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Commercial Space Launch and the April 2023 Starship Mishap

The commercial space industry, including the launch sector, has been expanding rapidly (see **Figure 1**). A mishap during a test of a new rocket in April 2023 has drawn congressional attention to issues such as federal regulation and licensing of commercial space launch, safety and liability, and the use of commercial space capabilities by the National Aeronautics and Space Administration (NASA) and other federal agencies.

The April 2023 Mishap

Space Exploration Technologies Corporation (SpaceX) is developing a new, very large rocket called Starship. It is designed to be the most powerful rocket ever built.

On April 20, 2023, a test flight of Starship from a SpaceX-owned launch site in Boca Chica, TX, flew for about 4 minutes, reaching an altitude of about 24 miles. At that point, problems with several of the engines caused SpaceX to order the rocket to self-destruct.

SpaceX collected a significant amount of data from the test flight, and from that perspective the test was at least a partial success. However, not everything went according to plan. Along with the early termination of the flight, the rocket engines caused extensive damage to the launch pad, a fire was started on parkland near the launch site, and debris from both the destroyed rocket and the damaged launch pad was scattered over a wide area, raising concerns about both safety and environmental impact.

Shortly after the mishap, a group of environmental and cultural-heritage organizations filed a lawsuit against the Federal Aviation Administration (FAA), which has the responsibility for regulation and licensing of commercial space launch, for authorizing the Starship launch. The lawsuit seeks to revoke the Starship launch license and require the preparation of an environmental impact statement before a new license can be issued.

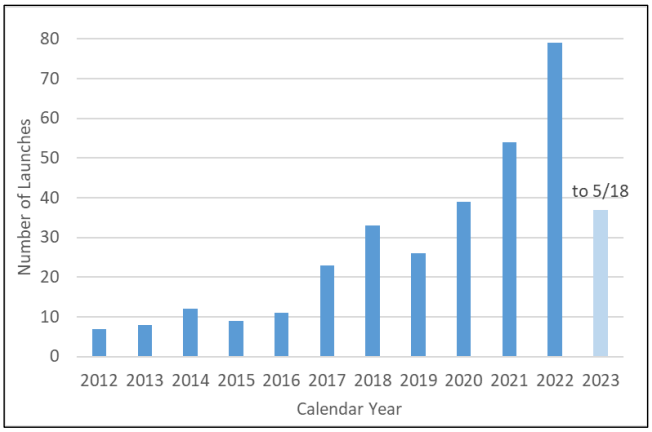
How Does the Federal Government Regulate and License Commercial Space Launch?

In 1984, the Commercial Space Launch Act (P.L. 98-575) assigned responsibility for commercial space launch regulation and licensing to the Department of Transportation (DOT). That act, as amended, is codified at 51 U.S.C. Chapter 509. DOT has delegated these responsibilities to the FAA Office of Commercial Space Transportation (AST). Companies must obtain a launch license from the FAA and comply with the regulations it issues with respect to safety, financial responsibility, oversight, and other topics (see 14 C.F.R. Chapter III).

As part of the licensing process, AST also conducts a payload review and an environmental review. The payload review is to make sure that payloads carried by the launch vehicle have all the required licenses and approvals from other agencies, such as the Federal Communications Commission and the Department of Commerce. The environmental review is to ensure compliance with the National Environmental Policy Act and other requirements (for more information, see CRS In Focus IF11549, *The Legal Framework of the National Environmental Policy Act*).

The FAA license under which SpaceX conducted the April 2023 test is valid for five years, but only for one flight (the one in which the mishap occurred) unless the FAA modifies it to allow additional flights. Under 14 C.F.R. §450.9, "the FAA may modify a vehicle operator license at any time by modifying or adding license terms and conditions to ensure compliance with the Act and regulations." In the case of Starship, the FAA has said it will not allow a return to flight until it determines that "any system, process, or procedure related to the mishap does not affect public safety."

Figure 1. Launches Licensed by the FAA, 2012-2023



Source: CRS, based on FAA data.

Notes: Data for 2023 are for launches through May 18. Licensed launches only (excludes launches under experimental permits).

How Are Mishaps Investigated?

The details of commercial space launch mishap investigations depend somewhat on the nature of the mishap. In most cases, the launch company itself has the primary responsibility to investigate what happened and why, but the FAA oversees and participates in that investigation and generally does not allow further launches until the company has identified and resolved the root cause

of the mishap. If another federal agency was involved in the launch—for example, if NASA or another agency was a customer for the launch—then it may participate in the investigation as an observer.

In some circumstances, the National Transportation Safety Board (NTSB) also has a role. In 2022, the FAA and the NTSB signed an updated memorandum of understanding that determines when the NTSB is the lead agency instead of the FAA. That occurs when there is a fatality or a serious injury to a person, or when there is damage from debris that could reasonably be expected to cause death or serious injury. Those circumstances do not appear to have happened in the April 2023 Starship mishap.

Who Is Liable If a Launch Mishap Causes Damage in the Surrounding Community?

Liability questions are potentially up to a court to decide. That said, part of the FAA licensing process is a calculation of the "maximum probable loss" from third party liability—that is, liability for harm to anyone other than the launch provider and the owners of payloads carried by the launch. The launch provider is then required, by the terms of its license, to carry insurance for the maximum probable loss amount, up to a cap of $500 million.

If a mishap were to result in liability above the required insurance amount—which has never yet happened—the federal government would cover the next $3 billion. The authorization for that federal indemnification (51 U.S.C. §50915) expires on September 30, 2025. It was enacted in the Commercial Space Launch Act Amendments of 1988 (P.L. 100-657) and was initially only effective through 1993, but Congress has extended the expiration date several times and may consider whether to extend it again.

How Is Safety Handled Differently if a Commercial Launch Carries Humans?

The April 2023 Starship test flight did not carry human occupants, but there have been several other commercial launches with humans on board (for more information, see CRS In Focus IF11940, *Commercial Human Spaceflight*). In addition, once Starship is operational, SpaceX intends it to carry humans on some of its potential missions.

Under 51 U.S.C. §50905(c), the FAA may issue regulations to address the safety of human occupants aboard commercial space launches, but only in response to actual incidents that have resulted in, or posed a high risk of, serious or fatal injuries. Those constraints on the FAA's authority to issue human safety regulations are scheduled to expire on October 1, 2023. In the past, Congress has extended the expiration date several times, calling it a "learning period" for the space launch industry. This time, however, there are a number of voices calling for the learning period to be allowed to expire.

Whether to let the learning period expire, extend it again, or create some compromise position, may be an active question for debate and legislation during the 118th Congress. It is possible that the regulation of human safety in commercial spaceflight may soon look quite different, but if so, the details of a new framework are not yet clear.

What Are the Implications of Possible Delays in the Development of Starship?

The April 2023 mishap could delay the development of Starship, either because of technical challenges in resolving the cause of the mishap or perhaps because of legal action to block the license modification that additional launch attempts would require. If the delays are extensive, they could have business consequences for SpaceX. Among other things, the company intends to use Starship to launch commercial satellites, including its own Starlink broadband internet satellites, at lower cost and higher volume than the Falcon Heavy rockets it currently uses for that purpose.

For the federal government, there could also be consequences for NASA's Artemis program to return humans to the Moon. For the first Artemis Moon landing mission, known as Artemis 3, NASA plans to use a variant of Starship called the Human Landing System to carry astronauts from lunar orbit to the lunar surface and back. The Artemis 3 mission is currently scheduled for December 2025. NASA has stated that it expects Starship to return to flight within a couple of months. If that timeline ends up slipping, it could affect the schedule for Artemis 3.

Is It Common for Federal Agencies to Rely on Commercial Space Service Providers?

Federal space programs have always relied on commercial contractors to provide hardware like rockets and satellites. A newer development is the purchase of commercial space services, such as launch or transport to the lunar surface, using hardware that is owned and operated by the commercial company, not by the government.

As well as the Human Landing System, for example, NASA now uses commercial providers to transport astronauts and cargo to and from the International Space Station. That used to be the job of the NASA-owned space shuttles. Now the companies providing those services use their own rockets and capsules and operate under FAA commercial launch licenses.

Other agencies, such as the Department of Defense, use commercial providers to launch their satellites and to provide space-based services such as satellite broadband communications and satellite surveillance imagery.

Increasing federal reliance on commercial space services, rather than government-owned hardware, has become a trend over the past decade or so. It has sometimes created controversy in Congress. Advocates argue that the commercial approach may stimulate innovation, competition, and cost reductions. Skeptics counter that it gives agencies less control and may limit their insight into factors such as development timelines and safety.

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