Commercial Space

The FAA's Office of Commercial Space Transportation (AST) licenses and regulates U.S. commercial space launch activities including launch and reentry of vehicles and operation of non-federal launch and reentry sites authorized by Executive Order 12465 and Title 51 U.S. Code, Subtitle V, Chapter 509 (formerly the Commercial Space Launch Act). Title 51 and the Executive Order also direct the U.S. Department of Transportation to encourage, facilitate, and promote U.S. commercial launches. The FAA's mission is to license and regulate commercial launch and reentry operations and non-federal launch sites to protect public health and safety, the safety of property, and the national security and foreign policy interests of the United States. With its dual mission of regulating and facilitating the emerging commercial space transportation industry, FAA faces unique challenges.

The FAA licenses launches or reentries carried out by U.S. persons inside or outside the United States. The FAA does not license launches or reentries the U.S. Government carries out for the Government (such as those owned and operated by NASA or the Department of Defense). FAA does not license or grant permits for amateur-class rockets.

To accomplish its mission, the FAA performs the following major functions:

- Maintains an effective regulatory framework for commercial space transportation activities,
- Provides guidance to prospective commercial operators on how to comply with regulatory requirements for obtaining an authorization and operating safely,
- Evaluates applications for licenses, experimental permits, and safety approvals for launch and reentry operations and related commercial space transportation activities,
- Evaluates applications for licenses for launch and reentry site operations,
- Monitors and enforces regulatory compliance through safety inspections of launches, reentries, sites, and other regulated commercial space activities,
- Provides U.S. Government oversight of investigations associated with the mishap of an FAA authorized launch or reentry,
- Facilitates the integration of commercial space launch and reentry operations into the National Airspace System (NAS) by coordinating airspace use and regulatory oversight with air traffic management and Federal launch ranges,

Per 14 CFR Chapter 1, Part 1, section 1.1: Amateur rocket means an unmanned rocket that is propelled by a motor or motors having a combined total impulse of 889,600 Newton-seconds (200,000 pound-seconds) or less; and cannot reach an altitude greater than 150 kilometers above the earth’s surface.
• Coordinates research into the safety, environmental, and operational implications of new technologies and the evolving commercial space transportation industry,

• Conducts outreach to the commercial space transportation industry by hosting working groups and conferences,

• Collaborates with Government partners, such as NASA, Defense Advanced Research Projects Agency (DARPA), and the U.S. Air Force to assure consistent approaches to regulations, policy, and standards, and

• Conducts outreach to international counterparts to promote the U.S. regulatory framework across the world.

In addition to AST headquarters offices in Washington, D.C., AST maintains staff with assigned duty locations near active launch ranges to facilitate communication with space launch operators and to implement FAA’s regulatory responsibilities more efficiently. AST personnel are currently assigned to duty locations in close proximity to: Kennedy Space Center in Florida, Johnson Space Center in Texas, and Vandenberg Air Force Base and the Mojave Air and Space Port in California. FAA also directly supports NASA’s commercial space initiatives by providing on-site staff at both the Johnson Space Center and Kennedy Space Center to coordinate the FAA’s regulatory and enforcement activities with NASA’s development and operational requirements for commercial space.

Regulatory Safety Oversight Activities of FAA

The business cycle from the time a firm first contacts FAA until the last launch of a licensed operation can be several years. There are many activities performed by FAA during this cycle. The most notable activities are described here.

Pre-Application Consultation for Licenses, Experimental Permits and Safety Approvals

Prospective applicants seeking commercial space transportation licenses, experimental permits, or safety approvals are required by regulation to consult with FAA before submitting their applications. During this period, FAA assists them in identifying potential obstacles to authorization issuance and determining potential approaches to regulatory compliance. In addition, many new operators are seeking to incorporate new technologies, vehicle types, or operational models creating challenges for FAA in determining the applicable regulations or approach to regulatory compliance.

Licenses, Permits and Safety Approvals

FAA authorizes commercial space transportation activities via the issuance of licenses, permits, and safety approval. Though many licenses authorize multiple launches (for mature launch systems), the need remains for FAA to also issue individual launch licenses for systems that are still maturing towards a high level of reliability. Furthermore, with the dynamic commercial space transportation industry, FAA often evaluates launch and reentry systems and operations that are evolving and changing, which may ultimately require license modifications or issuance of new licenses.

Inherent in the review process is the requirement to conduct policy reviews and payload reviews. When conducting a policy review,
FAA determines whether the proposed launch, reentry, or site operation presents any issues that would jeopardize public health and safety or the safety of property, adversely affect U.S. national security or foreign policy interests, or be inconsistent with international obligations of the United States. If not otherwise exempt from review, FAA reviews a payload proposed for launch or reentry to determine whether the payload would jeopardize public health and safety, the safety of property, U.S. national security or foreign policy interests, or the international obligations of the United States. The policy or payload determination becomes part of the licensing record on which FAA’s licensing determination is based.

FAA also reviews and issues launch and reentry site operator licenses and license renewals. FAA also reviews and evaluates launch site license applications for launch sites located in foreign countries but operating with U.S.-licensed launch or reentry systems. FAA coordinates range planning among Federal, state, and local governments and with the commercial range operators or users. As part of the evaluation of applications for launch licenses, reentry licenses, and site operator licenses, FAA also conducts environmental reviews consistent with its responsibilities under the National Environmental Policy Act.

FAA anticipates issuing a growing number of safety approvals for space launch systems equipment, processes, technicians, training and other supporting activities. FAA reviews, evaluates, and issues safety approvals to support the continued introduction of new safety systems, safety operations applications, and safety approval renewal applications.

**Safety Analyses**

FAA conducts flight safety, system safety, maximum probable loss, and explosive safety analyses to support the evaluation and issuance of licenses and permits. FAA also evaluates and analyzes the performance of safety-critical space flight personnel to determine how they affect public safety risk. In the near future, as commercial firms become more involved with human space flight activity, AST and the FAA’s Office of Aerospace Medicine may evaluate, analyze, and determine the health risks to the space flight participants (crew and space flight participants) due to natural and flight-induced launch and reentry environments, as well as any hazardous ground operations directly associated with the flight.

**Inspections and Enforcement**

FAA currently conducts as many as 400 pre-flight/ reentry, flight/ reentry, and post-flight/ reentry safety inspections per year. Inspections often occur simultaneously at any of the 11 licensed U.S. and international commercial space launch sites, as well as at 4 Federal launch ranges and 3 exclusive-use launch sites. The establishment of non-Federal launch sites requires additional inspections in areas such as ground safety that have traditionally been overseen by the U.S. Air Force at Federal ranges. At spaceports and launch sites with high launch rates (e.g., Cape Canaveral Air Force Station, Vandenberg Air Force Base, the Mid-Atlantic Regional Spaceport, and Spaceport America), at least 80 percent of the inspections will be conducted by locally-based field inspectors in order to respond to a dynamic operational tempo, minimize cost, and increase efficiency.

**Mishap Investigations**

Mishap events have demonstrated that FAA needs to have the capacity to investigate at
least two space launch or reentry mishaps or accidents simultaneously anywhere in the world, and to lead/oversee as many as six investigations during a single year. FAA should have the capabilities and resources to safely perform the investigations lasting as long as 16 weeks at remote sites with limited infrastructure or facilities. FAA should have the capability and resources to efficiently review all applicant mishap plans and accident investigation procedures as part of the license and permit evaluation process.

**NAS Integration**
AST works in partnership with all FAA lines-of-business, notably the Air Traffic Organization (ATO) and Office of Airports (ARP) to support the safe and efficient integration of commercial launch and reentry operations into the NAS and its system of airports and air traffic managed by the ATO. This includes an increased presence at the Air Traffic Control System Command Center to assist in the strategic and tactical planning of launch and reentry operations, as well as to provide support during these operations. Further, AST works with the ATO as FAA develops technologies to facilitate safe and efficient integration of commercial launch and reentry operations into the NAS, including technologies to improve the integration of launch and reentry data into FAA air traffic control systems and technologies to improve the timely and accurate development and distribution of notices of aircraft hazard areas.

**FAA’s Operations Forecast**
To improve its workforce planning process, in 2014, FAA adopted an approach to estimate its future staffing needs based on the ratio of regulatory safety oversight staff to a forecast of launch and reentry operations within the purview of the FAA mission. Although it was a modest improvement, this change set the groundwork for FAA to implement a more objective and transparent process for projecting staffing requirements and also necessitated development of credible operations forecasts. Since 2014, FAA has made several important improvements to its operations forecast:

- In 2015, FAA began using planned launch and reentry data collected from operators and prospective applicants as the starting point for its launch and reentry forecasts. This change enabled FAA to simplify and improve its forecasting methodology by tying launch and reentry forecasts directly to anticipated operations by commercial space transportation firms known to FAA, rather than to aggregate industry demand.

- Because commercial spaceflight is a highly dynamic and rapidly evolving industry, it was quickly determined that operator-provided data alone were not sufficient to reliably predict future activity. Consequently, a primary pillar of FAA’s forecasting methodology is to take a conservative view of industry growth in the near term. Therefore, in 2016, FAA began refining its forecasting methodology by using observations about historical launch activity to establish better forecasting parameters for both new applicants and existing operators.

Based on proprietary information available to FAA, a steady increase in launch and reentry activities is expected in the coming years. There are several factors that magnify the challenges associated with predicting the number of launches and reentries to expect in a given year. They include:
the list of firms intending to launch or actually launch is dynamic,
the continued development of new technologies,
launch rates for reusable launch vehicles,
space tourism,
dynamic nature of flight test programs, and
mishaps.

For example, the number of firms actively communicating with FAA increased from 14 in 2014 to 65 in 2019, an increase of more than 360 percent. New technologies [e.g., reusable launch vehicles (RLVs)] allow a faster operational tempo, and at the same time, early use of these technologies can increase the probability of a mishap. A mishap can drastically impact launch plans for one or more firms. Investigations and subsequent “return to flight” for firms impacted by a mishap can take months to years.

Taking these factors into account, the following table and graph provide industry’s forecast through 2022, FAA’s forecast through 2021, and historical activity. The commercial space transportation industry continues to evolve and innovate at such a rapid pace that it is currently impractical to generate a credible, conservative forecast beyond the end of fiscal year 2021.

<table>
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<th>Fiscal Year</th>
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<th>FAA Forecast</th>
<th>Actual</th>
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Notes:
1. FAA forecast entries represent the Low to High estimate.
2. Industry Forecast for 2015 follows COMSTAC methodology from 2014. Industry forecasts for all other years follow the same methodology.
It is important to note all FAA-authorized commercial space operations are included in this forecast, regardless of where they occurred in the world. That is, not all launch and reentry activity occurs at one location, for example, at Cape Canaveral, Florida. In the past year, FAA licensed launches and reentries throughout the National Airspace System (NAS) and beyond, including multiple reentries in the Pacific Ocean and six licensed launches from New Zealand. This forecast, however, does not include launch activity not authorized by the FAA (e.g. U.S. Department of Defense or NASA launches), launch activity for other nations, and this forecast is not tied exclusively to satellite demand.

Additional Factors Affecting Forecast Accuracy

Commercial space transportation is a rapidly evolving industry. The industry’s growth through technological innovation and the development of new markets increases the challenges associated with forecasting commercial space transportation operations.

New Commercial Launch Technologies and Operations are Emerging on an Accelerated Basis

The commercial space transportation industry is exploring a variety of new technologies and new approaches to space launch and reentry. In late 2015, both Blue Origin and Space Exploration Technologies Corp. (SpaceX) successfully demonstrated the reusability of their vertically launched rockets,
a development that could significantly reduce the cost of operations and lead to an increase in the number of launch and reentry operations per year. Other U.S. commercial entities are also pursuing the development of reusable launch vehicles (RLVs). At the same time, state and local governments are joining with commercial firms to promote additional launch and reentry sites, and some firms are seeking to establish launch sites for their exclusive use. This added launch capacity sets the stage for simultaneous operations and an increase in the number operations per year.

**New Markets for Commercial Space Transportation are Emerging**

The continuing development of commercial space transportation technology has spurred new markets for commercial space transportation services. As private industry continues to develop and test new vehicles capable of taking space flight participants on suborbital and orbital flights, companies and organizations are proposing to offer human space flight training and several organizations have already begun to provide this service. States and municipalities have sought to open new spaceports to attract commercial space transportation and associated high-tech firms and create business hubs for research and development. Since 2008, NASA has managed the Commercial Resupply Services (CRS) program, which acquires transportation services from commercial providers to deliver cargo to and from the International Space Station (ISS). NASA is also working with commercial companies under its Commercial Crew Transportation Capabilities contract to develop vehicles that will provide transportation for astronauts and international partners to and from the ISS. Testing of Commercial Crew vehicles developed by SpaceX and Boeing has begun, and crewed operational launches licensed by the FAA may begin in 2020. NASA is also seeking proposals from industry for a program called Commercial Lunar Payload Services. The commercial vehicles used by NASA for cargo and crew transportation will have other commercial applications that increase the capabilities of the commercial space transportation industry as a whole.

Looking further afield, there are several companies in the regulatory pipeline seeking authority to land commercial vehicles on the Moon, establish private-sector space stations, service satellites on-orbit, and establish launch sites using non-traditional technologies like railguns and tube launchers. Extensive FAA resources will be needed to determine how these unprecedented commercial space ventures will impact public safety and U.S. national interests.