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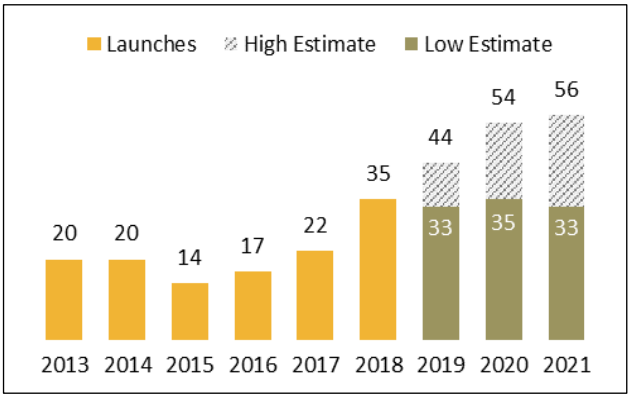
Impact of Commercial Space Launch Activities on Aviation

Introduction

Congress has encouraged the growth of commercial space activities by requiring federal agencies to use private launch services and establishing offices to oversee commercial activity. In 2018, 35 commercially licensed launch and reentry events occurred at U.S. spaceports, a 100% increase from the 2016 level. Some forecasts project a rapid increase in demand for commercial launch services in coming years. The growth in launch activity has been accompanied by a rise in the number of commercial launch providers and locations—spaceports—licensed for launch services.

Expanded commercial space activity has brought increasing attention to the use of U.S. airspace. Interest groups representing airlines and general aviation have voiced concerns about more frequent restrictions of airspace to accommodate commercial launch events. The Federal Aviation Administration (FAA), which controls the use of the national airspace, has been challenged to accommodate the needs of commercial space launch operators and their clients while at the same time ensuring the safety of traditional aircraft operations, which it predicts will also grow (**Figure 1**).

Figure 1. Commercial Launch Forecast Through 2021



Source: FAA Office of Commercial Space Transportation.

The Commercial Space Infrastructure

FAA has approved licenses for 11 commercial spaceports in Virginia, Florida, Texas, Oklahoma, Alaska, California, New Mexico, and Colorado. Additional sites have been proposed in Florida, Hawaii, Texas, Georgia, and Michigan. Some of these sites have been licensed for limited purposes. Certain spaceports are certified only for horizontal launch, in which a launch vehicle is attached to an aircraft that takes off from a runway. Others are approved for suborbital launch, in which a vehicle travels just short of orbit before returning to Earth.

Most commercial spaceports licensed by FAA are used infrequently if at all. However, several companies have begun signing leases and building infrastructure at these sites in anticipation of an uptick in operations.

Developments in the broader commercial space sector point to growth in the number of launches. Virgin Galactic has pre-sold about 700 seats for suborbital flights aboard its FAA-licensed commercial spacecraft, which can carry six passengers and is expected to launch from New Mexico. Space Exploration Technologies (SpaceX) submitted a proposal in October 2019 to the International Telecommunication Union to add an additional 30,000 satellites to its existing Starlink constellation. SpaceX launched its first Starlink payload of 60 satellites from Cape Canaveral, FL, in May 2019; thousands of new satellites—even small ones—could require hundreds of hours of closed airspace for launch windows. Many commercial launch sites are located along major airline routes (**Figure 2**).

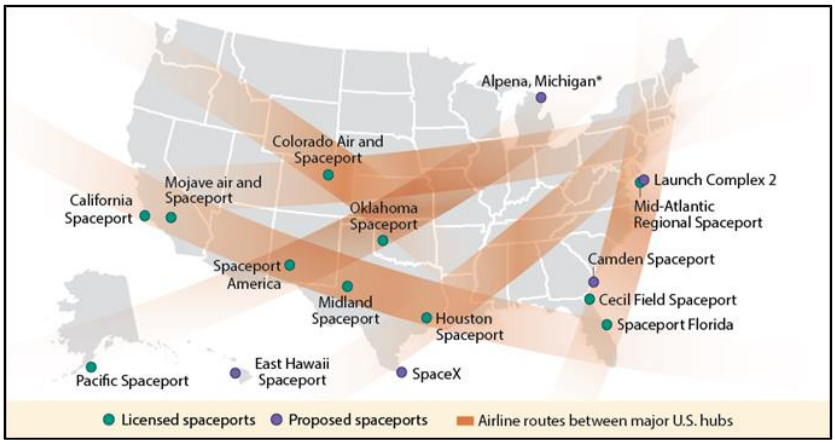
Launch windows are short periods of time—usually a few hours a day over several days—during which conditions are optimal for a launch. They are often bound by orbital mechanics and mission requirements and can close at short notice due to environmental factors like weather. For satellite launches and other launches to orbit, careful calculations identify when a rocket must be launched from Earth to intersect the orbital plane of its destination. As a consequence, operators have little control over the timing of launch activities. They identify a window and ask FAA to clear the necessary airspace during that time.

The experience of the Pacific Spaceport Complex-Alaska (PSCA), a launch site on a remote island that lies beneath a trans-Pacific airline route between North America and Asia, illustrates the potential conflicts between space activity and aviation. PSCA had its first two commercial launches in 2018. According to the president of Alaska Aerospace, which runs the spaceport, these launch windows required airspace restrictions for several days in a row, forcing international carriers to fly hundreds of miles out of their way. This resulted in expending additional fuel and increasing travel time for passengers.

Managing Traffic in the Skies

In addition to licensing each commercial launch facility, FAA requires commercial launch operators to obtain separate licenses or permits for their missions, though it is beginning to streamline these requirements for multiple launches of the same vehicle. No later than 60 days ahead of a requested launch, a licensed operator must file a detailed application to FAA containing launch plans and payload information. The operator must submit a safety analysis update 30 days prior to a scheduled launch and a detailed plan for the day of launch 15 days prior.

Figure 2. Major Airline Flight Corridors Near Spaceports



Source: CRS analysis and presentation of April 2019 FAA data.

Inflexible launch windows can coincide with busy travel periods for airlines. Air traffic volume sometimes plays a role in FAA's decision to approve a particular launch window. In one such case, FAA denied a commercial launch from Cape Canaveral, FL, during the week of Thanksgiving 2013, because the requested window fell within the year's projected heaviest airline travel period.

Once a launch is scheduled, multiple FAA divisions and regional offices are responsible for different parts of the airspace management process. FAA's Office of Commercial Space Transportation (AST) is charged with ensuring public safety on the ground and at sea during launch and reentry operations. FAA's Air Traffic Organization (ATO) is responsible for aircraft and passenger safety in the air during launches.

The area and duration of airspace restriction are largely based on a vehicle's anticipated trajectory and operations. Some launches require larger closure areas to protect other airspace users from planned debris like jettisoned payload fairings or rocket stages returning to Earth. Certain payloads may need to arrive at a specific on-orbit location at a precise time in order to rendezvous with an existing satellite constellation or the International Space Station.

Under the current process, a team of ATO and AST personnel uses computer modeling to account for variability in performance of the launch vehicle, atmospheric conditions, and other factors to determine how much airspace to close. Once they establish the boundaries of the restricted airspace and the duration of flight restrictions for aircraft, FAA issues a Notice to Airmen (NOTAM) with details, usually 10 days ahead of the launch. FAA coordinates with other federal agencies, spaceport personnel, regional air traffic controllers, U.S. military aviation units, and other airspace users during each launch to make sure all affected area is clear. This process is not always seamless or transparent to all airspace users. The Aircraft Owners and Pilots Association (AOPA), an interest group representing the general aviation interests, has cited inconsistencies in designations of aircraft hazard areas and called on FAA to make launch information easier to access.

The Future of Airspace Traffic Management

FAA's current system closes airspace based on approximation of hazard areas. It does not track live launch and reentry activities or generate real-time calculations of exactly which airspace would be affected by unexpected falling debris if a launch fails.

Therefore, FAA must restrict significant airspace for an hour or longer for a launch event that may last 10 minutes. If the launch is delayed due to weather or technical issues, the airspace closure may last longer than scheduled. This can result in extra fuel consumption, lost dollars and time for airlines and passengers, and rerouted flights. For example, the February 2018 SpaceX Falcon Heavy launch from Florida required more than 1,000 miles of closed airspace for three hours, which resulted in 563 flight delays and more than 34,000 additional miles flown. Any additional operating costs due to airspace closures are borne by aircraft operators: a 2018 study conducted by Embry-Riddle Aeronautical University calculated that individual launch events typically cost airlines between $10,000 and $30,000 in extra fuel required to avoid airspace closures.

Since 2014, FAA has been developing technology that will track launches and automatically integrate that data within the air traffic management system. This common operating picture—the Space Data Integrator—is expected to allow FAA to close smaller areas of airspace and for shorter windows. It is designed to also enable immediate responses to launch failures by identifying which specific airspace could be at risk. FAA is testing a prototype, but there is no date set for deployment.

Regulatory Developments

In April 2019, FAA published a Notice of Proposed Rulemaking (FAA-2019-0229) setting forth reforms intended to streamline the launch licensing process. The proposal was criticized by many space industry and general aviation stakeholders, and a Senate Appropriations Committee report (S.Rept. 116-109) cited regulatory and cost inefficiencies arising from the proposal. The proposal remains pending.

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