Welcome and thank you for joining us for today's Aviation Webinar Series. Our topic is **"Commercializing Space: The Next Frontier."** We have just a few announcements before we get started.

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Commercializing Space: The Next Frontier

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Government Regulation of Emerging Technology

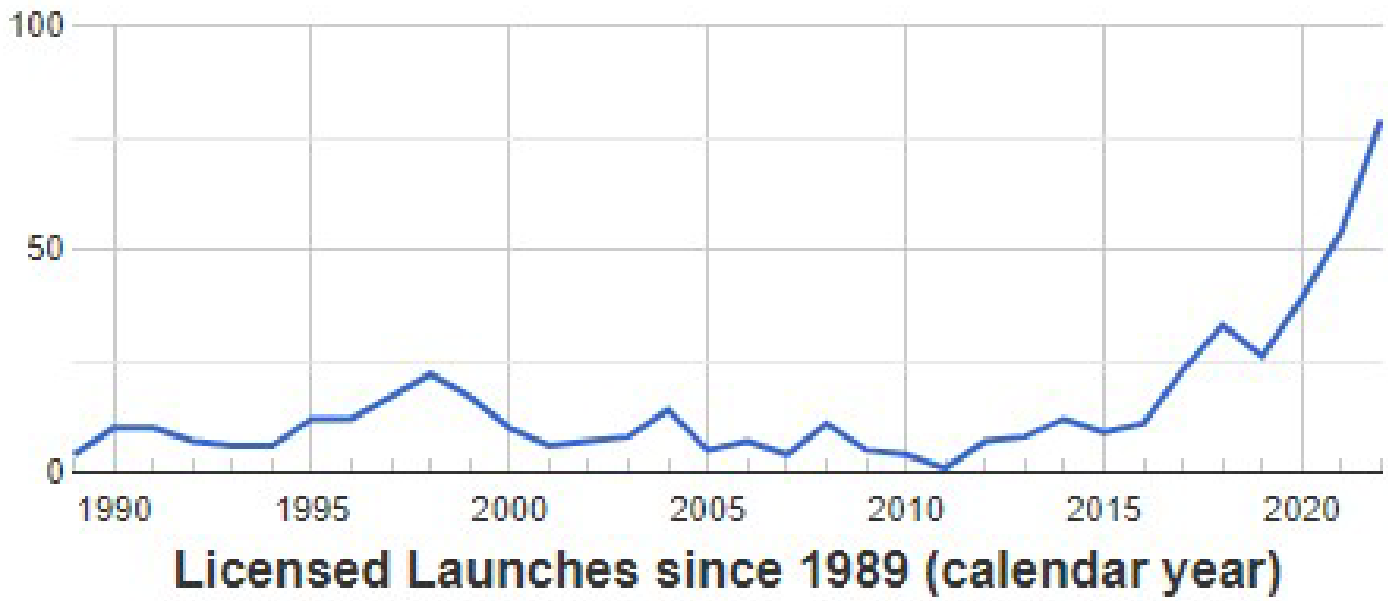
- Government initially takes a light touch to regulation
- Encourage development and commercial exploitation
- Control increased as industry is successful
- Ultimately broad regulation of safety, competition and commercial issues

Government Regulation of Emerging Technology

- Example - Unmanned Aircraft – Encouragement phase
  - FAA Reauthorization Act of 2012/2018
  - 14 CFR Part 107 (simple operating rules and low standards)
  - Creation of UAS test sites and Center for Excellence
- Unmanned Aircraft – Increased control phase
  - Limits on hobby aircraft
  - Registration Requirements
  - Remote ID requirements
  - Certification for BVLOS and large UAS
  - Air Carrier Certificate for commercial package delivery

Commercial Space – FAA Involvement

- FAA is involved in commercial space regulation through the issuance of licenses
- FAA grants launch licenses, reentry licenses, and spaceport licenses and has oversight on insurance issues
- FAA's role is to ensure that commercial space activities do not interfere with the safety of the National Airspace System



Commercial Space – State of Regulation

- In 2004, Congress forbid the FAA from regulating crew and passenger safety before 2012, except in response to events that either caused a serious or fatal injury or contributed to an unplanned event during a commercial human space flight that posed a high risk of causing a serious or fatal injury. The regulation is limited to the specific cause of the accident
- In 2015, the moratorium was extended until 2023
- GAO has repeatedly criticized FAA's dual role in promoting and regulating commercial spaceflight
- Department of Commerce also has some regulatory oversight through National Oceanographic and Atmospheric Administration (NOAA) and the National Telecommunication and Information Agency (NTIA)
- NOAA licenses commercial remote sensing satellites
- FCC and NTIA license commercial satellite communications
- Department of Commerce oversees licensing exports of space technology

Rand Report

- Currently a **moratorium** exists on the issuance of regulations relating to the health and safety of commercial passengers (“space flight participants”), unless a design feature or operating practice causes or nearly causes a serious or fatal injury
- The moratorium expires on October 1, 2023. Intended to provide a "learning period” for the industry to assess the safety implications of various designs and operations.
- Existing law takes an “informed consent” approach to passenger safety
- Operator must notify passengers (i.e., occupants who are not crew members employed by the operator) regarding the risks of launch and reentry, and must obtain occupants’ written consent
- With the anticipated expiration of the moratorium and the end of the “learning period,” Congress called for an independent study of the “readiness of the commercial space industry and the Federal Government to transition to a safety framework that may include regulations.” See Commercial Space Launch Competitiveness Act of (CSLCA) of 2015. FAA contracted with the Rand Corporation to conduct the study
- In April 2023, Rand issued its report, entitled “Assessing the Readiness for Human Commercial Spaceflight Safety Regulations”

Rand Report

- Report recommends:
  - Allowing moratorium to expire pursuant to current law
  - Continuation of development of voluntary consensus standards
  - FAA should form a Space Aerospace Rulemaking Committee, as a forum and mechanism for pre-rule development
  - Development of a regulatory framework that successfully supports participant safety while avoiding harm to industry requires input from industry and other expert stakeholders
  - Regardless of whether the moratorium is extended, Report recommends that all parties continue to engage in development of voluntary consensus standards and key metrics that support those standards
  - Development of such standards is a beneficial process for the safety and development of the industry, and is laying a foundation that supports the eventual development of a regulatory safety framework
  - Report's recommendation to allow moratorium to end is conditioned on concurrently resourcing the FAA appropriately. Providing FAA with sufficient resources is critical to development of a beneficial and carefully conceived regulatory safety framework

Rand Report

- “Overall, we recommend a measured approach whereby the systems and expertise necessary to regulate this nascent industry can be developed, but in a slow and systematic manner that does not unduly hamper innovation or industry’s ability to continue engaging in appropriately safe launches.”
- Report endorses a “middle-of-the-road” approach, between fully extending the existing moratorium on the one hand, and ending the moratorium and immediately implementing a regulatory regime regardless of the readiness of industry and the FAA on the other
- Report concludes that allowing expiration of the moratorium on October 1, 2023, combined with sufficient FAA funding, would allow for the development of well-informed regulations, while reducing the risk of hasty rulemaking that could harm development of the commercial spaceflight industry

Commercial Space – State of Regulation

- Total number of commercial launches since 1989

Number of launches from 1989 to 2017	214
Number of launches 2018 to 2022	231
Number of launches so far in 2023	50

- Right now there are the following active licenses:
- Launch License: 22
- Reentry License: 5
- Spaceport License: 14

Commercial Launch Licenses

- Commercial Space Launch Act establishes requirements for licensing of commercial space launch and reentry vehicles. 51 USC 50901 – 50923 Regulations at 14 CFR Part 450
- DOT/FAA charged with encouraging, facilitating, and licensing commercial launch vehicle activities
- Office of Commercial Space Transportation (AST) within the FAA is responsible for carrying out these duties
- FAA's launch regulations require a license or permit for all commercial launches taking place within the U.S., as well as launches conducted by U.S. entities abroad
- A vehicle operator license authorizes a licensee to conduct an unspecified number of launches or reentries, using a family of similar but not necessarily identical vehicles
- The vehicle operator license also authorizes pre-flight and post-flight ground activities
- No later than 60 days prior to launch, a licensed operator must file an application with FAA detailing launch plans and payload information

Commercial Launch Licenses

- A licensed operator must also perform a *flight safety analysis* that documents "all reasonably foreseeable events and failures of safety-critical systems" that could jeopardize public safety, and must demonstrate that FAA safety criteria are met, including:
  - Launch description, including launch site, vehicle, payload, and trajectory
  - Launch operator organization, including organization summary, organization charts and safety functions
  - Launch personnel certification program
  - Flight safety, including initial flight safety analysis, flight safety sub-analyses, methods, and assumptions, radionuclide data (where applicable), flight safety plan, flight safety rules, trajectory and debris dispersion data, flight hazard areas and safety clear zones
  - Ground safety
  - Launch plans, including launch support equipment and instrumentation plan, accident investigation plan, local agreements and Public Coordination Plan, Hazard Area Surveillance and Clearance Plan, Communications Plan
  - Launch schedule
  - Flight safety system design and operation data
- Information on potential environmental effects must be provided to FAA by applicant upon request, to enable FAA to assess compliance with National Environmental Policy Act (NEPA) requirements
- FAA requires launch operators to carry third-party liability insurance, up to "maximum probable loss"

Commercial Launches and the National Airspace System (NAS)

- Increasing cadence of commercial space launch activities poses challenges to FAA's air traffic management
- Launch windows may be narrow, due to need for payload to arrive at specific orbit location at a particular time
- FAA's Office of Commercial Space Transportation (AST) is responsible for ensuring public safety on ground and at sea during commercial space launch and reentry operations
- FAA's Air Traffic Organization (ATO) has responsibility for aircraft safety
- Depending on specific launch operation, AST and ATO analyze a variety of factors (type of launch vehicle, atmospheric conditions, congestion of airspace, etc.) to determine extent of airspace that needs to be closed or restricted, and duration of such flight restrictions
- FAA coordinates with air traffic controllers, commercial aviation, U.S. military, local authorities, and other airspace users, to manage airspace during commercial space launch operations

Commercial Launches and the National Airspace System (NAS)

- FAA develops Airspace Management Plan for each space operation
- FAA assesses how the launch will affect airspace, seeks input from commercial air carriers, and identifies potential Aircraft Hazard Areas (AHAs)
- As part of licensing and permitting process, launch operators and spaceport operators enter into Letter of Agreement (LOA) with the FAA Air Traffic Control office with jurisdiction over the airspace affected by the operations. LOA covers general procedures for notification, communication, and contingency plans for the operations
- After Airspace Management Plan is finalized, FAA issues NOTAM (Notice to Air Missions) to all U.S. airspace users. International partners also notified for appropriate closures of foreign airspace. NOTAM defines area of airspace closure and dates/times of launch and reentry
- FAA risk assessment considers possibility of falling debris and its potential effect on aircraft operations

Commercial Space Launches and the National Airspace System (NAS)

- Increase in numbers of commercial space launches, and resulting airspace closures/restrictions, have led to complaints from commercial air carriers and general aviation operators
- Efforts currently underway to develop technology and procedures that will aid in reducing the geographic scope and duration of closures/restrictions
- FAA has established a Space Collaborative Decision Making program with launch operators, airline industry, government agencies, and other stakeholders. Focus is on sharing pre-mission data, situational awareness during space operations, and reducing impact on other airspace users
- Key FAA objectives: reducing amount of airspace closure and length of time; reopening airspace as soon as possible; rerouting only aircraft directly affected by launch/reentry operations; tracking space vehicles in flight; and responding quickly to any in-flight problems or anomalies
- As pace of launches increases, FAA will continue to emphasize collaboration among launch operators, spaceport operators, Air Traffic Control, commercial air carriers, and other NAS stakeholders

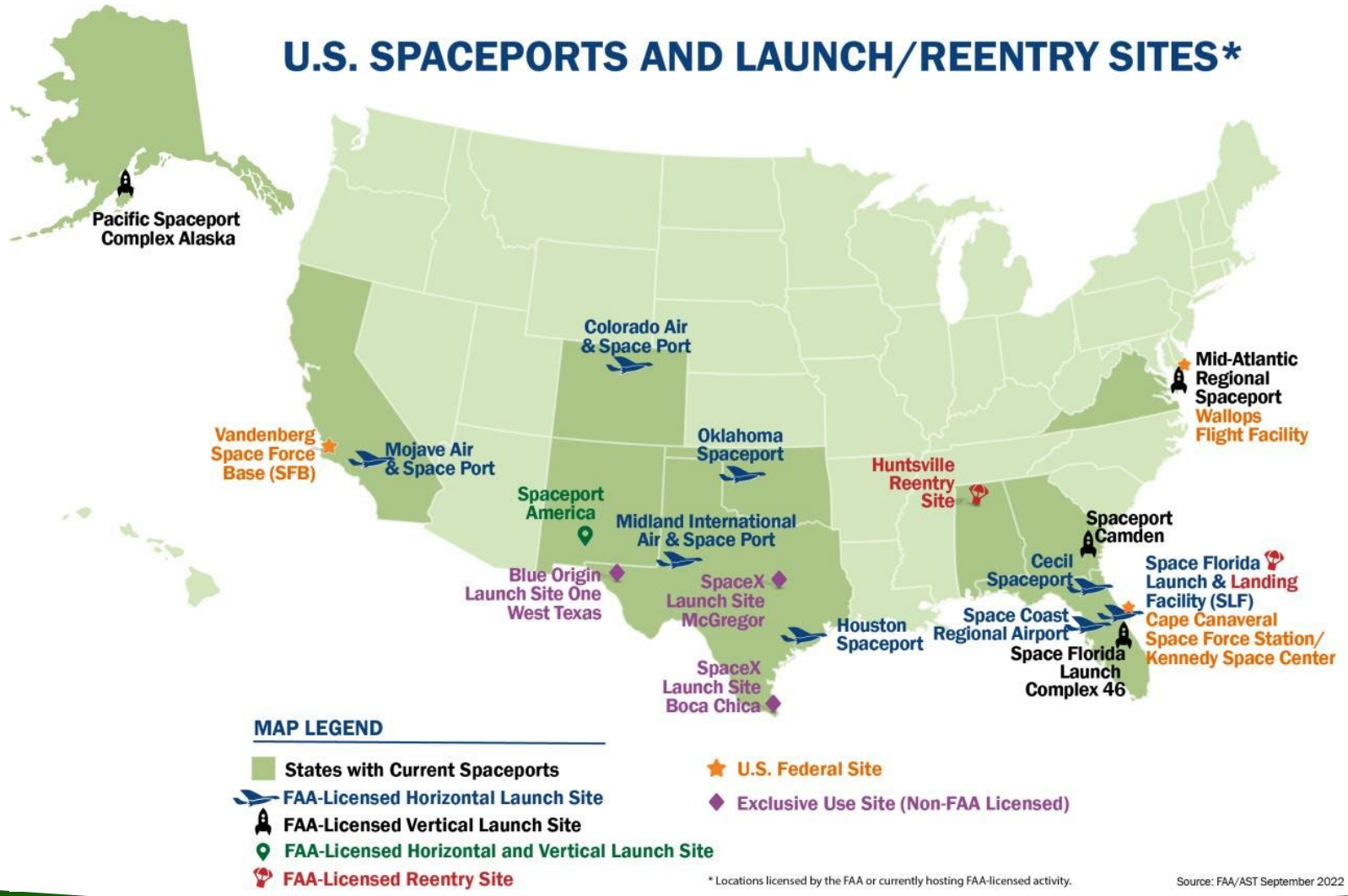
Commercial Spaceports

- Currently 14 Spaceport licensees operating in 10 states
  - **This license is granted subject to the terms, conditions, and limitations set forth in licensing order A and any subsequent orders issued by the Office of Commercial Space Transportation**
  - **Licenses contain the following Note:** License No. LSO 18-017 authorizes Adams County, Colorado to operate a launch site; it does not authorize FAA-licensed or permitted launches, which require separate authorizations from the FAA

OPERATOR	SITE	
Alaska Aerospace Corporation	Pacific Spaceport Complex Alaska	AK
Huntsville-Madison County Airport Authority	Huntsville Reentry Site	AL
Mojave Air & Space Port	Mojave Air & Space Port	CA
Adams County Colorado	Colorado Air & Space Port	CO
Space Florida	Cape Canaveral Spaceport	FL
Jacksonville Aviation Authority	Cecil Airport	FL
Space Florida	Cape Canaveral Air Force Station	FL

OPERATOR	SITE	
Titusville-Cocoa Airport Authority (TCAA)	Space Coast Regional Airport	FL
Camden County	Spaceport Camden	GA
New Mexico Spaceflight Authority	Spaceport America	NM
Oklahoma Space Industry Development Authority	Clinton-Sherman Industrial Airpark	OK
Midland International Airport	Midland International Airport	TX
Houston Airport System	Ellington Airport	TX
Virginia Commercial Space Flight Authority	Wallops Flight Facility	VA

Commercial Space – Spaceports



Spaceports – Licensing

- Applicant must provide a full description of the Launch site, including:
  - Layout of the launch site, including launch points;
  - Types of launch vehicles to be supported at each launch point;
  - The range of launch azimuths planned from each launch point; and
  - Any Foreign ownership

Table 2 of § 420.21—Minimum Distance From Launch Point to Launch Site Boundary (feet)

Orbital expendable launch vehicle class			Type of suborbital launch vehicle		
Small	Medium	Medium large	Large	Guided	Unguided
7300	9300	10600	13000	8000	1600

- The site must also be able to define a safe flight corridor
- For example, for a guided orbital expendable launch vehicle, it must:
  - Encompasses an area to contain debris with a ballistic coefficient of ≥3 pounds per square foot, from any non-nominal flight from the launch point to a point 5000 nm downrange
  - Includes an overflight exclusion zone where the public risk criteria of 1×10^{-4} would be exceeded if one person were present in the open
  - If a flight corridor contains a populated area, the applicant shall provide a casualty expectation

Spaceports – Environment

- The FAA is responsible for complying with the procedures and policies of the National Environmental Policy Act (NEPA) and other applicable environmental laws, regulations, and Executive Orders prior to issuing a launch site license. The applicant must:
  - Prepare an Environmental Assessment with FAA oversight
  - Assume financial responsibility for preparation of an Environmental Impact Statement by an FAA-selected and -managed consultant contractor
  - Submit information to support a written re-evaluation of a previously submitted Environmental Assessment or Environmental Impact Statement when requested
  - The submissions must meet the standards of NEPA and the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA

Spaceports – Mishap

- In the event of a mishap, the operator must notify the FAA Washington Operations Center
- An operator must also activate its emergency response services to protect the public and property following a mishap as necessary, preserve data and physical evidence
- Submit a written preliminary report to the FAA Office of Commercial Space Transportation within five days providing information regarding the incident, including:
  - Description of the mishap and sequence of events leading to the mishap, to the extent known
  - Hazardous debris impact points, including those outside a planned landing site or designated hazard area
  - Number and general description of any fatalities or injuries
  - Description and estimated costs of any property damage
  - Action taken by any person to contain the consequences of the event
  - Potential consequences for other similar vehicles, systems, or operations
- The Operator must also investigate the root causes of the mishap and report investigation results to the FAA

Spaceports – Agreements and Coordination

- **Necessary Agreements**
  - Coast Guard: Agreement with the local U.S. Coast Guard district to establish procedures for the issuance of a Notice to Mariners prior to a launch and other such measures as the Coast Guard deems necessary to protect public health and safety
  - FAA: Agreement with the FAA Air Traffic Control (ATC) office having jurisdiction over the airspace through which launches will take place, to establish procedures for the issuance of a Notice to Airmen prior to a launch and for closing of air routes during the launch window and other such measures as the FAA ATC office deems necessary to protect public health and safety
  - At least 2 days prior to flight of a launch vehicle, unless the Administrator agrees to a different time frame, the licensee must notify local officials and all owners of land adjacent to the launch site of the flight schedule
- Licenses are valid for 5 years and are not transferrable without FAA approval
- Licenses can be modified by FAA at any time on FAA's own initiative
- FAA retains the right to inspect the spaceport and all activities at any time

2023 FAA Reauthorization

- The Department of Transportation is instructed to create an airborne debris collision avoidance program - $15 million:
  - Track objects that are a potential source of hazard
  - Coordinate with the owners of the potential hazard to determine when and where reentry is likely
  - Evaluate the risk from the object
  - Establish coordination with ATC to protect aircraft in flight
- Amend the Airport Improvement Program to make funds available for improvements of runways at spaceports

2023 FAA Reauthorization

- COMMERCIAL SPACE TRANSPORTATION ACCIDENT INVESTIGATIONS (Section 914 of H.R. 3935)
- Requires NTSB to investigate commercial space transportation accidents in which there is—

  (i) a fatality or significant injury of any individual, regardless of whether the individual was on board the commercial launch vehicle at the time of the accident; or

  (ii) substantial damage to property that is not associated with commercial space launch activities and that is not located at the launch site.

- NTSB must enter into an MOU with other government agencies that might have jurisdiction over an investigation and rules for NTSB participation in the accident investigation

NTSB Involvement in Commercial Space Accident Investigations

- NTSB has been involved in commercial space investigations for more than 30 years
- The NTSB's Air Carrier and Space Investigations Division:
  - Investigates accidents and serious incidents involving launch or reentry of FAA-licensed or permitted commercial space vehicles
  - Participates in the Quad Agency Working Group (USAF/SF, FAA, NASA, and NTSB) which was formed to ensure good communication between all agencies in the event of a major mishap

NTSB Involvement in Commercial Space Accident Investigations

- Performs outreach to commercial space operators
- Participates in tabletop exercises to ensure all government and industry participants understand the likely actions of each organization following a commercial space mishap accident

NTSB Involvement in Commercial Space Accident Investigations

- In 1986, NTSB investigators assisted the Rogers Commission with the investigation into the loss of the Space Shuttle Challenger
- In 1993, led the investigation of a procedural anomaly associated with the launch of an Orbital Sciences Corporation Pegasus expendable launch vehicle
- In 2003, more than 40 NTSB investigators assisted the Columbia Accident Investigation Board with the investigation into the loss of the Space Shuttle Columbia
- In 2014, led the investigation into the fatal in-flight breakup of Scaled Composites' SpaceShipTwo

NTSB NPRM on Commercial Space Investigations

- The NTSB published an NPRM on November 16, 2021, seeking to "codify[ ] its investigative role in commercial space transportation" 2021-24766.pdf (govinfo.gov)
- Sixteen public comments were submitted to the rulemaking docket, including comments from FAA, Airlines for America, Blue Origin, Virgin Galactic Holdings, Inc., Aerospace Industries Association, and the Commercial Spaceflight Federation
- The NPRM includes provisions for immediate notification to NTSB of an accident, responsibility for preserving wreckage, control of dissemination of information regarding the investigation, and establishes the supremacy of the NTSB investigation and requirements for other agencies to coordinate with the NTSB

NTSB NPRM on Commercial Space Investigations

- The NTSB has not taken any further action on the NPRM
- The Spring 2023 Unified Agenda of Regulatory and Deregulatory Actions indicates the NTSB plans to issue a supplemental NPRM in December 2023

NTSB/FAA Memorandum of Agreement on Commercial Space Mishap Investigations

- The MOA (NTSB-FAA-Commercial-Space-MOU.pdf)

  Identifies investigative responsibilities, interagency notification procedures and reporting responsibilities of the NTSB and FAA in connection with commercial space mishap investigations

  Describes how the agencies will coordinate on the exchange of information, data and use of resources or services

NTSB/FAA Memorandum of Agreement on Commercial Space Mishap Investigations

- The NTSB will be the lead investigative agency for commercial space launch or reentry mishaps that result in:
  - A fatality or serious injury to any person, regardless of whether the person was on board the commercial space launch or reentry vehicle, or
  - Damage to property not associated with the commercial space launch or reentry activities or the launch site, from debris that could reasonably be expected to cause death or serious injury
- The FAA will be the lead investigative agency for all other commercial space mishaps

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