



November 2016

# COMMERCIAL SPACE LAUNCH INSURANCE

Views Differ on Need  
for Change to  
Insurance Approach  
but Clarification Is  
Needed

# GAO Highlights

Highlights of [GAO-17-88](#), a report to congressional committees

## Why GAO Did This Study

The U.S. commercial space industry has expanded, conducting eight launches in 2015 compared with none in 2011. These launches have traditionally been from federal facilities, but as of July 2016, there were 10 nonfederal FAA-licensed spaceport operators supporting both private and federal space activity. Almost all of these spaceport operators are local government entities. The complexity of the arrangements at these spaceports, and a mishap in October 2014 where the spaceport was not adequately insured, have raised questions about insurance coverage for spaceport assets, including potential federal involvement.

Congress included a provision in statute for GAO to report on the potential inclusion of local government property in the existing indemnification regime for commercial space launches. This report examines (1) the insurance coverage spaceport operators have in place and (2) stakeholder views on the need to change the current insurance approach and on options for revising it. GAO reviewed key documents; interviewed FAA and NASA officials and representatives of FAA-licensed spaceports, launch companies, insurance brokers, and insurance companies; and selected two spaceports to visit based on launch activity.

## What GAO Recommends

GAO recommends that FAA provide additional communication to clarify its interpretation of the financial responsibility regulations for commercial space launches. The Department of Transportation provided technical comments.

View [GAO-17-88](#). For more information, contact Alicia Puente Cackley at (202) 512-8678 or [cackleya@gao.gov](mailto:cackleya@gao.gov)

November 2016

## COMMERCIAL SPACE LAUNCH INSURANCE

### Views Differ on Need for Change to Insurance Approach but Clarification Is Needed

## What GAO Found

Of the 10 spaceport operators (entities that host launches from their property) that are currently licensed by the Federal Aviation Administration (FAA), 3 have had commercial activity in the last 5 years, and all 3 told GAO that they have both property and liability coverage to protect themselves from losses resulting from space launch mishaps. Federal laws and regulations do not require spaceport operators to have insurance, but operators of nonfederal spaceports that are located on federal property could have federal contracts that require them to have insurance to protect their own property from damage resulting from space launch mishaps. Moreover, for launches licensed by FAA, since the Commercial Space Launch Act Amendments of 1988, FAA has required launch companies (firms that conduct or will conduct the launch of vehicles and payloads) to purchase insurance to cover damage to the uninjured public, as well as damage to federal government property, in case of a launch mishap. Launch participants may also choose to negotiate additional insurance coverage through launch-specific contracts. However, spaceport operators said that they find the regulations that determine financial responsibility for commercial space launches to be confusing. Specifically, several spaceport operators GAO interviewed said that, based on their interpretation of the financial responsibility regulations, they were unsure whether their property would be covered under a launch company's insurance policy or whether they would need to purchase their own insurance for their property to be covered. FAA's mission includes encouraging, facilitating, and promoting commercial space launches by the private sector, among other things. Furthermore, federal internal control standards state that management should externally communicate the necessary quality information to achieve the entity's objectives. Unless spaceport operators have a clear understanding of FAA's financial responsibility regulations, a risk exists that they may not obtain adequate insurance against losses in the event of mishap. Uninsured losses, in turn, could potentially cause delays in resuming commercial launches following a mishap and unnecessary costs to the federal government, both of which could hinder the development of the domestic commercial launch industry.

Stakeholders in the space launch industry are divided on the need to change the current insurance approach, in which insurance for spaceports is not required but can be negotiated through contracts between launch companies, which operate launch vehicles, and spaceport operators, which run spaceports. Stakeholders identified some positive aspects of the current insurance approach—for example, some said that negotiating contracts specific to each launch allows for greater flexibility. However, they also raised concerns, including a lack of certainty about coverage for potential damage. GAO identified two potential options for requiring protection for spaceports: (1) requiring launch companies to purchase insurance to cover spaceport property and (2) requiring spaceport operators to purchase insurance to cover their own property. In general, stakeholders tended to oppose the option in which the burden of purchasing the insurance was on them. Specifically, most spaceport operators GAO interviewed favored the first option, while most launch companies favored continuing the current approach. Stakeholders discussed benefits associated with both options—for example, they said that both options could increase certainty by specifying which party was required to insure spaceport property. However, they also noted challenges, such as higher costs for the party required to purchase the insurance and decreased flexibility to customize their use of insurance depending on the details of a particular launch.

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### Abbreviations

CPI-U	Consumer Price Index for All Urban Consumers
CSLA	Commercial Space Launch Act
CSLAA	Commercial Space Launch Act Amendments of 1988
CSLCA	Commercial Space Launch Competitiveness Act
DOT	Department of Transportation
FAA	Federal Aviation Administration
MARS	Mid-Atlantic Regional Spaceport
NASA	National Aeronautics and Space Administration
Space Act	National Aeronautics and Space Act
VCSFA	Virginia Commercial Space Flight Authority

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November 22, 2016

The Honorable John Thune  
Chairman  
The Honorable Bill Nelson  
Ranking Member  
Committee on Commerce, Science and Transportation  
United States Senate

The Honorable Lamar Smith  
Chairman  
The Honorable Eddie Bernice Johnson  
Ranking Member  
Committee on Science, Space, and Technology  
House of Representatives

In recent years, the U.S. commercial space industry has been expanding—U.S. launch companies conducted eight launches in 2015, compared with none in 2011—and federal law includes insurance requirements for launch companies involved in commercial space launches.<sup>1</sup> Specifically, the Commercial Space Launch Act Amendments of 1988 (CSLAA) requires launch companies—firms that operate launch vehicles for launches licensed by the Federal Aviation Administration (FAA)—to purchase insurance to cover damage to the uninvolved public, or “third parties,” as well as damage to federal government property, in case of a launch mishap. The CSLAA also added a requirement, subject to appropriation, for the federal government to indemnify launch companies for claims that exceed their required insurance coverage, up to \$1.5 billion adjusted for post-1988 inflation, which was around \$3.06 billion in fiscal year 2016. Furthermore, the National Aeronautics and Space Act (Space Act) authorizes the National Aeronautics and Space Administration (NASA) to enter into legal agreements with spaceport operators—entities that host launches at their launch sites (i.e.,

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<sup>1</sup>For the purpose of this report, we refer to launch operators—entities that conduct the launch of a vehicle and any payload—as launch companies. See 14 C.F.R. § 415.1 et seq. for the launch operator licensing regime. We also refer to launch site operators—organizations that host launches at their launch sites (i.e., spaceports)—as spaceport operators.

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spaceports)—for use of NASA property in support of commercial space launches, which may include insurance requirements for companies involved in those launches. Almost all of the spaceport operators currently licensed by FAA are state or municipal government entities.

A recent commercial space launch mishap highlighted confusion about the insurance requirements for and protections of state and municipal spaceport property.<sup>2</sup> On October 28, 2014, an Orbital Sciences Corporation resupply mission to the International Space Station failed during lift-off. This mishap caused about \$15 million in damage to the Mid-Atlantic Regional Spaceport (MARS), a launch pad owned and operated by the Virginia Commercial Space Flight Authority (VCSFA), a state government entity, on land owned by the federal government at NASA's Wallops Flight Facility. In the aftermath of the failure, according to NASA officials, Orbital Sciences Corporation and VCSFA each paid \$5 million to help fund the repairs. The NASA Office of Inspector General later confirmed that NASA was not financially responsible for damage to NASA or VCSFA property and noted that the parties ultimately disagreed about financial responsibility for the mishap in light of Congressional direction to the contrary.<sup>3</sup> As a result of the confusion, NASA contributed by increasing the value of an existing contract with VCSFA by \$5 million to fund infrastructure at MARS. These funds were intended for other space operations projects. The mishap was resolved with involvement from Congress before the current insurance regulations could be tested. Nevertheless, this event highlighted a potential concern about the adequacy of insurance coverage obtained by FAA-licensed spaceport operators, an increasingly key part of the U.S. commercial space industry.

Section 115 of the U.S. Commercial Space Launch Competitiveness Act (CSLCA) contains a provision for GAO to report on the potential inclusion of all government property, including state and municipal property, in the existing indemnification regime established under 51 U.S.C. § 50914, which covers liability insurance and financial responsibility requirements.

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<sup>2</sup>For the purposes of this report, "state and municipal spaceport property" refers to spaceport property owned by state or municipal government entities, regardless of whether the property is located on the spaceport operator's own spaceport.

<sup>3</sup>National Aeronautics and Space Administration, Office of Inspector General, *NASA's Response to Orbital's October 2014 Launch Failure: Impacts on Commercial Resupply of the International Space Station*, IG-15-023 (Washington, D.C.: September 2015).

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This report examines (1) the insurance coverage spaceport operators have in place to protect themselves from losses resulting from space launch mishaps and (2) stakeholder views on the need to change the current insurance approach and options for revising it.<sup>4</sup>

To address these objectives, we reviewed our prior related reports and other studies and analyzed relevant laws and regulations.<sup>5</sup> We conducted semistructured interviews and analyzed responses from 9 of the 10 spaceport operators licensed by the FAA, as of July 2016.<sup>6</sup> We also visited 2 spaceports—sites where launches occur—selected based on various factors including number of years in operation, colocation with a federal range, commercial activity within the last 5 years, and occurrence of a commercial space launch mishap.<sup>7</sup> We visited MARS at NASA’s Wallops Flight Facility in Wallops Island, Virginia, and Cape Canaveral Spaceport at Cape Canaveral Air Force Station in Florida. We also conducted semistructured interviews with other stakeholders, including five launch companies that are active in the industry, all five key insurance industry stakeholders that had provided coverage to the commercial space industry (three insurance brokers and two insurance

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<sup>4</sup>FAA-licensed spaceport operators include, but are not limited by statute or regulation to, spaceports operated by state or municipal government entities. For the purposes of this report, we refer to operators of FAA-licensed spaceport (i.e., launch site) as spaceport operators. The 10 spaceports currently licensed for commercial activity are almost exclusively—if not entirely—operated by state and municipal governments.

<sup>5</sup>See, for example, GAO, *Commercial Space Launches: FAA Should Update How It Assesses Federal Liability Risk*, [GAO-12-899](#) (Washington, D.C.: July 30, 2012); *Commercial Space Launches: FAA’s Risk Assessment Process Is Not Yet Updated*, [GAO-14-328T](#) (Washington, D.C.: Feb. 4, 2014); *Federal Aviation Administration: Commercial Space Launch Industry Developments Present Multiple Challenges*, [GAO-15-706](#) (Washington, D.C.: Aug. 25, 2015). See also National Aeronautics and Space Administration, Office of Inspector General, *NASA’s Response to Orbital’s October 2014 Launch Failure: Impact on Commercial Resupply of the International Space Station*, IG-15-023 (Washington, D.C.: Sept. 17, 2015).

<sup>6</sup>We reached out to all 10 spaceport operators licensed by FAA, as of July 2016, and conducted semistructured interviews with 8 of these 10 spaceport operators. Two declined to be interviewed (due to transitions they were making in their operations) but one of these two provided written responses to our semistructured interview questions. Their responses were incorporated as appropriate. Therefore, we analyzed information from 9 of the 10 FAA-licensed spaceports.

<sup>7</sup>Federal range means a launch site that is owned and operated by the government of the United States and can host both government and commercial launches.

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companies), and two industry associations. Additionally, we interviewed officials from FAA and NASA.

To examine stakeholder views on the need to change the current insurance approach and options for revising it, we first conducted semistructured interviews with all stakeholders as described earlier and based on their inputs, we sent a follow-up questionnaire to the stakeholders for their opinions on the options identified through interviews.<sup>8</sup> Additional information on our methodology is provided in appendix I.

We conducted this performance audit from January 2016 to November 2016 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 our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

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### Overview of Commercial Space Transportation

Commercial space transportation is carried out using launch vehicles operated by private companies. In February 1984, Executive Order 12465 designated the Department of Transportation (DOT) as the lead federal agency for enabling private-sector launch capabilities. In October 1984, the Commercial Space Launch Act (CSLA) gave DOT the authority to, among other things, license and monitor the safety of commercial space launches and promote the commercial space industry. Regulatory oversight of the commercial sector was delegated to the Office of Commercial Space Transportation, within FAA, whose primary means of authorizing space launch activities is through its licensing process. Specifically, FAA's Office of Commercial Space Transportation is responsible for licensing launch and reentry vehicles and spaceport

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<sup>8</sup>We excluded industry associations from our follow-up questionnaire because many of their member organizations received our questionnaire individually, and members' views on the options are reflected in our analysis.

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operations carried out by U.S. citizens or within the United States, except for operations carried out exclusively by and for the federal government.

In an informal guidance, FAA defines commercial space launches as those that are licensed by FAA, among other characteristics.<sup>9</sup> During an FAA-licensed launch, several key parties are involved:

- The **spaceport operator** is the entity that hosts the launch (or reentry, or both) of the launch vehicle from its launch site. Almost all spaceport operators currently licensed by FAA are state or municipal government entities.
- The **launch company** is the entity that conducts the launch of a vehicle and any payload, such as a satellite, a probe, or a spacecraft carrying humans or cargo.
- The **customer** is the entity that pays the launch company to carry a payload into space.<sup>10</sup>

CSLA and its subsequent amendments require launch companies and spaceport operators to obtain licenses. To obtain a launch or reentry license, a launch company must meet safety and financial responsibility requirements, among other things.<sup>11</sup> FAA finalized its regulations related to financial responsibility and allocation of risk requirements for launch companies for licensed launches in August 1998.<sup>12</sup> Similarly, a spaceport

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<sup>9</sup>FAA defines a commercial space launch as having one or more of the following characteristics: (1) the launch is licensed by FAA, (2) the primary payload's launch contract was open to international competition, or (3) the launch was privately financed without government support. Launch companies that conduct commercial space launches may also carry out launches that are not considered commercial space launches, such as launches conducted for the U.S. military.

<sup>10</sup>The regulation states that a customer is "any person: (i) who procures launch or reentry services from a licensee or permittee; (ii) with rights to the payload (or any part of the payload) to be launched or reentered by the licensee or permittee, including a conditional sale, lease, assignment, or transfer of rights; (iii) who has placed property on board the payload for launch, reentry or payload services; or (iv) to whom the customer has transferred its rights to the launch or reentry services." 14 C.F.R. § 440.3.

<sup>11</sup>See 51 U.S.C. § 50914 and 14 C.F.R. § 440.1 et seq. for financial responsibility requirements for launch companies.

<sup>12</sup>Financial Responsibility Requirements for Licensed Launch Activities, 63 Fed. Reg. 45592 (Aug. 26, 1998). The regulations were updated by a final rule issued in December 2006. Human Space Flight Requirements for Crew and Space Flight Participants, 71 Fed. Reg. 75616 (Dec. 15, 2006). See 14 C.F.R. § 440.1 et seq.

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operator must also meet safety requirements to receive an FAA launch site license. FAA's regulations related to spaceport licensing, which were finalized in October 2000, require spaceport operators to demonstrate the level of safety of the spaceport, including information on trajectory, debris dispersion area, flight corridor, and if necessary, a risk analysis for populated areas.<sup>13</sup> In the following year, FAA issued its first spaceport operator license under these regulations.<sup>14</sup>

Although commercial activity has traditionally been from federal ranges, as of July 2016 there were 10 FAA-licensed spaceports to support private sector involvement in space-related activity. Three of the 10 were colocated with federal ranges at an Air Force base or a NASA facility: California Spaceport at Vandenberg Air Force Base, Cape Canaveral Spaceport at Cape Canaveral Air Force Station, and MARS at NASA's Wallops Flight Facility (see table 1).<sup>15</sup>

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<sup>13</sup>Licensing and Safety Requirements for Operation of a Launch Site, 65 Fed. Reg. 62812 (Oct. 19, 2000). See 14 C.F.R. § 420.1 et seq. for regulations related to spaceport licensing.

<sup>14</sup>According to FAA officials, several spaceport operators were issued licenses prior to the release of the final regulations for spaceport operator licensing. For example, the original licenses for California Spaceport, Mid-Atlantic Regional Spaceport, Pacific Spaceport Complex Alaska, and Cape Canaveral Spaceport were issued prior to 2000.

<sup>15</sup>In this report, Cape Canaveral Spaceport refers only to Launch Complex 46 because it is the only FAA-licensed spaceport at Cape Canaveral Air Force Station. NASA's Kennedy Space Center and Cape Canaveral Air Force Station encompass multiple facilities on Florida's east coast, and some of the spaceports at Kennedy Space Center and Cape Canaveral Air Force Station host commercial activity by launch companies such as SpaceX and the United Launch Alliance. However, this activity does not take place from Cape Canaveral Spaceport—the only spaceport at Kennedy Space Center or Cape Canaveral Air Force Station licensed by FAA.

**Table 1: Key Characteristics of Federal Aviation Administration-Licensed Spaceports, as of July 2016**

FAA-licensed spaceport	Spaceport operator	License issued	Colocated site <sup>a</sup>	Vertical launches supported <sup>b</sup>	Horizontal launches supported <sup>c</sup>
California Spaceport (California)	Spaceport Systems International	1996	✓ <sup>d</sup>	✓	n/a
Mid-Atlantic Regional Spaceport (Virginia)	Virginia Commercial Space Flight Authority	1997	✓ <sup>e</sup>	✓	n/a
Pacific Spaceport Complex Alaska (Alaska)	Alaska Aerospace Corporation	1998	n/a	✓	n/a
Cape Canaveral Spaceport - Launch Complex 46 (Florida) <sup>f</sup>	Space Florida	1999	✓ <sup>g</sup>	✓	n/a
Mojave Air and Space Port (California)	East Kern Airport District	2004	n/a	✓	✓
Oklahoma Spaceport (Oklahoma)	Oklahoma Space Industry Development Authority	2006	n/a	n/a	✓
Spaceport America (New Mexico)	New Mexico Spaceport Authority	2008	n/a	✓	✓
Cecil Field Spaceport (Florida)	Jacksonville Aviation Authority	2010	n/a	n/a	✓
Midland International Airport (Texas)	Midland International Airport	2014	n/a	n/a	✓
Ellington Airport (Texas)	Houston Airport System	2015	n/a	n/a	✓

Legend:

✓ = applicable to characteristics  
n/a = not applicable to characteristics  
Source: GAO analysis of FAA data. | GAO-17-88

<sup>a</sup>A colocated site is an FAA-licensed spaceport on federal government property.

<sup>b</sup>Vertical launches have a vertical orientation and require a launch pad.

<sup>c</sup>Horizontal launches have a horizontal orientation, similar to conventional airplanes, and require a runway.

<sup>d</sup>California Spaceport is colocated with Vandenberg Air Force Base.

<sup>e</sup>Mid-Atlantic Regional Spaceport is colocated with NASA's Wallops Flight Facility.

<sup>f</sup>Cape Canaveral Spaceport refers to territory that encompasses the real property boundaries of Kennedy Space Center and Cape Canaveral Air Force Station. Space Florida is only licensed as an operator for Launch Complex 46.

<sup>g</sup>Cape Canaveral Spaceport (Launch Complex 46) is colocated with Cape Canaveral Air Force Station.

FAA licenses the operation of spaceports for vertical takeoffs or landings, horizontal takeoffs or landings, or both. Four sites are dedicated to vertical launches, four conduct horizontal launches only, and two can host both types of operations. Figure 1 illustrates examples of vertical and horizontal spaceports.

**Figure 1: Vertical and Horizontal Spaceports**



Mid-Atlantic Regional Spaceport (vertical)

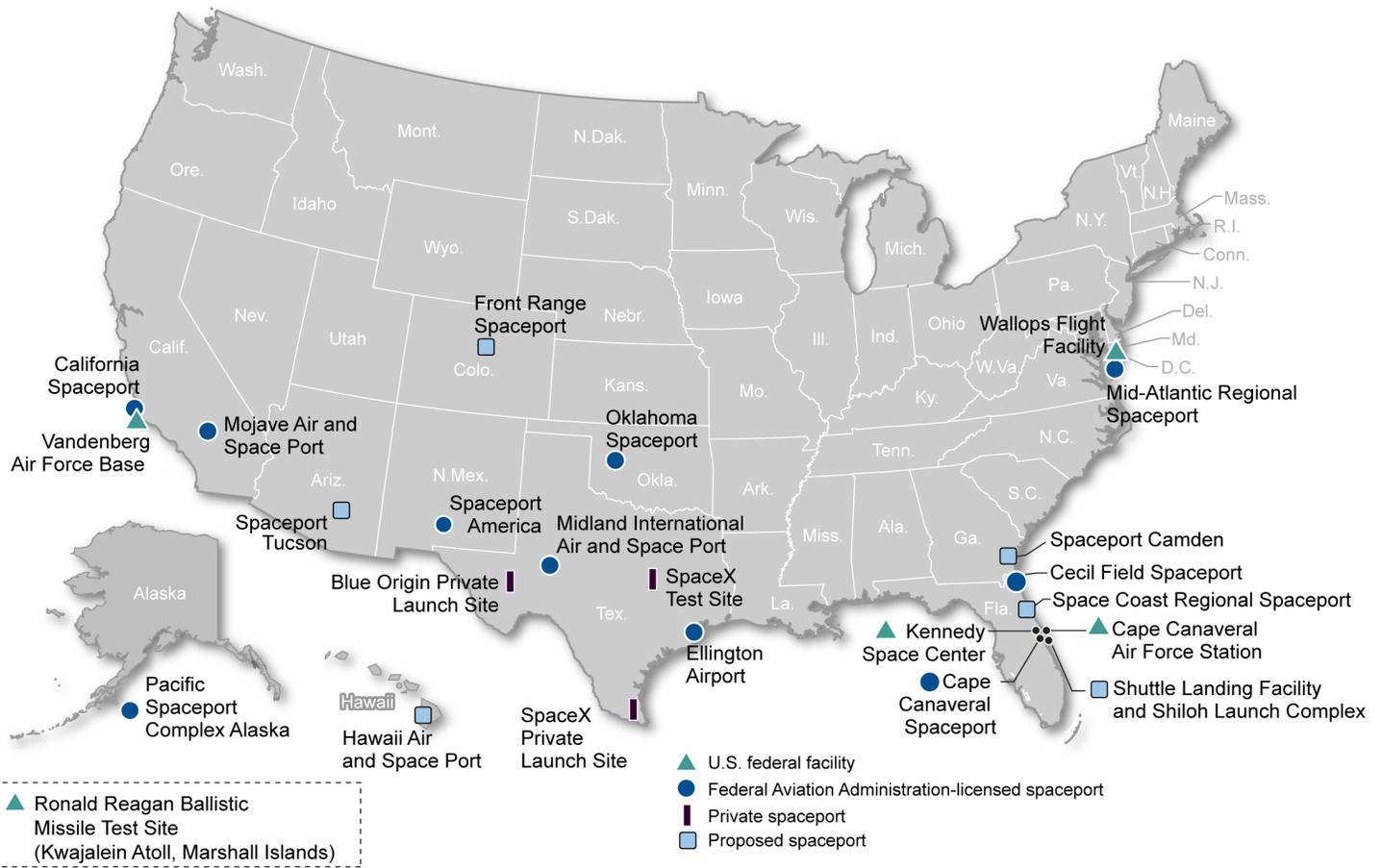


Mojave Air and Spaceport (horizontal)

Sources: Virginia Commercial Space Flight Authority (Mid-Atlantic Regional Spaceport), and East Kern Airport District (Mojave Air and Spaceport). Reprinted with permission. | GAO-17-88

In addition to these sites, there are three private spaceports where individual companies may conduct FAA-licensed or permitted launches. Because the companies own and operate these sites using their own vehicles exclusively, a launch site license is not required. Also, as of July 2016, FAA had conducted pre-application consultations for seven additional sites. Figure 2 illustrates the location of existing and proposed commercial spaceports as of July 2016.

**Figure 2: Commercial Spaceports and Proposed Sites, as of July 2016**



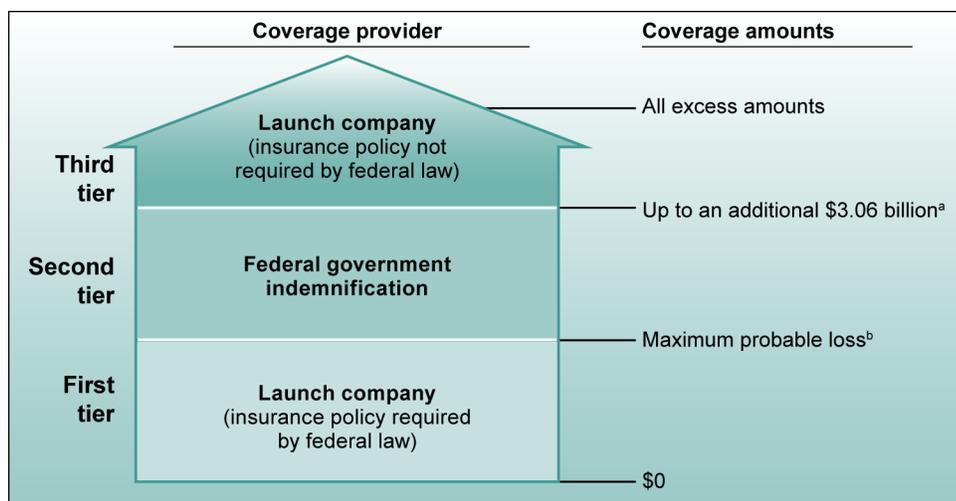
Sources: FAA and Map Resources. | GAO-17-88

## U.S. Indemnification Regime

CSLAA created a three-tiered approach for sharing liability between the federal government and the private sector for damages to third parties—known as the indemnification regime—to encourage the development of the U.S. commercial space launch industry and promote a competitive environment (see fig. 3). All FAA-licensed commercial space launches and reentries by U.S. companies, whether unmanned or manned and whether from the United States or overseas, are covered by the

indemnification regime for third-party damage that results from launch or reentry.<sup>16</sup> Third parties include persons that are not involved in launch or reentry services—those other than the federal government, the launch company, contractors and subcontractors of the federal government or the launch company, and customers of the launch company.<sup>17</sup>

**Figure 3: U.S. Indemnification Regime for FAA-Licensed Launches, as of Fiscal Year 2016**



Source: GAO analysis. | GAO-17-88

Notes: FAA stands for Federal Aviation Administration.

<sup>a</sup>In the second tier, \$3.06 billion is the \$1.5 billion in law adjusted for inflation to fiscal year 2016 dollars using the Consumer Price Index for All Urban Consumers (CPI-U).

<sup>b</sup>In the first tier, launch companies must purchase coverage to meet FAA's maximum probable loss amount, up to the maximum amount of coverage available on the world market at a reasonable cost, as determined by FAA. This first tier of required insurance coverage is capped at a maximum of \$500

<sup>16</sup>51 U.S.C. § 50904(a); 51 U.S.C. § 50914(a)(1)(A). Launches and reentries by foreign entities are also licensed by FAA if they take place from or into the United States and, therefore, are covered by federal indemnification.

<sup>17</sup>Specifically, regulation defines third parties to launches as any person other than: (i) the United States, any of its agencies, and its contractors and subcontractors involved in launch or reentry services for a licensed or permitted activity; (ii) a licensee, permittee, and its contractors and subcontractors involved in launch or reentry services for a licensed or permitted activity; (iii) a customer and its contractors and subcontractors involved in launch or reentry services for a licensed or permitted activity; (iv) a member of a crew; and (v) a space flight participant. Government personnel, as defined in this section, are considered to be third parties. See 14 C.F.R. § 440.3.

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million for third-party damages. Additionally, the required insurance coverage is capped at a maximum of \$100 million for any potential damage to government property. Launch companies must secure coverage for each launch or reentry.

The U.S. indemnification regime has a three-tier approach for sharing liability between the federal government and the private sector to cover third-party claims, from when the launch vehicle arrives at the spaceport to the end of a launch.<sup>18</sup>

- The **first tier** of coverage is an insurance policy the launch company is required to purchase for an individual launch or set of launches. As part of FAA's process for issuing a license for a commercial space launch or reentry, the agency determines the amount of insurance a launch company is required to purchase so the launch company can compensate third parties for claims and the federal government for any damage to its property that occurs as a result of activities carried out under the license. FAA calculates the insurance amount to reflect the maximum probable loss that is likely 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.<sup>19</sup> The liability insurance obtained by the launch company also protects its customer(s) (i.e., the entity(ies) paying the launch company to bring a payload into space), the federal government, and their respective contractors and subcontractors from claims by a third party.<sup>20</sup> Launch companies must purchase coverage to meet FAA's

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<sup>18</sup>When the end of the launch occurs varies by the type of vehicle. For an orbital expendable launch vehicle, the launch ends after the licensee's last exercise of control over its launch vehicle. For a launch of an orbital reusable launch vehicle with a payload, the launch ends after deployment of the payload. For any other orbital reusable launch vehicle, the launch ends upon completion of the first sustained, steady-state orbit of a reusable launch vehicle at its intended location. For a suborbital expendable launch vehicle or reusable launch vehicle, the launch ends after reaching apogee if the flight includes reentry, or otherwise after vehicle landing or impact on Earth, and after activities necessary to return the vehicle to a safe condition on the ground. 14 C.F.R. § 401.5.

<sup>19</sup>FAA makes this determination for each space launch by reviewing the specific circumstances of the launch, including the planned launch vehicle, spaceport, payload, flight path, and the potential casualties and fatalities that could result from varying types of launch failures at different points along that path. FAA estimates the total cost of estimated casualties from a launch failure and uses this information as the basis for determining property damage. FAA's evaluation of the methodology used to calculate the maximum probable loss is under review. A report by FAA was due in May 2016 and has not yet been released as of October 2016.

<sup>20</sup>14 C.F.R. § 440.9(b).

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maximum probable loss amount, up to the maximum amount of coverage available in the world market at a reasonable cost, as determined by FAA. This first tier of required insurance coverage is capped at a maximum of \$500 million for third-party damages.<sup>21</sup> Additionally, the required insurance coverage is capped at a maximum of \$100 million for any potential damage to government property.<sup>22</sup>

- The **second tier** of coverage—which is adjusted for inflation and is capped at \$3.06 billion in fiscal year 2016 dollars—may be provided by the U.S. government and covers any third-party claims in excess of the specific first-tier amount.<sup>23</sup> For the federal government to be able to make payments for these claims, Congress would need to appropriate funds.<sup>24</sup> The second tier of coverage has never been invoked because to date, no mishaps have resulted in third-party claims in excess of the first tier.<sup>25</sup>
- The **third tier** of coverage is for third-party claims in excess of the second tier. Like the first tier, this third tier is the responsibility of the launch company, which may seek insurance above the required first

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<sup>21</sup>51 U.S.C. § 50914(a)(3)(A)(i). This maximum amount is not automatically adjusted for inflation.

<sup>22</sup>51 U.S.C. § 50914(a)(3)(A)(ii). This maximum amount is not automatically adjusted for inflation.

<sup>23</sup>51 U.S.C. § 50915(a)(1)(B) requires that the \$1.5 billion maximum amount be adjusted for inflation. We used the Consumer Price Index for All Urban Consumers (CPI-U) to calculate the adjustment to 2016 dollars, which is \$3.06 billion.

<sup>24</sup>51 USC 50915(a). The federal government would only make any payment under tier two to the extent the funds were provided in advance by appropriations law or additional legislative authority is enacted providing for paying claims in a compensation plan.

<sup>25</sup>Statutory authorization for this second tier of coverage expires in September 2025. 51 U.S.C. § 50915(f). After expiration in 2025, there is no longer second tier coverage unless it is renewed or extended by an act of Congress.

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tier amount for this coverage. Unlike the first tier, no insurance for this third tier is required under federal law.<sup>26</sup>

Another component of the U.S. indemnification regime for commercial space launches and reentries is cross waivers. A cross waiver provides that each party involved in a launch agrees not to bring claims against the other parties and assumes financial responsibility for damage to its own property or loss or injury sustained by its own employees.<sup>27</sup> FAA officials we interviewed said that the launch company, its customer(s), and FAA (on behalf of the federal government) must sign each cross waiver. FAA verifies these parties' signatures on each cross waiver as part of the licensing process. These waivers include their respective contractors and subcontractors, who must sign them as well.

FAA can also issue permits—rather than licenses—for certain launch activities, such as launch or reentry of a reusable suborbital rocket.<sup>28</sup> Launch companies operating under an FAA-issued permit must purchase insurance under the first tier of the indemnification regime, but they do not gain coverage under the second tier of the indemnification regime. Therefore, permitted activities are excluded from the federal indemnification. Similar to launch companies operating under launch licenses, launch companies operating under permits are not required to purchase insurance under the third tier of the indemnification regime. Launch companies that receive permits for launch activities, rather than

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<sup>26</sup>FAA officials said that they organize the financial responsibility regulation for licensed launches into three components—insurance requirements, cross waivers, and federal indemnification. First, launch companies must obtain liability insurance or demonstrated financial responsibility to compensate claims by third parties and for damage or loss to government property. Second, launch companies must also sign cross waivers with their customers, the federal government (i.e., FAA) and their contractors and subcontractors. Third, subject to congressional appropriation, the federal government may indemnify launch operators up to \$1.5 billion, adjusted for inflation, for any claims that exceed the insurance obtained to cover liability claims by third parties.

<sup>27</sup>51 U.S.C. § 50914(b). Beginning in 2004, spaceflight participants were required to sign waivers with the federal government, and since CSLCA took effect, spaceflight participants are also required to sign cross waivers with others. For all parties signing waivers with the federal government, the waiver only applies to the extent that claims are more than the amount of insurance required under the federal government maximum probable loss calculation. 51 U.S.C. § 50914(b)(2).

<sup>28</sup>A reusable suborbital rocket is a launch vehicle that can be used more than once and it is capable of launching to space. However, it does not achieve orbit.

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licenses, are also required to sign cross waivers as part of the permitting process.

According to FAA, no FAA-licensed commercial space launch since CSLAA was enacted has resulted in casualties or substantial property damage to third parties that exceeded the amount of insurance coverage FAA required the launch company to provide. According to FAA officials, in the event of a third-party claim that exceeded the launch provider's first-tier coverage, FAA would be involved in any negotiation of the federal government's potential payment, and the Secretary of Transportation would have to approve any settlement to be paid out of the congressional appropriations.<sup>29</sup>

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## Spaceport Insurance Coverage Varies and Could Potentially Be Inadequate Because FAA Has Not Clearly Communicated Its Interpretation of Regulations

Federal statute does not give FAA the authority to require spaceport operators to obtain insurance, but spaceports colocated with federal ranges may be required under federal contractual agreements to insure their property against damage resulting from space launch mishaps. Spaceport insurance coverage varies among the spaceport operators we interviewed, and the stakeholders we spoke with had differing views on the affordability of insurance. Several spaceport operators we interviewed found the financial responsibility regulations for commercial space launches confusing, which could potentially result in their failure to obtain adequate insurance protection.

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## Federal Statute Does Not Require Spaceport Operators to Obtain Insurance, but Spaceports Colocated with Federal Ranges Could Face Insurance Requirements

Unlike launch companies, spaceport operators face no federal statutory or regulatory insurance requirements. Specifically, FAA's spaceport licensing process includes safety requirements for spaceport operators but does not include any insurance requirements. FAA officials stated that their focus is on ensuring public safety and that spaceport operators are responsible for protecting their own property against the risks associated with spaceflight.

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<sup>29</sup>51 U.S.C. § 50915(b).

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Operators of spaceports that are located on federal government properties, however, could have federal contracts or agreements that require them to have insurance to protect their own property from damage resulting from space launch mishaps. For example, through Space Act Agreements, which NASA signs with other organizations to formalize partnerships that help NASA achieve its mission, NASA has imposed insurance requirements for an FAA-licensed spaceport that is located on NASA property. As of July 2016, FAA has licensed just one spaceport that is colocated with a NASA facility—MARS at NASA’s Wallops Flight Facility. A Space Act Agreement between NASA and VCSFA, the spaceport operator at MARS, requires, among other things, that VCSFA certify that sufficient insurance is in place to cover MARS property from damage resulting from space launch mishaps.<sup>30</sup> Similarly, the Air Force could also require spaceport operators to hold insurance to protect the spaceport operators’ own property from damage resulting from space launch mishaps, but the Air Force does not always do so. For example, a Space Operations Support Agreement between the Air Force and Space Florida for Cape Canaveral Spaceport sets some insurance requirements for Space Florida, although the agreement does not explicitly mention insurance to cover Space Florida property against damage resulting from space launch mishaps.

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<sup>30</sup>According to NASA officials, although the Space Act Agreement between NASA and VCSFA already required VCSFA to maintain insurance coverage in the event of a mishap, the agreement was revised after the October 2014 mishap at MARS to require VCSFA to certify that sufficient insurance is in place.

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## Spaceport Insurance Coverage Varies among Spaceport Operators with Recent Commercial Activity, and Views Differ on the Affordability of Insurance

Three of the 10 spaceports FAA has licensed for commercial activity—MARS, Mojave Air and Space Port, and Spaceport America—have had commercial activity in the last 5 years, and their insurance coverage varies.<sup>31</sup> Even though FAA does not require spaceport operators to hold insurance, representatives of these three commercially active spaceports told us that they have both property and liability insurance coverage to protect themselves from losses resulting from space launch mishaps.<sup>32</sup>

Operators of the three commercially active spaceports said they have property insurance coverage either through their contracts with launch companies or through their state government.<sup>33</sup> Operators of two of the three commercially active spaceports said they receive property insurance coverage through the launch companies that operate from their property. Specifically, according to stakeholders, contracts between spaceport operators and launch companies may include provisions requiring the launch company to include the spaceport operator as an additional insured during launch activities. The operator of the other commercially active spaceport said its state provides property coverage for damage resulting from space launch mishaps.

Operators of the three commercially active spaceports receive liability insurance coverage through their status as launch companies' contractors, and additionally through their state if coverage is available. FAA officials said that when a spaceport operator hosts commercial activity at its spaceport, the spaceport operator is considered a contractor

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<sup>31</sup>We refer to spaceports that have hosted commercial space launches in the last 5 years as "commercially active." MARS and Spaceport America have had six and three licensed commercial space launches, respectively, in the last 5 years. All of these launches used a vertical launch orientation. Mojave Air and Space Port has had four permitted commercial space launches in the last 5 years, all with a horizontal launch orientation.

<sup>32</sup>Property insurance indemnifies an insured party whose property is stolen, damaged, or destroyed by a covered peril, in this case a space launch or reentry mishap. Liability insurance covers all sums that the insured becomes legally obligated to pay because of bodily injury or property damage, and sometimes other wrongs to which an insurance policy applies.

<sup>33</sup>These are insurance policies to cover launch activities. Spaceport operators also discussed insurance for day-to-day operations excluding launch activities, but we do not present information on insurance for day-to-day operations in this report.

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of the launch company, which is one kind of “involved party” to a launch.<sup>34</sup> Furthermore, the financial responsibility regulations for commercial space launches state that a launch company must include its contractors and subcontractors as additional insureds on the insurance policy or policies purchased to comply with the insurance requirements FAA sets for launch companies. This means that when a spaceport operator hosts commercial activity at its spaceport, it receives liability coverage under the insurance policy the launch company must purchase to comply with the insurance requirements FAA sets for launch companies. In addition to the liability insurance coverage spaceport operators receive through their status as launch companies’ contractors, operators of two of the three commercially active spaceports said their states provide some degree of liability coverage for damage resulting from space launch mishaps. This coverage may, however, be limited. For example, one commercially active spaceport operator said that it participates in its state’s minor liability program with a cap of \$1 million per event, which is small when compared to the \$500 million cap FAA sets for the liability insurance launch companies must purchase.

Operators of the seven spaceports that have not had commercial activity in the last 5 years have not recently had to obtain insurance to protect their property from damage resulting from launch mishaps. Several of these spaceport operators said they plan to evaluate options for insuring their property against launch-related damage if they host commercial space launches in the future. Operators of three of these spaceports—Cecil Field Spaceport, Midland International Airport, and Ellington Airport—also said their sites are still under development, another reason they have not had to obtain insurance to protect their property from damage resulting from launch mishaps. While these seven spaceports have not had to obtain insurance coverage to protect their property from damage resulting from space launch mishaps, several told us that they have independently purchased property and liability insurance to cover damage resulting from day-to-day operations.

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<sup>34</sup>In this report, we define “involved parties” to commercial space launches as those who are not third parties to commercial space launches. Specifically, involved parties generally include the federal government, the launch company, contractors and subcontractors of the federal government or the launch company, and customers of the launch company. See 52 U.S.C. § 50902 and 14 C.F.R. § 440.3 for the definition of a third party to a commercial space launch.

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While operators of the three commercially active spaceports were able to obtain or receive property and liability insurance coverage, five of the nine spaceport operators we interviewed—including two of the three commercially active spaceports—reported encountering difficulties in obtaining these kinds of insurance for commercial space launches or expressed concerns about their affordability. For example, representatives from one of the three commercially active spaceports explained that when they tried to purchase property insurance to protect the infrastructure at their spaceport from damage resulting from space launch mishaps, insurance providers either declined to provide quotations, provided quotations exceeding or similar to the site's launch fees, or included substantial deductibles. As a result, this spaceport operator, in negotiations with the launch company that operates from their site, pressed for a provision in their contract specifying that the launch company would include the spaceport operator as an additional insured in its insurance policy to protect the spaceport infrastructure against any damage resulting from the launch company's activities under the contract. Representatives from this spaceport also told us that based on the insurance quotations they received, purchasing their own property insurance would have been significantly more expensive than it was for the launch company that operates from their site to expand their policy to cover the spaceport infrastructure.

Other stakeholders we spoke with said insurance for commercial space launches is currently available and affordable. All five insurance companies and brokers we interviewed said insurance for commercial space launches is currently available, and four also categorized insurance for commercial space launches as affordable. Several insurance companies and brokers said the supply of capital invested in the market for this insurance is currently high, which reduces the cost of insurance. One insurance company we interviewed attributed the high supply of capital to relatively low interest rates across financial markets. Two insurance industry stakeholders also said one reason that the commercial space insurance market is an attractive option for investors is that space launch risks are not correlated with other market risks, such as the risk of a natural disaster or financial market risks, so investors can diversify portfolio risks.

Despite the consensus among insurance companies and brokers that insurance for commercial space launches is currently available and affordable, four of the five insurance companies and brokers we interviewed said a catastrophic space launch mishap could reduce its availability. Furthermore, according to two of the insurance companies

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and brokers we interviewed, the commercial space insurance market is linked to the market for aviation insurance, so a large aviation claim could affect the commercial space insurance market.

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**Because of Confusion about Financial Responsibility Regulations, Spaceport Operators May Not Obtain Adequate Protection**

FAA has not clearly communicated its interpretation of financial responsibility regulations to spaceport operators, and spaceport operators may not have adequate protection as a result. As previously discussed, CSLAA and its amendments require launch companies to purchase insurance to cover damage to third parties in case of a launch mishap. FAA officials told us they believe the statute and regulations are clear that during a launch, a spaceport operator that is an active participant in the launch is not considered a third party. Instead, FAA considers spaceport operators that host commercial space launches to be “involved parties” to launches. Because FAA considers spaceport operators hosting commercial space launches involved parties, any damage to spaceport property may not be covered under the liability insurance policy purchased by a launch company. However, spaceport operators may negotiate property insurance coverage with the launch companies that operate from their spaceports and document agreements related to insurance in their contracts, as described in earlier examples. FAA officials said they think the financial responsibility regulations are clear as-is. FAA officials reported that they have not had any significant internal disputes about how these laws and regulations should be interpreted.

However, several spaceport operators we interviewed reported that they find the financial responsibility regulations to be ambiguous. Specifically, they said they are unsure whether they are considered third parties or involved parties to launches. For example, among the spaceport operators, launch companies, and insurance industry stakeholders we interviewed, six said they believe spaceport operators are involved parties; one said it believes spaceport operators are third parties; and six said they believe spaceport operators may be involved parties, third parties, or both, depending on the circumstances. Furthermore, one spaceport operator told us that it asked FAA to clarify its status under a variety of hypothetical scenarios, but FAA officials did not address the confusion about whether the spaceport operator would be considered a third party or an involved party under the scenarios presented. Rather, FAA officials provided general guidance on the financial responsibility

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regulations. Similarly, another spaceport operator argued that its property should be covered under the liability insurance policy purchased by the launch company that operates from its site because it is a third party.<sup>35</sup> A few stakeholders indicated that guidance or further discussion to clarify the language of the financial responsibility regulations would be useful.

Furthermore, several factors can generate additional uncertainty for spaceport operators trying to determine whether they are involved parties or third parties to launches.

- Ownership of the assets involved in commercial space launches may be split among several different parties, including the federal government, a state or municipal government, a launch company, and a launch company's customer. Figure 4 shows the main assets involved in vertical space launches, as well as the variety of parties that stakeholders said may own each asset. A few spaceport operators told us that mixed ownership of spaceport assets can create confusion when they are trying to draw a line between their property and other parties' property.
- Complex launch arrangements or relationships may render unclear a spaceport operator's status as an involved party or a third party. For example, FAA officials acknowledged that a spaceport operator could, in theory, be both a third party and an involved party for a given launch but did not provide any real-world examples of this occurring. Moreover, according to FAA officials, a spaceport operator's status as an involved party or a third party could vary by launch. Spaceport operators may also have a stake in spaceports they themselves do not operate. For example, while Space Florida is licensed to operate Cape Canaveral Spaceport, it also provides financing for space transportation-related infrastructure at other nearby launch facilities. Because relationships like those Space Florida has with operators of nearby launch facilities are not explicitly mentioned in FAA's financial

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<sup>35</sup>In addition to reporting confusion related to whether they are considered a third party, representatives of this spaceport said they think it is unclear whether the insurance launch companies must purchase to protect government property is for federal government property only, or if it includes state and municipal government property as well. FAA officials said their interpretation is that the insurance launch companies must purchase to protect government property is for federal government property only, but 14 CFR § 440 does not explicitly define "government" as the federal government. However, it does define "Government personnel" as, in part, employees of the United States.

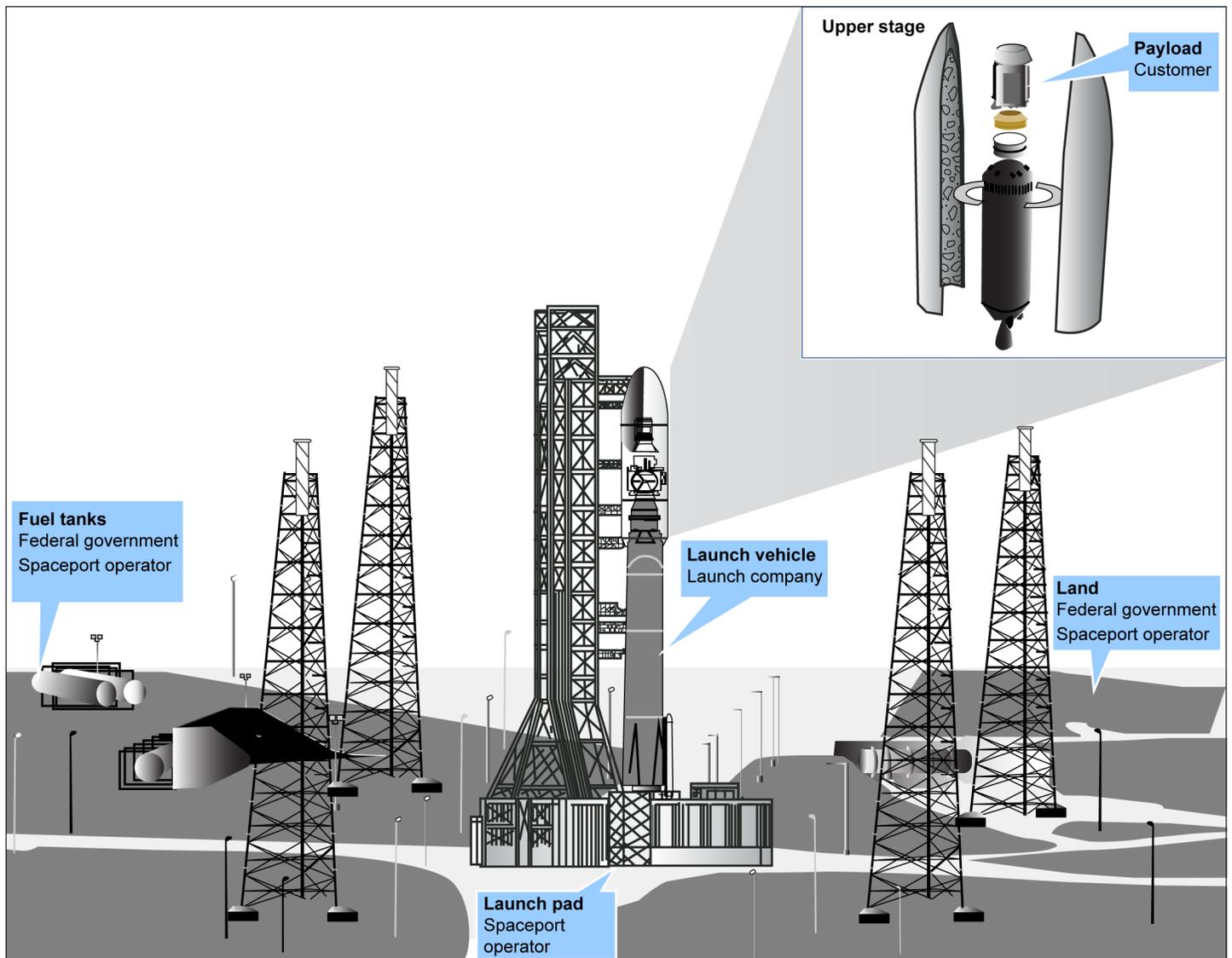
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responsibility regulations, Space Florida officials reported being unsure whether Space Florida is considered an involved party or a third party with regard to the financing it provides at spaceports for which Space Florida is not the licensed operator.<sup>36</sup>

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<sup>36</sup>On September 1, 2016, a SpaceX launch vehicle exploded during a pre-launch test at Launch Complex 40 at Cape Canaveral Air Force Station. While Launch Complex 40 is a federal range not licensed by FAA, Space Florida invested millions in the infrastructure of facilities near Launch Complex 40. Because an investigation into the explosion was under way as of September 2016, the extent to which Space Florida investments were affected by the explosion was not yet clear. However, according to FAA officials, Space Florida would be considered a third party with regard to any damage its property sustains as a result of that explosion.

**Figure 4: Key Assets and Their Possible Owners at FAA-Licensed Spaceports**



Source: GAO analysis of stakeholder interviews. | GAO-17-88

Notes: This figure depicts the main assets involved in vertical space launches and the possible owners of these assets at FAA-licensed spaceports, according to the stakeholders we interviewed. Because stakeholders may not have mentioned all possible ownership arrangements in their interviews, the possible owners included in this figure may not be an exhaustive list. Almost all of the spaceport operators currently licensed by FAA are state or municipal government entities.

When Congress passed CSLA in 1984 and significant amendments to CSLA in 1988, U.S. space launches occurred exclusively at federal ranges, which, as previously mentioned, are U.S. government facilities

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that can host both government and commercial space launches. At the time, Congress may not have anticipated that state and municipal governments would later become involved in the commercial space industry. For example, FAA first licensed California Spaceport for commercial activity in 1996, nearly a decade after Congress passed significant amendments to CSLA. Additionally, the original financial responsibility regulations for commercial space launches were finalized before regulations implementing a spaceport operator licensing regime were finalized.

Congress has stated that state participation in the commercial space industry is in the national interest and of public benefit, and FAA has the dual mission of both regulating and promoting this industry.<sup>37</sup>

Furthermore, to carry out its mission, FAA must communicate with spaceport operators. Federal internal control standards state that managers should communicate information externally to achieve the entity's objectives.<sup>38</sup> However, FAA has not clearly communicated its interpretation of financial responsibility regulations for commercial space launches to spaceport operators. Specifically, FAA has not issued guidance to spaceport operators to clarify when it considers them third parties and when it considers them involved parties. FAA officials told us that while they consult with prospective spaceport operators during the pre-application phase of licensing, they do not have formal guidance to provide to spaceport operators to help spaceport operators understand when they are considered involved parties and when they are considered third parties. According to FAA officials, issuing formal guidance, in general, has not been a high priority; officials believe spaceport operators have several opportunities to ask questions and receive answers about their financial responsibilities, including during pre-application consultation, when renewing a spaceport operator license, during an annual inspection, or informally at any time.

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<sup>37</sup> 51 U.S.C. §50901(a)(9) states that "the participation of State governments in encouraging and facilitating private sector involvement in space-related activity, particularly through the establishment of a space transportation-related infrastructure, including launch sites, reentry sites, complementary facilities, and launch sites and reentry site support facilities, is in the national interest and is of significant public benefit."

<sup>38</sup> GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: September 2014).

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If FAA does not clarify and communicate its interpretation of financial responsibility regulations, spaceport operators that consider themselves third parties may mistakenly assume any launch-related damage to their property would be protected under insurance purchased by launch companies operating from their property.<sup>39</sup> Uninsured losses, which could result from such misunderstandings, can be detrimental in several ways. Uninsured losses may require more recovery time than insured losses, delaying federal efforts to encourage state and municipal governments to establish space transportation-related infrastructure. They may also lead to unexpected costs to taxpayers. For example, VCSFA reported that confusion over who should pay for repairs in the aftermath of the mishap at Wallops Island contributed to delays in resuming launches to resupply the International Space Station from this spaceport.<sup>40</sup> Additionally, according to NASA officials, NASA contributed by increasing the value of an existing contract with VCSFA by \$5 million (funds that were intended for other space operations projects) to fund infrastructure repairs at MARS. The complicating factors that generate additional uncertainty for spaceport operators—mixed ownership of spaceport assets and the potential for a spaceport operator to be both an involved party and a third party or for their status to vary by launch—also underscore the need for FAA to provide clear guidance to spaceport operators.

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## Stakeholders Are Divided on the Need to Change the Current Insurance Approach and on Support for Potential Options

Stakeholders we interviewed were divided in their opinions on the need to revise the current insurance approach, which constitutes the first tier of the existing indemnification regime. Similarly, they expressed differing views about the options we identified for revising the approach: (1) requiring launch companies to purchase insurance to cover spaceport property, and (2) requiring spaceport operators to purchase insurance for their own property. Stakeholders identified some positive aspects and also raised concerns about each option.

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<sup>39</sup>The forms of communication could include, among other things, issuing additional guidance or using other forums to clarify when a spaceport operator is covered by a launch company's insurance policy and when it is not.

<sup>40</sup>Missions to resupply the International Space Station have occurred from Wallops Island, Virginia, as well as from Cape Canaveral Air Force Station, Florida.

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## Stakeholders Presented Mixed Views on the Current Insurance Approach and the Need for Change

Stakeholders we spoke with offered various views on the current insurance approach and on the need to revise it. Several stakeholders noted that the domestic space industry is still in a nascent stage of development and that damage caused by launch mishaps has been limited and infrequent. As a result, a few stakeholders said, the current insurance approach has not yet been sufficiently tested to suggest a need for change. As previously discussed, spaceport operators currently are not required to hold insurance to cover their own property, and launch companies are not explicitly required to purchase insurance to protect spaceport property. In the absence of such requirements, spaceport operators may purchase their own property insurance to protect against damage resulting from launch activity, negotiate insurance protections through contractual agreements with launch companies, or forgo insurance entirely. Few (3 of 10) FAA-licensed spaceports have had commercial activity in the last 5 years. Moreover, as of October 2016, the only FAA-licensed space launch mishap to occur at a nonfederal spaceport was Orbital Sciences Corporation's incident in October 2014 which resulted in damages to the spaceport. The mishap was resolved among the spaceport, the launch company, and NASA outside of any requirements of the current insurance approach.<sup>41</sup>

Stakeholders we interviewed—spaceport operators, launch companies, and insurance industry stakeholders—provided mixed views on the current insurance approach. Specifically, stakeholders were almost evenly split in their views of supporting, opposing, or neither supporting nor opposing the current insurance approach (see table 2). Two of the three launch companies supported continuing the current insurance approach, while spaceport operators and insurance industry stakeholders were more divided on the need for change.

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<sup>41</sup>The Virginia Commercial Space Flight Authority was required to insure its own property as part of its Space Act Agreement with NASA.

**Table 2: Summary of Stakeholder Views on the Continuation of the Current Insurance Approach, as of August 2016**

Continuation of the current insurance approach	Spaceport operators	Launch companies	Insurance industry stakeholders	Total
Support	3	2	1	6
Oppose	4	0	2	6
Neither support nor oppose	2	1	2	5
<b>Total number of stakeholders</b>	<b>9</b>	<b>3</b>	<b>5</b>	<b>17</b>

Source: GAO analysis of stakeholder questionnaire responses. | GAO-17-88

Furthermore, stakeholders had mixed views on how well the current insurance approach is working. In particular, some felt that the current approach creates a lack of certainty, creates an uneven playing field between federal and nonfederal ranges, and increases inefficiency, although views were not always uniform:

- Lack of certainty.** Some stakeholders we spoke with said that the current insurance approach—which, for example, relies on contracts between launch companies and spaceport operators to determine insurance coverage—does not promote certainty because contracts can be open to interpretation and unclear. One spaceport operator also said that such confusion is likely to continue as more states build spaceports, because each state and spaceport may have different policies or agreements with each launch company. However, concerns about the current insurance approach lacking certainty were not shared by all stakeholders. We heard from two launch companies and one insurance industry stakeholder that as long as the insurance coverage specified in the contracts is agreed upon in advance of any launches, all involved parties should be certain about the terms and levels of protections.
- Uneven playing field.** Some spaceport operators we interviewed said that the current insurance approach has not promoted a level playing field between federal ranges and state or municipal spaceports. These operators pointed out that federal ranges enjoy a competitive advantage because launch companies are already required to

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purchase insurance to cover damage to federal property, while nonfederal spaceports are not similarly protected.<sup>42</sup>

- **Inefficiency.** Some stakeholders said that the current approach is less efficient because currently insurance coverage has to be negotiated for every launch or set of launches, whereas if insurance were required by law or regulation, such negotiations would be unnecessary. On the other hand, some stakeholders said that negotiating contracts could be more efficient and that the contracts could be adjusted more quickly than creating new regulations or amending existing regulations.

However, stakeholders also identified reasons why the current insurance approach should be continued, including greater flexibility, enhanced competition, and assured consistency, although here again views were not always uniform.

- **Greater flexibility.** Several stakeholders we interviewed, including at least one from each of our three stakeholder groups, said that using contractual agreements for insurance coverage allows involved parties to individually assess their assets and risks and to make decisions on how best to protect them given the varying characteristics of the launch vehicles and sites. For example, a spaceport may have expensive equipment to protect, or it may be interested in only hosting experimental activity, some of which is designed to fail for testing purposes. In either of these cases, the involved parties can determine the desired level of protection.
- **Enhanced competition.** Some stakeholders we interviewed, including at least one from each of our three stakeholder groups, said that the flexibility to make their own business decisions regarding what type and how much insurance coverage to obtain allows for competitive pricing to attract businesses. Specifically, spaceport operators might keep their launch prices low by purchasing less coverage, which might allow them to attract new launch companies to

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<sup>42</sup> FAA officials noted that while federal ranges may have access to this protection, commercial spaceports may have more of an advantage over federal ranges in pricing and flexibility. For example, launch companies operating from federal ranges must pay federal range prices which, according to FAA officials and a launch company, may be higher than prices at commercial spaceports and are nonnegotiable. In addition, commercial spaceports may be able to offer greater flexibility than federal ranges with respect to the scheduling of launches.

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their spaceports. In contrast, some stakeholders, including at least one from each of our three stakeholder groups, said they would like to remove the temptation for spaceport operators to forego insurance in order to attract new customers with lower prices, as it puts those operators at risk of not being able to recover from a mishap.

- **Assured consistency.** An insurance industry stakeholder said that because commercial space launch activities require significant advanced planning, changing regulatory conditions after such activities have begun can create an additional expense that they did not consider in their initial plans. One launch company we spoke with added that continuing the current insurance approach is important, as changes to the insurance rules may complicate the business environment for launch companies in the early stages of operations.

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## Stakeholders Had Differing Views on Potential Options for Revising the Insurance Approach

Based on interviews with FAA, spaceport operators, launch companies, and insurance industry stakeholders, we identified two primary options for implementing a revised insurance approach as it relates to state and municipal spaceports:

- **Require launch companies to purchase insurance** to cover spaceport property against damage resulting from launch accidents. This option would likely be implemented through FAA's launch licensing process by including an insurance requirement for potential damage to spaceport property.<sup>43</sup>
- **Require the spaceport operators to purchase insurance** to cover their own property against damage resulting from launch accidents. This option would likely be implemented through the spaceport operator licensing process.<sup>44</sup>

While stakeholder groups we interviewed expressed differing views about the options, within stakeholder groups, views on the potential options were fairly consistent. Most spaceport operators we interviewed favored

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<sup>43</sup>Variations of this option include requiring launch companies purchase insurance for only licensed spaceports on state and municipal property, or requiring launch companies purchase insurance for all licensed spaceports.

<sup>44</sup>Variations of this option include requiring only licensed spaceports on state and municipal property to purchase insurance, or requiring insurance at all licensed spaceports.

the option to require launch companies to purchase insurance, while most launch companies favored continuing the current approach. Others, such as those among the insurance industry stakeholders we interviewed, tended to favor the option to require launch companies to purchase insurance.<sup>45</sup> In general, stakeholders tended to oppose options where the burden of purchasing the insurance was on them.

Stakeholder groups we interviewed expressed differing views about the option of requiring launch companies to purchase insurance to cover spaceport property against damage resulting from a mishap. Nearly all spaceport operators and insurance industry stakeholders we interviewed supported this option, while launch companies either opposed it or were neutral (see table 3).

**Table 3: Summary of Stakeholder Views on Requiring Launch Companies to Purchase Insurance for Protection of Licensed Spaceports on State and Municipal Property, as of August 2016**

Require launch companies to purchase insurance	Spaceport operators	Launch companies	Insurance industry stakeholders	Total
Support	7	0	5	12
Oppose	1	2	0	3
Neither support nor oppose	1	1	0	2
<b>Total number of stakeholders</b>	<b>9</b>	<b>3</b>	<b>5</b>	<b>17</b>

Source: GAO analysis of stakeholder questionnaire responses. | GAO-17-88

Similarly, stakeholder groups we interviewed expressed differing views about the option of requiring spaceport operators to purchase insurance to cover their own property against damage resulting from mishaps. Most spaceport operators opposed this option, while launch companies either opposed it or were neutral, and insurance industry stakeholders were divided (see table 4).

<sup>45</sup>With regard to the variations to include requiring only licensed spaceports on state and municipal property to purchase insurance, or requiring insurance at all licensed spaceports for each option, most stakeholders did not express a preference between these two scenarios.

**Table 4: Summary of Stakeholder Views on Requiring the Spaceport Operators to Purchase Insurance for Licensed Spaceports on State and Municipal Property, as of August 2016**

Require spaceport operators to purchase insurance	Spaceport operators	Launch companies	Insurance industry stakeholders	Total
Support	2	0	2	4
Oppose	6	1	2	9
Neither support nor oppose	1	2	1	4
<b>Total number of stakeholders</b>	<b>9</b>	<b>3</b>	<b>5</b>	<b>17</b>

Source: GAO analysis of stakeholder questionnaire responses. | GAO-17-88

In addition, stakeholders we interviewed said that one or both options would benefit participants by leveling the playing field, increasing certainty, and increasing efficiency:

- Leveled playing field.** Many stakeholders we interviewed, including at least one from each of the three stakeholder groups, said that the option of requiring launch companies to purchase insurance to cover spaceport property would help promote a level playing field with federal ranges. This is because commercial spaceports would then receive the same level of insurance protection as federal spaceports, which launch companies are already required to cover in their insurance policies. According to a number of spaceport operators and insurance industry stakeholders we spoke with, this option would be more equitable, as state and municipal spaceports are no different from federal ranges in terms of function or capabilities.
- Increased certainty.** Depending on which option was implemented, several stakeholders from all three stakeholder groups said each of the potential options would provide certainty to all parties on what would be covered, and by whom, should a mishap occur. Moreover, they said that one or both options would provide certainty to all involved parties that spaceport operators would have the financial means to repair damage quickly after a mishap and resume launch activities without keeping the launch customers waiting. In addition, several stakeholders, including at least one from each stakeholder group, said that the option of requiring launch companies to purchase insurance would promote investment in and development of spaceports. Specifically, some stakeholders said that investors and owners would have greater assurance that the assets they have invested in would have adequate protections in the event of a launch mishap.

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- **Increased efficiency.** Several stakeholders, including at least one from each stakeholder group, said that either option would make contract negotiations more efficient, as the insurance protections would be clearly stipulated in law.

However, stakeholders raised several concerns about one or both options to revise the current insurance approach. Specifically, stakeholders said one or both options could provide less flexibility, increase costs for some participants, and limit participants' ability to do business in some ways.

- **Less flexibility.** Some stakeholders we spoke with told us that one or both options could reduce flexibility in various ways. For example, one spaceport operator said that either option would require launch companies or spaceport operators to purchase insurance to cover spaceport property rather than allowing them to make decisions on how best to protect and manage their risk and property assets. For example, this representative said that spaceport operators may not want to insure some of their own property because of its low value. According to two spaceport operators, requiring full protection of this property could burden a spaceport operator to take on a cost it otherwise would not. For example, requiring spaceport operators to purchase insurance may also be overly burdensome for spaceports that host experimental activity or for those that have more facilities and expensive assets to insure.
- **Higher costs.** Some stakeholders also noted that one or both options could increase costs or shift them to certain participants, depending on which option was implemented. A few spaceport operators expressed concerns that the option of requiring spaceport operators to purchase insurance would be onerous because of the potentially high cost of securing such coverage. According to some insurance industry stakeholders, the cost for the launch company to add the spaceport as an insured party under the launch company's policy would be less than the cost for the spaceport to have its own policy covering the same property.<sup>46</sup>

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<sup>46</sup>We did not conduct our own independent analysis of whether a spaceport operator purchasing its own insurance would be more expensive than a launch company adding that spaceport to its existing insurance policy. Other stakeholders reported different opinions regarding the costs of insurance.

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On the other hand, some stakeholders, including at least one from each of our three stakeholder groups, raised the concern that the option of requiring launch companies to purchase insurance would increase their cost of conducting business. According to one insurance industry stakeholder it could disproportionately affect smaller launch companies that may have fewer resources. Additionally, according to another insurance industry stakeholder and one spaceport operator, the increased cost of conducting business for launch companies could reduce the amount of launch activity that would otherwise take place. However, a few stakeholders—namely, spaceport operators and insurance industry stakeholders—said that the government maximum probable loss calculation would not be significantly different if state and municipal spaceport property were included, as the addition of such property would present little increased cost in the maximum probable loss calculation.<sup>47</sup>

- **Limited ability to do business.** For one or both options, several stakeholders, including at least one from each of our three stakeholder groups, expressed concern that requiring the purchase of insurance would negatively affect participants' ability to do business. For example, one spaceport operator raised the concern that if launch companies were required to purchase insurance, the amount of liability insurance required to protect each spaceport would become part of the launch company's business decision regarding which spaceport to partner with. As a result, according to a launch company and a spaceport operator, such a requirement could affect competition between spaceports because some spaceports would require less insurance due to less property that needs protection. In another example, some stakeholders said that requiring spaceport operators to purchase insurance may be more burdensome for newer spaceports due to their limited track records or for spaceports with lower risks.<sup>48</sup>

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<sup>47</sup>We did not verify this statement with FAA, as FAA is currently evaluating its maximum probable loss methodology.

<sup>48</sup>These options to amend the current insurance approach could have implications outside of the United States. However, international implications of changes to the current approach were outside of our scope of work.

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Stakeholder views were mixed on which party was in the best position to determine risk. Both spaceport operators and insurance industry stakeholders said that the responsibility should be on the entity that has the most control over launch activities and is in the best position to avoid causing damage. Specifically, they said that launch companies perform the risky activities and exercise the most control over those activities, and it would therefore be most fair for the launch companies to be responsible for insuring against damages caused by those activities. One spaceport operator also said that because the launch companies, which conduct the launches, have a clearer idea of the risk of each launch (e.g., the vehicle's track record), they are better positioned to make an informed decision on insurance coverage for those risks. However, two stakeholders said that spaceport operators are aware of the risks of their involvement and are well positioned to make informed business decisions about whether or not to purchase insurance and to what extent.

In addition to the issues stakeholders raised, limiting costs to the federal government before and after a disaster is another relevant consideration for revising the current insurance approach, as our prior work suggests.<sup>49</sup> The potential cost to the federal government of revising the current insurance approach related to FAA-licensed spaceports depends on the accuracy of the related maximum probable loss calculation. As discussed previously, this calculation evaluates and estimates the risk and potential losses associated with launch activity and the corresponding insurance coverage a launch company must purchase. An inaccurate calculation that understates the amount of insurance a launch company must obtain would increase the exposure to the federal government, as the insurance amount would be less than the potential losses associated with the launch activity and the property would be inadequately protected. In a July 2012 report, we found that the potential cost to the federal government of indemnifying third-party losses is currently unclear because it depends in part on a calculation that may not be sound. We recommended that FAA review and periodically reassess its maximum probable loss methodology, including assessing the reasonableness of

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<sup>49</sup>See GAO, *National Flood Insurance Program: Options for Providing Affordability Assistance*, [GAO-16-190](#) (Washington, D.C.: Feb. 10, 2016).

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the assumptions used.<sup>50</sup> FAA is currently evaluating its maximum probable loss methodology. We have an ongoing review to independently assess the methodology used by FAA.<sup>51</sup>

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## Conclusions

Congress has clearly expressed an interest in the development of the commercial space industry, which has begun to move beyond launching exclusively from federal ranges to launching from state, municipal, and private spaceports. Expansion in the number of spaceport operator licenses—and the potentially complex ownership and contractual arrangements at the spaceports FAA has licensed—developed largely after the legislation authorizing the current indemnification approach were established. The spaceport operators we spoke with expressed confusion about the financial responsibility regulations for commercial space launches, which could potentially result in gaps in insurance protection. Among other things, FAA is tasked with regulating and promoting commercial space launches by the private sector, as well as facilitating the expansion of U.S. commercial space transportation. Gaps in insurance protection can result in uninsured losses, which can, in turn, hinder the development of space-transportation-related infrastructure that supports the commercial space launch industry. Given the growth in nonfederal spaceports, ensuring that spaceport operators have an accurate understanding of the financial responsibility regulations will only become more important.

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## Recommendations for Executive Action

To better ensure spaceport operators' understanding of FAA's financial responsibility regulations for commercial space launches, we recommend that the Secretary of Transportation ensure that the FAA Administrator provides additional communication to clarify FAA's interpretation of the financial responsibility regulations for commercial space launches. The forms of communication could include, among other things, issuing

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<sup>50</sup>See GAO, *Commercial Space Launches: FAA Should Update How It Assesses Federal Liability Risk*, [GAO-12-899](#) (Washington, D.C.: July 30, 2012). The recommendation was closed on September 2016.

<sup>51</sup>U.S. Commercial Space Launch Competitiveness Act, Pub. L. No. 114-90, § 102(c), 129 Stat. 704, 705 (2015).

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additional guidance or using other forums to clarify when a spaceport operator is a third party to a launch and when it is not.

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## Agency Comments

We provided a draft of this report to the Department of Transportation for its review and comment. The Department of Transportation provided us with technical comments, which we incorporated as appropriate, but did not comment on the recommendation.

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We will send copies of this report to the appropriate congressional committees, the Secretary of the Department of Transportation, and the Administrator of the National Aeronautics and Space Administration. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact Alicia Puente Cackley at (202) 512-8678 or [cackleya@gao.gov](mailto:cackleya@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last part of this report. GAO staff who made major contribution to this report are listed in appendix III.



Alicia Puente Cackley  
Director  
Financial Markets and Community Investment

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# Appendix I: Scope and Methodology

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The report examines (1) the insurance coverage spaceport operators have in place to protect themselves from losses resulting from space launch mishaps and (2) stakeholder views on the need to change the current insurance approach and options for revising it.

To address these objectives, we reviewed our prior related reports and other studies and analyzed relevant laws and regulations.<sup>1</sup> We reached out to all 10 spaceport operators licensed by the Federal Aviation Administration (FAA), as of July 2016, and conducted semistructured interviews with 8 of these 10 spaceport operators. Two declined to be interviewed (due to transitions they were making in their operations) but one of these two provided written responses to our semistructured interview questions. Their responses were incorporated as appropriate. Therefore, we analyzed information from 9 of the 10 FAA-licensed spaceports.

We also conducted semistructured interviews with launch companies. We selected all launch companies that had conducted more than one commercial space launch from a spaceport in the last 5 years for interviews. Of the seven launch companies we identified that conducted a launch in the last 5 years, we interviewed four. Of the remaining three, two declined our request and another was no longer in operation. We also included one launch company that had not launched in the last 5 years but has been active in advancing the commercial space launch activities. Therefore, we interviewed a total of five launch companies. Furthermore, we conducted semistructured interviews with all five key insurance industry stakeholders—three insurance brokers and two insurance companies—that had provided coverage to the commercial space industry, and two industry associations. Additionally, we interviewed officials from FAA and National Aeronautics and Space Administration (NASA).

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<sup>1</sup>See, for example, GAO, *Commercial Space Launches: FAA Should Update How It Assesses Federal Liability Risk*, [GAO-12-899](#) (Washington, D.C.: July 30, 2012); *Commercial Space Launches: FAA's Risk Assessment Process Is Not Yet Updated*, [GAO-14-328T](#) (Washington, D.C.: Feb. 4, 2014); and *Federal Aviation Administration: Commercial Space Launch Industry Developments Present Multiple Challenges*, [GAO-15-706](#) (Washington, D.C.: Aug. 25, 2015). See also National Aeronautics and Space Administration, Office of Inspector General, *NASA's Response to Orbital's October 2014 Launch Failure: Impacts on Commercial Resupply of the International Space Station*, IG-15-023 (Washington, D.C.: Sept. 17, 2015).

We also visited two spaceports selected based on various factors including number of years in operation, colocation with federal ranges, commercial activity within the last 5 years, and occurrence of a commercial space launch mishap. We visited Mid-Atlantic Regional Spaceport at NASA's Wallops Flight Facility in Wallops Island, Virginia, because it is the site of the most recent mishap at a nonfederal spaceport, among other factors. In addition, we visited Cape Canaveral Spaceport because it has conducted many commercial space activities within the last 5 years, among other factors.

In addition to analyzing information from our semistructured interviews, to examine the insurance coverage spaceport operators have put in place to protect themselves from losses resulting from space launch mishaps, we requested documentation, such as agreements with language related to insurance coverage, from a nonprobability sample of operators of spaceports. Specifically, we requested documentation from one spaceport that conducts vertical launches and one that conducts horizontal launches to understand how spaceports are protecting themselves against losses from space launch mishaps.<sup>2</sup> We reviewed agreements from one spaceport; the other spaceport provided standard insurance language in an email. We selected these two spaceports based on factors such as number of years in operation and commercial space launch activities within the last 5 years. In some cases, the information we requested is proprietary, and spaceport operators said that they could not provide it.

To examine the stakeholder views on the need to change the current insurance approach and options for revising it, we first conducted semistructured interviews with all stakeholders as described earlier, and based on their inputs, we sent a questionnaire to the stakeholders for their opinion on the options identified.<sup>3</sup> We excluded industry associations

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<sup>2</sup>There are two types of launch orientation—vertical and horizontal takeoff or landing. Vertical takeoff or landing requires a launch pad, while horizontal takeoff and landing are similar to those of conventional airplanes, requiring a runway to take off and land.

<sup>3</sup>After we received the responses from the stakeholders, we noticed a typographical error in the questionnaire pertaining to the existing insurance approach (i.e., status quo). We do not believe the typo affected the responses because the current insurance approach is known to the stakeholders. Furthermore, the error did not make the statement inaccurate but redundant.

from our follow-up questionnaire because many of their member organizations received our questionnaire individually, and members' views for the options are reflected in our analysis. We sent questionnaires to nine spaceport operators—those that we interviewed or received written responses from—and received responses from all nine. Of the five launch companies, we sent questionnaires to four and excluded one launch company because during our first round of data collection, its representatives expressed that they did not feel comfortable providing their opinion on the options. We received responses from three of the four launch companies. Lastly, we sent questionnaires to five insurance industry stakeholders and received responses from all five. A copy of our questionnaire is included as appendix II.

We conducted this performance audit from January 2016 to November 2016 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 our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

# Appendix II: GAO Questionnaire to Stakeholders on Options for Addressing the Protection of Launch Site (i.e., Spaceport) Property



U.S. Government Accountability Office

## Space Insurance Expansion Follow-up Questionnaire for Stakeholders

**Background:** We are following up with the stakeholders we interviewed on the potential inclusion of state and municipal property in the three-tiered approach for sharing liability between the government and private launch companies (often referred to as the indemnification regime) for commercial space launches. We have developed a list of potential options to address the protection of launch site (i.e., spaceport) property, along with a list of key considerations that we believe are consistent with the spirit of the CSLA and its amendments, and could serve as goals supporting FAA's mission ("to encourage, facilitate, and promote U.S. commercial space transportation"). Both our list of potential options and our list of key considerations are informed by interviews with stakeholders such as yourself.

**Key Considerations:** Please provide feedback from your organization's perspective by answering the questions below on the extent to which each option furthers the following key considerations, which are consistent with FAA's mission to promote the commercial space industry:

- **Promoting a level playing field among launch sites**, characterized as launch sites being able to compete with similar access to federal resources (e.g. insurance).
- **Promoting certainty**, characterized as understanding the rules, regulations, and risks related to being involved in the space industry so stakeholders can obtain adequate protections against losses resulting from space launch mishaps.
- **Promoting efficiency**, characterized as stakeholders being able to operate in an environment that does not place too onerous of a responsibility on involved parties.

**Instructions:** To answer this questionnaire, please save this file to your computer as a Word document. Enter your responses directly into the saved Word document. After you have finished recording your responses, save the file once more. Please return the completed questionnaire to [redacted] by attaching your final saved Word file to an email. If you have any questions, please contact [redacted] by phone at [redacted] or by email at [redacted].

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**Appendix II: GAO Questionnaire to Stakeholders on Options for Addressing the Protection of Launch Site (i.e., Spaceport) Property**

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**Questionnaire:** We will ask your opinion of each option, first as it relates only to licensed launch sites (i.e., spaceports) on state and municipal property, and secondly as it relates to licensed launch sites on state, municipal, and privately owned property.

**Option A: Require launch companies to purchase insurance to cover launch site (i.e., spaceport) property against damages resulting from launch accidents.** This option would likely be implemented through FAA's launch licensing process, by revising the Maximum Probable Loss (MPL) calculation to include potential damages to launch site property.

1. To what extent do you support or oppose **Option A** as it relates to licensed launch sites (i.e., spaceports) on **state and municipal** property?

- Strongly Support
- Somewhat Support
- Neither Support nor Oppose
- Somewhat Oppose
- Strongly Oppose
- Don't Know

Please explain your choice in the text box below, including how this option fulfills any or all of the key considerations listed at the beginning of this questionnaire.

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**Appendix II: GAO Questionnaire to Stakeholders on Options for Addressing the Protection of Launch Site (i.e., Spaceport) Property**

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2. To what extent do you support or oppose **Option A** as it relates to **all** licensed launch sites (i.e., spaceports) on **state, municipal, and privately** owned property?

- Strongly Support
- Somewhat Support
- Neither Support nor Oppose
- Somewhat Oppose
- Strongly Oppose
- Don't Know

Please explain your choice in the text box below, including how this option fulfills any or all of the key considerations listed at the beginning of this questionnaire.

**Option B: Require launch site operators (i.e., spaceport operators) to purchase insurance to cover their own property against damages resulting from launch accidents.** This option would likely be implemented through the launch site operator licensing process, as long as coverage is reasonably affordable and available.

3. To what extent do you support or oppose **Option B** as it relates to licensed launch sites (i.e., spaceports) on **state and municipal** property?

- Strongly Support
- Somewhat Support
- Neither Support nor Oppose
- Somewhat Oppose
- Strongly Oppose
- Don't Know

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**Appendix II: GAO Questionnaire to Stakeholders on Options for Addressing the Protection of Launch Site (i.e., Spaceport) Property**

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Please explain your choice in the text box below, including how this option fulfills any or all of the key considerations listed at the beginning of this questionnaire.

4. To what extent do you support or oppose **Option B** as it relates to **all** licensed launch sites (i.e., spaceports) on **state, municipal, and privately** owned property?

- Strongly Support
- Somewhat Support
- Neither Support nor Oppose
- Somewhat Oppose
- Strongly Oppose
- Don't Know

Please explain your choice in the text box below, including how this option fulfills any or all of the key considerations listed at the beginning of this questionnaire.

**Appendix II: GAO Questionnaire to Stakeholders on Options for Addressing the Protection of Launch Site (i.e., Spaceport) Property**

**Option C: Maintain the status quo.** Preserve the existing structure with no insurance requirements for a) launch site operators (i.e., spaceport operators) to cover launch site property or b) launch site operators to cover their own property. Launch site operators may purchase their own property insurance or negotiate insurance protections in contracts with launch companies.

5. To what extent do you support or oppose **Option C**?

- Strongly Support
- Somewhat Support
- Neither Support nor Oppose
- Somewhat Oppose
- Strongly Oppose
- Don't Know

Please explain your choice in the text box below, including how this option fulfills any or all of the key considerations listed at the beginning of this questionnaire.

6. Please describe any other considerations—beyond promoting a level playing field, promoting certainty, and promoting efficiency—that informed your answers or are important to you.

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**Appendix II: GAO Questionnaire to Stakeholders on Options for Addressing the Protection of Launch Site (i.e., Spaceport) Property**

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7. Please describe any other options you would suggest for consideration.

8. If you indicated support for multiple options listed above, please indicate which one(s) you most prefer in the text box below.

**For additional follow-up purposes, please provide the name and phone number of the person who completed this questionnaire:**

**Name of respondent:**

**Organization:**

**Phone number of respondent:**

**Thank you for taking the time to complete this questionnaire!**

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# Appendix III: GAO Contact and Staff Acknowledgments

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## GAO Contact

Alicia Puente Cackley, (202) 512-8678 or [cackleya@gao.gov](mailto:cackleya@gao.gov)

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## Staff Acknowledgments

In addition to the contact named above, Patrick A. Ward (Assistant Director), Chir-Jen Huang (Analyst-in-Charge), Caitlin Cusati, Shilpa Grover, Anne Kruse, Maureen Luna-Long, Jessica Sandler, Jennifer Schwartz, Joseph Silvestri, Jena Sinkfield, Molly Traci and Shana Wallace made key contributions to this report.

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