Spaceport Categorization Aviation Rulemaking Committee (ARC)

ARC Recommendations Final Report

March 29, 2019

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1. BACKGROUND

The Federal Aviation Administration (FAA or the Agency) chartered the Spaceport Categorization Aviation Rulemaking Committee (SC-ARC or ARC) to assist the FAA in providing the appropriate spaceport categorization framework to develop FAA policy and future regulations, while considering the impacts to established aviation operations.

As the commercial space transportation industry has grown in vehicle technology, operational capability, and market penetration, enthusiasm of state, regional, and private entities to invest in commercial spaceports has also increased rapidly. The FAA has expressed a desire to encourage a broad, resilient infrastructure supporting a multitude of companies and missions, and to identify potential spaceport integration issues and provide early regulatory clarity to municipalities and enterprises developing their business places. Co-location at airports, impacts to air traffic, and general public safety considerations are all emergent issues as the commercial space transportation industry becomes more widespread and normalized. The FAA believes a spaceport categorization framework provides a primary means to enhance clarity and communication for space and aviation stakeholders and the FAA. The FAA chartered the SC-ARC to assist the FAA in defining a working set of spaceport categories that includes strong consideration of the needs for airspace and airport integration.

2. OBJECTIVES AND SUMMARY OF ACTIVITIES OF THE ARC

ARC Membership

The ARC was composed of members representing airports, spaceports, launch operators, consulting firms and numerous industry member organizations. A complete list of ARC members is included in Appendix A to this report.

ARC Objectives

The SC-ARC was tasked with assisting the FAA in reviewing category criteria defining ranges of launch and reentry vehicle types and the ease with which they could be accommodated at spaceport locations.

Overall, the goal of the SC-ARC was to provide a forum for the United States aviation and space communities to review and discuss a spaceport categorization scheme to be used as a primary communication tool by the FAA and the stakeholder community.

The FAA charged the SC-ARC with the following specific task: Review the FAA's draft spaceport categorization scheme and provide specific consensus comments and recommendations on its overall framework as well as each of its specific elements to assist the FAA in developing clear and useful spaceport categories.

ARC Working Groups

The members of the SC-ARC were organized into three working groups:

- Task Group One – Concerns/Gaps Identified in Current Site Licensing Process
- Task Group Two – Common Language/Terminology
- Task Group Three – Spaceport Categorization

ARC Meetings

The initial meeting with the FAA and industry took place in Washington, DC on February 28, 2018. FAA representatives presented industry members with a draft spaceport categorization scheme. Following the initial meeting, the SC-ARC held the meetings and teleconferences on the following dates to discuss the FAA's effort:

March 19, 2018	Teleconference
April 16, 2018	Teleconference
June 25, 2018	Teleconference
July 20, 2018	In-person at Delta HQ in Atlanta, as a joint meeting with the Airspace Access ARC
August 6, 2018	Teleconference
September 3, 2018	Teleconference
September 19, 2018	In-person meeting at NBAA HQ
October 1, 2018	Teleconference
October 15, 2018	Teleconference
November 16, 2018	In-person at Denver International Airport
March 15, 2019	Teleconference

3. EXECUTIVE SUMMARY

The SC-ARC membership represented diverse interests and viewpoints. During the course of the ARC activities described above, the three task groups met on several occasions to address the specific issues they were tasked to consider. The individual task groups' findings and conclusions were captured in separate task group reports, which were presented to and considered by the full ARC and form the basis of the ARC's recommendations. Although some decisions were not unanimous, the ARC reached general agreement on their recommendations to the FAA. The recommendations in this report reflect the final statements of the ARC.

Because of the variety of stakeholders represented in its membership, the ARC found it necessary to address the fact that many terms were being used and often interpreted differently across stakeholders in the proceedings of the ARC. Section 4 of this report contains a description of common terms agreed to by the ARC for purposes of its activities.

The initial goal of the SC-ARC was to provide a forum for the United States aviation and space communities to review and discuss a spaceport categorization scheme to be used as a primary communication tool by the FAA and the stakeholder community. During the course of its deliberations, however, the ARC concluded that a categorization scheme was unnecessary and represented only one way in which the FAA and the stakeholder community could communicate to

other interested stakeholders and the general public about the activities that may take place at a spaceport. Instead of developing a spaceport categorization scheme, the ARC recommends a data disclosure requirement for prospective spaceports. The specific data and factors that potential spaceports would be required to disclose are discussed in Section 5.B. of this report.

The ARC also considered and makes recommendations to the FAA about the spaceport licensing process. The ARC spent considerable time identifying issues and concerns it has with the existing licensing process. Rather than make specific recommendations about how the FAA should change the licensing process, however, the ARC chose to present its concerns for the FAA to consider. Because these concerns differ between the aviation community and the commercial space community, each community's concerns is presented separately in Section 5.A. of this report.

4. COMMON LANGUAGE

This section is intended to review terms that have been used and often interpreted differently across stakeholders in the proceedings of the ARC. Initially, a survey was conducted of ARC participants to gather a catalog of terms that were confusing, misunderstood, or meant different things to different NAS stakeholders. This section is structured such that for each term, a legal or published definition is listed along with a source reference. In some cases, terms provided in this section are colloquial in nature and thus do not have an associated legal or published definition. In many cases the legal or published definition does not provide the detail needed to generate understanding of what the term actually means. In an attempt to increase understanding and correct use of these terms, a description/discussion section was added that is intended to cover the generally accepted meaning of each term as well as address any areas the same term is used with different intent across NAS stakeholders. This section is structured with the terms in alphabetical order and includes a table of applicability at the end, indicating whether the term applies to the launch/reentry operator, the launch/reentry site, the aircraft/airspace, or some combination of the three.

A. Definitions

Accident (Launch Site)

Legal or Published Definition: Launch site accident means an unplanned event occurring during a ground activity at a launch site resulting in a fatality or serious injury (as defined in 49 Code of Federal Regulations (CFR) 830.2) to any person who is not associated with the activity, or any damage estimated to exceed $25,000 to property not associated with the activity.

Legal or Published Definition Location: 14 CFR 420.5

Description/Discussion: Launch sites are responsible for developing procedures for responding to a launch site accident as well as developing an accident investigation plan for supporting accident investigation activities.

Accident (Launch)

Legal or Published Definition: Launch accident means:

(1) An event that causes a fatality or serious injury (as defined in 49 CFR 830.2) to any person who is not associated with the flight;

(2) An event that causes damage estimated to exceed $25,000 to property not associated with the flight that is not located at the launch site or designated recovery area;

(3) An unplanned event occurring during the flight of a launch vehicle resulting in the impact of a launch vehicle, its payload or any component thereof:

(i) For an expendable launch vehicle, outside designated impact limit lines; and

(ii) For a reusable launch vehicle, outside a designated landing site.

(4) For a launch that takes place with a person on board, a fatality or serious injury to a space flight participant or crew member.

Legal or Published Definition Location: 14 CFR 401.5

Description/Discussion: Commercial launch operators are responsible for accident reporting and conducting/supporting accident investigations. In the context of property damage, the launch or recovery site is a specifically designated launch facility or landing zone, not the entirety of a spaceport or Federal Range. Unassociated property outside these designated areas generally indicates third party or government property. An event during flight includes both ascent and descent phases of flight. In practice, section 3i of the legal definition applies not only to expendable launch vehicles, but also to reusable vehicles during the ascent phase. Both expendable and reusable launch vehicles may jettison components during flight; jettisoned item impact zone boundaries are similar to impact limit lines but not analogous as they're based on nominal debris containment vs. public risk. Section 3 of the legal definition is far more conservative than the equivalent aviation definition which is limited to injury and property damage criteria.

Aircraft Approach Category

Legal or Published Definition: A grouping of aircraft based on a speed of 1.3 times the stall speed in the landing configuration at maximum gross landing weight.

Legal or Published Definition Location:
FAA Order JO 7110.65X, Air Traffic Control, Effective October 12, 2017.[1]

See also, FAA Order 8260.3D, United States Standard for Terminal Instrument Procedures (TERPS), effective February 16, 2016.[2]

Description/Discussion: An aircraft must fit in only one category. If it is necessary to maneuver at speeds in excess of the upper limit of a speed range for a category, the minimums for the category for that speed must be used. For example, an aircraft which falls in Category A, but is circling to

[1] https://www.faa.gov/documentLibrary/media/Order/7110.65X_ATC_w_chg_1_and_chg_2.pdf.
[2]https://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.information/documentID/1032731.

land at a speed in excess of 91 knots, must use the approach Category B minimums when circling to land. The categories are as follows:

(a) Category A− Speed less than 91 knots.
(b) Category B− Speed 91 knots or more but less than 121 knots.
(c) Category C− Speed 121 knots or more but less than 141 knots.
(d) Category D−Speed 141 knots or more but less than 166 knots.
(e) Category E− Speed 166 knots or more. (Refer to 14 CFR part 97) (Certain military aircraft).

Aircraft Certification (Airworthiness Certificate)

Legal or Published Definition: An airworthiness certificate is an FAA document which grants authorization to operate an aircraft in flight.

Legal or Published Definition Location: FAA website, "Airworthiness Certificates Overview" page.[3]

FAA Order 8130.2, Airworthiness Certification of Aircraft, provides information regarding the definition of the term "airworthy," and contains descriptions of the various airworthiness certificates and their uses.[4]

Description/Discussion: Under the authority of Title 49 of the U.S. Code, the FAA issues airworthiness certificates to aircraft. There are two different classifications of FAA airworthiness certificates: Standard Airworthiness Certificate, and Special Airworthiness Certificate. The Office of Aviation Safety (AVS) issues airworthiness certificates.

A **Standard** airworthiness certificate is the FAA's official authorization allowing for the operation of type-certificated aircraft in the following categories:

- Normal
- Utility
- Acrobatic
- Commuter
- Transport
- Manned free balloons
- Special classes

A Standard airworthiness certificate remains valid as long as the aircraft meets its approved type design, is in a condition for safe operation and maintenance, preventative maintenance, and alterations are performed in accordance with 14 CFR parts 21, 43, and 91.

A **Special** airworthiness certificate is issued for aircraft that do not have a type certificate. Aircraft that have an FAA approved design (type design) are eligible for a type certificate. Since these aircraft typically do not hold a FAA approved design, they are not eligible for a standard airworthiness certificate. The most common of these special categories are Experimental.

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[3] https://www.faa.gov/aircraft/air_cert/airworthiness_certification/aw_overview.
[4] https://www.faa.gov/documentLibrary/media/Order/FAA_Order_8130.2J.pdf.

There are eight categories of Special airworthiness certificates.

- Primary
- Restricted
- Multiple
- Limited
- Light-sport
- Experimental
- Special flight permit
- Provisional

Aircraft that hold an experimental airworthiness certificates, do not meet the same safety rigor as aircraft that hold a type certificate and have a standard airworthiness certificate. Experimental aircraft have limitations that are issued with the airworthiness certificate. These operation limitations help mitigate the safety risks by limiting how, when and where the aircraft is to be operated.

There are 10 purposes where the FAA issues experimental airworthiness certificates.

- Research and development
- Showing compliance with regulations
- Crew training
- Exhibition
- Air racing
- Market surveys
- Operating amateur-built aircraft
- Operating kit-built aircraft
- Operating light-sport aircraft
- Unmanned Aircraft Systems (UAS)

Aircraft Departure Window

Legal or Published Definition: Sometimes referred to as a departure slot, is a period of time within which take-off has to take place. In Europe, (EUROCONTROL's area of operations), a slot is defined as the period between 5 minutes before and 10 minutes after the Calculated Takeoff Time (CTOT). The aircraft is required to be at the runway, ready for departure at its CTOT.

Legal or Published Definition Location: EUROCONTROL website, "ATFM slots" page.[5]

Description/Discussion: Too many aircraft in the air at the same time and place can lead to an unsafe situation. One of the tools used by the Network Manager Operations Centre to prevent this from happening is to apply CTOTs (calculated take-off times), which is also known as issuing Air Traffic Flow Management (ATFM) slots or simply slot. The slot is actually a period of time within which take-off has to take place. In Europe, (EUROCONTROL's area of operations), a slot is defined as the period between 5 minutes before and 10 minutes after the CTOT. In the US, the CTOT is issued by the ATCSSC (Air Traffic Control System Command Center) using very similar procedures. The aircraft is required to be at the runway, ready for departure at its CTOT. The

[5] https://www.eurocontrol.int/articles/atfm-slots.

leeway is to allow air traffic control to integrate the aircraft into the other traffic. If a slot is missed (or if it is already certain in advance that it will be missed), the Network Operations Centre assigns a new one. A different aircraft which has a slot because of the same regulation may be issued an improvement on its slot to make use of the newly available capacity. The slot and any revisions are communicated to the aircraft operator as well as the air traffic control unit at the departure airport via a special network called AFTN. More technical means of communicating slot information are available, such as operational applications and computer-computer interfaces.

Aircraft Separation (Separation Minima)

Legal or Published Definition: The spacing of aircraft to achieve their safe and orderly movement in flight and while landing and taking off.

Legal or Published Definition Location: Aircraft separation is described in FAA Order JO 7110.65X, Section 9-3-2, as separation minima.

Description/Discussion: Standardized separation between vehicles that holds true wherever a vehicle goes in the NAS. Separation is used to space aircraft from each other by fixed distances longitudinally and laterally (e.g., 5 miles separation en route; 3 miles separation terminal), and vertically (2000 ft. above/below standard; 1,000 ft. above/below RVSM). The distances are measured relative to the present positions of the aircraft. You can think of it as bubbles around each airplane that move with the airplane as the airplane moves. Their purpose is to keep airplanes from colliding with each other, and in some cases to keep them from flying into another airplane's wake.

AST Regulation

Legal or Published Definition:

1. The Code of Federal Regulations (CFR) is the codification of the general and permanent rules published in the *Federal Register* by the departments and agencies of the Federal Government produced by the Office of the Federal Register (OFR) and the Government Publishing Office.

   Title 14 of the CFR - Aeronautics and Space, Chapter III – Commercial Space Transportation, Federal Aviation Administration, Department of Transportation contains Subchapters A, B and C and includes CFR parts 400 – 460, which make up the regulatory framework followed by FAA – Office of Commercial Space Transportation (AST).

2. The basis for the regulations in Chapter III of 14 CFR is the Commercial Space Launch Act of 1984, and applicable treaties and international agreements to which the United States is party.

3. The regulations in Chapter III set forth the procedures and requirements applicable to the authorization and supervision under 51 U.S.C. subtitle V, chapter 509 (Commercial Space Launch Activities), of commercial space transportation activities conducted in the United States or by a U.S. citizen. The regulations in Chapter III *do not apply to*—

(a) Space activities carried out by the United States Government on behalf of the United States Government;
(b) The launch of an amateur rocket as defined in §1.1 of Chapter I of Title 14; or
(c) A launch of a tethered launch vehicle meeting the criteria outlined in 14 CFR 400.2

Legal or Published Definition Location:

1. Code of Federal Regulations

2. 14 CFR 400.1

3. 14 CFR 400.2

Description/Discussion: The Commercial Space Launch Act 1984 – Section 2-Findings – Numbers 6 and 7 states that "Congress finds the provision of launch services by the private sector is consistent with the national security interests and foreign policy interests of the United States and would be facilitated by stable, minimal, and appropriate regulatory guidelines that are fairly and expeditiously applied; and (7) the United States should encourage private sector launches and associated services and, only to the extent necessary, regulate such launches and services in order to ensure compliance with international obligations of the United States and to protect the public health and safety, safety of property, and national security interests and foreign policy interests of the United States."

Clearance Void Time (also Departure Window)

Legal or Published Definition:

1. A pilot may receive a clearance, when operating from an airport without a control tower, which contains a provision for the clearance to be void if not airborne by a specific time. A pilot who does not depart prior to the clearance void time must advise ATC as soon as possible of their intentions. ATC will normally advise the pilot of the time allotted to notify ATC that the aircraft did not depart prior to the clearance void time. This time cannot exceed 30 minutes. Failure of an aircraft to contact ATC within 30 minutes after the clearance void time will result in the aircraft being considered overdue and search and rescue procedures initiated.

2. *Clearance Void if Not Off By (Time)* – Used by ATC to advise an aircraft that the departure clearance is automatically canceled if takeoff is not made prior to a specified time. The pilot must obtain a new clearance or cancel his/her IFR flight plan if not off by the specified time. A time specified by an air traffic control unit at which a clearance ceases to be valid unless the aircraft concerned has already taken action to comply therewith.

Legal or Published Definition Location:

1. FAA Aeronautical Information Manual (AIM), October 12, 2017, Section 5−2−6, Departure Restrictions, Clearance Void Times, Hold for Release, and Release Times

2. AIM, Pilot/Controller Glossary

Description/Discussion: Clearance void times are one of the many tools used by ATC to ensure safe and orderly release of aircraft from uncontrolled departure points into the NAS. Specifically a clearance void time is used by ATC to advise an aircraft that the departure clearance is automatically canceled if takeoff is not made prior to a specified time. The pilot must obtain a new clearance or cancel his/her IFR flight plan if not off by the specified time. Other similar Traffic Management Tools are EDCT, En route Spacing tools, release times for specific routes or destinations, ground stops and flow message through ATC. (See Departure Windows above)

Climb VIA

Legal or Published Definition: An abbreviated ATC clearance that requires compliance with the procedure lateral path, associated speed restrictions, and altitude restrictions along the cleared route or procedure.

Legal or Published Definition Location: AIM, Pilot/Controller Glossary and FAA Order JO7110.65X

Description/Discussion: This is instructions given a pilot who is established on a published arrival/departure route, to climb/descend at pilot's discretion following the altitudes published for that route.

Commercial Flights

Legal or Published Definition:

1. Commercial operator (operation) for aviation means a person who, for compensation or hire, engages in the carriage by aircraft in air commerce of persons or property, other than as an air carrier or foreign air carrier or under the authority of 14 CFR part 375. Where it is doubtful that an operation is for "compensation or hire," the test applied is whether the carriage by air is merely incidental to the person's other business or is, in itself, a major enterprise for profit.

2. Commercial Space – A space launch conducted by a member of the private sector for fulfilling a mission not being conducted as a matter of national security or defense, but for the furtherance of human exploration in space and economic gain.

Legal or Published Definition Location:

1. 14 CFR 1.1

2. Commercial Space Launch Act 1984

Description/Discussion: While a definition of "Commercial" relative to Space Transportation was not located, 14 CFR 400.2 (Commercial Space Transportation, FAA, Department of Transportation) stipulates:

The regulations in 14 CFR Chapter III set forth the procedures and requirements applicable to the authorization and supervision under 51 U.S.C. subtitle V, chapter 509, of commercial space transportation activities conducted in the United States or by a U.S. citizen. The regulations in this chapter do not apply to—

(a) Space activities carried out by the United States Government on behalf of the United States Government;
(b) The launch of an amateur rocket as defined in §1.1 of chapter I of this title; or
(c) A launch of a tethered launch vehicle that meets all the following criteria:
  (1) *Launch vehicle.* The launch vehicle must—
    (i) Be unmanned;
    (ii) Be powered by a liquid or hybrid rocket motor;
    (iii) Not use any of the toxic propellants of Table I417-2 and Table I417-3 in Appendix I of part 417 of this chapter; and
    (iv) Carry no more than 5,000 pounds of propellant.
  (2) *Tether system.* The tether system must—
    (i) Not yield or fail under—
    (A) The maximum dynamic load on the system; or
    (B) A load equivalent to two times the maximum potential engine thrust.
    (ii) Have a minimum safety factor of 3.0 for yield stress and 5.0 for ultimate stress.
    (iii) Constrain the launch vehicle within 75 feet above ground level as measured from the ground to the attachment point of the vehicle to the tether.
    (iv) Display no damage prior to the launch.
    (v) Be insulated or located such that it will not experience thermal damage due to the launch vehicle's exhaust.
  (3) *Separation distances.* The launch operator must separate its launch from the public and the property of the public by a distance no less than that provided for each quantity of propellant listed in Table A of 14 CFR 400.2.

Commercial Service Airports

Legal or Published Definition: Commercial Service Airports are publicly owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service. Passenger boardings refer to revenue passenger boardings on an aircraft in service in air commerce whether or not in scheduled service. The definition also includes passengers who continue on an aircraft in international flight that stops at an airport in any of the 50 States for a non-traffic purpose, such as refueling or aircraft maintenance rather than passenger activity. Passenger boardings at airports that receive scheduled passenger service are also referred to as Enplanements.

Legal or Published Definition Location: FAA website, "Airport Categories" page.[6]

[6] https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/.

Categories of Airport Activities			
Airport Classifications		**Hub Type: Percentage of Annual Passenger Boardings**	**Common Name**
Commercial Service: Publicly owned airports that have *at least 2,500* passenger boardings each calendar year and receive scheduled passenger service **§47102(7)**	**Primary:** Have *more than 10,000* passenger boardings each year **§47102(16)**	**Large:** 1% or more	**Large Hub**
		Medium: At least 0.25%, but less than 1%	**Medium Hub**
		Small: At least 0.05%, but less than 0.25%	**Small Hub**
		Nonhub: More than 10,000, but less than 0.05%	**Nonhub Primary**
	Nonprimary	**Nonhub:** At least 2,500 and no more than 10,000	**Nonprimary Commercial Service**
Nonprimary (Except Commercial Service)		Not Applicable	**Reliever §(47102(23))** **General Aviation (47102(8))**

Description/Discussion: Nonprimary Commercial Service Airports are Commercial Service Airports that have at least 2,500 and no more than 10,000 passenger boardings each year. Primary Airports are Commercial Service Airports that have more than 10,000 passenger boardings each year. Hub categories for Primary Airports are defined as a percentage of total passenger boardings within the United States in the most current calendar year ending before the start of the current fiscal year. For example, calendar year 2014 data are used for fiscal year 2016 since the fiscal year began 9 months after the end of that calendar year. The table above depicts the formulae used for the definition of airport categories based on statutory provisions cited within the table, including Hub Type described in 49 U.S.C. § 47102.

Controlled Airspace

Legal or Published Definition: An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification. (See discussion below)

Legal or Published Definition Location: FAA Order JO 7110.65X, Pilot/Controller Glossary.

Description/Discussion: An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification

a. Controlled airspace is a general term used that covers specific Class A, Class B, Class C, Class D, and Class E airspace.
b. Controlled airspace is also that airspace within which all aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements in 14 CFR part 91 (for specific operating requirements, please refer to 14 CFR part 91). For IFR operations in any class of controlled airspace, a pilot must file an IFR flight plan and receive an appropriate ATC clearance. Each Class B, Class C, and Class D airspace area designated for an airport contains at least one primary airport around which the airspace is designated (for specific designations and descriptions of the airspace classes, please refer to 14 CFR part 71).
c. Controlled airspace in the United States is designated as follows:
    1. CLASS A− Generally, that airspace from 18,000 feet MSL up to and including FL 600, including the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska. Unless otherwise authorized, all persons must operate their aircraft under IFR.
    2. CLASS B− Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of airport operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers (some Class B airspace areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is "clear of clouds."
    3. CLASS C− Generally, that airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually consists of a surface area with a 5 nautical mile (NM) radius, a circle with a 10NM radius that extends no lower than 1,200 feet up to 4,000 feet above the airport elevation, and an outer area that is not charted. Each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace. VFR aircraft are only separated from IFR aircraft within the airspace. (See OUTER AREA.)
    4. CLASS D− Generally, that airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the

procedures. Arrival extensions for instrument approach procedures may be Class D or Class E airspace. Unless otherwise authorized, each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace. No separation services are provided to VFR aircraft.

5. CLASS E− Generally, if the airspace is not Class A, Class B, Class C, or Class D, and it is controlled airspace, it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Also in this class are Federal airways, airspace beginning at either 700 or 1,200 feet AGL used to transition to/from the terminal or en route environment, en route domestic, and offshore airspace areas designated below 18,000 feet MSL. Unless designated at a lower altitude, Class E airspace begins at 14,500 MSL over the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska, up to, but not including 18,000 feet MSL, and the airspace above FL 600. CONTROLLED AIRSPACE [ICAO]− An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.

Corridor

Legal or Published Definition: None

Legal or Published Definition Location: None

Description/Discussion: This is a proposed term to indicate routes from the surface of the earth through the NAS. This is for regularly used routes as proposed. It can be used to standardize so all users are aware of these.

Descend VIA

Legal or Published Definition: An abbreviated ATC clearance that requires compliance with a published procedure lateral path and associated speed restrictions and provides a pilot-discretion descent to comply with published altitude restrictions.

Legal or Published Definition Location: AIM, Pilot/Controller Glossary and FAA Order JO 7110.65X

Description/Discussion: This is instructions given a pilot who is established on a published arrival/departure route, to climb/descend at pilot's discretion following the altitudes published for that route.

Emergency Plan (Aircraft)

Legal or Published Definition: For airports specifically, an emergency is any occasion or instance, natural or man-made that warrants action to save lives and protects property and public health. The airport emergency plan (AEP) should address those emergencies that occur on or directly impact, an airport or adjacent property that:

(a) Is within the authority and responsibility of the airport to respond; or
(b) May present a threat to the airport because of the proximity of the emergency to the airport; or
(c) Where the airport has responsibilities under local/regional emergency plans and by mutual aid agreements.

Legal or Published Definition Location:

- Advisory Circular 150/5200-31C, Airport Emergency Plan, June 19, 2009.
- *See also*, 14 CFR 139.325

Description/Discussion: In 14 CFR part 139, for Airports facilitating scheduled passenger-carrying operations of an air carrier operating aircraft configured for more than 9 passenger seats, or unscheduled passenger-carrying operations of an air carrier operating aircraft configured for at least 31 passenger seats, an approved Emergency Plan is required as part of the Airport Certification Manual. Section 139.203 of 14 CFR lists those items required to be addressed as part of the Emergency Plan.

Emergency Plan (Launch/Reentry)

Legal or Published Definition:
(a) *Mishap investigation plan and emergency response plan.* An applicant shall submit a mishap investigation plan (MIP) containing the applicant's procedures for reporting and responding to launch and reentry accidents, launch and reentry incidents, or other mishaps, as defined in §401.5 of this chapter, that occur during the conduct of an RLV [reusable launch vehicle] mission. An acceptable MIP satisfies the requirements of paragraphs (b)–(d) of this section. An applicant shall also submit an emergency response plan (ERP) that contains procedures for informing the affected public of a planned RLV mission. An acceptable ERP satisfies the requirements of paragraph (e) of this section. The MIP and ERP shall be signed by an individual authorized to sign and certify the application in accordance with §413.7(c) of this chapter, the person responsible for the conduct of all licensed RLV mission activities designated under §431.33(b) of this subpart, and the safety official designated under §431.33(c) of this subpart.

Legal or Published Definition Location: 14 CFR 431.45(a)

Description/Discussion: For space operations, part of the licensing requirements is to have an emergency response plan. This plan outlines the likely conditions that could lead to an emergency and the organizations response to those conditions; who is called, what recovery actions are taken, etc.

Expendable Launch Vehicle (ELV)

Legal or Published Definition: Expendable launch vehicle (ELV) means a launch vehicle whose propulsive stages are flown only once.

Legal or Published Definition Location: 14 CFR 401.5

Description/Discussion: For launch of an orbital ELV, launch ends after the licensee's last exercise of control over its launch vehicle. For a suborbital ELV launch, launch ends after reaching apogee if the flight includes a reentry, or otherwise after vehicle landing or impact on Earth, and after activities necessary to return the vehicle to a safe condition on the ground.

A Launch Accident involving an ELV includes an unplanned event occurring during the flight of a launch vehicle resulting in the impact of a launch vehicle, its payload or any component outside designated impact limit lines.

Experimental Aircraft

Legal or Published Definition: Experimental certificates are issued for the following purposes: (a) research and development; (b) showing compliance with regulations; (c) crew training; (d) exhibition; (e) air racing; (f) market surveys; (g) operating amateur-built aircraft; (h) operating primary kit-built aircraft; and (i) operating light-sport aircraft.

Legal or Published Definition Location: 14 CFR 21.191

Description/Discussion: An experimental airworthiness certificate allows an aircraft manufacturer or operator to conduct experimental operations before they're ready for commercial operations.

Experimental Permit

Legal or Published Definition: FAA will issue an experimental permit to a person to launch or reenter a reusable suborbital rocket only for-
(a) Research and development to test new design concepts, new equipment, or new operating techniques;
(b) A showing of compliance with requirements for obtaining a license under this subchapter; or
(c) Crew training before obtaining a license for a launch or reentry using the design of the rocket for which the permit would be issued.

Legal or Published Definition Location: 14 CFR 437.5

Description/Discussion: Allows an operator to conduct experimental operations before they're ready for commercial operations. This allows them to learn their vehicle and operational parameters of their vehicle under less stringent requirements as compared to a launch license. The regulatory

language for an experimental permit is similar to that of an experimental airworthiness certificate for aircraft because the language for the experimental permit was borrowed from the existing airworthiness certificate regulations.

Fuel

General Definition: A substance that when mixed with an oxidizer provides propulsive thrust for a launch vehicle.

Definition Location: None

Description/Discussion: Common fuels for launch vehicles include RP-1 (Kerosene), Isopropyl Alcohol, Ethanol, Liquid Hydrogen, HTPB, and Hydrazine.

Government Flights

Legal or Published Definition:

1. The aviation community uses the term "Civil Aircraft" to indicate aircraft other than public aircraft.

2. An operation carried out under the direction of and for the purpose of the Federal government, withstanding operations conducted by the Department of Defense and Military Operations.

Legal or Published Definition Location:

1. 14 CFR 1.1

2. General reasoning

Description/Discussion: Regarding Space Transportation, 14 CFR 1201.101 defines National Aeronautics and Space Administration (NASA) as the entity to "carry out aeronautical and space activities of the United States. Such activities shall be the responsibility of, and shall be directed by, the NASA, except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States shall be the responsibility of, and shall be directed by, the Department of Defense."

Hazard Area

Legal or Published Definition: Hazard areas are identified for ground safety (14 CFR 417.413) and flight safety (14 CFR 417.107) as regions where hazardous conditions could potentially exist and risk to the public needs to be minimized. A launch operator must define a hazard area that confines the adverse effects of a hardware system should an event occur that presents a public hazard or

launch location hazard. A launch operator must prohibit public access to the hazard area whenever a hazard is present unless the requirements for public access of paragraph (b) of this section are met.

Legal or Published Definition Location: 14 CFR §§ 417.413 and 417.107, and Appendix B to part 417 of 14 CFR

Description/Discussion: For ground systems, a launch operator must define a hazard area that confines the adverse effects of a hardware system should an event occur that presets a public hazard. For flight safety, a launch operator must establish water borne vessel hazard areas necessary to ensure the probability of impact with debris capable of causing a casualty for water borne vessels does not exceed 1×10^{-5}. In addition, for flight safety, a launch operator must establish aircraft hazard areas necessary to ensure the probability of impact with debris capable of causing a casualty for an aircraft does not exceed 1×10^{-6}.

Also Flight Hazard Area A417.23 Includes definitions for Launch Site Flight Hazard Area, Debris Impact Hazard Area, Near-launch-point blast hazard area, Aircraft Hazard Area.

Aircraft Hazard Area is also defined in JO 7110.65X:
Airspace defined as an area to protect non-participating aircraft from a launch vehicle, reentry vehicle amateur rocket, jettisoned stages, hardware, or falling debris generated by failures associated with any of these activities. Unless otherwise specified, the vertical limits of an AHA are from the surface to unlimited. See also contingency hazard area, refined hazard area, transitional hazard area.

Hazard or System Hazard

Legal or Published Definition: *System hazard means* a hazard associated with a system and generally exists even when no operation is occurring.

Legal or Published Definition Location: 14 CFR 417.3

Description/Discussion: In the context of launch/reentry sites and vehicles, a hazard is anything that can pose a threat to people working around a vehicle or the uninvolved public in the vicinity of where the hazard outcome could manifest. Typically a system safety approach is utilized to identify hazards and either mitigate or control them to lower the likelihood of occurrence to an acceptable level.

Horizontal Launch

Legal or Published Definition: See "Launch"

Legal or Published Definition Location: N/A

Description/Discussion: The act of conducting a launch of a vehicle in a horizontal manner. This is could include:

1) Utilizing a jet-powered carrier aircraft, that takes off and lands on a runway, to transport a rocket or other launch vehicle to a designated ignition point where rocket engine ignition occurs;
2) Utilizing a rocket-powered winged launch vehicle, that takes off under rocket power and lands on a runway;
3) Utilizing a jet-powered aircraft to take off from a runway, to transport the vehicle to a designated ignition point where the jet engines turn off and the rocket engines ignite.
4) Utilizing a rail-based system to accelerate a launch vehicle prior to departing the Earth's surface.

Ignition

Legal or Published Definition:

1. The action of setting something on fire or starting to burn.
   - The process of starting the combustion of fuel in the cylinders of an internal combustion engine.
   - The mechanism for bringing about ignition in an internal combustion engine, typically activated by a key or switch.

2. Ignition may also refer to exothermic chemical reactions between a fuel and an oxidant accompanied by the production of heat and conversion of chemical species.

3. The initiation of the reaction in an engine that produces a thrust due to an exhaust consisting entirely of material, as oxidizer, fuel, and inert matter, that has been carried with the engine in the vehicle it propels, none of the propellant being derived from the medium through which the vehicle moves.

Legal or Published Definition Location:

1. Google

2. Wikipedia

3. Dictionary.com (Rocket Engine Ignition)

Description/Discussion: "Ignition" is different from "launch" on that ignition is essentially the moment that the rocket engines light up. Ignition may occur at the launch site or at a location away from the launch site. In the case of launch sites that support horizontally launched vehicles, the "launch" may occur prior to takeoff, while ignition may occur in the air at an operating area away from the spaceport boundary.

Incident (Aircraft)

Legal or Published Definition: Effective May, 10, 2018, FAA Order 8020.11D, Aircraft Accident and Incident Notification, Investigation, and Reporting, defines Incident as "An occurrence other than an accident, associated with the operation of an aircraft which affects or could affect the safety

of operations." This Order includes a Chapter on "Special Types of Aircraft Accident/Incident Investigations," which includes information on commercial space vehicle and unmanned aircraft systems investigations. This Order was developed by the FAA Office of Accident Investigation and Prevention (AVP-100).

Legal or Published Definition Location:

- FAA Order 8020.11D, Aircraft Accident and Incident Notification, Investigation, and Reporting, Effective October 4, 2011.[7]
- *See also* FAA Order JO 8020.16 and Annex 13 to The Convention on International Civil Aviation, Aircraft Accident and Incident Investigation.

Description/Discussion: Considering the fact Aviation and Commercial Space are global industries with international implications, Annex 13 of the Convention on International Civil Aviation was also reviewed. In accordance with International Civil Aviation Organization (ICAO) Standards, accidents and serious incidents must be reported and investigated. Annex 13 defines "Accident" as an occurrence associated with the operation of an aircraft, which takes place from the time any person boards the aircraft with the intention of flight until all such persons have disembarked, and in which a) a person is fatally or seriously injured, b) the aircraft sustains significant damage or structural failure, or c) the aircraft goes missing or becomes completely inaccessible.

Serious injury includes the following:

a) Requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or
b) Results in a fracture of any bone (except simple fractures of fingers, toes or nose); or
c) Involves lacerations which cause severe hemorrhage, nerve, muscle or tendon damage; or
d) Involves injury to any internal organ; or
e) Involves second or third degree burns, or any burns affecting more than 5 per cent of the body surface; or
f) Involves verified exposure to infectious substances or injurious radiation.

Annex 13 defines an "Incident" as an occurrence, other than an accident, associated with the operation of an aircraft that affects or could affect the safety of operation. A "Serious Incident" defined is an incident involving circumstances indicating that an accident nearly occurred. The difference between an accident and a serious incident lies only in the result. Examples of "Incidents" meeting the classification as "Serious" are provided below.

- Near collisions requiring an avoidance maneuver to avoid a collision or an unsafe situation or when an avoidance action would have been appropriate.
- Controlled flight into terrain only marginally avoided.
- Aborted take-offs on a closed or engaged runway.
- Take-offs from a closed or engaged runway with marginal separation from obstacle(s).
- Landings or attempted landings on a closed or engaged runway.
- Gross failures to achieve predicted performance during take-off or initial climb.
- Fires and smoke in the passenger compartment, in cargo compartments or engine fires, even though such fires were extinguished by the use of extinguishing agents.
- Events requiring the emergency use of oxygen by the flight crew.

[7] https://www.faa.gov/documentLibrary/media/Order/8020.11C%20with%20Chg%201.pdf.

- Aircraft structural failures or engine disintegrations not classified as an accident.
- Multiple malfunctions of one or more aircraft systems seriously affecting the operation of the aircraft.

Incident (Launch)

Legal or Published Definition: Launch incident means an unplanned event during the flight of a launch vehicle, other than a launch accident, involving a malfunction of a flight safety system or safety-critical system, or a failure of the licensee's or permittee's safety organization, design, or operations.

Legal or Published Definition Location: 14 CFR 401.5

Description/Discussion: An incident does not impact the uninvolved public and warrants a different level of scrutiny by the FAA if one occurs. In general, in the event of an incident it is the operator's vehicle or property that is impacted and thus the operator is in charge of leading a root cause investigation with the FAA as observers.

Integration

Legal or Published Definition: Integration is referred to in many documents without a specific definition.

Legal or Published Definition Location: None

Description/Discussion: It is generally accepted that integration is the opposite of segregation. The goal of integration is to allow the integrated operations to access the National Airspace System much like most other operations, whether Rockets, Balloons, unmanned aircraft systems (UAS), and others.

Launch

Legal or Published Definition: Launch means to place or try to place a launch or reentry vehicle and any payload from Earth in a suborbital trajectory, in Earth orbit in outer space, or otherwise in outer space, and includes preparing a launch vehicle for flight at a launch site in the United States.

Launch includes the flight of a launch vehicle and includes pre- and post-flight ground operations as follows:

1) *Beginning of launch.*
    i) Under a license, launch begins with the arrival of a launch vehicle or payload at a U.S. launch site.
    ii) Under a permit, launch begins when any pre-flight ground operation at a U.S. launch site meets all of the following criteria:
        A) Is closely proximate in time to flight,

B) Entails critical steps preparatory to initiating flight,
C) Is unique to space launch, and
D) Is inherently so hazardous as to warrant the FAA's regulatory oversight.

2) *End of launch.*
   i) For launch of an orbital expendable launch vehicle (ELV), launch ends after the licensee's last exercise of control over its launch vehicle.
   ii) For launch of an orbital reusable launch vehicle (RLV) with a payload, launch ends after deployment of the payload. For any other orbital RLV, launch ends upon completion of the first sustained, steady-state orbit of an RLV at its intended location.
   iii) For a suborbital ELV or RLV launch, launch ends after reaching apogee if the flight includes a reentry, or otherwise after vehicle landing or impact on Earth and after activities necessary to return the vehicle to a safe condition on the ground.

Legal or Published Definition Location: 14 CFR 401.5

Description/Discussion: It is important to know that activities included with "launch" are much broader than simply ignition of rocket engines or the initiation of other propulsive methods.

Launch Site

Legal or Published Definition: Launch site means the location on Earth from which a launch takes place (as defined in a license the Secretary issues or transfers under this chapter) and necessary facilities at that location.

Legal or Published Definition Location: 14 CFR 401.5

Description/Discussion: A common perception of launch sites is the support for only vertically launched rockets. This perception of launch sites needs to be revised as there are a wide variety of launch systems in various stages of development. Currently a launch site can support a wide range of operations and is not limited to expendable fixed-point vertical launch systems.

Launch Window

Legal or Published Definition:

1. In the context of spaceflight, a launch window is a time period of time during which the flight of a launch vehicle may be initiated.

2. The launch window is a term used to describe a time period in which a particular vehicle (rocket, Space Shuttle, etc.) mission must be launched in order to reach its intended target. If the rocket vehicle intends to rendezvous with another spacecraft, a planet, or other point in space, the launch must be carefully timed so that the orbits overlap at some point in the future. Should meteorological conditions decline to a point less than that recommended to conduct a safe launch operation, or a malfunction is detected within the primary or secondary systems of the launch vehicle, preventing the execution of the operation within the time parameters established

for the launch window, the mission will be delayed or postponed until the next appropriate launch window.
3. The period of time during which a missile, spacecraft, etc. must be launched so that it can arrive at a desired location at a specific time.

Legal or Published Definition Location:

1. 14 CFR 417.3

2. European Space Agency

3. Collins Dictionary

Description/Discussion:
Appendix A to part 417 of 14 CFR A417.31, Collision Avoidance
(1) At least 15 days prior to the first attempt at flight, a launch operator must provide United States Strategic Command with the launch window and trajectory data needed to perform a collision avoidance analysis for a launch. The FAA will identify a launch operator to United States Strategic Command as part of issuing a license and provide a launch operator with current United States Strategic Command contact information.

(2) A launch operator must obtain a collision avoidance analysis performed by United States Strategic Command 6 hours before the beginning of a launch window.

(3) A launch operator may use a collision avoidance analysis for 12 hours from the time that United States Strategic Command determines the state vectors of the manned or mannable orbiting objects. If a launch operator needs an updated collision avoidance analysis due to a launch delay, the launch operator must file the request with United States Strategic Command at least 12 hours prior to the beginning of the new launch window.

(4) For every 90 minutes, or portion of 90 minutes, that pass between the time United States Strategic Command last determined the state vectors of the orbiting objects, a launch operator must expand each wait in a launch window by subtracting 15 seconds from the start of the wait in the launch window and adding 15 seconds to the end of the wait in the launch window. A launch operator must incorporate all the resulting waits in the launch window into its flight commit criteria established as required by 14 CFR 417.113.

License (Launch)

Legal or Published Definition: Under the authority of Title 51 of the U.S. Code (§ 50905), the FAA issues licenses (under 14 CFR part 415) to conduct commercial space operations. Launch licenses are issued by the Office of Commercial Space (AST).

Legal or Published Definition Location: 14 CFR part 415

Description/Discussion: When a launch is being conducted under Title 51 the airworthiness certificate is not in effect since it is not an aviation operation under Title 49. Commercial space operators request and receive experimental airworthiness certificates because before a launch is conducted (under Title 51) flight testing of the vehicle is conducted. Because these flight tests are conducted under Title 49, an airworthiness certificate is required.

As part of the launch license, AST requires that the limitations set forth in the experimental airworthiness certificate issued to the vehicle must be complied with during launch operations.

An airworthiness certificate (issued by AVS) allows an aircraft to operate in the NAS. A launch license (issued by AST) allows commercial space operations.

Military Flight

Legal or Published Definition: 14 CFR 1.1 uses the term "Armed Forces," which means the Army, Navy, Air Force, Marine Corps, and Coast Guard, including their regular and reserve components and members serving without component status. Military Flights include those operations carried out under the direction of any branch of the armed forces for the purpose of maintaining national security.

Legal or Published Definition Location: 14 CFR 1.1

Description/Discussion: FAA Advisory Circular 210-5B provides the following guidance regarding Military Operations.

Our national security depends largely on -the deterrent effect of our airborne military forces. To maintain aircrew proficiency the military services must continually train in a wide range of military tactics. Various routes and areas have been developed to inform the public of locations where military aircraft are practicing maneuvers and tactics which may hamper the see-and-avoid aspects of visual flight rules (VFR) flight. VFR pilots can significantly enhance flight safety by availing themselves of the latest information regarding military activities which may affect their planned flight.

SPECIAL USE AIRSPACE – Special use airspace (SUA) consists of airspace wherein activities must be confined because of its nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. The purpose of SUA is to identify for other airspace users where military activity occurs/ segregate that activity from other users to enhance safety, and to allow charting to keep airspace users informed.

PROHIBITED AREAS – §1.1 definition of prohibitive area: "A prohibited area is airspace designated under §73 within which no person may operate an aircraft without the permission of the using agency." Prohibited areas are designated for security, or other reasons of national welfare.

RESTRICTED AREAS – §1.1 definition of restricted area is "A restricted area is airspace designated under §73 within which the flight of aircraft, while not wholly prohibited, is subject to restriction." Airspace established to denote, the existence of unusual, often invisible hazards to

aircraft such as artillery firing, aerial gunnery, or missiles, etc. Penetration of restricted areas may be extremely hazardous to the aircraft and its occupants and is legally prohibited. Authorization to transit restricted areas which are not in use may be obtained from the using or controlling agencies.

MILITARY OPERATIONS AREAS (MOA's) – §1.1 definition of military operations area is "A military operations area (MOA) is airspace established outside Class A airspace to separate or segregate certain nonhazardous military activities from IFR Traffic and to identify for VFR traffic where these activities are conducted." Whenever an MOA is active, nonparticipating IFR traffic may be cleared through the area provided ATC can ensure IFR separation; otherwise, ATC will reroute or restrict nonparticipating IFR traffic. Although MOA's do not restrict VFR operations, pilots operating under VFR rules should exercise extreme caution while flying within an active MOA. During initial preflight briefing, pilots should always request information on the status of MOA's along their planned route of flight (local flight service stations retain and update schedules, as provided by the appropriate military authority, for MOA's within its flight plan areas). This information is available, but only upon pilot request. Additionally, prior to entering an active MOA, pilots are encouraged to contact the controlling agency for traffic advisories due to the frequently changing status of these areas.

WARNING AREAS – §1.1 definition of Warning Area: "A warning area is airspace of defined dimensions, extending from 3 nautical miles outward from the coast of the United States, that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both." Areas established in international airspace to identify for pilots where military activities occur that can be hazardous to nonparticipating aircraft. Pilots planning to penetrate warning areas should contact the using or controlling agencies for real-time information on the activities being conducted along their route of flight.

ALERT AREAS – Airspace which way contain a high volume of pilot training or an unusual type of aerial activity. Alert areas do not impose any flight restrictions or communications requirements* Operations within Alert Areas are conducted in accordance with Federal Aviation Regulations without waiver. All pilots flying in an alert area are equally responsible for collision avoidance, and they should be particularly alert when operating within these areas.

CONTROLLED FIRING AREAS (CFA) – Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft. Limitations are imposed on the use of CFAs to ensure that these areas do not impact civil aviation operations.

MILITARY TRAINING ROUTE (MTRs) - Routes established to accommodate low-altitude training operations that must be conducted at speeds in excess of 250 KIAS below 10,000 feet MSL (some segments may extend above 10,000 feet MSL due to terrain or other requirements). Only the route centerline is depicted on aeronautical charts. Although normal route width is 5 to 10 miles from centerline, some segments may be as narrow as 2 miles or as wide as 20 or more miles from centerline.

Mishap

Legal or Published Definition: A launch or reentry accident, launch or reentry incident, launch site accident, failure to complete a launch or reentry as planned, or an unplanned event or series of events resulting in a fatality or serious injury (as defined in 49 CFR 830.2), or resulting in greater than $25,000 worth of damage to a payload, a launch or reentry vehicle, a launch or reentry support facility or government property located on the launch or reentry site.

Legal or Published Definition Location: 14 CFR 401.5

Description/Discussion: As defined a mishap refers to either an accident or an incident (defined in other sections). In general, a mishap is an event where either the uninvolved public is impacted or the company being licensed sees an impact. Overall, depending on the situation, if is an accident or an incident, will shape how the FAA and the National Transportation Safety Board (NTSB) get involved.

National Airspace System (NAS)

Legal or Published Definition: The common network of U.S. airspace; air navigation facilities, equipment, and services, airports, or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

Legal or Published Definition Location: FAA Order JO 7110.65X

Description/Discussion: As defined above the NAS includes all classes and categories of navigable airspace, special use airspace (SUA), Navigational Aids (NAVAIDs), services, and rules/regulations within that area contained within the United States and adjacent airspace as defined by international treaties.

NOTAM/TFR

Legal or Published Definition: A Notice to Airman (NOTAM) is a notice containing information essential to personnel concerned with flight operations but not known far enough in advance to be publicized by other means. It states the abnormal status of a component of the NAS – not the normal status.

- Every user of the NAS is affected by NOTAMs because they indicate the real-time and abnormal status of a component of the NAS.
- NOTAMs concern the establishment, condition, or change of any facility, service, procedure or hazard in the NAS.

Legal or Published Definition Location: FAA website, "Notice to Airmen (NOTAMs)" page.[8] *See also* 14 CFR §§ 91.137, 91.138, 91.141, and 91.143, based on the subject matter.

[8] https://www.faa.gov/about/initiatives/notam/.

Description/Discussion: NOTAMs are the method of notifying flight operations personnel of any abnormal or change to normal NAS operations. Temporary Flight Restrictions (TFRs) are issued in response to events planned or unplanned and distributed to flight personnel by way of NOTAMs. TFRs are not enforceable until a NOTAM is issued, but ATC immediately assists all aircraft receiving services in avoiding those identified area.

Oxidizer

Legal or Published Definition: Oxidizer means a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials.

Legal or Published Definition Location: 49 CFR 173.127

Description/Discussion: Common aerospace oxidizers for propulsion include liquid oxygen (LOX or LO2), hydrogen peroxide (H2O2), nitrous oxide (N2O), and ammonium perchlorate. The oxidizers are typically stored at launch sites or trucked in prior to loading onto launch vehicles or spacecraft. Oxidizers are mixed with fuels during propulsion to propel launch vehicles or spacecraft. Oxidizers need to be stored at a safe distance from fuels and other incompatible liquids or materials.

Part 139 Airport

Legal or Published Definition: Certification of airports in any State of the United States, the District of Columbia, or any territory or possession of the United States Serving any:
(1) Scheduled passenger-carrying operations of an air carrier operating aircraft configured for more than 9 passenger seats, as determined by the regulations under which the operation is conducted or the aircraft type certificate issued by a competent civil aviation authority; and
(2) Unscheduled passenger-carrying operations of an air carrier operating aircraft configured for at least 31 passenger seats, as determined by the regulations under which the operation is conducted or the aircraft type certificate issued by a competent civil aviation authority.

Legal or Published Definition Location: 14 CFR 139.1

Description/Discussion: There are over 500 airports in the U.S. with a 14 CFR part 139 Certification for commercial passenger service. These airports have to maintain an Airport Certification Manual and are subject to annual inspection for administrative records, movement areas, aircraft rescue and firefighting, fueling facilities, markings and lighting.

Participants

Legal or Published Definition:

1. *Space flight participant* means an individual, who is not crew, carried aboard a launch vehicle or reentry vehicle.

2. One that participates.

3. Any person who takes part in any activity, service or program.

Legal or Published Definition Location:

1. 14 CFR §401.5

2. Merriam-Webster

3. Blacks Law Dictionary

Description/Discussion: In context 14 CFR part 460 – Human Spaceflight Requirements describes "Participants" as anyone on a launch vehicle excluding crew members. As opposed to a "Passenger", a "Participant" requires a greater level of consent and understanding prior to the launch activity as a result of unfamiliarity with the operation. Additionally, a "Participant" may have activities in which they may be involved during the launch operation, whereas a "Passenger" is considered more as an inactive participant with little or no activities.

Passenger

Legal or Published Definition: *Passenger-carrying operation* means any aircraft operation carrying any person, unless the only persons on the aircraft are those identified in §§121.583(a) or 135.85 of this chapter, as applicable. An aircraft used in a passenger-carrying operation may also carry cargo or mail in addition to passengers.

Legal or Published Definition Location: 14 CFR 110.2

Description/Discussion: In context, anyone on an aircraft excluding required flight crew members.

Permit

Legal or Published Definition: A permission, accorded by a competent authority, conferring the right to do some act which without such authorization would be illegal, or would be a trespass or a tort.

Legal or Published Definition Location: Black's Law Dictionary

Description/Discussion: 14 CFR part 437 applies the term "Experimental Permit" to describe the permission granted to a person/operator to operate an experimental vehicle. Under §437.3, "*permitted vehicle* means a reusable suborbital rocket operated by a launch or reentry operator under an experimental permit." Under § 437.5, "the FAA will issue an experimental permit to a person to launch or reenter a reusable suborbital rocket…" A "permit" is issued to a person to

conduct permitted activities. This language for an "Experimental Permit" issued under 14 CFR 437.5 was borrowed from 14 CFR 21.191 "Experimental Certificate"

Propellants

Legal or Published Definition: Rocket propellants are materials that when combined and properly ignited, create thrust for a launch vehicle or spacecraft to be propelled or maneuvered.

Legal or Published Definition Location: None

Description/Discussion: Unlike a traditional air-breathing aircraft which only carry large quantities of fuel onboard, launch vehicles must bring both the fuel and oxidizer with them to create thrust. Liquid propellants typically consist of a mix of fuel and oxidizer such as Liquid Oxygen / Kerosene. Liquid propellants may also consist of hypergolic combinations such as Nitrogen Tetroxide / Hydrazine or monopropellants, such as hydrogen peroxide. Hybrid propellants often consist of a solid fuel with a liquid oxidizer such as hydroxyl-terminated polybutadiene (HTPB) and nitrous oxide. Solid propellants are all-in-one propellants that homogeneously mix a fuel and binder, such as aluminum powder and HTPB, with a solid oxidizer, such as ammonium perchlorate. Solid propellants are storable for long periods of time at room temperature and have a wide range of uses. Propellants of different types have a wide range of explosive potential when stored individually or co-located and need to be handled appropriately.

Public Protection (Aircraft)

Legal or Published Definition:
(a) In a manner authorized by the Administrator, each certificate holder must provide -
(1) Safeguards to prevent inadvertent entry to the movement area by unauthorized persons or vehicles; and
(2) Reasonable protection of persons and property from aircraft blast.
(b) Fencing that meets the requirements of applicable FAA and Transportation Security Administration security regulations in areas subject to these regulations is acceptable for meeting the requirements of paragraph (a)(l) of this section.

Legal or Published Definition Location: 14 CFR 139.335

Description/Discussion: Each Part 139 airport must provide safeguards to prevent inadvertent entry to the movement area by unauthorized persons or vehicles and reasonable protection of persons and property from aircraft blast.

Public Safety (Launch/Reentry)

Legal or Published Definition: For a particular licensed launch, the safety of people and property that are not involved in supporting the launch and includes those people and property that may be

located within the boundary of a launch site, such as visitors, individuals providing goods or services not related to launch processing or flight, and any other launch operator and its personnel.

Legal or Published Definition Location: 14 CFR 401.5

Description/Discussion: Public safety refers to individuals who are not directly involved in an operation and could be impacted by a hazard manifestation. In the licensing process, public safety it taken into account in many elements but primarily in the flight safety analysis which weights the likelihood of a hazard presenting itself and the probability it impacts a member of the public.

Range Requirements

Legal or Published Definition:

1. *Federal launch range* means a launch site, from which launches routinely take place that is owned and operated by the government of the United States.

2. Range Requirements defines safety responsibilities and authorities, delineates policies, processes, required approvals and approval/waiver levels for all activities from or onto the range, as describes investigating and reporting mishaps and incidents to include instructions for standing up a mishap interim safety board and impounding data. Range activities include any activities range users plan to perform on the range (aeronautical tests/operations, missile tests/operations, space launch, pre-launch processing, reentry activities, etc.). These range activities include the life cycle of launch vehicles, reentry vehicles (RVs) and payloads from design concept, test, checkout, assembly and launch to orbital insertion including space vehicle (or payload) separation from launch vehicle, reentry from orbit for reusable launch vehicles (RLVs)/RVs, flyback/landing of launch vehicle components not reaching orbit, or impact.

Legal or Published Definition Location:

1. 14 CFR 401.5

2. AIR FORCE SPACE COMMAND MANUAL (AFSPCMAN) 91-710, VOLUME 1 (3 NOVEMBER 2016 Certified Current 02 December 2016)

Description/Discussion: Range Users include, but are not limited to, any individual or organization that conducts or supports any activity on resources (land, sea or air) owned or controlled by the specific range. Typically, a range will publish a User Handbook written to increase a launch operator's awareness of the Range Safety Program and provide assistance in meeting mission objectives in the most efficient, safest manner possible. With an understanding of the specific range's processes, proper planning, and proper engineering, an operator's goals may be accomplished in a manner consistent with mission objectives resulting in little or no impact to a program budget or schedule.

While regulatory in nature, Range Requirements are policies and procedures devised and drafted by the specific range. For Commercial Operators, FAA will conduct a Launch Site Safety Assessment

(LSSA) of a Federal launch range to determine if the range meets FAA safety requirements. A difference between range practice and FAA requirements is documented in the LSSA. Following the assessment, should FAA find the Federal launch range's safety-related launch service or property satisfy the requirements of 14 CFR part 417, subpart B – Launch Safety Responsibilities, FAA will treat the Federal launch range's process as that of a launch operator.

Reentry

Legal or Published Definition: Reentry means to return or attempt to return, purposefully, a reentry vehicle and its payload, if any, from Earth orbit or from outer space to Earth. The term "reenter; reentry" includes activities conducted in Earth orbit or outer space to determine reentry readiness and that are critical to ensuring public health and safety and the safety of property during reentry flight. The term "reenter; reentry" also includes activities conducted on the ground after vehicle landing on Earth to ensure the reentry vehicle does not pose a threat to public health and safety or the safety of property.

Legal or Published Definition Location: 14 CFR 401.5

Description/Discussion: Reentry can include orbital reentry vehicles returning from earth orbit or suborbital vehicles that have entered outer space, but did not achieved orbit, and are reentering the atmosphere.

Reliever Airport

Legal or Published Definition: Reliever Airports are airports designated by the FAA to relieve congestion at Commercial Service Airports and to provide improved general aviation access to the overall community. These may be publicly or privately-owned.

Legal or Published Definition Location: 49 U.S.C. § 47102. *See also* FAA website, "Airport Categories" and National Plan of Integrated Airport Systems (NPIAS) Report" pages.[9]

Description/Discussion: Nonprimary airports primarily support general aviation aircraft. The nonprimary category includes nonprimary commercial service airports (public airports receiving scheduled passenger service and between 2,500 and 9,999 enplaned passengers per year), general aviation airports, and reliever airports (FAA, National Plan of Integrated Airport Systems [NPIAS] 2019-2023).

The term "reliever" is defined in the FAA's authorizing statute at 49 U.S.C., section 47102, as "an airport the Secretary designates to relieve congestion at a commercial service airport and to provide more general aviation access to the overall community." The term "reliever" is relevant in a small number of contexts but is increasingly problematic because only a small number of commercial service airports still experience significant congestion. Regardless, because the term is still defined

[9] https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/ https://www.faa.gov/airports/planning_capacity/npias/reports/.

and used in statute, the FAA continues to report the current designations in this report (FAA, NPIAS 2019-2023).

Reusable Launch Vehicle

Legal or Published Definition: Reusable launch vehicle (RLV) means a launch vehicle that is designed to return to Earth substantially intact and therefore may be launched more than one time or that contains vehicle stages that may be recovered by a launch operator for future use in the operation of a substantially similar launch vehicle.

Legal or Published Definition Location: 14 CFR 401.5

Description/Discussion: A Reentry Vehicle, which is a vehicle designed to return from Earth orbit or outer space to Earth substantially intact, may also include an RLV designed to return from Earth orbit or outer space to Earth substantially intact is a reentry vehicle.

For launch of an orbital RLV with a payload, launch ends after deployment of the payload. For any other orbital RLV, launch ends upon completion of the first sustained, steady-state orbit of an RLV at its intended location.

For a suborbital RLV launch, launch ends after reaching apogee if the flight includes a reentry, or otherwise after vehicle landing or impact on Earth, and after activities necessary to return the vehicle to a safe condition on the ground.

A Launch Accident involving an RLV includes an unplanned event occurring during the flight of a launch vehicle resulting in the impact of a launch vehicle, its payload or any component outside a designated landing site.

Rocket

Legal or Published Definition:

1. Rocket (Suborbital) means a vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent.

2. A Rocket is a vehicle, in which its thrust is derived from propulsion created by a rocket engine. A rocket engine is a reaction engine, which is propelled by the expulsion of exhaust created by the combustion generated by the burning of propellant and oxidizer. The operation of the rocket engine demonstrates Newton's 3rd Law, which states, "all forces between two objects exist in equal magnitude and opposite direction." Comparatively, an air breathing engine, which is associated with jet aircraft, relies on the ability and availability of oxygen to compress prior to being mixed with jet fuel and ignited.

3. A reaction engine that produces a thrust due to an exhaust consisting entirely of material, as oxidizer, fuel, and inert matter, that has been carried with the engine in the vehicle it propels, none of the propellant being derived from the medium through which the vehicle moves.

Legal or Published Definition Location:

1. 14 CFR 401.5

2. Various Internet Sites & Personal interpretation

3. Dictionary.com

Description/Discussion: Rocket is generally a generic term intended to refer to launch vehicle systems.

Safety Risk Analysis

Legal or Published Definition: A study of potential risk.

Legal or Published Definition Location: AFSPCMAN 91-710, Volume 7

Description/Discussion: This analysis (Often referred to as Expected Casualty (Ec) Analysis) is completed as part of a commercial space license application and it ultimately assesses the risk to the uninvolved public on the ground, risk to aircraft, and maritime vessels. This analysis uses vehicle nominal trajectories and 3-sigma dispersions coupled with probabilities of failure, expected failure modes, and debris generated each respective failure. Combining these inputs for an operation, one is able to assess the probability of impact of debris on the surface of the earth or at different flight level. Equating the resulting probability of impact to relative population in those impact areas allows Ec to be calculated.

Segregation of Airspace (often referred to as Sterilization)

Legal or Published Definition: None

Legal or Published Definition Location: None

Description/Discussion: Segregation is an airspace management practice to ensure no non-participating aircraft are allowed to operate in the airspace reserved for the segregated operation. Segregation involves a fixed volume of airspace (which may extend vertically from the surface to an infinite altitude) in which the segregated operation is fully contained vs. using a separation distance between participating and non-participating vehicles. Sterilization is the active control of segregated airspace using surveillance to identify and monitor any unauthorized aircraft, and taking response actions (e.g., sending chase aircraft, aborting a space launch) as appropriate to mitigate the conflict. Sterilization is a higher degree of segregation.

Separation Distance (Explosive Siting)

Legal or Published Definition: The safe distance to be maintained between potentially explosive materials (i.e., propellants) and other incompatible materials or incompatible operations.

Legal or Published Definition Location: 14 CFR 400.2(c)(3)

Description/Discussion: Separation distances (such as the Intraline distance) are often maintained between incompatible commodities to prevent an accident with one commodity from setting off a chain reaction with others. Separation distances (such as the public area distance or inhabited building distance) are used to safety separate the public from potentially hazardous operations, such as propellant loading. An explosive site plan is developed for a launch site to properly identify potential explosive hazard areas and safely separate those areas from public areas or other hazard facilities.

Space

Legal or Published Definition: There is no definition of where "Space" begins. This is intentional, to avoid having to establish the point where a country's airspace rights end.

Legal or Published Definition Location: None (intentional)

Description/Discussion: It is generally accepted that Space begins at the point where there is not enough air to allow for normal airfoils to be effective. This is where an aircraft would have to travel at a speed greater than orbital velocity to get enough lift from its wings to stay in the air. This point can vary on a day to day based on many factors. However, the Karman line has been used at the commonly accepted point. The Karman line is 100 KM (62 miles, or 328,000 feet MSL) above the earth.

Spacecraft

Legal or Published Definition: A launch or reentry vehicle designed for travel or operation in the environment located beyond the lower portions of earth's atmosphere or in orbit around the earth.

Legal or Published Definition Location: Combination of Dictionary.com and 14 CFR 401.5

Description/Discussion: A vehicle designed to operate, with or without a crew, in a controlled flight pattern above Earth's lower atmosphere. Spacecraft is a general term for objects launched into space

Spaceport

Legal or Published Definition: "(e) Definition.—In this section the term 'spaceport' means a launch or reentry site that is operated by an entity licensed by the Secretary of Transportation."

Legal or Published Definition Location: FAA Reauthorization Act of 2018.[10]

Description/Discussion: The term spaceport is commonly used to describe launch sites or collections of multiple launch sites / pads. Existing airports that have a "Launch Site Operator License" are often referred to as "spaceports" or "Air and Space Ports." Spaceports can support combinations of the following activities: vertical launch, horizontal launch, vertical landing, horizontal landing, suborbital operations, and/or orbital operations.

Special Activity Airspace (SAA)

Legal or Published Definition: Any airspace with defined dimensions within the National Airspace System wherein limitations may be imposed upon aircraft operations. This airspace may be restricted areas, prohibited areas, military operations areas, air ATC assigned airspace, and any other designated airspace areas. The dimensions of this airspace are programmed into EDST and can be designated as either active or inactive by screen entry. Aircraft trajectories are constantly tested against the dimensions of active areas and alerts issued to the applicable sectors when violations are predicted.

Legal or Published Definition Location: FAA Order JO 7110.65X, Pilot/Controller Glossary

Description/Discussion: Special Activity Airspace (SAA) is defined as above. The purpose is to include SUA and non-SUA airspace. Basically, anything that has the potential to limit aircraft operations. This can include TFRs, IR Routes, even Aircraft Hazard Areas or other items to be established later.

Special Use Airspace (SUA)

Legal or Published Definition:

21−1−3. DEFINITION AND TYPES
a. SUA is airspace of defined dimensions wherein activities must be confined because of their nature, or wherein limitations may be imposed upon aircraft operations that are not a part of those activities.
b. The types of SUA areas are Prohibited Areas, Restricted Areas, Military Operations Areas (MOA), Warning Areas, Alert Areas, Controlled Firing Areas (CFA), and National Security Areas (NSA).

[10] https://www.congress.gov/bill/115th-congress/house-bill/302/text#toc-HD319A89AA4BA4BFCB5C016DF240E83E9 under 508.

21−1−4. CATEGORIES
There are two categories of SUA: regulatory (rulemaking) and other than regulatory (nonrulemaking). Prohibited Areas and Restricted Areas are rulemaking actions that are implemented by a formal amendment to part 73. MOAs, Warning Areas, Alert Areas, CFAs, and NSAs are nonrulemaking actions

Legal or Published Definition Location: FAA Order JO 7400.2L, Procedures for Handling Airspace Matters, effective April 27, 2017, Part 5

Description/Discussion: Special Use Airspace is defined for specific purposes and is charted. They have a Using Agency and Controlling Agency. The Using Agency is the entity that can activate the airspace in accordance with the purpose and times. The Controlling Agency (usually an ATC facility) releases the airspace to the Using Agency IAW agreements. Nonrulemaking actions are usually not as large of an impact on NAS users as rulemaking actions. In terms of real time status of SAA/SUA: There are 3 basic requirements placed on the Using Agency, one is Scheduling in accordance to the agreement, another is Activation which can be by times IAW the schedule per real time coordination. The third is utilization. Often airspace is activated by schedule, but not being used in its entirety or experience delays, therefore that portion is returned to the Controlling Agency or made available for Joint Use under the Joint Use agreement(s) IAW FAA JO 7400.2L section 21 General which requires the Using Agency to ensure the SUA is released for Joint Use when not being used for its designated purpose. Currently, it is difficult to plan on Joint Use but with future NextGen updates and improved communication (VIA SWIM?) real-time usage will be more accessible.

Suborbital/Orbital

Legal or Published Definition: *Suborbital trajectory* means the intentional flight path of a launch vehicle, reentry vehicle, or any portion thereof, whose vacuum instantaneous impact point does not leave the surface of the Earth.

Legal or Published Definition Location: 14 CFR 401.5

Description/Discussion: Orbital was not specifically defined in part 401, however by inference the definition of suborbital tends to define orbital.

Third Party (Uninvolved)

Legal or Published Definition:
1) Any person other than:
(i)The United States, any of its agencies, and its contractors and subcontractors involved in launch or reentry services for a licensed or permitted activity;
(ii) A licensee, permittee, and its contractors and subcontractors involved in launch or reentry services for a licensed or permitted activity;
(iii) A customer and its contractors and subcontractors involved in launch or reentry services for a licensed or permitted activity;

(iv) A member of a crew; and
(v) A space flight participant.
2) Government personnel, as defined in this section, are third parties.

*United States means the United States Government, including each of its agencies.

Legal or Published Definition Location: 14 CFR 440.3

Description/Discussion: Often used interchangeably with the term public (defined in another section), are people not directly involved in the operation.

Vertical Launch

Legal or Published Definition: See "Launch."

Legal or Published Definition Location: N/A

Description/Discussion: Traditional vertical launch consisting of rockets flying vertically from a fixed dedicated launch pad.

B. Table of Applicability of Terms

Term	Launch/Reentry Operator	Launch/Reentry Site	Aircraft/Airspace
Accident (Launch Site)		x	
Accident (Launch)	x		
Aircraft Approach Category			x
Aircraft Departure Window			x
Aircraft Separation (Separation Minima)			x
AST Regulation	x	x	
Certification			x
Clearance Void Time (also Departure Window)			x
Climb VIA			x
Commercial Flights	x		x
Commercial Service Airports			x
Controlled Airspace			x
Corridor	x		x
Descend VIA			x
Emergency Plan (Aircraft)			x
Emergency Plan (Launch/Reentry)	x	x	
Expendable Launch Vehicle (ELV)	x		

Term	Launch/Reentry Operator	Launch/Reentry Site	Aircraft/Airspace
Experimental Aircraft			x
Fuel	x		x
Government Flights	x		
Hazard Area	x	x	x
Hazard or System Hazard	x		
Horizontal Launch	x		
Ignition	x		
Incident (Aircraft)			x
Incident (Launch)	x	x	
Integration			x
Launch	x	x	
Launch Site		x	
Launch Window	x		
License	x	x	
Military Flights			x
Mishap	x	x	
National Airspace System (NAS)			x
NOTAM/TFR			x
Oxidizer	x	x	
Part 139 Airport			x
Participants	x		
Passenger			x
Permit	x		
Propellants	x	x	
Public Protection (Aircraft)			x
Public Safety (Launch/Reentry)	x	x	
Range Requirements	x	x	
Reentry	x	x	
Reliever Airport			x
Reusable Launch Vehicle	x		
Rocket	x		
Safety Risk Analysis	x	x	
Segregation of Airspace			x
Separation Distance (Explosive Siting)	x	x	
Space			
Spacecraft	x	x	
Spaceport		x	
Special Activity Airspace (SAA)			x
Special Use Airspace (SUA)			x
Sterilization of Airspace			x
Suborbital / Orbital	x		
Uninvolved Third Party	x	x	
Vertical Launch	x		

5. ARC RECOMMENDATIONS

A. The Licensing Process

Task Group 1 was given the task of identifying concerns and gaps in the current site licensing process.

The aviation and commercial space communities both appreciate FAA AST's invitation to participate on the SC-ARC. At the start of this initiative, several questions were raised about how AST ought to categorize future spaceports to better communicate with various stakeholders about the potential activities taking place at the spaceport. Both the aviation community and the space community had several concerns about the initiative, but for very different reasons. The narratives in this section are meant to express some of each community's general concerns for AST to consider.

1) The Aviation Community's Issues and Concerns in the Licensing Process

(a) Site License Linked with Operator Launch License

There was significant discussion about the need to more effectively use AST resources to focus on operators and sites that are ready to launch. It was agreed that linking the site license process to at least one operator, in the same way the Part 139 commercial aviation process is linked to a least one commercial carrier, has merit and would resolve much of the uncertainty in the current site licensing process. It will identify the anticipated operations and enhance evaluation of the impacts.

(b) Operational Impacts to Adjacent Airports or Spaceports, Surrounding Airspace and the National Airspace System

While Task Group 1 acknowledges that FAA has assigned a separate ARC to address integration in the NAS, there was agreement that FAA should better address impacts to existing airspace users and operators during the site license application process, including discussions on how to minimize the operational impact. It is important to have early and formal communication with stakeholders that is separate from and prior to the existing environmental process. Aviation stakeholders contend that the environmental assessment does not provide a comprehensive process for evaluating and soliciting feedback on airspace impacts.

(c) Aircraft Rescue and Firefighting Considerations

There was significant concern expressed about the requirements for firefighting at contingency landing sites. Currently, the responsibility for ensuring proper firefighting equipment is with the launch operator, not the site operator, and that can create concern and confusion – particularly with regard to the responsibility of contingency airports to have firefighting equipment rated corresponding to varying fuel types.

(d) Consideration of Population and Development Density around the Site and Impact of Off-Site Events

Aviation stakeholders are concerned that FAA does not more broadly consider safety impacts to the public, both on and off the spaceport property, related to all aspects of potential missions – including contingency/emergency airports, potential recovery field location, and fuel dumping

zones. Consideration should be given to adding population density around contingency sites in the analysis as to whether sites should be considered as contingency.

(e) Assessment of Noise Impact in Conjunction with Existing Airport Noise

Potential noise impacts from spacecraft operations are evaluated as part of the environmental review, in conjunction with the site license application. A shortcoming of FAA's licensing for a launch site is that it does not require the noise study to be overlaid on noise generated from neighboring facilities (military bases, commercial aviation), so it may not accurately analyze cumulative noise experienced by the surrounding community. The aviation stakeholders contend that FAA should consider the cumulative noise impact to residents during its license review.

(f) Grant Assurance Compliance

Concerns were expressed as to whether a prospective spaceport operator would be in compliance with its Federal obligations and grant assurances because accommodating spacecraft operations may negatively impact use of the facility by other aeronautical users. To help guide prospective spaceport operators, the FAA should establish whether launch vehicle operations are considered "aeronautical activity."

(g) Continuous Discovery and Re-Evaluation Process

The FAA should consider a process that allows for continual improvement, analysis, and resolution throughout the numerous steps in the spaceport licensing process. It was agreed that information may be discovered during the EIS process that is not pertinent to the NEPA process, but should still be addressed before a licensing decision is made.[11]

2) <u>The Commercial Space Community's Issues and Concerns in the Licensing Process</u>

(a) AST Prioritization

As the current spaceport and operator community accommodates requirements, AST should consider adopting a prioritization system to determine where AST's efforts should focus:

- Priority 1: an existing site licensed operator requesting a modification of license for an identified launch operator.
- Priority 2: a proposed site operator with a letter of intent (LOI) from a commercial operator.
- Priority 3: a proposed site operator with a concept vehicle, but no identified launch operator.

This recommendation would allow those with an identified need to be processed quickly, while recognizing that a site licensing effort is important to many potential sites.

[11] Under NEPA (the National Environmental Policy Act, 42 U.S.C. § 4321 et seq. (1969)), Federal agencies are required to prepare an environmental impact statement (EIS) if a proposed major Federal action (as defined under 49 CFR 1508.18) is determined to significantly affect the quality of the human environment. *See* 40 CFR part 1502.

(b) Operational Impacts to Adjacent Airports or Spaceports, Surrounding Airspace and the National Airspace System

Under existing FAA Orders (JO 7400.2) there is a requirement for FAA AST and Air Traffic Organization (ATO) to consult with the Office of the Associate Administrator for Airports (ARP) and other entities to assess the impact and airspace issues during the pre-application phase of licensing, which allows the FAA to have discussions with any stakeholders identified. ATO then provides AST with a memorandum of assessment of potential impacts on the NAS from the proposed site of any initial issues or constraints. FAA should ensure that all applicable offices are included and reach out to affected NAS stakeholders/users during this pre-application period to provide a more complete airspace impact assessment.

(c) Aircraft Rescue and Firefighting Considerations

The responsibility for ensuring proper firefighting equipment is with the launch operator, not the site operator, which can create concern and confusion during a site license application when a specific operator is not identified. During the site licensing application process for a launch site at an airport, it is common to identify nearby contingency landing sites the meet certain airport geometric requirements. AST can consider providing a guidance document for identified contingency sites to better inform the site about potential obligations.

(d) Assessment of Noise Impact in Conjunction with Existing Airport Noise

Potential noise impacts from launch vehicle operations are evaluated as part of the environmental review done in conjunction with the launch site operator license application. Currently, there is no accepted threshold of significance for sonic boom. Accepted metrics for evaluating the cumulative impacts of noise may not fully capture the significance of individual spacecraft operations and the combined effect of spacecraft operations and traditional aircraft operations.

(e) Clarification of Role of ARP in Licensing Process

Prospective airport/spaceport operators will need to ensure that they are in compliance with applicable Federal obligations and grant assurances when considering a site license, including whether accommodating spacecraft operations may negatively impact use of the facility by other aeronautical users. To help guide prospective spaceport operators, the FAA should establish whether launch vehicle operations – by any or all vehicle types – is an "aeronautical activity."

(f) Continuous Discovery and Re-Evaluation Process

Neighboring airports and the general public will continue to lean on AST to provide feedback throughout a spaceport application process. The space community understands AST's communication to various stakeholders throughout an application process should be iterative while the application is being considered but believes this process cannot be continuous due to the timeframes contained in the CFR.

B. Spaceport Data Disclosure

One of the fundamental purposes of the SC-ARC is to ensure that potential site operators, potential launch or reentry operators, aviation stakeholders, and the general public are aware of launch or reentry operations that a launch site may be able to support. All stakeholders need to be made aware

of the capabilities of a potential spaceport before a potential site operator or launch or reentry operator begins planning and investing to develop or launch from the site. Determining the capabilities and characteristics of a future spaceport is also critical for coordinating the appropriate approvals within the FAA.

Task Group 3 was given the assignment to evaluate methods for categorizing spaceports or develop another approach to ensure that critical information about the prospective spaceport is properly communicated to interested stakeholders and the general public.

Initially, the FAA proposed categorizing each spaceport site in order to communicate the capabilities of the prospective spaceport. In 2017, the FAA developed a proposal to categorize spaceports based on the type of vehicle operation. However, based on discussions with the ARC plenary and Task Group 3, the ARC determined that separating spaceports into arbitrary categories was unnecessary and just one specific method to address the needs outlined above. Other methods were ultimately discussed and considered.

The ARC discussed a method for prospective spaceports to disclose certain data about their operation and capabilities to all stakeholders. In particular, prospective launch or reentry operators believe this information would be helpful and informative for planning purposes. An appropriate analogy is to the digital chart supplement, commonly known as the Airport/Facility Directory, which discloses critical details about this country's airports for prospective aircraft operators and other stakeholders that want to understand more about the capabilities of a specific airport. As a result, the ARC proposes that prospective spaceports disclose the data and factors identified below.

The ARC believes the following factors are appropriate for a spaceport to disclose to interested stakeholders and the general public. A short description of the information is provided where necessary.

- **Name of Site**

- **State/City**: The state and city where the spaceport is located. In the event a launch site is located in the ocean, the nearest coastal state and city should be identified. GPS location will also be provided for more specificity.

- **Point of Contact**: A point of contact designated by the spaceport should be identified for interested stakeholders in case additional information is needed.

- **License Data**:
    - **Status**: Whether a license application has been filed, approved, renewing, or not been sought.
    - **Original Issuance Date**
    - **Expiration Date**

- **Elevation**

- **GPS position (latitude and longitude)**: GPS position of the site provides as much clarity as possible for stakeholders.

- **Launch Activity**: Data on the number of launches that occurred in the previous calendar year, including the number of vertical launches and the number of horizontal launches.

- **Surrounding Population Density** (per square mile)

- **Environmental Assessments**: Identify any environmental assessments completed or in progress (e.g., sonic boom, wildlife).

- **Launch Orientation**: Identify whether the site can accommodate horizontal or vertical launches.

- **Landing Orientation**: Identify what types of landing orientations can be accommodated.

- **Highest Achieved Altitude/Orbit**

- **Orbital Inclination**

- **Achievable Space Access**
    - **Corridors/Azimuth**
    - **Launch and/or Landing**

- **Type of Payload**: Identify the type of payload accommodated at the spaceport or any applicable restrictions or limitations.

- **Heaviest Launch Vehicle**

- **Runway Data**: The following data should be provided for each runway located at the spaceport:
    - **Length and width** (in feet)
    - **Type** (e.g., asphalt)
    - **Restrictions/Launch-Landing Conditions** (e.g., lights)

- **Emergency Resources Available**: Identify all emergency resources offered, including times available, such as firefighting capabilities, security, or hazardous materials crew.

- **Co-located Airport Data**: The following data should be provided for the airport co-located with the spaceport, if applicable:
    - **Name and Location ID**
    - **Type**: The airport category and role designated under the FAA's National Plan of Integrated Airport Systems (NPIAS), if applicable.
    - **Part 139 Certification**: The status and level of Part 139 certification, if applicable.

- **Nearest Airport Data**: The following data should be provided for the airport nearest to the spaceport:
    - **Name and Location ID**

    - **Distance**

- **Ownership**: Whether the spaceport is owned by a public or private operator.
- **Spaceport Use**: Whether the spaceport is available for private or public use.

The ARC has not discussed or reached consensus on *how* this data would be disclosed, including the form and manner. There is currently no regulatory requirement or mandate for prospective spaceport applicants to disclose information to interested stakeholders or the general public. Notwithstanding, the FAA could collect this data on its own during the license application process and make it available through the appropriate communication channel.

6. APPENDIX

Appendix A – ARC Membership List
Appendix B – ARC Member Voting Matrix
Appendix C – ARC Member Voting Forms

Appendix A

ARC Membership List

VOTING MEMBERS	
1	Airport Council International – North America
2	Mojave Air and Spaceport
3	Aircraft Owners and Pilots Association
4	Airlines for America
5	Airports Consultants Company
6	Alaska Aerospace
7	American Association of Airport Executives
8	Colorado Air and Space Port
9	Commercial Spaceflight Federation
10	Denver International Airport
11	Helicopter Association International
12	Houston Airport System – Ellington Field
13	Jacksonville Aviation Authority/Cecil Spaceport
14	Kimley-Horn
15	National Air Transportation Association
16	National Association of State Aviation Officials
17	National Business Aviation Association
18	Northrop Grumman Corporation (formerly Orbital ATK)
19	Sierra Nevada Corp
20	Space Florida
21	Space X
22	Spaceport America/ New Mexico Spaceport Authority
23	Spaceport Camden
24	The Boeing Company
25	Tucson Airport Authority
26	Virgin Galactic/Orbit
27	WorldView

Appendix B

ARC Member Voting Matrix

Voting Member	Concur	Concur w/ Exception	Non-concur	Abstain
Airport Council International – North America	X			
Mojave Air and Spaceport	X			
Aircraft Owners and Pilots Association				X
Airlines for America	X			
Airports Consultants Council	X			
Alaska Aerospace				X
American Association of Airport Executives	X			
Commercial Space Foundation	X			
Denver International Airport	X			
Front Range Spaceport	X			
Helicopter Association International	X			
Houston Airport System – Ellington Field				X
Jacksonville Aviation Authority/Cecil Air and Space Port				X
Kimley-Horn	X			
National Air Transportation Association	X			
National Association of State Aviation Officials	X			
National Business Aviation Association	X			
Northrop Grumman Corporation (formerly Orbital ATK)		X		
Sierra Nevada Corp		X		
Space Florida	X			
Space X				X
Spaceport America/ NM Spaceport Authority	X			
Spaceport Camden		X		
The Boeing Company		X		
Tucson Airport Authority	X			
Virgin Orbit/ Galactic	X			
WorldView	X			

Appendix C

Voting Member:	Debby McElroy
Company Name:	ACI-NA
Date Received:	3/25/19
Response:	Concur with the final report as written

Voting Member:	Karina Drees
Company Name:	Mojave Air & Space Port
Date Received:	March 25, 2019
Response:	I Concur with the final report as written

Voting Member:	Paul McGraw
Company Name:	Airlines for America
Date Received:	March 27, 2019
Response:	Concur with the final report as written

Voting Member:	Matt Griffin
Company Name:	Airport Consultants Company
Date Received:	3/28/19
Response:	Concur with the final report as written

Voting Member:	Craig Campbell
Company Name:	Alaska Aerospace
Date Received:	
Response:	Abstain

Voting Member:	Melissa Sabatine
Company Name:	American Association of Airport Executives
Date Received:	March 27, 2019
Response:	Concur with the final report as written

Voting Member:	Melissa Rudinger
Company Name:	AOPA
Date Received:	
Response:	Abstain

Voting Member:	David Ruppel
Company Name:	Colorado Air and Space Port
Date Received:	March 28, 2019
Response:	Concur with the report as written

Voting Member:	Eric Stallmer
Company Name:	Commercial Spaceflight Federation
Date Received:	March 28th, 2019
Response:	Concur with the final report as written

Voting Member:	Kim Day
Company Name:	Denver International Airport
Date Received:	3/24/2019
Response:	Concur with the final report as written

Voting Member:	Matthew Zuccaro
Company Name:	Helicopter Association International
Date Received:	March 28, 2019
Response:	Concur with the final report as written

Voting Member:	Arturo Machuca
Company Name:	Houston Spaceport / Ellington Airport
Date Received:	3/22/2019
Response:	Abstain

Voting Member:	Todd Lindner
Company Name:	Jacksonville Aviation Authority/Cecil Air and Space Port
Date Received:	
Response:	Abstain

Voting Member:	Brian Gulliver
Company Name:	Kimley-Horn
Date Received:	March 27, 2019
Response:	Concur with the final report as written

Voting Member:	Chris Baum
Company Name:	National Air Transportation Association
Date Received:	March 26, 2019
Response:	Concur with the report as written

Voting Member:	Shelly Simi
Company Name:	National Association of State Aviation Officials
Date Received:	March 28, 2019
Response:	Concur with the report as written

Voting Member:	Heidi Williams
Company Name:	National Business Aviation Association
Date Received:	March 27, 2019
Response:	Concur with the final report as written

Voting Member:	Christopher DeMars
Company Name:	Northrop Grumman
Date Received:	3/27/19
Response:	Concur with exception

1) **Pg 9 <u>Commercial Flights</u> Legal Definition: 2. Commercial Space.** Spacelift of DoD, NASA or other USG agency payloads and missions can be performed by commercially licensed private sector launch vehicles. Both NASA and DoD routinely utilize commercial launch services to achieve their goals. It is a contracting decision by the USG as to which of the three USG authorized entities for sapcelift (DoD, NASA or DoT/FAA) will have liability for the launch. As noted, the tem commercial launch is ambiguous and needs to be defined. Most often it is assumed to mean a commercially licensed (ie, FAA) launch. National Security payloads can and do launch to orbit on commercially licensed launches.
2) **Pg 16 <u>Government Flights</u> Legal Definition: 1.** The term "public" aircraft is not defined in this document but should be.
3) **Pg 20 <u>Incident</u> Legal Definition: Description/Discussion:** The definition is incorrect. An incident can impact the uninvolved public. Consider a malfunction of a safety critical system that is protecting the public. Even with fault tolerance multiple failures can (and have) endangered the public. With regard to the conclusion of who leads an investigation, an incident can (and has) been led by the NTSB even though the public was not harmed. The failure "could have" harmed the public. I don't recommend trying to define who investigates an incident and instead focus on what constitutes an incident.
4) **Pg 24 <u>Mishap</u> Legal Definition: Description/Discussion:** Mishaps can also include unplanned events such as failure to complete launch. The NTSB will be involved if the public was or could have been at risk. The NTSB has first right of refusal. If they choose not to lead the investigation, the FAA gets to decide who leads.
5) **Pg 29 <u>Range Requirements</u> Legal Definition:** It is important to note that while federal launch ranges are owned and operarted by USG, not all launch ranges owned and operated by the USG are considered federal launch ranges. KSC for example is not a federal range even though NASA and commercially licensed launches take place there.

Voting Member:	Christopher Allison
Company Name:	Sierra Nevada Corporation (SNC)
Date Received:	3/27/2019
Response:	Concur with the final report with exception

SNC does not have an issue with the report of a substantive nature. Rather, the report often refers to "Launch Vehicles" or "Launch Operations". SNC interprets the report to imply reentry vehicles and operations to be included in these references where it makes sense to include.

Voting Member:	James Kuzma
Company Name:	Space Florida
Date Received:	March 28, 2019
Response:	Concur with the final report as written

Voting Member:	Caryn Schenewerk
Company Name:	Space X
Date Received:	
Response:	Abstain

Voting Member:	Daniel Hicks
Company Name:	Spaceport America
Date Received:	March 28, 2019
Response:	Concur with the final report as written

Voting Member:	Andrew Nelson
Company Name:	Spaceport Camden
Date Received:	3.27.2019
Response:	Concur with exceptions

The final report needs refinement to provide balance and accuracy. Sectipn 4.A (definitions) should be moved to an appendix and replaced with a summary of the issues of definitions and differences in industry lingo.

Section 5.A.1 has strong and direct statements that are inaccurate or based on opinions and not facts, and is strongly biased against the commercial space industry. Also, in many sections it describes a condition as applicable to all of commercial space operations, but is in fact, an artifact of only horizontal launch and landing (e.g., paragraph 5.A.1).(c), (d), (e), and (f)). This section should be softened and harmonized to remove bias and accurately reflect launch situations being described. Additional clarifications should also be added to this section such as there is only one horizontal launch company in the world today, and none on the horizon, so that many of these issues are remote possibilities at best.

Section 5.A.2 is more balanced, but still has its own issues. For example, 5.A.2.(a) is not supported by Spaceport Camden. We believe that FAA/AST is perfectly capable of determining their own approach to their work load without the ARC proposing an intervention prioritizing an existing airport / spaceport above a vertical launch site or other horizontal launch site. Such a clear cut prioritization creates an unfair competitive advantage against new market entrants and will cause an unbalanced competitive playing field in favor of existing entrants.

Section 5.B has several terms that don't make much sense on their own, without explanation. For example, "Orbital Inclination" without context is meaningless. With launch ascent, 2nd stage and satellite / payload maneuvers, numerous orbital inclinations may be reached from a launch site. With a horizontal launched first stage (think Virgin Orbit), numerous different orbital inclinations may be reached that do not necessarily have anything to do with the site location. Similar arguments may be made about "Achievable Space Access." Also, "Surrounding Population Density" needs to use be clarified. In what direction, how far away, etc., should this data be defined?

Voting Member:	Lisa Loucks
Company Name:	The Boeing Company
Date Received:	3/27/2019
Response:	Concur with Exception

Exceptions:

Reference Pages 16, 36 Definition of Government Flights:

1. Aviation definition compares *civil* and *public* aircraft, but does not address the relationship between *public* and government flight; the Table of Applicability of Terms does not indicate this term as relevant to aircraft. **Recommendation**: Delete *civil* comparison in favor of reference to "public aircraft" definition per Title 49 U.S.C. § 40102(a)(41) and 40125; amend Table of Applicabilty to include aircraft

Reference Pages 38-40, Licensing Process:

2. Despite significant consensus between aviation and space, separate sections addressing their respective issues and concerns imply a division of the ARC across operations boundaries. Additionally, this segregation between aviation and space can be confusing (e.g., discussion of AST matters under aviation issues) and repetitive (i.e., same categories addressed in both sections). **Recommendation:** Organize by topic, combine aviation/space verbiage into recommendations representing the entire ARC membership. Any differences between aviation and space communities can be noted in the discussion.

Reference Pages 38-42, Recommendations:

3. There are numerous mentions of launch without mention of equally relevant reentry/landing. **Recommendation:** add reentry/landing as applicable (proposed edits attached).

4. The content of this section is not presented as recommendations, but as discussion of issues, concerns, and beliefs. This does not completely satisfy the intent of the Recommendations Report task in the ARC charter. **Recommendation:** Reformat as recommendations, with associated discussion retained as rationale.

Voting Member:	Bonnie Allin
Company Name:	Tucson Airport Authority
Date Received:	March 27, 2019
Response:	Yes/Approve final report as presented

Voting Member:	Todd Ericson
Company Name:	Virgin Galactic/Orbit
Date Received:	March 28, 2019
Response:	Concur with the final report as written

Voting Member:	Taber MacCallum
Company Name:	World View
Date Received:	March 26, 2019
Response:	Concur with the final report as written