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Commercial Human Spaceflight

Recent commercial flights to space by wealthy businesspeople and other private individuals have attracted interest both in Congress and among the general public. This In Focus summarizes current capabilities and plans for commercial human spaceflight, explains how it is regulated and licensed, defines some commonly used terminology, and discusses selected policy issues that may be of interest to Congress.

Capabilities and Plans

The first nongovernmental flight to carry a human into space took place in 2004. An experimental rocketplane called SpaceShipOne, launched from beneath a carrier aircraft, briefly reached an altitude just above 100 kilometers (62 miles), which is one common definition of the boundary of space. SpaceShipOne, developed by Mojave Aerospace Ventures, made two additional suborbital flights later in 2004 but was then retired.

In 2020, SpaceX became the first company to launch humans into Earth orbit, using its Crew Dragon capsule and Falcon 9 rocket to deliver astronauts to the International Space Station (ISS) under contract to the National Aeronautics and Space Administration (NASA). Crew Dragon's first non-NASA mission, a three-day flight carrying four private individuals, took place in September 2021 (see **Figure 1**). SpaceX is also developing a larger spacecraft called Starship for future human flights to Earth orbit and beyond.

In December 2018, Virgin Galactic flew an aircraft-launched rocketplane called SpaceShipTwo, carrying a crew of two, to an altitude just above 50 miles (80 kilometers), another definition sometimes used for the boundary of space. In July 2021, a subsequent flight of SpaceShipTwo drew public attention because it carried, among others, Virgin Galactic founder Richard Branson. The anticipated future market for SpaceShipTwo is space tourism.

Also in July 2021, Blue Origin flew its New Shepard spacecraft to an altitude just above 100 kilometers, carrying, among others, Blue Origin founder Jeff Bezos. Like SpaceShipTwo, New Shepard's anticipated future market is space tourism.

As a competitor to SpaceX's Crew Dragon, Boeing is developing the Starliner spacecraft, to be launched into orbit atop an Atlas V rocket made by United Launch Alliance. The first crewed demonstration flight of Starliner is anticipated in 2022, under contract to NASA.

Regulation and Licensing

In the United States, commercial space launch and reentry—whether carrying humans or just cargo—are regulated and licensed by the Department of Transportation, via the Office of Commercial Space Transportation in the Federal Aviation Administration (FAA). These functions are authorized by the Commercial Space Launch Act (P.L. 98-575), as amended (51 U.S.C. Chapter 509). Implementing regulations are at 14 C.F.R. Chapter III.

Commercial space launch operators must obtain a license from the FAA. There is no fee for this. Most of the requirements for obtaining a launch license are similar, whether or not the planned launch will carry humans. In most cases, the FAA is explicitly prohibited from issuing regulations to protect the health and safety of humans aboard commercial spacecraft. That prohibition, which the law describes as a learning period, was intended to avoid burdening a nascent industry. The learning period was initially scheduled to expire in 2012. It has been extended several times, most recently to October 1, 2023.

In lieu of FAA regulations for occupant safety, the Commercial Space Launch Act takes an informed consent approach. Operators must notify spaceflight participants (i.e., occupants who are neither government astronauts nor crew employed by the operator) about the risks of launch and reentry and inform them in writing that the U.S. government has not certified their spacecraft as safe. Participants must then provide written informed consent.

In anticipation of the end of the learning period, the U.S. Commercial Space Launch Competitiveness Act (P.L. 114-90) directed the FAA to facilitate the development of voluntary industry consensus standards to improve human occupant safety; report to Congress on the progress of those standards; and by December 31, 2022, report on its assessment of the industry's readiness to transition to a safety framework that may include FAA regulations.

Figure 1. Private Individuals in Space.

The personnel of the three-day Inspiration4 mission, launched by SpaceX in September 2021, in Earth orbit at an altitude of about 585 kilometers (350 miles).

Source: Photo credit: SpaceX / CC BY-NC-ND 2.0.

Terminology

Where Does Space Begin?

There is no legal definition of the boundary of space, under either U.S. or international law. One commonly used definition is an altitude of 100 kilometers, known as the von Kármán line. This is the definition used by the World Air Sports Federation (Fédération Aéronautique Internationale), an organization that maintains world records for aeronautical and astronautical activities.

In 2004, the FAA established the Commercial Space Astronaut Wings Program to honor commercial spaceflight crew (see FAA Order 8800.2, revised July 2021). One of the program's eligibility requirements is flight "beyond 50 statute miles above the surface of the Earth," a definition for the boundary of space somewhat lower than the von Kármán line.

Who Is an Astronaut?

Similarly, the term *astronaut* is not defined in law. In the Commercial Space Launch Act, 51 U.S.C. §50902 defines the term *government astronaut* based on, among other criteria, designation by NASA under 51 U.S.C. §20113(n). The act categorizes other individuals aboard commercial spacecraft as either *crew*, if employed by the launch provider, or *spaceflight participants*. The Commercial Space Astronaut Wings Program, which identifies crew who receive the award as astronauts, was established administratively by the FAA rather than on the basis of specific statutory direction. The 1967 Outer Space Treaty, a multilateral treaty that forms the basis of international space law, uses the term *astronaut* but does not define it. The 1968 companion treaty known as the Rescue Agreement uses the term *astronaut* only in its formal title (the Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space); its text uses the phrase *personnel of a spacecraft*.

Suborbital vs. Orbital

A trajectory that reaches a high enough altitude to be considered as space, but returns without orbiting the Earth, is known as *suborbital*. A trajectory that makes a complete orbit around the Earth—or more commonly, several complete orbits—is called *orbital*. Suborbital flights typically last a few minutes, and commercial providers are marketing them to potential space tourists for a few hundred thousand dollars. Orbital flights may last several days or more, and commercial providers may charge tens of millions of dollars per person.

Selected Issues for Congress

As commercial spaceflight with humans on board becomes more common, Congress is focusing more closely on related issues, including safety regulation and the approaching end of the learning period; the possibility of requiring fees or taxes analogous to those imposed on other forms of transportation; environmental impacts; and evolving public attitudes toward the industry.

Safety Regulation and the Learning Period

As the end of the learning period approaches, Congress may consider whether to extend it again or allow it to lapse. This decision may depend on Congress's assessment of the maturity of the commercial spaceflight industry, the status of the voluntary standards currently under development as an alternative to regulation, and the FAA's proposals for safety regulations it might issue if permitted. For more details of the current safety framework, including the timeline of requirements for reports to Congress in the lead-up to the end of the learning period, see 51 U.S.C. §50905.

Fees/Taxes

The FAA licensing process for commercial human spaceflight does not currently require any fees or taxes. Some Members of Congress have suggested that fees or taxes analogous to those charged for commercial airline flights might be appropriate. At a House hearing in June 2021, Representative John Garamendi asked, "Who pays for all this, the commercial space operators or the taxpayers? ... This is going to become much more expensive as more and more space flights occur." In July 2021, Representative Earl Blumenauer announced plans to introduce a SPACE Tax Act that would impose a tax on "commercial space flights carrying human passengers for purposes other than scientific research."

Environmental Impacts

The FAA licensing process for commercial space launch and reentry includes an environmental review. In addition, assessing potential environmental impacts is often a major factor in the licensing of new commercial spaceports. High-altitude emissions from rockets directly into the stratosphere (which includes the ozone layer) have recently drawn increased attention. Emissions impacts can vary widely, as different rockets use different fuels.

Public Attitudes

Commercial spaceflight, including commercial human spaceflight, is perceived by many as a high-tech marvel that can create new markets, contribute to economic growth, and inspire the public. Localities seeking to establish licensed commercial spaceports often cite the potential to promote local economic development and sometimes explicitly note the potential to attract space tourism. Supporters also argue that a commercial market will reduce costs to the government when NASA purchases launch and reentry services commercially.

Yet as the industry grows, some critics are less positive. Jeff Bezos was widely criticized for commenting, after returning from his suborbital flight in July 2021, "I want to thank every Amazon employee, and every Amazon customer, because you guys paid for all this." In September 2021, the United Nations Secretary-General said that "billionaires joyriding to space while millions go hungry on earth" contributes to a worldwide "malady of mistrust" in governments and other institutions. Intense publicity about recent launches has increased the visibility of incidents such as an unapproved course deviation during the July 2021 Virgin Galactic flight. How public attitudes evolve may affect congressional decisions on the learning period, fees and taxes, environmental impacts, and other issues.

Daniel Morgan, Specialist in Science and Technology Policy

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