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Regulation of Commercial Human Spaceflight Safety: Overview and Issues for Congress

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SUMMARY

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Regulation of Commercial Human Spaceflight Safety: Overview and Issues for Congress

Commercial human spaceflight is a nascent but growing industry, and that is reflected in how the safety of the industry is regulated. Customers for commercial human spaceflight include national space agencies, such as the National Aeronautics and Space Administration (NASA), as well as private citizens. As the industry and its safety evolves, Congress continues to consider how to approach safety regulations for commercial human spaceflight and the responsibilities of the federal agencies involved.

Safety Record

In recent years, the frequency of commercial human spaceflight missions has increased. As of June 2024, no commercial human spaceflight mission has resulted in the death of a government astronaut, a spaceflight participant (a private citizen on a commercial flight that is not part of the crew), or a member of the general public. However, an accident during a 2014 test flight of Virgin Galactic's SpaceShipTwo caused the death of a crew member and injury to another employed by the company.

Learning Period and Informed Consent Regime

Since the enactment of the Commercial Space Launch Amendments Act of 2004 (P.L. 98-575), the Department of Transportation has regulatory authority for commercial human spaceflight safety during launch and reentry. The DOT delegates its authority to the Federal Aviation Administration (FAA). Pursuant to statute (51 U.S.C. §50905(c)) starting on January 1, 2025, the agency may propose regulations for the safety of human occupants. The period before January 1, 2025, is referred to as a "learning period." The learning period allows commercial companies the opportunity to mature their capabilities without regulatory oversight, which could be potentially burdensome to the development of this market. Currently, the FAA and industry operate under an informed consent regime, in which customers are informed of the potential risk of human spaceflight and that the U.S. government has not certified the spacecraft.

The potential for an end to the learning period is spurring more discussion on the timing for potential development of regulations and the status of industry standards that would inform regulations. The FAA maintains the learning period does not need to be extended and that both the agency and industry are ready to transition to a new safety framework that will eventually include regulations. In 2023, FAA indicated that, if the learning period is not extended, it may be able to publish a final rule approximately five years later (i.e., 2028). Major industry groups disagree and have advocated for an extension until the industry is more mature, has a base of shared safety knowledge, and has made more progress towards voluntary consensus standards.

Issues for Congress

After various extensions from the original expiration date in 2012, the learning period is set to expire on January 1, 2025. Congress may wish to consider whether to extend the learning period for a fixed time or indefinitely or whether to allow it expire and allow the FAA to commence the process of developing regulations. Congress's interest may be driven by concern for the safety of government astronauts, who are potential customers of the commercial human spaceflight industry.

Some Members of Congress also have raised the issue of the FAA's dual mandate to both promote the commercial space industry and regulate its activities in the interest of public safety. Congress may also consider whether to address overlaps and gaps in federal agency oversight of commercial space activities, such as the lack of regulatory oversight for commercial activity in space, or on orbit.

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Introduction

Commercial human spaceflight is a nascent industry. Congress shapes commercial spaceflight through its actions on the development of safety regulations and its direction to the agencies involved in regulation and the scope of regulatory authorities.

As of June 2024, 42 Federal Aviation Administration (FAA)-licensed or -permitted commercial human spaceflight missions have occurred.[1] FAA-licensed or -permitted commercial human spaceflights have increased recently, with more launches occurring since 2021 than in the 17 years prior.[2]

The FAA, within the Department of Transportation (DOT), is responsible for regulating the safety of commercial space launch and reentry, including the safety of humans onboard.[3] Since 2004, statute (51 U.S.C. §50905(c)(9)) established a "learning period," during which the FAA is prohibited from proposing regulations addressing the safety of humans on commercial spacecraft during launch and reentry, with a few exceptions. This learning period is set to expire on January 1, 2025.

After providing an overview of the commercial human spaceflight industry in the United States, the report discusses the existing status of safety regulations and authorities and other potential safety considerations for Congress. Specific topics addressed include the term of the learning period for regulating the safety of human occupants, the roles and responsibilities of federal agencies (in particular the FAA), and regulatory oversight of commercial human spaceflight after launch and before reentry (i.e., on orbit).

Human spaceflight missions conducted solely by the U.S. government are not addressed in this report, as the responsible federal agency has authority for the safety of such missions.

Overview of the Commercial Human Spaceflight Industry

Until the 2004 launch of SpaceShipOne by U.S. aerospace company Scaled Composites,[4] human spaceflight was limited to government missions, and only a few countries were able to launch humans into space. Currently, three companies—Blue Origin, SpaceX, and Virgin Galactic—are able to launch humans into space, with additional companies developing the capability to transport humans to space or host them on private orbital platforms, commonly referred to as "space stations." In the coming years, commercial space companies hope to develop the human spaceflight industry, in which private citizens and government astronauts can travel to or stay in space on privately owned spacecraft or space stations.

[1] The Federal Aviation Administration (FAA) issues experimental permits for commercial launch or reentry of reusable suborbital rockets for research and development, demonstrating compliance with licensing conditions, or crew training, as described in 14 C.F.R. §437.5. The FAA issues licenses for all other types of commercial space launch or reentry.

[2] Number of missions determined from the FAA, "Commercial Space Data," August 31, 2023, https://www.faa.gov/data_research/commercial_space_data.

[3] The FAA's authorities are limited to commercial missions and, as such, the agency does not oversee missions conducted by other government agencies.

[4] The company Scaled Composites conducted the first commercial spaceflight on June 21, 2004, with the launch of SpaceShipOne. Tim Sharp, "SpaceShipOne: The First Private Spacecraft," *Space.com*, March 5, 2019, https://www.space.com/16769-spaceshipone-first-private-spacecraft.html.

Types of Commercial Human Spaceflight

The commercial human spaceflight industry is composed of companies providing suborbital and orbital spaceflight,[5] as well as companies developing commercial orbital platforms to host customers. SpaceX, for example, has launched both National Aeronautics and Space Administration (NASA) astronauts and commercial customers into orbit. Virgin Galactic is currently offering suborbital flights.[6] Blue Origin currently offers suborbital flights and intends to offer orbital flights in the future.[7]

Orbital platforms, or "space stations," are crewed spacecraft that operate in Earth orbit for an extended period of time. The International Space Station (ISS) is an example of a crewed, government-owned orbital platform. Several companies, such as Axiom Space and NanoRacks, intend to operate commercial orbital platforms in low Earth orbit (LEO).[8]

Customers for Commercial Human Spaceflight

Customers for commercial human spaceflight include both governments and private citizens. Governments can contract with space companies to launch government astronauts and researchers or to host them on commercial orbital platforms.

NASA relies on commercial human spaceflight services for three of its programs: the Commercial Crew program, which transports NASA astronauts to the ISS; the Artemis program through its Human Landing System, which NASA plans to use to transport its astronauts to the Moon's surface; and the Commercial LEO Development program, which NASA hopes will host its astronauts in Earth orbit. For all of these programs, NASA does not plan to develop its own capabilities; the agency plans on using commercial human spaceflight services instead. The commercial providers offer transportation or orbital hosting *as a service*, retaining ownership of their spacecraft.

Private citizens may also pay to travel to space for recreation, tourism, privately funded research, or other purposes. So far, relatively few private citizens have traveled to space on either orbital or suborbital flights. The first crewed private spaceflight occurred in 2004, with the flight of SpaceShipOne. Between 2001 and 2009, seven private citizens traveled to the ISS on Russian government-owned Soyuz spacecraft.[9] No additional commercial human spaceflight missions occurred until 2018. In the years since, Blue Origin, SpaceX, and Virgin Galactic have each transported private citizens to space on multiple missions.[10]

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[5] Although both suborbital and orbital spacecraft reach space, only orbital spacecraft reach sufficient speed (known as orbital velocity) to complete at least one orbit—or more commonly, several orbits—around the Earth. In contrast, a suborbital flight reaches space and then returns without making a full orbit around the Earth, usually after a few minutes.

[6] Doug Messier, "U.S. Commercial Human Spaceflight Set to Accelerate as Regulatory Battle Looms," *Parabolic Arc*, April 10, 2023, https://parabolicarc.com/2023/04/10/current-state-future-commercial-spaceflight/.

[7] Eric Berger, "Blue Origin Just Validated the New Space Movement," *ArsTechnica*, October 6, 2016, https://arstechnica.com/science/2016/10/blue-origin-just-validated-the-new-space-movement/.

[8] National Aeronautics and Space Administration (NASA), "NASA Selects Companies to Develop Commercial Destinations in Space," press release, *NASA*, December 2, 2021, https://www.nasa.gov/news-release/nasa-selects-companies-to-develop-commercial-destinations-in-space/.

[9] Mike Wall, "An Interview with the First Space Tourist," *SpaceNews*, May 2, 2011, https://spacenews.com/interview-first-space-tourist/.

[10] Sissi Cao, "Every Person Launched into Space by Blue Origin, So Far," *Observer*, June 22, 2023, https://observer.com/2023/06/blue-origin-passenger-list/; William Harwood, "Virgin Galactic Launches Third (continued...)

The number of private citizens who have visited space, while still relatively small, is expected to grow, given expectations that these companies may increase the frequency of their missions and that more companies may enter the commercial human spaceflight market. The industry has already grown and increased the frequency of its spaceflights in recent years. In fact, more FAA-licensed or -permitted commercial human spaceflights occurred since 2021 than in the 17 years prior.[11]

Safety of U.S. Commercial Human Spaceflight

As of June 2024, no U.S. commercial human spaceflight mission has resulted in the death of a government astronaut, a spaceflight participant,[12] or a member of the general public. An accident during a 2014 test flight of Virgin Galactic's SpaceShipTwo caused the death of a crew member and injury to another employed by the company.[13]

The FAA, which regulates and licenses commercial space launch and reentry, tracks U.S. human spaceflight data—from both government and commercial missions—including the numbers of persons launched, casualties, and catastrophic failures. The FAA defines a "catastrophic failure" as an accident that caused death or serious injury to the people onboard.[14] CRS analysis of FAA data shows a catastrophic failure rate of 3.3% for commercial *suborbital* missions and 0% for commercial *orbital* missions.[15] Out of the 30 suborbital commercial human launches licensed or permitted in the United States, the 2014 SpaceShipTwo test flight is the only catastrophic failure recorded.

Comparisons may provide useful, yet limited, points of reference, as commercial human spaceflight is a developing activity with relatively little flight history. In 2022, U.S. commercial air carriers had an accident rate[16] of less than 0.3 per 100,000 scheduled flights, or less than 0.0003%.[17]

Companies that wish to participate in NASA's Commercial Crew program must demonstrate their ability to meet the agency's safety standards. For these companies to meet NASA's safety standards, their proposed spacecraft design must meet a "loss of crew" threshold of 1 in 270, or

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Suborbital 'Space Tourist' Flight," *CBSNews*, September 8, 2023, https://www.cbsnews.com/news/virgin-galactic-launches-third-suborbital-space-tourist-flight/; Will Gendron, "Virgin Galactic's First Space Tourism Flight Took off This Week. Here Are the Players Taking Civilians to Space," *Business Insider*, August 12, 2023, https://www.businessinsider.com/virgin-galactic-blue-origin-spacex-commercial-space-flights-tourism-cost-2023-7.

[11] Between January 2021 and June 2024, 27 FAA-licensed or -permitted commercial human spaceflights occurred. From 2004 through 2020, 15 such spaceflights occurred. FAA, "Commercial Space Data," August 31, 2023, https://www.faa.gov/data_research/commercial_space_data.

[12] The FAA considers a spaceflight participant "[a]n individual, who is not crew, carried aboard a launch vehicle or reentry vehicle." FAA, *Human Space Flight*, February 1, 2024, https://www.faa.gov/space/human_spaceflight.

[13] National Transportation Safety Board (NTSB), *In-Flight Breakup During Test Flight, Scaled Composites SpaceShipTwo, N339SS, Near Koehn Dry Lake, California, October 31, 2014*, NTSB/AAR-15/02, 2015, p. 1, https://www.ntsb.gov/investigations/AccidentReports/Reports/AAR1502.pdf.

[14] FAA, "U.S. Human Space Flight Safety Record (As of 20 May 2024)," *FAA*, May 20, 2024, https://www.faa.gov/media/77636.

[15] Ibid. The FAA lists SpaceShipTwo as having conducted 19 spaceflights, while the agency's "Commercial Space Data" dashboard only lists 18 licensed- or permitted- SpaceShipTwo launches.

[16] The NTSB uses the definition of "aircraft accident" provided by 49 C.F.R. §830.2, which is substantively similar to the definition the FAA uses to define "catastrophic failures" for commercial human spaceflight. The FAA uses the definition of "catastrophic failures" found in 14 C.F.R. §460.45(c).

[17] NTSB, "Aviation Accident Rates, 2003-2022," spreadsheet, 2023, https://www.ntsb.gov/safety/StatisticalReviews/Documents/AviationAccidentStatistics_2003-2022_20231228.xlsx.

0.37%. This threshold is for a probabilistic risk assessment of the proposed spacecraft designs, as there is not yet sufficient flight experience to determine a number based on actual accidents.[18]

A 2023 RAND Corporation report, *Assessing the Readiness for Human Commercial Spaceflight Safety Regulations: Charting a Trajectory from Revolutionary to Routine Travel*, conducted in response to congressional direction to the Secretary of Transportation, noted that the commercial human spaceflight industry has a strong incentive to ensure that missions are safe and that no accidents occur.[19] Accidents—particularly those that are high profile—could discourage potential customers, negatively impacting the economic prospects of either single companies or even the industry more broadly. In addition, the RAND report posited that Congress or regulating agencies might be motivated to impose additional oversight or regulation in response to an accident.[20]

The RAND report noted several factors that may negatively impact the safety of the industry.[21] Some companies—particularly new entrants to the industry—may not have sufficient knowledge of and expertise in various safety measures. Implementation costs could also discourage companies from adopting some safety measures or processes. Companies may also be reluctant to share lessons learned or mishap data, as they may fear sharing proprietary data may hurt their competitiveness. The report noted that this concern may, in turn, inhibit the creation of voluntary industry standards or voluntary safety reporting systems, both of which could improve safety.

Current and Proposed Federal Role in Commercial Human Spaceflight Safety

This section discusses the FAA's regulatory oversight of commercial human spaceflight during launch and reentry by U.S. citizens or launching from areas within U.S. jurisdiction, including the learning period; the FAA's proposal for future regulatory action for commercial spaceflight safety for launch and reentry; and stakeholder positions on the federal role in commercial human spaceflight safety.

Existing Regulatory Authorities

The Commercial Space Launch Act (P.L. 98-575) gave the DOT the authority to regulate the launch and reentry of commercial spacecraft, as codified in 51 U.S.C. Chapter 509. The Commercial Space Launch Amendments Act of 2004 (P.L. 108-492) extended the scope of DOT's regulatory authority to address the health and safety of humans onboard launch and reentry vehicles.[22] These authorities are implemented by the FAA Office of Commercial Space

[18] U.S. Government Accountability Office (GAO), *NASA Commercial Crew Program: Plan Needed to Ensure Uninterrupted Access to the International Space Station*, GAO-18-476, July 2018, pp. 22-24, https://www.gao.gov/assets/gao-18-476.pdf; NASA Office of the Inspector General, *NASA's Management of Crew Transportation to the International Space Station*, IG-20-005-, November 14, 2019, p. 14, https://oig.nasa.gov/docs/IG-20-005.pdf.

[19] Doug C. Ligor, Benjamin M. Miller, Maria McCollester, et al., *Assessing the Readiness for Commercial Human Spaceflight Safety Regulations: Charting a Trajectory from Revolutionary to Routine Travel*, RAND Corporation, October 2023, p. 34, https://www.rand.org/pubs/research_reports/RRA2466-1.html. Hereinafter RAND 2023.

[20] Ibid.

[21] Ibid., p. 36.

[22] See various subsections in 51 U.S.C. §§50903-50905. The Commercial Space Launch Amendments Act of 2004 (P.L. 108-492; 51 U.S.C. §50902) defines three types of human occupants on commercial spaceflight missions: government astronauts, crew, and spaceflight participants. Per §50902, government astronaut is a designation either assigned by NASA under 51 U.S.C. §20113(n) or referring to an employee of the U.S. government or its international (continued...)

Transportation (AST), which oversees a licensing process for commercial space launch and reentry.[23] Its regulatory focus is public health and safety.[24] It does not have the authority to regulate mission assurance (i.e., the design or operations of vehicles), as the FAA does for the commercial aviation industry.[25]

The Commercial Space Launch Amendments Act of 2004 directed the FAA to implement an "informed consent" regime and medical and training requirements for commercial human spaceflight, as well as to develop and implement regulations on liability insurance and financial responsibility (referred to as *indemnification*). The Commercial Space Launch Amendments Act of 2004 also created the learning period, during which the FAA cannot propose regulations specific to the safety of humans on spacecraft. [26]

Informed Consent and Other Existing Requirements

The Commercial Space Launch Amendments Act of 2004 directed the FAA to develop and implement informed consent requirements for commercial human spaceflight companies. The companies must inform spaceflight participants in writing of the safety records of their intended launch vehicle and of the risks of launch and reentry more broadly.[27] Both crew and spaceflight participants must be informed that the U.S. government has not certified their intended launch vehicle.[28] These requirements are often referred to as the *informed consent regime*.[29]

Spaceflight participants were also included in the existing regime for liability and indemnification by the Commercial Space Launch Amendments Act of 2004. The FAA must require licensees to sign reciprocal waivers of claims with their spaceflight participants, its contractors, and the U.S. government.[30] These waivers ensure that each party releases claims against the others and assumes financial responsibility for any property damage or bodily injury. The FAA established the regulations for these requirements in 14 C.F.R. Part 440. The current indemnification regime for spaceflight participants is set to expire on September 30, 2025.[31]

The Commercial Space Launch Amendments Act of 2004 also directed the FAA to establish basic medical and training requirements for spaceflight participants and crew.[32] Among these

partners. Crew is defined as an employee of a launch provider that is involved in operating a launch or reentry vehicle. The term spaceflight participant refers to an individual being transported on a human spaceflight mission who is neither crew nor a government astronaut.

[23] 51 U.S.C. §50904(d).

[24] George C. Nield, John Sloan, and David Gerlach, "Recommended Practices for Commercial Human Space Flight," International Astronautical Congress, Toronto, Canada, 2014, p. 2, https://www.faa.gov/sites/faa.gov/files/space/additional_information/international_affairs/recommended_practices_human_space_flight_iac_toronto_nield_october_2014_508.pdf.

[25] Ibid, p. 2.

[26] 51 U.S.C. §50905(c).

[27] 51 U.S.C. §50905(b)(4); 14 C.F.R. §460.45.

[28] 51 U.S.C. §50905(b)(4); 14 C.F.R. §§460.9 and 460.45.

[29] FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, September 29, 2023, p. 11, https://www.faa.gov/sites/faa.gov/files/2023_10_06%20PL_114-90_Sec_111_7_Commercial_Human_Spaceflight_Activities.pdf. Hereinafter, FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for a New Safety Framework*.

[30] 51 U.S.C. §50914.

[31] 51 U.S.C. §50914.

[32] P.L. 108-492, Sec. 2(c)(13); 51 U.S.C. §50905(b); 14 C.F.R. Part 460.

requirements, human spaceflight companies must give their pilots vehicle and mission-specific training and train spaceflight participants on how to respond to emergency situations.

Per 51 U.S.C. §50905(c)(10), the FAA may implement these and other regulations and requirements in support of its mission to protect the public. For instance, the FAA has imposed regulations and requirements for spacecraft crew, as the crew is considered by the agency to be part of the flight safety system. The FAA has requirements for crew qualifications, medical screening, life support, and similar basic safety elements (14 C.F.R. §460) and has implemented basic security requirements for spaceflight participants to protect the crew and public (14 C.F.R. §460.53).

The Learning Period

The Commercial Space Launch Amendments Act of 2004 set a period of eight years in which the FAA cannot propose regulations specifically addressing the safety of persons on commercial space vehicles—aside from the informed consent, liability and indemnification, medical, and training requirements—codified at 51 U.S.C. §50905(c). The learning period provides commercial companies with the opportunity to mature their capabilities without regulatory oversight, which could be potentially burdensome to the development of this market. The length of the learning period has been extended multiple times since it was first set to expire on October 1, 2012.[33] Most recently, the learning period was extended to January 1, 2025, by the FAA Reauthorization Act of 2024 (P.L. 118-63, Section 1111).

During the learning period, the FAA may only issue human occupant safety regulations in response to a serious or fatal injury to an in-flight event or events with a high risk of such casualties.[34] Should such an incident occur, the FAA may develop and implement regulations in response, but the agency is not obligated to do so. For instance, the FAA did not issue new regulations after the only event that met these criteria—the 2014 SpaceShipTwo accident, in which a Virgin Galactic suborbital spacecraft crashed.[35] Notably, the National Transportation Safety Board (NTSB)—which was the lead investigator of that accident—did not recommend additional regulations in its report.[36]

The Commercial Space Launch Competitiveness Act (CSLCA) of 2015 (P.L. 114-90) required the FAA to produce several reports to inform a transition from the learning period to a safety framework that may include safety regulations.[37] The CSLCA directed the FAA to consult and coordinate with the Commercial Space Transportation Advisory Committee (COMSTAC)[38] to develop these reports for the Senate Committee on Commerce, Science, and Transportation and the House Committee on Science, Space, and Technology. The required reports were to address

[33] Prior to the most recent extension in P.L. 118-41, the learning period had been extended to October 1, 2015, by the FAA Modernization and Reform of 2012 (P.L. 112-95); to October 1, 2023, by the Commercial Space Launch Competitiveness Act (CSLCA) of 2015 (P.L. 114-90); to January 1, 2024, by the Continuing Appropriations and Other Extensions Act, 2024 (P.L. 118-22); to March 9, 2024, by the Airport and Airway Extension Act of 2023, Part II (P.L. 118-34); and to May 11, 2024, by the Airport and Airway Extension Act of 2024 (P.L. 118-41).

[34] 51 U.S.C. §50905(c)(2).

[35] RAND 2023, pp. 3-4.

[36] NTSB, *In-Flight Breakup During Test Flight, Scaled Composites SpaceShipTwo, N339SS, Near Koehn Dry Lake, California, October 31, 2014*, NTSB/AAR-15/02, 2015, pp. 70-71, https://www.ntsb.gov/investigations/AccidentReports/Reports/AAR1502.pdf.

[37] P.L. 114-90, Sec. 111; 51 U.S.C. §50905.

[38] For more information on COMSTAC, see FAA, "Commercial Space Transportation Advisory Committee (COMSTAC)," https://www.faa.gov/space/additional_information/comstac.

- the commercial space transportation industry's progress in developing voluntary consensus standards and best practices, by December 2016 and every 30 months thereafter;[39]
- key industry metrics that could be used to indicate the industry's readiness to transition to a safety framework that may include regulations, by August 2016;[40] and
- the activities most appropriate for a new safety framework, which could include regulatory action and a possible transition plan, by March 2018 with an update by March 2022.[41]

Similarly, the CSLCA required the FAA to contract for an independent report, due by December 2022, assessing the readiness of the federal government and commercial industry to transition to a safety framework that may include regulations.[42] To produce this report, the FAA contracted with the RAND Corporation, which published the congressionally mandated independent assessment in April 2023.[43]

The FAA has delivered several reports addressing these requirements. A list of these reports can be found in **Appendix B**.

In 2023, in preparation for the learning period's potential end, the FAA detailed its proposed approach for a safety framework inclusive of regulations. The proposed approach is described in the following section.

FAA's Proposed Approach to Commercial Human Spaceflight Safety

The CSLCA required the FAA to submit a proposed transition plan before the expiration of the learning period; the agency delivered the report to Congress, titled *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, in September 2023.[44]

The FAA outlined a phased approach to develop a safety framework that includes regulation. The FAA intends to develop regulations "only to the extent necessary" and as one element of a broader safety framework.[45] Elements of such a safety framework may also include industry consensus standards, best practices, inspections, compliance monitoring, safety management

[39] 51 U.S.C. §50905(c)(5); FAA, *Final Report on Voluntary Industry Consensus Standards Development*, December 20, 2022, https://www.faa.gov/sites/faa.gov/files/PL_114-90_Sec111-5-Voluntary_Industry_Consensus_Standards.pdf.

[40] 51 U.S.C. §50905(c)(6); FAA, *FAA Evaluation of Commercial Human Space Flight Safety Frameworks and Key Industry Indicators*, 2017, https://www.faa.gov/sites/faa.gov/files/2021-11/CSLCA_Sec111_Report_to_Congress.pdf. Hereinafter, FAA, *FAA Evaluation of Commercial Human Space Flight Safety Frameworks and Key Industry Indicators.*

[41] 51 U.S.C. §50905(c)(7); FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework.*

[42] 51 U.S.C. §50905(c)(8).

[43] RAND 2023.

[44] FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework.*

[45] Ibid., p. 3.

systems, and accident investigations.[46] Using an incremental approach over five years, the FAA hopes to create a safety framework that can evolve as industry develops.[47]

As the first step, the FAA updated its *Recommended Practices for Human Space Flight Occupant Safety*, which is a nonbinding set of practices developed by the FAA to aid human spaceflight companies.[48] The FAA intends the updated document to be used by standards development organizations as the basis for human spaceflight standards.[49]

In 2023, the FAA indicated that it planned to increase its efforts to solicit industry input to potential regulations. In April 2023, the FAA chartered the Human Space Flight Occupant Safety (HSFOS) Aerospace Rulemaking Committee (SpARC), an advisory group formed of industry representatives and subject matter experts.[50] The FAA has directed the HSFOS SpARC to submit its recommendations within 18 months of its establishment. After receiving the SpARC recommendations, the FAA intends to draft a notice of proposed rulemaking (NPRM) to solicit public comment.[51] The FAA plans to develop a phased transition plan using the HSFOS SpARC recommendations, as well as drawing on case studies from other transportation modes.[52] The agency projects that it will take approximately five years to publish a final rule from the start of the SpARC, with an effective date to be set sometime after publication.[53] The FAA is directed in statute to "take into consideration the evolving standards" of the commercial human spaceflight industry.[54] The agency plans to create performance-based regulations.[55] According to the FAA,

> Performance-based regulatory regimes can be positive guardrails allowing innovation and development within established bounds for safety. These requirements also allow voluntary consensus standards to be developed to provide a means of compliance and can be the basis for updating or establishing new performance requirements for the industry to increase the safety of participants.[56]

[46] Josef S. Koller, Samira Patel, Angie Buckley, et al., *Commercial Human Spaceflight Safety Regulatory Framework*, Aerospace Corporation, Aerospace Report No. ATR-2002-02101, September 28, 2022, p. 1, https://aerospace.org/sites/default/files/2023-03/ATR-2022-02101.pdf.

[47] FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, p. 11.

[48] FAA, *Recommended Practices for Human Space Flight Occupant Safety: Version 2.0*, September 2023, https://www.faa.gov/media/71481.

[49] FAA, U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework, p. 11. For information on the standards development organizations involved in commercial human spaceflight, see FAA, Final Report on Voluntary Industry Consensus Standards Development, December 20, 2022, https://www.faa.gov/sites/faa.gov/files/PL_114-90_Sec111-5-Voluntary_Industry_Consensus_Standards.pdf.

[50] FAA, "Human Space Flight Occupant Safety Aerospace Rulemaking Committee Charter," FAA, April 21, 2023, https://www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/document/information/documentID/5883.

[51] FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, pp. 11-12.

[52] Ibid., p. 12.

[53] Ibid., p. 12.

[54] 51 U.S.C. §50905(c)(9).

[55] Performance-based regulations focus on performance and desired outcomes, giving companies flexibility in how to meet the mandated standard. Conversely, prescriptive regulations specify the processes, design, or technology standards that companies must use.

[56] FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, p. 11.

Should the FAA promulgate safety regulations, the FAA must use a structured process that would provide opportunities for public comment and possibly benefit-cost analysis on the potential impact of proposed regulations. This rulemaking would be subject to the Administrative Procedure Act (APA) (P.L. 79-404, as amended). The APA sets forth a structured process by which regulations can be promulgated, with opportunities for public comment. Depending on the economic effects of the regulations, the FAA could also be required to conduct a benefit-cost analysis of any proposed regulation of human spaceflight, per Executive Order 12866 and consistent with guidance provided in Office of Management and Budget (OMB) Circular A-4.[57]

Regulating Commercial Human Spaceflight Safety

The possible end of the learning period and the FAA's 2023 proposal have spurred discussions between government and industry about whether the learning period should be extended and the status of the development of industry standards.

Many government officials, commercial stakeholders, industry group representatives, and standards development organizations agree that commercial human spaceflight regulations are "inevitable."[58] Disagreement generally stems from differing views on when such regulations would be appropriate and how to assess when that point is reached.

This section briefly summarizes the major approaches to how to assess whether the industry is ready for the end of the learning period; perspectives on whether the learning period should be extended; and progress on and challenges to developing industry standards.

Assessments of Government and Industry Readiness for Commercial Human Spaceflight Safety Regulation

While statute does not define or describe regulatory readiness in the context of commercial human spaceflight, statute (as codified at 51 U.S.C. §50905(c)(6)) directed the Secretary of Transportation to deliver to Congress "a report specifying key industry metrics that might indicate readiness of the commercial space sector and the Department of Transportation to transition to a safety framework that may include regulations." Additionally, Congress directed the Secretary of Transportation to contract with "an independent systems engineering and technical assistance organization or standards development organization" to report on "the readiness of the commercial space industry and the Federal Government to transition to a safety framework that may include regulations," using the key industry metrics for readiness submitted by the Secretary of Transportation.[59]

Pursuant to 51 U.S.C. §50905(c), in its 2017 report to Congress, *FAA Evaluation of Commercial Human Space Flight Safety Frameworks and Key Industry Indicators*, the FAA developed three sets of readiness areas and associated indicators to assess whether industry and government are prepared to transition to a new safety framework.[60]

[57] Office of Management and Budget, "OMB Circular A-4" (Washington, DC): Executive Office of the President, Office of Management and Budget, November 9, 2023, pp. 27-41, https://www.whitehouse.gov/wp-content/uploads/2023/11/CircularA-4.pdf; Executive Order 12866, "Regulatory Planning and Review," 58 *Federal Register* 190, October 4, 1993, https://www.archives.gov/files/federal-register/executive-orders/pdf/12866.pdf.

[58] RAND 2023, p. 48.

[59] 51 U.S.C. §50905(c)(8).

[60] FAA, *FAA Evaluation of Commercial Human Space Flight Safety Frameworks and Key Industry Indicators*, 2017.

- For *industry readiness*, the readiness areas are the purpose of people flying into space, the size and complexity of the industry, and the safety of the industry.[61]
- For *industry's progress in developing a safety framework*, the readiness areas are a voluntary safety reporting system, voluntary consensus standards, and compliance.[62]
- For *the Department of Transportation's readiness*, the readiness areas are the DOT and FAA's authority to transition to a safety framework and their expertise in human spaceflight safety.[63]

The FAA notes that, rather than being pass/fail criteria, the readiness indicators were designed to provide "maximum flexibility for Congress in assessing readiness to transition to a safety framework that may include regulations."[64] Each of these areas has specific readiness indicators, which are described in **Appendix A**.

In its 2017 report, the FAA noted that "proactive" industry participation in a safety framework (e.g., through the development of consensus standards, systems for data sharing) may "influence the timing and extent of government regulatory involvement, and successful implementation of an industry-led framework could minimize the need for government involvement."[65]

Some groups are skeptical of the FAA's readiness indicators. RAND, in its 2023 report on assessing the readiness for regulation of the human commercial spaceflight industry, noted that the FAA's indicators do not allow for "an appropriate and scientifically valid assessment" of progress, as the metrics are not sufficiently defined or specific.[66] How data would be collected is also undefined, and RAND notes that the FAA did not provide targets to signify readiness.[67]

COMSTAC, in response to a draft version of the FAA's 2023 report to Congress, expressed skepticism of the FAA's assessment that industry and the agency were ready for the transition to regulation and requested clarification on how FAA used its metrics in order to verify the agency's conclusions.[68] Although it did not address each individual indicator, COMSTAC did specifically note that industry continued to work towards consensus standards, that missions are still infrequent, and that there are few operational providers.[69] It stated that regulatory readiness will not be reached until commercial human spaceflight missions are "routine and the flight rates substantial, which could take decades."[70]

More broadly, some industry stakeholders maintain that regulation will be appropriate when the industry is more mature, has a base of shared safety knowledge, and has made more progress

[61] Ibid., pp. 16-18.

[62] Ibid., pp. 19-21.

[63] Ibid., pp. 22-24.

[64] FAA, *FAA Evaluation of Commercial Human Space Flight Safety Frameworks and Key Industry Indicators*, 2017, p. 2.

[65] Ibid., p. 3.

[66] RAND 2023, p. 25.

[67] Ibid.

[68] COMSTAC Human Space Flight Working Group, *Report to Congress: U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework,* July 11, 2023, p. 2, https://www.faa.gov/media/68011. Hereinafter, COMSTAC Human Space Flight Working Group, *Report to Congress: U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework.*

[69] Ibid., p. 2.

[70] Ibid., p. 2.

towards voluntary consensus standards.[71] Some industry stakeholders maintain that as the industry matures, it will develop a shared base of safety knowledge, which will in turn enable industry to develop, reach consensus on, and individually adopt voluntary consensus standards.[72] While developing shared safety expertise may be aided by a larger number of providers with frequent missions, the diversity of industry vehicle designs and operating conditions may be a limiting factor.[73]

Discussions on the Possible End of the Learning Period

The FAA maintains that both the agency and industry are ready to transition to a new safety framework that will eventually include regulations and that the learning period does not need to be extended. The FAA in its 2023 report stated that "The human space flight industry is moving at the pace of innovation, and the FAA believes that as the leader in transportation safety, the United States is ready for the sunset of the moratorium."

The FAA report states that, given the recent growth of the commercial human spaceflight industry, the expiration of the learning period would allow for the implementation of a new safety framework.[74] RAND, in its 2023 report, recommends that the learning period be allowed to expire and that Congress take steps "to concurrently resource the FAA appropriately to engage in additional actions and activities to meet its statutory responsibilities."[75]

The FAA anticipates that a final rule could be published approximately five years after "the start of a SpARC," if the learning period is not extended.[76] The HSFOS SpARC was chartered in April 2023. Both RAND and the FAA note that industry standards may be developed concurrently with regulations. Doing so, they note, may allow for industry standards to inform regulations, while also giving direction and motivation for the development of industry standards.[77] The FAA argues that regulations provide performance requirements that establish boundaries and direction for standards development, that the "development of robust voluntary consensus standards is ... not as advanced as expected," and that the lack of regulations to date may have contributed to the "less-than robust number of published standards."[78] The RAND 2023 report did not "find that the

[71] Michael Lopez-Alegria, "The Future of Human Spaceflight Safety Is in the Hands of Congress," *SpaceNews*, September 8, 2023, https://spacenews.com/the-future-of-human-spaceflight-safety-is-in-the-hands-of-congress/. Testimony of William H. Gerstenmaier, in U.S. Congress, Senate Committee on Commerce, Science, and Transportation, Subcommittee on Space and Science, *Promoting Safety, Innovation, and Competitiveness in U.S. Commercial Human Space Activities*, hearings, 118th Cong., 1st sess., October 18, 2023, p. 11, https://www.commerce.senate.gov/services/files/ADC08FC1-E28D-4178-8D39-16E02BB803CE. Hereinafter, Testimony of William H. Gerstenmaier.

[72] Testimony of Sirisha Bandla, in U.S. Congress, Senate Committee on Commerce, Science, and Transportation, Subcommittee on Space and Science, *Promoting Safety, Innovation, and Competitiveness in U.S. Commercial Human Space Activities*, hearings, 118th Cong., 1st sess., October 18, 2023, p. 5, https://www.commerce.senate.gov/services/files/07881B07-FCFF-4B7C-8857-432BF66216C6.

[73] Testimony of William H. Gerstenmaier, p. 11.

[74] FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, p. 3.

[75] RAND 2023, p. 74.

[76] FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, p. 12.

[77] Ibid, p. 7; RAND 2023, p. 61.

[78] Ibid, p. 7.

moratorium has supported, per se, the development of voluntary consensus standards, key metrics, or regulation readiness."[79]

The commercial human spaceflight operators serving on COMSTAC, which includes all such companies operating in the United States, "unanimously agree that the learning period is crucial to supporting a robust and safe" human spaceflight industry.[80] A senior SpaceX executive argued that ending the learning period and implementing "premature occupant safety regulations" could "risk freezing the industry at an early stage, slowing or inhibiting the development of technologies that would materially improve safety."[81] According to RAND's 2023 report, some commercial operators are concerned that regulations may compel them to divulge sensitive and proprietary information, which they view as hindering their competitiveness. RAND, however, found no quantifiable evidence to support these concerns.[82]

Some industry representatives have expressed concern that the FAA may not have sufficient resources to develop human spaceflight safety regulations should the learning period end.[83] A senior SpaceX official has claimed that the agency is "overwhelmed in executing its core launch and reentry mission" and that diverting resources would cause further delays and "would not improve safety."[84]

Developing Industry Standards

The FAA must consider industry standards when developing regulations. Following the expiration of the learning period, the FAA has a statutory mandate (51 U.S.C. §50905(c)(9)) to "take into consideration the evolving standards of the commercial space flight industry" when proposing regulations, specifically those identified in the three reports mandated by the Commercial Space Launch Competitiveness Act (CSLCA) of 2015 (P.L. 114-90). Additionally, 51 U.S.C. §50901(a)(15) stipulates that "regulatory standards governing human space flight must evolve as the industry matures so that regulations neither stifle technology development nor expose crew, government astronauts, or space flight participants to avoidable risks." More broadly, federal agencies are directed by statute and executive branch policy to use voluntary consensus standards in their regulatory and procurement activities, when feasible, by the National Technology Transfer and Advancement Act of 1995 (P.L. 104-113) and Office of Management and Budget (OMB) Circular A-119, respectively.[85]

RAND noted that individual commercial human spaceflight companies' compliance with standards is "not quantified or well characterized."[86] COMSTAC has described the commercial human spaceflight industry's use of published safety standards as "minimal," but urged the FAA

[79] RAND 2023, p. 74.

[80] COMSTAC Human Space Flight Working Group, *Report to Congress: U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, pp. 1-3.

[81] Testimony of William H. Gerstenmaier, p. 11.

[82] RAND 2023, p. 50.

[83] Testimony of William H. Gerstenmaier, p. 12; COMSTAC Human Space Flight Working Group, *Report to Congress: U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, p. 3; testimony of Sirisha Bandla, in U.S. Congress, Senate Committee on Commerce, Science, and Transportation, Subcommittee on Space and Science, *Promoting Safety, Innovation, and Competitiveness in U.S. Commercial Human Space Activities*, hearings, 118th Cong., 1st sess., October 18, 2023, p. 4, https://www.commerce.senate.gov/services/files/07881B07-FCFF-4B7C-8857-432BF66216C6.

[84] Testimony of William H. Gerstenmaier, p. 10.

[85] P.L. 104-113; Office of Management and Budget, *Circular No. A-119 Revised*, Executive Office of the President, February 10, 1998, https://www.whitehouse.gov/wp-content/uploads/2017/11/Circular-119-1.pdf.

[86] RAND 2023, p. 39.

to conduct an assessment of industry compliance once a set of "high-priority" standards are developed.[87]

COMSTAC recommended that the FAA "consider incentives for operators to participate in industry voluntary standards [development] and ensure that the agency devotes sufficient resources to enable such activities."[88] COMSTAC did not specify in its recommendation what form that the proposed incentives should take.

Data Protections

The FAA and RAND have identified the potential reluctance among private-sector companies to share data due to proprietary concerns as a barrier to the development of voluntary consensus standards and sharing safety data.[89] Unlike for voluntarily provided aviation industry safety data, there are currently no statutory data protection safeguards specific to the commercial space industry safety information shared with the U.S. government.[90] Aside from industry-specific provisions, information constituting trade secrets or commercial information shared with the U.S. government may be withheld from public disclosure under certain Freedom of Information Act exemptions.[91] The 2023 RAND report recommended that "the FAA and industry explore a means to identify, collect, report, and analyze these data in a manner that prevents public release of sensitive or otherwise proprietary data and information," while recognizing the potential role for legislation and FAA rulemaking to enable this.[92]

Considerations for Congress

Per statute, the learning period for the commercial human spaceflight industry is set to expire on January 1, 2025. Congress may wish to consider whether to extend the learning period for a fixed period of time or indefinitely or whether to let it expire and have the FAA commence the process of developing regulations. Some Members of Congress have also raised concerns over the FAA's dual mandate to promote the commercial space industry and protect the general public and its potential impact on commercial human spaceflight. Congress may also consider whether to address overlaps and gaps in federal agency oversight of commercial space activities.

Extension or Expiration of the Learning Period

Congress may consider whether to extend the learning period again, for a fixed amount of time or indefinitely, or to allow the learning period to lapse. The FAA and some other stakeholders have suggested that, given the growth of the commercial human spaceflight industry, the learning

[87] COMSTAC Safety Working Group, "COMSTAC Safety WG Report—DRAFT," *FAA.gov*, September 14, 2020, p. 2, https://www.faa.gov/sites/faa.gov/files/space/additional_information/comstac/presentations/COMSTAC_Safety_WG_white_paper_14_Sept_2020.pdf; COMSTAC Safety Working Group, "COMSTAC Safety Working Group Report, May 2023," FAA, May 2023, https://www.faa.gov/media/31151.

[88] COMSTAC Human Space Flight Working Group, *Report to Congress: U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, p. 3.

[89] FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, p. 7; RAND 2023, p. 19.

[90] 49 U.S.C. §40123 (for the protections of voluntarily provided aviation industry safety data); FAA, *U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, p. 7.

[91] For more information, see CRS Report R46238, *The Freedom of Information Act (FOIA): A Legal Overview*, by Daniel J. Sheffner.

[92] RAND 2023, p. 76.

period should be allowed to lapse and the FAA should begin the process of developing regulations.

Conversely, Congress may determine that the industry is not yet ready for regulation specific to the safety of human occupants and that the learning period should be extended for a set duration. For example, the Space Transformation and Reliability Act (H.R. 5617), as introduced during the 118th Congress, would extend the learning period until October 1, 2031, and the Commercial Standards Paramount to Accelerating Cosmic Exploration (SPACE) Leadership Act (S. 4064), as introduced during the 118th Congress, would extend the learning period for five years from date of enactment. Another option could be to extend the learning period indefinitely, relying on the informed consent regime to inform potential customers of risks.

Regulation and Industry Standards

Congress may consider whether to provide specific direction to the FAA or industry on the development of industry standards, the creation of potential regulations, or other matters relating to commercial human spaceflight safety. For instance, Congress could direct the FAA to evaluate or develop potential mechanisms to incentivize industry participation in standards development. Another option could be to require additional input from the FAA and industry. For example, the Commercial Space Act of 2023 (H.R. 6131), as ordered to be reported out of the House Committee on Science, Space, and Technology, would direct the FAA to continue providing updates to relevant congressional committees on the status of voluntary industry consensus standards until 2031.[93]

Congress may also consider potential data protection safeguards for the commercial spaceflight industry. Such an approach could include directing the FAA to develop a method of collecting and handling sensitive data to facilitate collaboration across industry or implementing statutory data protections for voluntarily submitted information through legislation, similar to those of the aviation industry (49 U.S.C. §40123). Addressing potential concerns over the protection of proprietary or sensitive data could help facilitate industry's development of voluntary consensus standards.

The FAA's Dual Mandate

The FAA's statutory mission is with respect to commercial spaceflight is both to "encourage, facilitate, and promote" commercial space launch and reentry, as well as to regulate those activities to protect the general public.[94] As the commercial space industry grows, Congress and other stakeholders have discussed the appropriateness of this dual role. The potential impact on commercial human spaceflight, in particular, has driven many of these discussions, due to concerns for the safety of humans onboard.[95]

[93] H.R. 6131 was order to be reported, but has not been reported. While the official reported text of H.R. 6131 is not yet available, the amendments adopted during the markup did not appear to change the introduced bill provisions related the FAA's updates on the status of voluntary industry consensus standards. (House Committee on Science, Space, and Technology, "Full Committee Markup of H.R. 6213 & H.R. 6131," November 29, 2023, https://science.house.gov/2023/11/markup-h-r-6213-h-r-6131.)

[94] 51 U.S.C. §§50901, 50903.

[95] Prepared Testimony of GAO Director of Physical Infrastructure Heather Krause, in U.S. Congress, House Committee on Transportation and Infrastructure, Subcommittee on Aviation, *Stars and Stripes Forever—An Examination of the FAA's Role in the Future of Spaceflight*, hearings, 117th, 1st sess., June 16, 2021, p. 14, https://www.gao.gov/assets/gao-21-105268.pdf.

Representative Babin of Texas stated in a June 2021 hearing of the House Committee on Transportation and Infrastructure, Subcommittee on Aviation on the role of the FAA in spaceflight that the dual mandate creates "a tension that results in a balanced and measured relationship between the public and private sector."[96] In the same hearing, FAA Associate Administrator Wayne Monteith stated that safety is the foundation of the dual mandate, and that it allows for "the right regulations or the right scope at the right time to ensure safety, while also allowing these companies to innovate and grow and continue to lead on the global stage."[97]

At the June 2021 hearing, Government Accountability Office (GAO) Director of Physical Infrastructure Heather Krause noted that the dual role "could give rise to a potential conflict of interest" and could hinder the FAA's ability to regulate the industry. Krause also pointed to the DOT's 2008 statutorily required assessment of the dual mandate, the last formal review to date, which recommended that the DOT "periodically review its dual role specifically for safety and promotion of human space flight."[98]

At the same 2021 hearing, Representative DeFazio—who was, at the time, chair of the House Committee on Transportation and Infrastructure—drew a comparison to commercial aviation, pointing to Congress's decision to remove the FAA's similar dual mandate for aviation in the Federal Aviation Reauthorization Act of 1996 (P.L. 104-264, Sec. 401) after a high-profile aviation accident.[99] Similarly, a 2006 GAO report on commercial space launch described this decision as "evidence of the importance of maintaining FAA's focus on safety oversight" and as a cautionary tale for commercial spaceflight.[100]

In light of these contrasting perspectives, options for Congress could include evaluating the FAA's dual mandate, through congressional oversight or by directing the FAA or another organization to conduct a review; amending the statute codified at 51 U.S.C. §50903 to redefine the FAA's statutory mission; or allowing the dual mandate to remain unaltered.

Potential Overlap and Gaps in Existing Regulatory Authorities

Multiple federal agencies have jurisdiction over aspects of commercial space operations.[101] The FAA has authority for commercial launch and reentry, including for spacecraft carrying humans.[102] The Federal Communications Commission (FCC) regulates satellite

[96] Representative Brian Babin of Texas, in U.S. Congress, House Committee on Transportation and Infrastructure, Subcommittee on Aviation, *Stars and Stripes Forever—An Examination of the FAA's Role in the Future of Spaceflight*, hearings, 117th, 1st sess., June 16, 2021, p. 73, https://www.congress.gov/117/chrg/CHRG-117hhrg46249/CHRG-117hhrg46249.pdf.

[97] Testimony of FAA Associate Administrator Wayne Monteith, in U.S. Congress, House Committee on Transportation and Infrastructure, Subcommittee on Aviation, *Stars and Stripes Forever—An Examination of the FAA's Role in the Future of Spaceflight*, hearings, 117th, 1st sess., June 16, 2021, pp. 30-31, 39-40, https://www.congress.gov/117/chrg/CHRG-117hhrg46249/CHRG-117hhrg46249.pdf.

[98] Ibid., p. 14.

[99] Representative Peter DeFazio of Oregon, in U.S. Congress, House Committee on Transportation and Infrastructure, Subcommittee on Aviation, *Stars and Stripes Forever—An Examination of the FAA's Role in the Future of Spaceflight*, hearings, 117th, 1st sess., June 16, 2021, p. 14, https://www.congress.gov/117/chrg/CHRG-117hhrg46249/CHRG-117hhrg46249.pdf.

[100] GAO, *Commercial Space Launches: FAA Needs Continued Planning and Monitoring to Oversee the Safety of the Emerging Space Tourism Industry*, GAO-07-16, October 2006, p. 31, https://www.gao.gov/assets/gao-07-16.pdf.

[101] For more information, see CRS Report R45416, *Commercial Space: Federal Regulation, Oversight, and Utilization*, by Daniel Morgan.

[102] P.L. 108-492; 51 U.S.C. Ch. 509.

communications.[103] The Department of Commerce, through the National Oceanic and Atmospheric Administration (NOAA), regulates private satellite remote sensing.[104] These authorities do not address all current or potential commercial space activities, particularly those on orbit or beyond Earth orbit, including human safety on commercial spacecraft. For example, the FAA's launch and reentry authorities do not extend to operations in space. Authorities that would cover activities in space are referred to interchangeably as "on-orbit authority" or "mission authorization."

Proposals for On-Orbit Human Safety on Commercial Spacecraft

Stakeholders have long discussed which federal agency should assume the responsibility of mission authorization, including for on-orbit human safety on commercial spacecraft. Some stakeholders propose granting broad mission authorization authority to either the FAA or the Office of Space Commerce within NOAA.[105] Others propose a framework that splits authorities, granting authority over commercial human activities in space to the FAA, while commercial missions without humans onboard would be overseen by another agency or agencies.[106]

In September 2022, Vice President Kamala Harris, chair of the National Space Council, directed the Council to develop a proposal for authorization and supervision of "commercial novel space activities." The National Space Council released its proposal on December 20, 2023.[107] Among other provisions, the Administration's legislative proposal would extend the FAA's authority for human spaceflight safety regulation to human activities in outer space, such as commercial space stations or operations on the Moon, rather than only launch and reentry as under current law.[108]

H.R. 6131 (Commercial Space Act of 2023) would assign mission authorization for all "space objects" to the Department of Commerce. This legislation does not include provisions specific to commercial human spaceflight, although orbital platforms with humans onboard would appear to fall into the category of "space objects" and, therefore, would appear to fall under the proposed purview of the Department of Commerce.

Congress may consider whether existing regulatory authorities are sufficient to address nascent commercial space activities, including commercial human spaceflight, and if it is determined that additional authorities are needed, could consider legislation to assign mission authorization authority, in whole or in part, to one or more federal agencies. Alternatively, Congress may judge that existing regulatory authorities are sufficient, given the nascence of commercial activity on orbit.

[103] 47 U.S.C. §§151-614.

[104] P.L. 102-555; 51 U.S.C. §§60101, et seq.

[105] Jeff Foust, "An extended mission for authorization," *The Space Review*, December 18, 2023, https://www.thespacereview.com/article/4712/1.

[106] Josef Koller and Carson Coursey, "Hazards Don't Stop at the Kármán Line," *SpaceNews*, December 26, 2022, https://spacenews.com/op-ed-hazards-dont-stop-at-the-karman-line/.

[107] The White House, "FACT SHEET: U.S. Novel Space Activities Authorization and Supervision Framework," December 20, 2023, https://www.whitehouse.gov/briefing-room/statements-releases/2023/12/20/fact-sheet-u-s-novel-space-activities-authorization-and-supervision-framework/.

[108] The White House, "Draft Bill Text, 'Authorization and Supervision of Novel Private Sector Space Activities Act,'" December 20, 2023, https://www.whitehouse.gov/wp-content/uploads/2023/11/Authorization-and-Supervision-of-Novel-Private-Sector-Space-Activities_Legislative-Text_final.pdf.

Appendix A. FAA's Readiness Sets, Areas, and Indicators

Table A-1. FAA's Readiness Sets, Areas, and Indicators

The Federal Aviation Administration (FAA) framework from 2017 to assess whether industry and the federal government are ready to transition to a new safety framework that may include regulation in response to 51 U.S.C. §50905(c)(6).

Readiness Indicator Set	Readiness Area	Readiness Indicator
Industry Readiness	Purpose of People Flying in Space	• The extent to which people are flying for adventure purposes; part of their occupation; or as a mode of transportation
	Size and Complexity of the Industry	• The number of suppliers of orbital or suborbital spaceflight, as well as of similar spaceflight types (e.g., vertical suborbital, horizontal suborbital, and balloon) • The extent to which there is a broad supplier network • The extent to which operations occur internationally
	Safety of the Industry	• The extent to which there is evidence of unsafe operations • The extent to which industry is having difficulty attracting new customers • The extent to which insurance companies are willing to insure human spaceflight operations
Industry's Progress in Developing a Safety Framework	Voluntary Safety Reporting	• The extent to which individual companies have an internal voluntary reporting system to identify and address potential precursors to accidents • The extent to which industry members share safety data with each other, with a common data format and taxonomy
	Voluntary Consensus Standards	• The extent to which industry has formed a consensus on top-level performance standards • The extent to which industry has developed and maintains voluntary consensus standards in high-priority areas • The extent to which industry has developed and maintains a robust set of voluntary consensus standards
	Compliance	• The extent to which individual companies self-verify compliance with voluntary consensus standards • The extent to which a third party verifies compliance with voluntary consensus standards
Department of Transportation Readiness	FAA Authority to Transition to a Safety Framework	• Status of the learning period

Readiness Indicator Set	Readiness Area	Readiness Indicator
(Particularly That of FAA)	FAA Expertise in Human Spaceflight Safety	• The extent to which the FAA has helped create elements of a space safety framework • The extent to which the FAA has engaged with industry regarding standards development • The extent to which the FAA has published safety practices related to commercial human spaceflight • The extent to which the FAA has experience participating in a space safety framework

Source: CRS using FAA, *FAA Evaluation of Commercial Human Space Flight Safety Frameworks and Key Industry Indicators*, 2017, pp. 17-24, https://www.faa.gov/sites/faa.gov/files/2021-11/CSLCA_Sec111_Report_to_Congress.pdf.

Appendix B. Reports Required by P.L. 114-90

Table B-1. Reports Required by P.L. 114-90

Human spaceflight reports submitted by the Federal Aviation Administration (FAA) to Congress in fulfillment of requirements from the Commercial Space Launch Competitiveness Act of 2015 (P.L. 114-90, Sec. 111), as codified in 51 U.S.C. §50905(c).

Report	Statutory Requirements Addressed in Report
FAA, U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework, September 29, 2023, https://www.faa.gov/sites/faa.gov/files/2023_10_06%20PL_114-90_Sec_111_7_Commercial_Human_Spaceflight_Activities.pdf.	• activities most appropriate for a new safety framework that could include regulatory action and a possible transition plan
Doug C. Ligor, Benjamin M. Miller, Maria McCollester, et al., Assessing the Readiness for Human Commercial Spaceflight Safety Regulations: Charting a Trajectory from Revolutionary to Routine Travel, RAND Corporation, RR-A2466-1, 2023, https://www.rand.org/pubs/research_reports/RRA2466-1.html.	• readiness of the federal government and commercial industry to transition to a safety framework that may include regulations
FAA, *Final Report on Voluntary Industry Consensus Standards Development*, December 20, 2022, https://www.faa.gov/sites/faa.gov/files/PL_114-90_Sec111-5-Voluntary_Industry_Consensus_Standards.pdf.	• industry's progress in developing voluntary consensus standards and best practices
FAA, *Report to Congress: Interim Report on Voluntary Industry Consensus Standards Development—January 2022*, January 14, 2022, https://www.faa.gov/sites/faa.gov/files/2022-04/PL_114-90_Sec_111_5_Voluntary_Industry_Consensus_Standards.pdf.	• industry's progress in developing voluntary consensus standards and best practices
FAA, U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for a New Safety Framework, February 26, 2019, https://www.faa.gov/sites/faa.gov/files/2021-11/New-Safety-Framework-for-Commercial-Human-Space-Flight-Completed-report.pdf.	• activities most appropriate for a new safety framework that could include regulatory action and a possible transition plan
FAA, *FAA Evaluation of Commercial Human Space Flight Safety Frameworks and Key Industry Indicators*, 2017, https://www.faa.gov/sites/faa.gov/files/2021-11/CSLCA_Sec111_Report_to_Congress.pdf.	• industry's progress in developing voluntary consensus standards and best practices • key industry metrics to indicate industry's readiness to transition to a safety framework that may include regulations • activities most appropriate for a new safety framework that could include regulatory action and a possible transition plan

Source: Collected by CRS from several sources, as noted.

Notes: The reports are listed in reverse chronological order.

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