



Testimony

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Committee on Transportation and
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COMMERCIAL SPACE TRANSPORTATION

FAA Continues to Update Regulations and Faces Challenges to Overseeing an Evolving Industry

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GAO@100 Highlights

Highlights of [GAO-21-105268](#), a testimony before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

Why GAO Did This Study

The commercial space transportation industry provides launch services for government and private customers that carry objects, such as satellites and vehicles with scientific research, or passengers to or from space. Continued growth and evolution in the industry is expected as reliance on space-based applications increases. Within FAA, the Office of Commercial Space Transportation (AST) is charged both with overseeing the industry, including licensing and monitoring launch vehicle operations, and promoting the industry.

This statement describes FAA's efforts to update regulations governing commercial space transportation; challenges FAA faces regulating an evolving industry; and steps FAA has taken to help ensure it is positioned to meet the needs of the evolving industry. This statement is based largely on GAO's body of work on commercial space transportation, including GAO-19-437 issued in May 2019. To update this information, GAO interviewed FAA officials and reviewed applicable statutes, regulations and selected industry documents.

What GAO Recommends

GAO made several recommendations in its prior reports, including that FAA improve AST's workforce planning and address weaknesses in FAA's methodologies for evaluating and calculating potential third-party losses from launch and reentry mishaps. Progress has been made in addressing some of these recommendations. Continued attention is needed to ensure that the remainder of these recommendations are fully addressed.

View [GAO-21-105268](#). For more information, contact Heather Krause at (202) 512-2834 or KrauseH@gao.gov.

June 16, 2021

COMMERCIAL SPACE TRANSPORTATION

FAA Continues to Update Regulations and Faces Challenges to Overseeing an Evolving Industry

What GAO Found

The Federal Aviation Administration (FAA) recently updated and streamlined its launch and reentry licensing regulations but has made less progress on other key commercial space transportation regulations. The new licensing regulations, issued in December 2020, replaced prescriptive requirements—in which a certain technology or action was required—with a performance-based regulatory framework, which provides applicants flexibility in how they achieve required outcomes, such as a specific level of safety. Given its focus on the licensing regulations, FAA placed on hold revisions to other regulations governing commercial space transportation—revisions which, according to FAA officials, are warranted given the industry's evolution. For example, FAA has not yet begun to revise its financial responsibility regulations, which require launch companies conducting FAA-licensed launches to purchase insurance to cover damage to third parties in case of a launch mishap. According to FAA officials, revising these regulations is their next planned rulemaking and when finalized, will respond to GAO's recommendations to improve FAA's methodologies for evaluating and calculating potential third-party losses from launch and reentry mishaps and help ensure the federal government is not exposed to greater liability than expected.

FAA also faces ongoing challenges regulating an evolving industry. In particular, as GAO previously reported, FAA continues to face the challenge of whether and when to regulate the safety of crew and spaceflight participants. While some companies have announced plans to take tourists to space within the next several years, FAA is prohibited by statute from regulating crew and passenger safety before 2023, except in response to events that caused or posed a risk of serious or fatal injury. However, FAA has taken some steps in anticipation of the expiration of the statutory moratorium, such as working with its industry advisory committee to develop and disseminate human spaceflight best practices.

FAA also has taken some steps to help the agency keep pace with changes in the industry. For example, in response to recommendations GAO made in 2019, FAA recently assessed its workforce to identify skills and competencies that are needed among its workforce and is working to improve its workload projections to better account for the full range of its regulatory activities and the timeline of its licensing process. Such efforts are critical for ensuring FAA can better anticipate and respond to the growing and evolving commercial space industry and FAA's emerging workforce needs.

Chairman Larsen, Ranking Member Graves, and Members of the Subcommittee:

Thank you for the opportunity to testify today on developments in the commercial space transportation industry and the Federal Aviation Administration's (FAA) oversight. Since 1995, when FAA first assumed regulatory responsibility for commercial launch companies and operators of launch sites, the industry has experienced substantial growth and evolution.¹ Over the years, commercial launch providers have made more than 400 launches and reentries carrying astronauts and supplies to and from the International Space Station and delivering thousands of satellites to space that support global television, high-speed Internet, weather forecasts, and much more. Globally, commercial launch providers generated an estimated \$5 billion in revenue in 2019, up from about \$2.4 billion in 2012. FAA has licensed an increasing number of launches since 2015—an average increase of 41 percent year-over-year as of December 2020.² In addition, FAA reports that the number of unique commercial launch providers holding, modifying, or potentially seeking an FAA license has increased from 23 in August 2015 to 39 in June 2021. FAA and the commercial space transportation industry itself forecast continued growth and evolution as new space applications continue to emerge, such as human space tourism, and demand continues to increase for large constellations of small satellites that depend on space transportation services.

My testimony today focuses on (1) FAA's efforts to update regulations governing commercial space transportation, (2) challenges FAA faces regulating an industry that continues to grow and evolve, and (3) steps FAA has taken to help ensure it is positioned to meet the needs of the

¹The Commercial Space Launch Act of 1984, Pub. L. No. 98-575, 98 Stat. 3055, established commercial space launch responsibilities with the Department of Transportation, which were subsequently transferred to FAA.

²According to FAA officials and several industry stakeholders, the on-going Coronavirus 2019 global pandemic has had minimal effect on the commercial space transportation industry.

evolving industry. This statement is based largely on our work since 2006 on industry developments and challenges faced by FAA.³

To conduct our prior work, we reviewed relevant statutes and regulations. We also reviewed FAA documents on its oversight of the commercial space transportation industry and interviewed officials from the responsible FAA organizations, most notably the Office of Commercial Space Transportation (AST). In addition, we interviewed a range of industry stakeholders to discuss the industry's growth and evolution, as well as to obtain their perspectives on FAA's oversight. More detailed information on our objectives, scope, and methodology can be found in each of the reports.

For this statement, in June 2021, we interviewed FAA officials about recent FAA actions, including those to address the recommendations in our prior reports, as well as developments in the industry. We also reviewed applicable FAA regulations and documents produced by FAA's Commercial Space Transportation Advisory Committee (COMSTAC)—a group of industry members and others who provide FAA with information, advice, and recommendations related to commercial space transportation.

We conducted the work on which this testimony is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Space transportation is the movement of objects, such as satellites and vehicles carrying cargo, scientific payloads, or passengers, to or from space. In the United States, commercial space transportation is carried out using orbital and suborbital launch vehicles owned and operated by

³See, for example, GAO, *Commercial Space Launches: FAA Needs Continued Planning and Monitoring to Oversee the Safety of the Emerging Space Tourism Industry*, [GAO-07-16](#) (Washington, D.C.: Oct. 20, 2006); *Federal Aviation Administration: Commercial Space Launch Industry Developments Present Multiple Challenges*, [GAO-15-706](#) (Washington, D.C.: Aug. 25, 2015); *Commercial Space Launch Insurance: FAA Needs to Fully Address Mandated Requirements*, [GAO-18-57](#) (Washington, D.C.: Jan. 16, 2018); and *Commercial Space Transportation: Improvements to FAA's Workforce Planning Needed to Prepare for the Industry's Anticipated Growth*, [GAO-19-437](#) (Washington, D.C.: May 23, 2019).

private companies referred to as commercial launch providers.⁴ A site operator is the entity that hosts the launch (or reentry, or both) of the launch vehicle from its launch site. Almost all launch site operators are either commercial launch providers or state or municipal government entities.

FAA's Office of Commercial Space Transportation

Within FAA, AST is responsible for regulating the U.S. commercial space transportation industry to oversee and coordinate the conduct of commercial launch and reentry operations, and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States. AST conducts its oversight mainly by licensing or permitting commercial launch and reentry vehicle operations and non-federal launch sites, as well as conducting safety inspections of licensed launch providers and site operators. AST is also charged with encouraging, facilitating, and promoting the industry.⁵

In addition, to assist in the development of the commercial space launch industry, the federal government shares liability risks for losses from damages to third parties or federal property. AST is responsible for determining maximum probable loss (MPL), which is the greatest dollar amount of loss for bodily injury or property damage that is reasonably expected to result from a licensed or permitted activity. This MPL determination forms the basis for financial responsibility requirements AST issues in a license or permit order.⁶ The federal government is potentially liable for damages above the MPL, subject to appropriation, up to \$3.36 billion in 2021 (the equivalent to \$1.5 billion in 1988).⁷ Anything

⁴Orbital launch vehicles are those launched with enough velocity to achieve orbit around the Earth. Suborbital launch vehicles are those that reach space but do not have sufficient velocity to achieve orbit.

⁵14 C.F.R. § 401.3.

⁶As part of a launch license, FAA requires launch companies to purchase insurance to cover losses to third parties or damage or loss to U.S. government property in the event of a commercial launch or reentry accident. 51 U.S.C § 50914; 14 C.F.R. §§ 440.5, 440.9. FAA calculates the insurance amount to reflect the maximum probable loss that is reasonably expected to occur because of a mishap that results in (1) third-party damage, including deaths and injuries on the ground and damage to property caused by anything that resulted from a launch or reentry, and (2) damage to government property. 14 C.F.R. § 440.7.

⁷Since 1988, the federal government has sought to assist in the development of the commercial space launch industry by sharing liability risks for accidents leading to damages to third parties or federal property and personnel. This risk-sharing arrangement requires that commercial launch providers purchase insurance against claims by third parties and for loss or damage to federal property and personnel up to a maximum probable loss (MPL) amount.

above this amount is the responsibility of the launch or reentry licensee, which may seek additional insurance but is not required to under federal law.

AST's workforce size and operations budget has increased over recent years (about 34 percent and 66 percent, respectively, since 2016) to help accommodate growth in the industry and AST's workload (see table 1). DOT is also requesting an increase of almost \$5 million for AST's FY2022 operations budget to support the anticipated growth within the commercial space transportation industry.

Table 1: Office of Commercial Space Transportation Staffing and Operations Budget Fiscal Years 2015–2021

Fiscal year	Full time permanent	Operations budget (in millions)
2015	81	\$16.61
2016	106	\$17.80
2017	106	\$19.83
2018	97	\$19.70
2019	108	\$24.95
2020	108	\$26.04
2021	109	\$27.56

Source: GAO presentation of Federal Aviation Administration data | GAO-21-105268

Industry Trends

In addition to the increasing number and frequency of launch and reentry operations, industry developments, according to FAA officials, necessitate that FAA amend its regulations and adjust its workforce skills and competencies. For example, more commercial providers are introducing reusable elements into the design of their vehicles where one part or all of the launch vehicle returns to a runway or landing pad. AST found that these new vehicles rendered some parts of its regulations on reusable launch vehicles—originally established in 2000—obsolete, and required revisions to portions of its launch vehicle licensing regulations.⁸ In addition, companies are developing new technologies, such as autonomous flight safety systems, which allow the flight of a launch

⁸14 C.F.R. pt. 431 addresses the requirements for obtaining a reusable launch vehicle mission license. The FAA amended its regulations to establish these operational requirements in November, 2000. Commercial Space Transportation Reusable Launch Vehicle and Reentry Licensing Regulations, 65 Fed. Reg. 56,618 (Sept. 19, 2000).

vehicle that is off course to be aborted⁹ without humans taking action, and new launch vehicle propulsion systems, which, according to FAA officials, require specific AST workforce skills or expertise to evaluate certain launch license applications.

We have previously reported that commercial launch providers have also been testing reusable suborbital launch vehicles intended for human space tourism, which are now expected to launch soon.¹⁰ These vehicles include horizontal hybrid suborbital launch vehicles, such as Virgin Galactic's SpaceShipTwo, and vertical reusable suborbital launch vehicles, such as Blue Origin's New Shepard. Blue Origin recently announced that its first flight with a commercial customer is scheduled for July 2021, and Virgin Galactic is planning to launch its first commercial customers in 2022.

As the number of launches and reentries continues to grow, the number of operators of launch and reentry sites that FAA has licensed to host commercial launches has also increased. In 2006, FAA had licensed six launch site operators. By December 2020, FAA had licensed site operators for 12 U.S. launch sites, with nine additional entities seeking licenses for 11 prospective U.S. launch sites. As we reported in 2020, despite the increase in the number of licensed site operators, the majority of FAA-licensed commercial launch operations take place at seven sites that do not require an FAA site operator license; that is, at exclusive-use launch sites where a single company conducts launches either at its privately owned and operated site or at an exclusive-use launch complex that is on or co-located with a federal range. FAA officials told us that exclusive-use launch sites do not require a site operator license, as public safety requirements are met through that single launch provider's launch license.¹¹

⁹14 C.F.R. § 401.7 states that "[f]light abort means the process to limit or restrict the hazards to public safety, and the safety of property, presented by a launch vehicle or reentry vehicle, including any payload, while in flight by initiating and accomplishing a controlled ending to vehicle flight."

¹⁰In May 2020, for the first time since NASA's space shuttle was retired in 2011, astronauts were launched from U.S. soil to the International Space Station. While not an FAA-licensed launch, NASA coordinated with FAA. NASA also has plans to partner with a private launch company to fly tourists to the International Space Station planned for later 2022.

¹¹GAO, *Commercial Space Transportation: FAA Should Examine a Range of Options to Support U.S. Launch Infrastructure*, [GAO-21-154](#) (Washington, D.C.: Dec. 22, 2020).

FAA Recently Streamlined Its Launch and Reentry Regulations but Less Progress Has Been Made on Other Key Commercial Space Transportation Regulations

FAA Issued a Final Rule for Launch and Reentry Licensing in December 2020

In response to a May 2018 Presidential Directive,¹² AST accelerated its approach to updating its launch and reentry licensing regulations and issued a final rule in December 2020 that streamlined those regulations in two key ways.

- The rule consolidated multiple regulatory parts to create a single licensing regime for all types of commercial space flight launch and reentry operations.
- The rule replaced prescriptive requirements—in which a certain technology or action is required—with a performance-based regulatory framework, which provides applicants flexibility in how they achieve required outcomes, such as a specific level of safety.

With few exceptions the final rule's requirements are in effect,¹³ though FAA is still finalizing most of its guidance materials, the purpose of which is to provide transparency and help licensing applicants understand the new requirements. As of June 8, 2021, all new applicants for a launch or reentry license will be required to meet the requirements in the final rule.

¹²In May 2018, a Presidential Directive was issued that addressed both the timing and content of FAA's regulatory updates. The directive contained a deadline to publish a proposed regulation for public comment by February 1, 2019.

¹³Streamlined Launch and Reentry License Requirements, 86 Fed. Reg. 13,448 (Mar. 9, 2021). Companies holding an active launch or reentry license at the time the final rule was issued will be considered in compliance with the rule and may continue to operate until their current license expires, for up to 5 years from the effective date of the rule. Streamlined Launch and Reentry License Requirements, 85 Fed. Reg. 79,566, 79,569 (Dec. 10, 2020).

As of June 2021, AST had held some industry workshops on the new requirements and had finalized three of the nearly two dozen total advisory circulars (i.e., guidance documents) that it plans to issue by the end of 2022.¹⁴ FAA officials told us that they also meet individually with license applicants to provide guidance.

FAA Has Plans to Update Other Key Commercial Space Transportation Regulations

Financial Responsibility Regulations

To date, FAA has made little progress in improving its methodology for calculating potential third-party losses from launch and reentry mishaps and updating its related financial responsibility regulations.¹⁵ The federal government's shared liability risk for licensed operations is an important element to promote the commercial space launch industry as the government bears a portion of the risk for third-party damages and losses to government property and government personnel resulting from potential space launch accidents. In 2012, we made one recommendation for FAA to address weaknesses in that methodology, which FAA subsequently addressed.¹⁶ However, subsequent recommendations we made related to the methodology have not been addressed. In November 2015, the U.S. Commercial Space Launch Competitiveness Act (CSLCA) was enacted, which required FAA to evaluate its MPL methodology and report the results of that evaluation to two committees of Congress.¹⁷ In 2017, we reported that FAA had not updated the value the MPL assigned to a casualty—a key component of the MPL methodology—since 1988, and recommended FAA do so, which the agency has yet to address.¹⁸

¹⁴In June 2021, FAA officials told us that 10 advisory circulars are undergoing internal review and that they plan to issue them in September 2021.

¹⁵14 C.F.R. pt 440 establishes financial responsibility and allocation of risk requirements for any launch or reentry authorized by a license or permit issued by FAA.

¹⁶GAO, *Commercial Space Launches: FAA Should Update How It Assesses Federal Liability Risk*, [GAO-12-899](#) (Washington, D.C., Jul. 30, 2012).

¹⁷U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, § 102(b), 129 Stat. 704, 705 (2015).

¹⁸GAO, *Commercial Space Launch Insurance: Weakness in FAA's Insurance Calculation May Expose the Federal Government to Excess Risk*, [GAO-17-366](#) (Washington, D.C.: Mar. 23, 2017).

Launch Site Operator
Licensing Regulations

In 2018, we again reported on several weaknesses in FAA's evaluation and MPL methodology and made four additional recommendations to FAA to address these weaknesses.¹⁹ For example, we found that FAA had not updated or reviewed the appropriateness of the probability threshold that determines the balance of risk between launch providers and the federal government since the 1990s. As of June 2021, FAA has not yet addressed our recommendations. By not resolving these issues, FAA lacks assurance that launch companies are purchasing the appropriate amount of insurance and that the federal government is not exposed to greater liability than expected.

FAA continues to postpone its efforts to address these issues while it focuses its resources on its streamlined launch and reentry licensing rulemaking. While FAA agreed with our recommendations in 2017 and 2018, FAA officials told us in June 2021 that to fully address the recommendations they need to undertake a financial responsibility rulemaking. FAA officials said updating the financial responsibility regulations is the next new rulemaking effort they plan to begin. This approach is consistent with COMSTAC's recommendation that FAA prioritize supporting the industry's transition to, and compliance with, the streamlined launch and reentry licensing regulations first, followed by updating the regulations governing financial responsibility. FAA tasked COMSTAC with recommending improvements to the financial responsibility regulations by fall 2021.

FAA officials told us in December 2020 that they recognize that the site operator licensing regulations,²⁰ which have been in place since 2000, need to be reviewed and potentially amended to ensure that they are appropriate for the current state of the commercial space transportation industry.²¹ We also reported at that time that industry stakeholders had differing views on FAA's existing launch site operator licensing regulations. For instance, some stakeholders told us that FAA was using its limited resources to review license applications for sites that may not be desirable to current launch providers because the proposed sites were too close to populated areas, which could result in higher MPLs and make the launches more expensive than at other sites. Other stakeholders

¹⁹[GAO-18-57](#).

²⁰14 C.F.R. §§ 420, 433.

²¹[GAO-21-154](#).

disagreed, stating that sites with FAA-licensed operators not currently hosting launches may nonetheless be suitable for future operations, such as human transportation, depending on the market's evolution. An industry rulemaking committee convened by FAA also raised concerns that the site operator licensing regulations do not adequately consider a site's proximity to congested airspace or noise effects on communities.²²

FAA officials in June 2021 confirmed that they plan to initiate the site operator licensing rulemaking after they complete their efforts related to the streamlined launch and reentry licensing rulemaking and update the financial responsibility regulations, which aligns with COMSTAC's recommended rulemaking priorities for FAA.

Orbital Debris Mitigation Regulations

In 2013, FAA began efforts to revise its launch and reentry licensing regulations governing the steps a launch provider must take to prevent launch vehicle stages that are "expended" or discharged from the vehicle as it gains altitude and speed from generating dangerous orbital debris. FAA officials told us they put this effort on hold when they began working with other agencies to update the U.S. Government Orbital Debris Mitigation Standard Practices, which they completed in 2019. FAA officials told us they plan to align their own regulations with those practices under a separate rule to be finalized in the next few years.²³

FAA Faces Ongoing Challenges Regulating an Evolving Industry

²²In December 2020, we reviewed issues related to space transportation infrastructure and made a recommendation that FAA should examine a range of potential options to support space transportation infrastructure and that this examination include a discussion of trade-offs. [GAO-21-154](#).

²³While FAA regulates the mitigation of orbital debris for launch vehicles and intact re-entry, many stakeholders have recently raised concerns about potential orbital debris from growing constellations of small satellites and that the U.S. approach to tracking increasing numbers of satellites and other space objects is limited in its ability to address current and future risks, such as catastrophic collisions. For instance, while 52 small satellites were launched globally in 2012, 389 were launched in 2019, increasing the potential of a satellite to collide with another space object and create debris. The Federal Communications Commission and the National Oceanic Atmospheric Administration also possess regulatory authority to mitigate such debris for non-government entities.

Compliance Oversight and Enforcement Approaches

Industry growth may present challenges to AST's approach to overseeing compliance and enforcement. AST oversees launch and reentry operators' compliance with applicable laws, including licensing regulations, and the terms of the license or permit. It does so mainly through safety inspections before, during, and after FAA-regulated operations that can impact public safety and the safety of property. In 2015, FAA shifted its agency-wide enforcement policy to emphasize collaboration with industry participants and use of compliance actions, such as counseling or training, to address violations.²⁴ AST is also party to a 2000 memorandum of agreement with the National Transportation and Safety Board and a 2021 memorandum of agreement with NASA, both covering issues related to public and human spaceflight safety for commercial space transportation activities, including efforts in accident investigations. In light of the growing number and diversification of launch and reentry operations and locations, AST's approach to overseeing compliance and enforcement may warrant review.²⁵ We plan to begin a requested review of safety oversight of commercial space activities later in 2021.

Regulation of Safety for Human Spaceflight Participants

As we previously reported, FAA continues to face the challenge of whether and when to regulate the safety of crew and spaceflight participants, such as space tourists.²⁶ While several companies have announced plans to take tourists to space within the next several years, FAA is prohibited by law from regulating crew and passenger safety before 2023, except in response to events that either caused a serious or fatal injury or contributed to an unplanned event during a commercial human space flight that posed a high risk of causing a serious or fatal

²⁴FAA also continues to use more punitive enforcement actions, including assessing civil penalties and suspending a person's or entity's certificate, when it finds that a commercial space operator is not in compliance with statutory or regulatory requirements. We have previously reported on issues related to FAA's enforcement policy. See GAO, *Aviation Safety: Actions Needed to Evaluate Changes to FAA's Enforcement Policy on Safety Standards*, [GAO-20-642](#) (Washington, D.C.: Aug. 18, 2020,

²⁵For example, in December 2020, a commercial launch provider launched an uncrewed spacecraft for a test flight from its private site after AST denied the company a safety waiver that would have allowed it to exceed the maximum public risk allowed by regulations. Shortly after landing, the launch vehicle exploded, with damage limited to the test site.

²⁶[GAO-07-16](#); [GAO-15-706](#); and GAO, *Commercial Space: Industry Developments and FAA Challenges*, [GAO-16-765T](#) (Washington, D.C.: Jun. 22, 2016)

injury.²⁷ To date, one fatal accident occurred in 2014 involving a crew member of a spaceflight undertaken by a private company and licensed by FAA. According to FAA officials, FAA could promulgate regulations if such an event occurred, but under the moratorium, it would be limited to the design feature that caused the accident.

FAA is required to periodically report to specified congressional committees on metrics that could indicate FAA's and the industry's readiness to transition to a safety framework that may include regulating crew, government astronauts, and spaceflight participant safety.²⁸ In the most recent report, submitted to Congress in February 2019, FAA concluded that no commercial human spaceflight activities had advanced to a stage that would necessitate a new safety framework. FAA's next and final report is due by March 2022.

FAA has taken some other steps in anticipation of the expiration of the moratorium. For example, in 2014, FAA published a document providing a compilation of performance-based recommended practices for commercial human spaceflight. FAA also tasked COMSTAC to formulate human spaceflight best practices to guide the industry. In September 2020, COMSTAC determined that published voluntary standards for commercial human spaceflight safety were in minimal use by the U.S. commercial industry and that the development of such standards, as in other industries, has been slow. COMSTAC recommended FAA evaluate several of the standards as potential inputs to future regulations and guidance. COMSTAC also recommended that FAA form an industry rulemaking committee to help focus industry efforts on voluntary standards development, apply relevant lessons learned, and to inform future spaceflight safety regulations. In June 2021, FAA officials told us that they plan to implement COMSTAC's recommendations when they begin their rulemaking effort assuming the moratorium expires.

FAA Has Taken Some Actions to Keep Pace with Industry

²⁷51 U.S.C. § 50905(c)(2)(C)-(D). This moratorium was established in statute in 2004 and set to expire in 2012, to allow the industry grow. The U.S. Commercial Space Launch Competitiveness Act, enacted in November 2015, extended the moratorium to October 1, 2023. Pub. L. No. 114-90, § 111, 129 Stat. at 709-11.

²⁸51 U.S.C. § 50905 (c)(6)-(7).

AST Is Improving Its Workforce Planning to Meet Its Own and Industry's Evolving Needs

AST has made strides in more strategically aligning its workforce with evolving industry demands. With the anticipated continued growth and development of new technologies and types of launches and supporting infrastructure, it is vital that AST ensure that the size, composition, and skills of its workforce are aligned with its projected workload, both the amount and type of work. In response to a recommendation we made in 2015, AST took steps to better understand how it uses its staff resources, including developing indicators for workload activities, such as inspections and consultations with potential applicants, in addition to the number of launches licensed.²⁹

AST has taken additional steps to more strategically plan for its future workforce needs since 2015, including some in response to four recommendations we made in 2019.³⁰ For example:

- AST recently assessed the workforce to identify skills and competencies that are currently needed among its workforce as well as specific competency areas that may be needed in the future to meet AST's growing and evolving workload, which addressed one of our recommendations. Using that information, AST officials told us that they developed strategies to address skill gaps, which include training and development for its current workforce, and enhancing collaboration with other FAA offices and the space industry to gain insight into the latest advances and changes in commercial space transportation.
- Since 2015, AST also has improved its workload projections to better account for the full range of its regulatory activities and the timeline of its licensing process. In June 2021, officials told us that they extended their current 2-year workload projections out to 5-years, to better anticipate and respond to emerging workforce needs. Officials also told us that by summer of 2021, they plan to finalize a more robust set of metrics for the entire office's workload to help AST determine its appropriate workforce size and composition, which would address an additional recommendation.

While AST has taken steps to strategically plan for its future workforce needs, continuing its efforts to strategically plan for its workforce needs will help position FAA to meet the needs of the evolving industry.

²⁹[GAO-15-706](#).

³⁰[GAO-19-437](#).

FAA is Taking Interim Steps to Reduce Inefficiencies in the National Airspace System, but Full Integration Is Still Years Away

The continuing growth in the number of launches places a premium on FAA's ability to safely and efficiently integrate commercial space users into the National Airspace System. However, we reported in 2019, that both FAA officials and selected industry stakeholders said FAA's current approach is inefficient.³¹ FAA officials, for example, told us in 2019 that when a space launch occurs, they have closed the airspace in the surrounding area to commercial airlines and other airspace users for longer than may have been needed and included a larger area of airspace to ensure public safety. The resulting inefficiencies have included flight delays for airlines and difficulties for launch providers to secure launch windows—the period of time in which the launch or reentry is expected to occur.

Since our 2019 report, FAA has made progress in its development of procedures, technologies, and industry coordination that are designed to reduce some of the inefficiencies experienced to date. For example:

- In May 2020, FAA updated its prior 2014 Concept of Operations for commercial space integration. The 2020 update describes the document as a high-level, long-term vision to help guide FAA in integrating space launches into the National Airspace System.
- FAA reported that in October 2020, it began using data-driven air traffic control procedures for Atlantic Route air traffic around Cape Canaveral, Florida, where more than 80 percent of the 2020 FAA-licensed launches from U.S. launch sites occurred. According to FAA officials, these procedures help air traffic control coordinate when to implement and release the airspace closure to other uses, ultimately reducing aircraft delays and reroutes caused by space launches.
- In June 2021, FAA officials told us they the agency plans to begin implementing a technology that it developed called the Space Data Integrator, which is able to receive real-time data on a launch vehicle's position and movement to improve situational awareness of launch activities in the airspace. FAA officials told us other technologies planned for implementation in the coming years may enable air traffic control to calculate a dynamic hazard area for a launch, rather than the static hazard areas that result in larger, longer airspace closures.
- FAA officials told us that in summer 2021, they plan to stand up its first of a planned series of collaborative decision-making committees to establish a forum in which commercial space, aviation, and airport

³¹[GAO-19-437](#).

representatives can work together to improve how commercial space transportation activities are integrated into the National Airspace System. The first committee will focus on data-sharing, including how to standardize and formalize data and make it available to more airspace users.

The progress FAA has made is promising, but full and efficient integration of all users of the National Airspace System is years away and will require continued work and focus.

FAA Has a Dual Role of Industry Promotion and Safety

The industry's evolution, particularly with respect to the rise in space tourism, may require a reexamination of FAA's dual role of overseeing the safety of commercial space launches while also promoting the industry. In 2006 and 2009, we stated that FAA's dual role could give rise to a potential conflict of interest as the space tourism sector develops, but found no evidence that FAA's promotional activities—such as sponsoring an annual industry conference and publishing industry studies—conflicted with its safety regulatory role at that time.³² A 2008 statutorily required DOT-commissioned report similarly concluded that there was no compelling reason to remove FAA's promotional role in the near term (through 2012), but recommended that DOT periodically review its dual role specifically for safety and promotion of human space flight.³³ We again emphasized in 2009 that FAA and Congress must remain vigilant that an inappropriate relationship between FAA and the commercial space launch industry does not occur.

In June 2021, FAA officials told us that while they agree that a reassessment may be appropriate in time, they do not think such an assessment is currently warranted. They also explained that promoting the industry was in their view related to their role in ensuring that industry participants understand relevant regulatory requirements and that FAA takes regulatory and other actions consistent with the still-developing nature of the industry. Nonetheless, given that 13 years have passed since DOT last examined its dual role and that the moratorium on DOT regulating the safety of crew and spaceflight participants is due to expire

³²GAO-07-16 and GAO, *Commercial Space Transportation: Development of the Commercial Space Launch Industry Presents Safety Oversight Challenges for FAA and Raises Issues Affecting Federal Roles*, GAO-10-286T (Washington, D.C.: Dec. 2, 2009).

³³Commercial Space Launch Amendments Act of 2004, Pub. L. No. 108-492, § 3, 118 Stat. 3974, 3982.

in 2023, a reexamination of DOT's dual role may be warranted as the industry continues to evolve.

Chairman Larsen, Ranking Member Graves, and Members of the Subcommittee, this completes my prepared remarks. I would be pleased to respond to any questions that you or other Members of the Subcommittee may have at this time.

GAO Contact and Staff Acknowledgments

If you or your staff have any questions about this statement, please contact me at (202) 512-2834 or krauseh@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement.

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