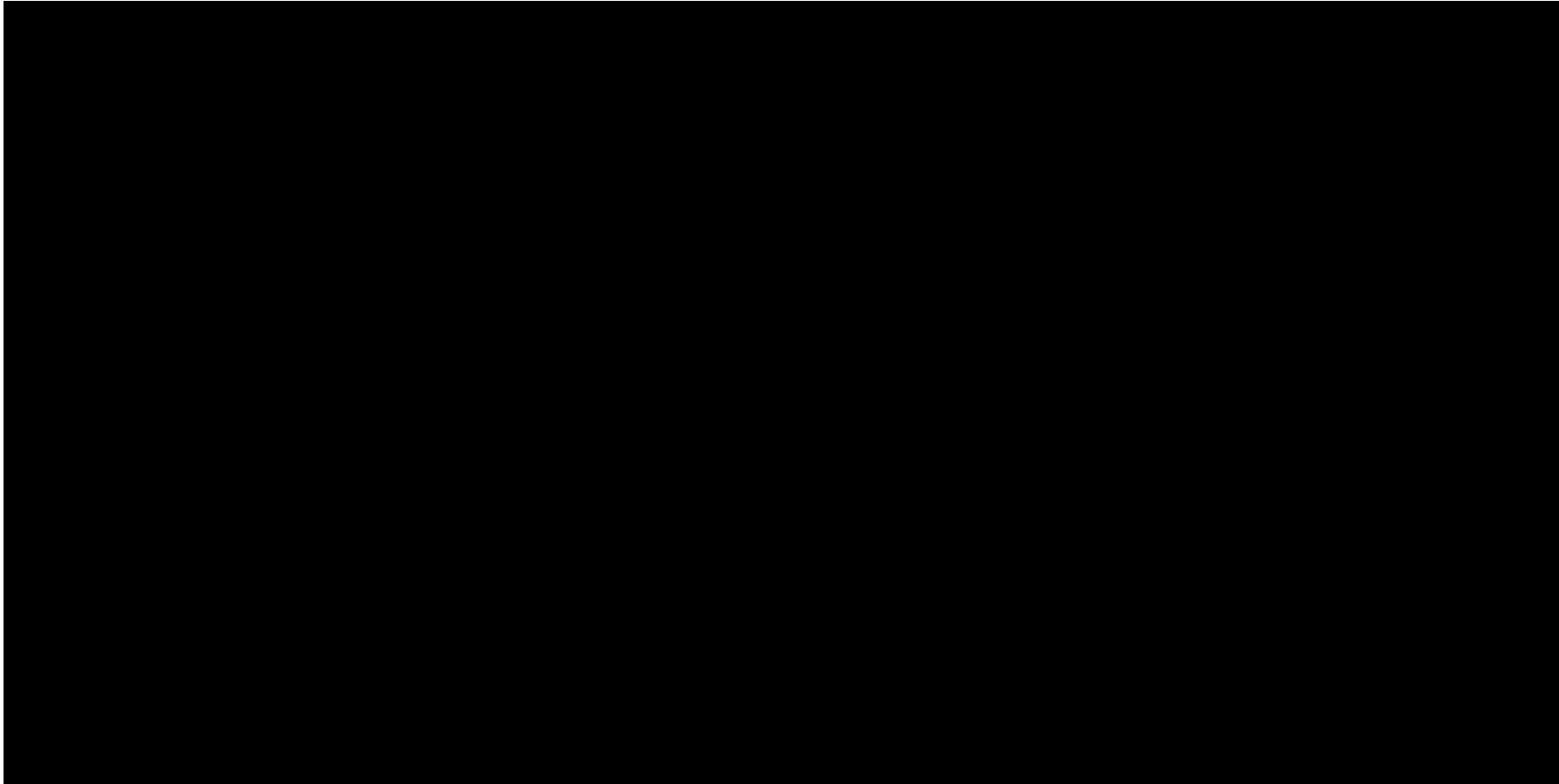


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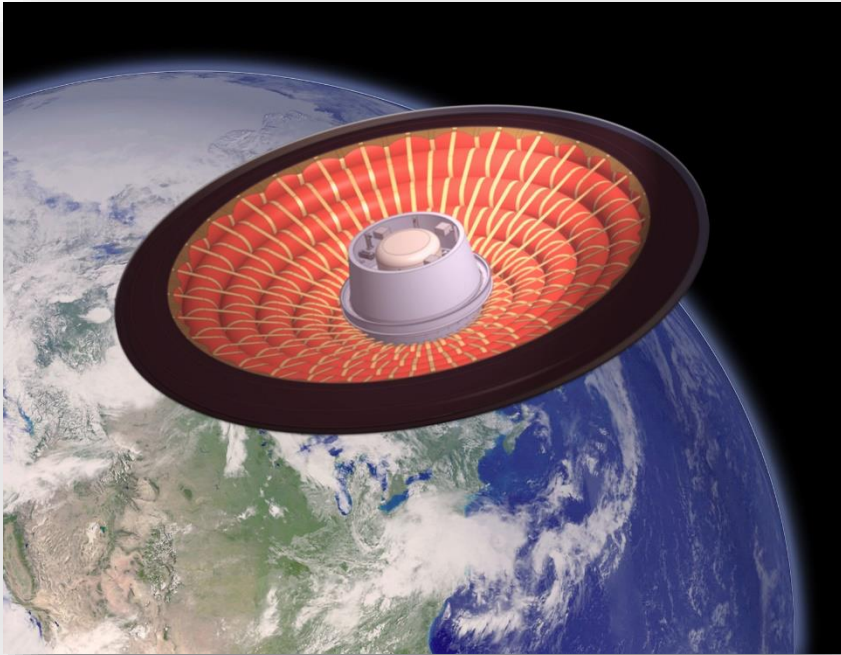
Managing Space Operations- UAL 1639



Managing Space Operations UAL 1639 (AHA)



NASA's LOFTID: A New Kind of Heat Shield



Federal Aviation
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The bottom line

- **Know where and when your flight path will be close to a launch or reentry operation.**
- **Avoid these areas by at least 1 nautical mile during launch or reentry operations**
- **If not on IFR Flight Plan request VFR flight following**



Resources



LET'S GIVE 'EM SOME "SPACE"

How to Safely Steer Clear of Aircraft Hazard Areas
During Spacecraft Launch and Reentry

By Tom Hoffmann

In case you hadn't noticed, the commercial space race is on. Today's headlines regularly tout the commercial space industry's blistering pace of advancement and innovation — everything from reusable rockets to space tourism to nanosatellites the size of a shoebox. Launch frequency has recently picked up too. In just the last 12 years, we've seen the cadence of U.S. commercial space launch and reentry operations grow from about three licensed operations a year to approximately two per week!

As this industry has grown, the FAA has developed a safe operating infrastructure that ensures the safety of the public, and all National Airspace System (NAS) users, including general aviation. However, the complexities of space operations require some innovative ideas to balance industry growth, operational efficiency, and more importantly, safety for all.

Celestial Changes

GA pilots know all too well that change in aviation is a constant, but it's also something this group is keenly adept at handling well. Depending on where in the country you regularly fly, it's possible you've encountered some changes spurred by commercial space activity. And if you haven't, well, it's probably just a matter of time.

FAA licensed launch and reentry sites, a.k.a. "spaceports," are expanding geographically and are no longer limited to the coastlines. Becoming familiar with this growing sector of the NAS is just as important to your safety as it is to any humans strapped in and waiting to

<https://tinyurl.com/3e5288pz>



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Fly Safely!

- We hope we've provided insight into what it means to fly in "proximity" of space launch operations, as well as an awareness of the industry's expanding geographical areas of operation and increasing operational cadence.
- Use the information provided to enhance future preflight planning and ensure your safety and the safety of the NAS!
- **Thank you for your participation!**

•StratoLaunch / Talon – Hypersonic Flight



Federal Aviation
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Fly Safely!

www.faa.gov/space

Answers to Frequently Asked Questions:

https://www.faa.gov/space/additional_information/faq/

Inquiries:

pressoffice@faa.gov



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The National FAA Safety Team Presents-



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