COMMERCIAL SPACE TRANSPORTATION

Since 1989, the Department of Transportation/Federal Aviation Administration has licensed over 230 U.S. commercial space launches. The FAA has also granted over 30 experimental permit launches since 2006. Activity in the U.S. commercial sector is expected to increase for both orbital and suborbital launches.

The FAA's Office of Commercial Space Transportation (AST) licenses and regulates U.S. commercial space launch activity including launch vehicles and non-federal launch 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 Department of Transportation to encourage, facilitate, and promote U.S. commercial launches. AST'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.

Overview

The FAA licenses several expendable vehicles used for commercial orbital launches. The most frequently used launch vehicles are:

- Falcon 9, an intermediate-class launch vehicle built, operated, and marketed by Space Exploration Technologies Corp. (SpaceX);
- Antares, Minotaur, and Pegasus vehicles built, operated, and marketed by Orbital Sciences Corporation (now Orbital ATK, Inc.);
- Zenit-3SL, a heavy-class vehicle built by the Ukrainian company KB Yuzhnoye for the Russian-owned Sea Launch venture, launched from a floating launch platform based at Long Beach, CA;
- Atlas V, a heavy-class vehicle built by United Launch Alliance (ULA), a joint venture between Boeing and Lockheed Martin, and marketed by Lockheed Martin Commercial Launch Services (LMCLS); and
- Delta IV, a heavy-class vehicle built and provided by ULA.

Companies such as Armadillo Aerospace have also carried out suborbital licensed launches. In addition to launch licenses, experimental permits were first granted by the FAA in 2006. Permits are used for suborbital reusable vehicle development and test flights. Companies that have been active in conducting permitted launches include Blue Origin, Scaled Composites, and SpaceX.

The FAA Office of Commercial Space Transportation does not license or grant permits for amateur-class rockets which are unmanned rockets that have less than 200,000 pound-seconds of total impulse and cannot reach an altitude greater than 150 kilometers above the Earth's surface.
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 operated for and by NASA or the Department of Defense).

Nine commercial spaceports are currently licensed by the FAA. These are located in six states: Alaska (Kodiak Launch Complex), California (California Spaceport, part of Vandenberg Air Force Base, and Mojave Air and Space Port), Florida (Cape Canaveral Spaceport and Cecil Field Spaceport), New Mexico (Spaceport America), Oklahoma (Oklahoma Spaceport), Texas (Midland International Air and Space Port), and Virginia (Mid-Atlantic Regional Spaceport). Several other commercial spaceports around the United States have been proposed, including locations in Colorado, Georgia, and Hawaii.

### Review of 2014

There were twelve orbital FAA-licensed launches in 2014, an increase from seven in 2013. SpaceX’s Falcon 9 vehicle was used for six launches including two Dragon missions to the International Space Station (ISS), three missions to geosynchronous orbit, and one multiple satellite launch to low Earth orbit. There are nearly 50 future launches on the SpaceX manifest. Orbital Sciences conducted three launch attempts of the new Antares vehicle, two successful and one resulted in a launch failure. ULA performed two FAA-licensed launches, one by an Atlas V and the other by a Delta IV Heavy. Sea Launch (a multinational launch provider) conducted one launch of the Zenit 3SL launch vehicle. SpaceX carried out two licensed reentry missions when both Dragon capsules returned from orbit for an ocean landing after being berthed at the ISS for about two weeks following launch. The third licensed reentry was of the Orion space capsule, successfully concluding the NASA EFT 1 test mission.

In addition, there were seven suborbital flights during 2014 conducted under experimental permits. Five were carried out by SpaceX in Texas using its Falcon 9R Dev 1 test vehicle. Two permitted suborbital flights were performed by Scaled Composites with SpaceShipTwo; the second test flight resulted in a failure. Other companies are preparing experimental permit flights in 2015.

Launch providers such as SpaceX plan an increased number of licensed orbital launches in 2015. The increase in the number of permit flights and the commencement of licensed suborbital flights could take place in the years following 2015, depending on the results of the SpaceShipTwo launch failure investigation.

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<tr>
<td>Permitted Launches</td>
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**FAA Licensed and Permitted Launches**

Overall there were 92 civil, commercial and military orbital launches worldwide in 2014, compared to 81 in 2013. Of these, 23 were commercial launches, the same number as in 2013.
Launch providers in the United States led with 11 orbital commercial launches of U.S.-manufactured vehicles in 2014, followed by six by Europe, four by Russia, one by India, and one by Sea Launch.

For more details, see the annual Compendium and Year in Review reports available online at: http://www.faa.gov/about/office_org/headquarters_offices/ast/reports_studies/#accst

Global Orbital Launch Forecast

In July 2014, the FAA and the Commercial Space Transportation Advisory Committee (COMSTAC) published their annual global forecast for commercial launch demand, the 2014 Commercial Space Transportation Forecasts. The report calculates satellite demand and then applies models to estimate international commercial launch demand. Multiple satellites can fly on one launch vehicle. The 2014 forecast estimated an average global demand of about 16 commercial launches per year to geosynchronous orbit (GSO) and a global demand of about 14 launches per year to non-geosynchronous orbits (NGSO). The forecast covers the years 2014-2023. The 2014 forecast is up slightly down from the 2013 forecast for GSO and up for NGSO destinations.

Commercial GSO launches are used for communications satellites with masses ranging from 2,500 to over 6,000 kilograms. Demand for commercial NGSO launches spans a number of markets and payload sizes, including resupply of the ISS, commercial remote sensing; science and technology demonstration; and replenishment and replacement of low Earth orbit communications satellite systems reaching the end of their lifespan. The forecast shows a continuing trend in demand for medium-to-heavy sized launch vehicles. Many small satellites, including a rapidly growing number of very small satellites known as CubeSats, find rides aboard medium-to-heavy lift launch vehicles as secondary payloads. The forecast demand for
small launch vehicles is an average of only one launch per year; however, it is up slightly from only 0.3 projected in the 2013 forecast.

The GSO and NGSO forecasts are not a prediction of what will actually be launched but instead represents the expected demand for launch services, based on a variety of inputs. The complete forecast report is available at:
http://www.faa.gov/about/office_org/headquarters_offices/ast/reports_studies/forecasts/

**Suborbital Reusable Vehicle Forecast**

The most recent global forecast for suborbital reusable vehicles (SRVs) was completed in July 2012. A report prepared by the Tauri Group for FAA AST and Space Florida covered a 10-year period that estimated demand once new suborbital vehicles begin flying. The goal of the study was to provide information for government and industry decision makers on the emerging SRV market by analyzing trends and areas of uncertainty in eight distinct markets SRVs could address. The eight markets include: Commercial Human Spaceflight, Basic and Applied Research, Aerospace Technology Test and Demonstration, Media and Public Relations, Education, Satellite Deployment, Remote Sensing, and Point-to-Point Transportation. The forecast includes three demand scenarios: baseline, growth, and constrained. Instead of flights, the forecast estimates seat demand. The demand is either for one seat for a single occupant or a cargo equivalent of 3.3 lockers (based on the size of mid-deck lockers used aboard the Space Shuttle).

Total projected demand for SRVs, across all eight markets, is estimate to begin at around 373 seat/cargo equivalents in Year 1 and increasing to 533 seat/cargo equivalents in the tenth year of the baseline case. Year 1 represents the first year of regular SRV operations. Demand under the growth scenario, which reflects increases due to factors such as marketing, research successes, and flight operations, grows from about 1,100 to more than 1,500 seat/cargo equivalents over ten years. The constrained scenario, which reflects significantly reduced consumer spending and government budgets, shows demand from about 213 to 255 seat/cargo equivalents per year.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
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**Total projected demand for suborbital reusable vehicles by seat/cargo equivalents**

Demand for SRVs is dominated by Commercial Human Spaceflight. The analysis indicates that about 8,000 high net worth individuals from across the globe are sufficiently interested and have spending patterns likely to result in the purchase of a suborbital flight. The second largest area of demand is Basic and Applied Research, funded primarily by government agencies, and also by research for not-for-profits, universities, and commercial firms. Aerospace Technology Test and Demonstration, Education, Satellite Deployment, and Media and PR generate the
remaining demand. The Remote Sensing and Point-to-Point Transportation markets are not forecasted to drive launches at this time.

For more details, see the Suborbital Reusable Vehicles: A 10-Year Forecast of Market Demand report available online at:
http://www.faa.gov/about/office_org/headquarters_offices/ast/reports_studies/forecasts/