



# Federal Register

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**Thursday,  
December 29, 2005**

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**Part II**

## **Department of Transportation**

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**Federal Aviation Administration**

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**14 CFR Parts 401, 415 et al.  
Human Space Flight Requirements for  
Crew and Space Flight Participants;  
Proposed Rule**

**DEPARTMENT OF TRANSPORTATION****Federal Aviation Administration**

**14 CFR Parts 401, 415, 431, 435, 440, 450, and 460**

[Docket No. FAA-2005-23449; Notice No. 05-17]

RIN 2120-A157

**Human Space Flight Requirements for Crew and Space Flight Participants**

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Notice of proposed rulemaking (NPRM).

**SUMMARY:** The FAA proposes requirements for human space flight of crew and space flight participants as required by the Commercial Space Launch Amendments Act of 2004. If adopted, this rulemaking would establish requirements for crew qualifications, training, and notification. It would also establish training and informed consent requirements for space flight participants. The rulemaking would also modify existing financial responsibility requirements to account for the FAA's new authority for space flight participants and crew, and to issue experimental permits. The experimental permit is the subject of a separate rulemaking. The FAA is conducting this rulemaking in order to fulfill its responsibilities under the new act. The requirements are designed to provide an acceptable level of safety to the general public, and to notify individuals on board of the risks associated with a launch or reentry.

**DATES:** Send your comments on or before February 27, 2006.

**ADDRESSES:** You may send comments [identified by Docket Number FAA-2005-23449] using any of the following methods:

- DOT Docket Web site: Go to <http://dms.dot.gov> and follow the instructions for sending your comments electronically.

- Government-wide rulemaking Web site: Go to <http://www.regulations.gov> and follow the instructions for sending your comments electronically.

- Mail: Docket Management Facility; U.S. Department of Transportation, 400 Seventh Street, SW., Nassif Building, Room PL-401, Washington, DC 20590.

- Fax: 1-202-493-2251.

- Hand Delivery: Room PL-401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

For more information on the rulemaking process, see the

**SUPPLEMENTARY INFORMATION** section of this document.

*Privacy:* We will post all comments we receive, without change, to <http://dms.dot.gov>, including any personal information you provide. For more information, see the Privacy Act discussion in the **SUPPLEMENTARY INFORMATION** section of this document.

*Docket:* To read background documents or comments received, go to <http://dms.dot.gov> at any time or to Room PL-401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

**FOR FURTHER INFORMATION CONTACT:** For technical information, contact Kenneth Wong, Deputy Manager, Licensing and Safety Division, Commercial Space Transportation, AST-200, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591; telephone (202) 267-8465; facsimile (202) 267-3686, e-mail [ken.wong@faa.gov](mailto:ken.wong@faa.gov). For legal information, contact Laura Montgomery, Senior Attorney, Office of the Chief Counsel, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591; telephone (202) 267-3150; facsimile (202) 267-7971, e-mail [laura.montgomery@faa.gov](mailto:laura.montgomery@faa.gov).

**SUPPLEMENTARY INFORMATION:****Comments Invited**

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. We also invite comments relating to the economic, environmental, energy, or federalism impacts that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. We ask that you send us two copies of written comments.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking. The docket is available for public inspection before and after the comment closing date. If you wish to review the docket in person, go to the address in the **ADDRESSES** section of this preamble between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. You may also review the docket using the Internet at the web address in the **ADDRESSES** section.

*Privacy Act:* Using the search function of our docket Web site, anyone can find

and read the comments received into any of our dockets, including the name of the individual sending the comment (or signing the comment on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477-78) or you may visit <http://dms.dot.gov>.

Before acting on this proposal, we will consider all comments we receive on or before the closing date for comments. We will consider comments filed late if it is possible to do so without incurring expense or delay. We may change this proposal in light of the comments we receive.

If you want the FAA to acknowledge receipt of your comments on this proposal, include with your comments a pre-addressed, stamped postcard on which the docket number appears. We will stamp the date on the postcard and mail it to you.

**Proprietary or Confidential Business Information**

Do not file in the docket information that you consider to be proprietary or confidential business information. Send or deliver this information directly to the person identified in the **FOR FURTHER INFORMATION CONTACT** section of this document. You must mark the information that you consider proprietary or confidential. If you send the information on a disk or CD ROM, mark the outside of the disk or CD ROM and also identify electronically within the disk or CD ROM the specific information that is proprietary or confidential.

Under 14 CFR 11.35(b), when we are aware of proprietary information filed with a comment, we do not place it in the docket. We hold it in a separate file to which the public does not have access, and place a note in the docket that we have received it. If we receive a request to examine or copy this information, we treat it as any other request under the Freedom of Information Act (5 U.S.C. 552). We process such a request under the DOT procedures found in 49 CFR part 7.

**Availability of Rulemaking Documents**

You can get an electronic copy using the Internet by:

- (1) Searching the Department of Transportation's electronic Docket Management System (DMS) Web page (<http://dms.dot.gov/search>);
- (2) Visiting the Office of Rulemaking's Web page at <http://www.faa.gov/avr/arm/index.cfm>; or

(3) Accessing the Government Printing Office's Web page at <http://www.gpoaccess.gov/fr/index.html>.

You can also get a copy by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267-9680. Make sure to identify the docket number, notice number, or amendment number of this rulemaking.

#### Authority for This Rulemaking

The FAA's authority to issue rules regarding commercial space transportation safety is found under the general rulemaking authority, 49 U.S.C. 322(a), of the Secretary of Transportation to carry out Subtitle IX, Chapter 701, 49 U.S.C. 70101-70121 (Chapter 701). Additionally, the recently enacted Commercial Space Launch Amendments Act of 2004 (the CSLAA), describes in more detail the scope of the agency's authority. Under 49 U.S.C. 70105(b)(4), no holder of a license or permit may launch or reenter crew unless the crew has received training and has satisfied medical or other standards specified in a license or permit in accordance with FAA regulations. This rulemaking would impose crew qualification and training requirements and implement the statutory requirement that an operator advise the flight crew that the U.S. Government has not certified the launch vehicle as safe. Section 70105(b)(5) provides for the FAA to promulgate regulations for the holder of a license or permit to inform a space flight participant in writing about the risks of launch or reentry. Under the FAA's public safety mandate, the FAA here proposes training and security requirements for a space flight participant.

#### Table of Contents

- I. Background
- II. General Discussion of the Proposals
  - A. Launch and Reentry With Crew
    - 1. Definitions Applicable to Crew
    - 2. Authority and Process
    - 3. Pilot and Remote Operator Qualifications
    - 4. Medical Standards for Crew
    - 5. Crew Training
    - 6. Crew Notification
    - 7. Environmental Control and Life Support System
    - 8. Smoke Detection and Fire Suppression
    - 9. Human Factors
    - 10. Verification Program
    - 11. Crew and Space Flight Participant Waiver of Claims Against U.S. Government
  - B. Launch and Reentry With a Space Flight Participant
    - 1. Risk to Space Flight Participants

- 2. Informed Consent
- 3. Physical Examination
- 4. Space Flight Participant Training
- 5. Security Requirements
- C. Financial Responsibility and Waiver of Liability
  - 1. Proposal To Combine Parts 440 and 450
  - 2. Customers of Permittee
  - 3. Space Flight Participants and Crew
- III. Rulemaking Analyses and Notices
- IV. The Proposed Amendment

#### I. Background

Chapter 701 authorizes the Secretary of Transportation and, through delegations, the FAA's Associate Administrator for Commercial Space Transportation, to oversee, license, and regulate both launches and reentries, and the operation of launch and reentry sites when carried out by U.S. citizens or within the United States. 49 U.S.C. 70104, 70105; U.S. Federal Aviation Administration, Commercial Space Transportation Delegations of Authority, N1100.240 (Nov. 21, 1995). Chapter 701 directs the FAA to exercise this responsibility consistent with public health and safety, safety of property, and the national security and foreign policy interests of the United States, and to encourage, facilitate, and promote commercial space launch and reentry by the private sector. 49 U.S.C. 70105, 70103.

In September 2000, the FAA issued regulations for licensing reusable launch vehicle (RLV) missions and for the conduct of space reentry activities. Commercial Space Transportation Reusable Launch Vehicle and Reentry Licensing Regulations; Final Rule, 65 FR 56618, 56620 (Sept. 19, 2000). Later, the FAA developed "Draft Guidelines for Licensed Suborbital RLV Operations With Flight Crew," (Oct. 7, 2003).

Historically, license applicants have consisted of operators of expendable launch vehicles, which do not carry crew or passengers. Accordingly, the FAA's regulation of space launch activities has mainly addressed the safety of the uninvolved public from launch hazards. New developments in technology, potential markets, and the law have changed this. Lured by a prize of \$10 million, a group of inventors and entrepreneurs began working to create suborbital reusable launch vehicles to take private citizens into space for short periods of weightlessness and a view of outer space and their home planet. The X Prize Foundation, which set up a \$10 million prize for this contest, modeled the prize after early aviation prizes, intending the X Prize to jumpstart the space tourism industry.

The FAA in April 2004, issued two RLV mission specific licenses: one for Scaled Composites and one for XCOR

Aerospace in accordance with 14 CFR parts 431 and 440. These licenses apply to suborbital RLV missions with a pilot on board.<sup>1</sup> The FAA used the draft flight crew guidelines to assist in these two license application evaluations. To protect the safety of the uninvolved public, the FAA imposed operational requirements, as well as a system safety process to identify hazards and risk mitigation measures, including operational constraints. Operational constraints included restraints on the trajectory of SpaceShipOne over specific populated areas.

Scaled Composites won the X Prize on October 4, 2004, by being the first to finance privately, build, and launch a vehicle able to carry three people to an altitude of 100 kilometers (62 statute miles). Scaled Composites' SpaceShipOne had to return safely to Earth, and then repeat the trip within two weeks.

Although Scaled Composites won the prize, other developers were contestants and are still working to reach space. More than 20 teams from seven countries registered to compete. Concurrent with Scaled Composites winning the X Prize, a new company, Virgin Galactic, announced that it would offer rides to space on a new model of the vehicle that won the prize. Space may soon open up to citizen explorers, businesses, and tourists.

In December 2004, Congress passed the Commercial Space Launch Amendments Act. The CSLAA requires that a phased approach be used in regulating commercial human space flight; that is, regulatory standards governing human space flight must evolve as the industry matures. In the near term, the CSLAA requires that the FAA: (1) Issue guidelines or advisory circulars to guide the implementation of the CSLAA as soon as practical after the date of its enactment; (2) issue proposed regulations relating to crew, space flight participants, and permits for launch or reentry of reusable suborbital rockets not later than December 23, 2005; and (3) issue final regulations not later than June 23, 2006. On February 11, 2005, the FAA issued "Draft Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations With Flight Crew" and "Draft Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations With Space Flight Participants."

The CSLAA made the FAA responsible for the safety of space flight participants and crew. The CSLAA limits, however, the FAA's ability to

<sup>1</sup> The FAA treats a pilot as part of a flight safety system for protecting the public.

carry out that responsibility for eight years from the date of enactment. The CSLAA requires that a space flight participant be informed of the risks of taking a ride on a rocket, and the FAA may issue regulations requiring space flight participants to undergo an appropriate physical examination.<sup>2</sup>

These rules also would apply to expendable launch vehicle (ELV) launches with humans on board. Although the FAA prepared this NPRM to accommodate reentry and reusable launch vehicles, the FAA is aware that there are plans to launch crewed vehicles on ELVs. Expendable launch vehicles could carry humans on board as they did during the Mercury, Gemini and Apollo programs. This could involve mounting crew capsules on ELVs in order to launch crew or space flight participants to orbit. Unless the National Aeronautics & Space Administration (NASA) or the Department of Defense conducted the launch for the Federal Government, the FAA would license these activities as commercial launches and reentries and the requirements proposed here would apply.

The requirements proposed as a new part 460 would apply to licensees and permittees under Chapter 701, and to crew and space flight participants on board a launch vehicle and to a remote operator. This rulemaking proposes crew notification, medical, qualification, and training requirements. The FAA would also establish requirements governing environmental control and life support systems, smoke detection and fire suppression, and human factors. The FAA would require an operator to account for human factors whenever the crew must perform safety-critical roles. Additionally, the FAA proposes to require an operator to implement a verification program sufficient to verify the integrated performance of a vehicle's hardware and any software in an operational flight environment before allowing a space flight participant to be on board.

The FAA would also impose requirements for space flight participants. This rulemaking would require an operator to inform a space flight participant of the risks of space travel generally and of the operator's

vehicle in particular. An operator would also have to advise a space flight participant that the U.S. Government has not certified the vehicle as safe for carrying flight crew or space flight participants. Although the FAA continues to recommend that a prospective space flight participant obtain a physical examination before embarking on a journey to space, the FAA does not propose to require it here. This rulemaking would require training and general security requirements for a space flight participant.

Finally, the FAA proposes to implement the changes to its financial risk sharing and responsibility requirements due to the recently enacted Commercial Space Launch Amendments Act of 2004. In brief, the CSLAA requires crew and space flight participants to enter into reciprocal waivers of claims with the U.S. Government. Crew includes flight crew and any remote operator. The CSLAA expressly excludes space flight participants for eligibility from indemnification against third party claims. Launches and reentries performed pursuant to a permit are also excluded from eligibility for indemnification. The FAA is otherwise addressing its new authority under the CSLAA to issue permits in a separate rulemaking.

## II. General Discussion of the Proposals

The proposed requirements would apply to licensees and permittees under Chapter 701, and to crew and space flight participants on board a launch vehicle. This rulemaking would define crew and flight crew and propose crew notification, medical, qualification, and training requirements. It would also impose informed consent and training requirements for space flight participants.

### A. Launch and Reentry With Crew

#### 1. Definitions Applicable to Crew

This rulemaking would apply to flight crew and any remote operator not on board the vehicle. The only ground crew to which this rulemaking would apply is a remote operator.

In keeping with the statutory definition, the FAA would define crew to mean any employee or independent contractor of a licensee, transferee, or permittee, or of a contractor or subcontractor of a licensee, transferee, or permittee, who performs activities in the course of that employment directly relating to the launch, reentry, or other operation of or in a launch vehicle or reentry vehicle that carries human beings. Although the CSLAA only

mentions employees as being eligible for the status of crew, the FAA considers flight crew part of the flight safety system. Therefore the FAA proposes to treat as crew any human being who is part of the flight safety system, regardless of whether the person's status is that of an employee or independent contractor. The FAA would treat as crew those persons on board a vehicle and any remote operator of the vehicle. A remote operator would only include someone engaged actively in controlling the vehicle, and not someone with some ability to affect the vehicle but no ability to control its course. Congress provided the agency some latitude in determining what individuals on the ground to include in the definition of crew. This has implications for safety, notification requirements, and crew waivers of liability against the U.S. Government. The CSLAA itself defines crew broadly to include a person "who performs activities in the course of that employment directly relating to the launch, reentry, or other operation of or in a launch vehicle or reentry vehicle that carries human beings." 49 U.S.C. 70102(2). The House proposed this definition in H.R. 3752, a predecessor bill to H.R. 5382, which was enacted as the CSLAA. Accordingly, the House Report accompanying H.R. 3752 may be useful in interpreting the CSLAA. The report states that the FAA should not interpret the definition of crew "overly broadly" to encompass individuals with peripheral roles, such as sales agents or insurance providers. Commercial Space Launch Amendments Act, H.R. 3752, H. Rep. 429, 108th Cong., 2d Sess. (Mar. 1, 2004). Nonetheless, the House Science Committee contemplated that the FAA would apply it more broadly than pilots or remote operators of a launch vehicle. *Id.*

The FAA's proposed definition of crew would include all crew on board, namely the flight crew<sup>3</sup>, as part of the crew, and thus give a broader meaning to "crew" than one consisting of only a pilot or remote operator. Because Congress contemplated operation of or in a vehicle (emphasis added), Congress appears to have intended some persons on the ground to be included as part of the crew. A remote operator of a vehicle satisfies the Congressional direction to include some ground crew as part of the crew. Also, a remote operator is someone whose employment would directly relate to a launch or reentry, thus satisfying the other statutory prong.

<sup>2</sup> The FAA has decided against prescribing specific medical requirements for space flight participants at this time. Instead, the FAA issued guidelines recommending that space flight participants obtain an evaluation of their medical history to determine whether a physical examination might be appropriate. "Draft Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations with Space Flight Participants," Federal Aviation Administration (Feb. 11, 2005).

<sup>3</sup> The FAA proposes to define flight crew as crew that is on board a vehicle during a launch or reentry.

If Congress meant to include as ground crew those who are involved only in preparation but who are not on board during flight, certain perverse consequences would ensue. For example, under such an interpretation, the CSLAA would require an operator to inform employees working on the ground that the U.S. Government has not certified a vehicle as safe for carrying crew or space flight participants. 49 U.S.C. 70105(b)(4)(B). In light of the fact that those employees would not be on board, this would not be a meaningful exercise because they do not need the warning. A statute should not be read to reach an irrational result, and the FAA will not do so here.

XCOR commented on the FAA's February 11, 2005 draft guidelines on flight crew. Those comments are available in the docket. XCOR commented that flight crew, in the RLV community, is usually taken to mean those crewmembers whose roles are essential to public safety. XCOR believes that the definition of flight crew in the guidelines is too broad because it would include a pilot, a flight engineer, and a steward. XCOR maintains that although a pilot's function is essential to public safety, and a flight engineer's function may be essential to public safety, a steward's duty to maintain the safety and comfort of passengers is not essential to public safety if the vehicle is designed or operated so that unruly or panicked passengers cannot interfere with the operation of the vehicle. Consequently, XCOR would define what commercial aviation calls "cabin crew," those crewmembers aboard a vehicle whose roles are not essential to public safety, to distinguish them from those crewmembers aboard the vehicle whose roles are essential to public safety. Furthermore, XCOR recommends a definition of flight crew that excludes cabin crew so that the qualification, training, and medical guidelines for flight crew would not apply to such cabin crew as a steward.

The FAA's training proposal should alleviate XCOR's concerns in this area. Although the FAA proposes to employ a definition of flight crew that would encompass the same persons as the definition of the draft guidelines, the FAA would not require all members of a flight crew to undergo the same training or to possess the same qualifications. Most of a flight attendant's or steward's duties will not affect public safety. Those duties would not be the subject of regulatory oversight. However, some duties might affect public safety, such as preventing space flight participants from having

access to the flight deck and interfering with the pilot. In order to address the various flight crew roles and responsibilities, the FAA proposes that each flight crew member train for his or her role. This would mean that a flight attendant or steward would not be required to undergo unnecessary training, only that required for his or her role.

## 2. Authority and Process

The CSLAA allows the FAA to impose crew training requirements. Additionally, the FAA retains full authority to continue protecting the uninvolved public. Accordingly, as it has in the past, the FAA finds that it needs to protect the crew when it is part of the flight safety system, and proposes crew training requirements that are intended for the safety of members of the public, including those on the ground, in the air, and in space. In a piloted vehicle, the vehicle's flight crew is an integral part of its flight safety system. This is because they are in a position to respond to risk to the public, such as aborting the flight or maneuvering a vehicle away from populated areas. For purposes of public safety, therefore, the FAA proposes a number of crew training requirements.

In brief, the FAA would require that crew be properly trained. As authorized by the CSLAA, the FAA would require each crew member to receive training and satisfy medical or other standards as specified in a license or permit. 49 U.S.C. 70105(b)(4)(A). As is the case now, this means that the FAA will be able to add terms and conditions specific to a particular vehicle to a license or permit. If for example, a particular situation required additional training measures, the FAA would impose them through the license or permit process. Where the FAA proposes a performance standard, the agency also proposes that an operator describe to the FAA during the license or permit process the measures it would take to satisfy that performance standard. Accordingly, the FAA proposes some changes to parts 415, 431 and 435 to ensure that an operator demonstrates how it will achieve compliance before it obtains a license.<sup>4</sup> Where the FAA requirements would be more specific, the FAA does not propose to require a demonstration from an applicant, merely compliance. For example, an applicant would not have to demonstrate that informed consent

<sup>4</sup> Likewise, for an applicant seeking an experimental permit under 49 U.S.C. 70105a, the FAA is currently conducting another rulemaking to ensure that a permit applicant demonstrates compliance with proposed part 460.

has been obtained from a space flight participant as part of its application process.

## 3. Pilot and Remote Operator Qualifications

The FAA would require, for purposes of proposed part 460, that a pilot and any remote operator of a launch or reentry vehicle that will operate in the National Airspace System (NAS), possess an FAA pilot certificate with an instrument rating and that they demonstrate the knowledge of the NAS necessary to operate the vehicle. The pilot or remote operator would also need to have the aeronautical experience and skills necessary to pilot and control the vehicle. In order to obtain a pilot certificate, a person must become educated in the rules of operating in the NAS. A pilot certificate also provides evidence of a person's skill level. When the FAA licensed SpaceShipOne missions, the agency accepted the pilots' commercial pilot certificates as demonstrating adequate skills. A person holding a sport pilot certificate or a student pilot would be unlikely to satisfy this standard.

The FAA does not propose to specify the particular kind of pilot certificate required nor what category, class, type or instrument ratings are needed because different operators are proposing vehicles of varied and unique designs. For example, there are numerous possible vehicle configurations and operations: vertical take-off and landing and horizontal take-off and landing. A vehicle may or may not be a winged vehicle, and it may or may not be air launched. It may land powered like an airplane or unpowered like a glider. Accordingly, the FAA would assess, through the licensing or permitting process, the type of pilot certificate, flight experience, and mission-specific training for proposed operations that a pilot possessed. For example, during its licensing evaluation, the FAA took into consideration the extensive mission-specific training that the SpaceShipOne pilots underwent with a ground simulator and aircraft with operating characteristics similar to SpaceShipOne and that these pilots possessed commercial pilot certificates.

The FAA proposes to require an instrument rating as well. The FAA anticipates that regardless of the kind of vehicle used, there will be times when a pilot will be relying on instrument skills and competency. Accordingly, a person who held an instrument rating would indicate an appropriate level of skill and competency to pilot these launch and reentry vehicles.

The FAA's February 11, 2005 draft crew guidelines recommend that a pilot hold ratings to operate one or more aircraft with similar characteristics for as many phases of the mission as practicable. The guidelines use the term "as practicable" because the FAA realizes that some launch vehicles will not possess operating characteristics similar to existing aircraft. The FAA continues to consider this advisable, but because of the differences in proposed vehicles and the likelihood that there will be vehicles without characteristics similar to aircraft, the FAA will not, other than an instrument rating, mandate such a requirement through regulation. Nonetheless, if an operator proposed to demonstrate the adequacy of the training of its crew by showing that a pilot held ratings for similar operations, the FAA would look favorably on such a demonstration. In addition to holding commercial pilot certificates, the SpaceShipOne pilots held ratings to operate aircraft with similar characteristics for certain phases of flight of SpaceShipOne and underwent rigorous training.

The FAA considered two alternatives to its proposed requirements. The FAA considered not requiring a pilot certificate at all, and only relying on the proposed performance requirement that a pilot possess the necessary skills and experience. This is because possession of a pilot certificate could demonstrate that a pilot possessed the skills and experience necessary to control the vehicle. Thus, a requirement to possess a pilot certificate might be redundant. Alternatively, the FAA could require that the pilot or any remote operator possess a commercial pilot certificate to demonstrate the minimum pilot skills required by 14 CFR part 61. In that case, the FAA would likely require in the final rule that a pilot or any remote operator hold a valid and current commercial pilot certificate with an instrument rating. Additionally, the FAA would require that the pilot or remote operator possess aeronautical experience and skills necessary to pilot and control the launch and reentry vehicle being applied for. The aeronautical experience would include a certain amount of aeronautical experience in an aircraft in flight, instrument training, and training in the launch and reentry vehicle being applied for. The FAA may still adopt one of these proposals and requests comment on these options as well.

Conversely, the FAA considered proposing that a remote operator not be required to possess a pilot certificate. In this case, a remote operator would still have to demonstrate knowledge of the

NAS and have the aeronautical experience and skills necessary to pilot and control the vehicle. In aviation, there is no consensus on whether requiring piloting experience is necessary or appropriate for remote operators. The U.S. Air Force currently requires such experience for remote operators of unmanned aerial vehicles (UAVs).<sup>5</sup> Thus, U.S. Air Force remote operators are experienced pilots who have at least one operational tour of duty in another combat aircraft. Unlike the U.S. Air Force, the U.S. Army does not require a remote operator of a UAV to be a pilot.

Regardless of vehicle design, having a pilot certificate and aeronautical experience provides evidence of a basic level of knowledge of and experience with the NAS, such as communications, navigation, airspace limitations, and other aircraft traffic avoidance, that will help promote public safety. Furthermore, a pilot with an instrument rating has been trained to fly and navigate entirely by reference to flight instruments.

The FAA requests comments on whether a remote operator of a launch or reentry vehicle with a human on board should possess a pilot certificate. The FAA anticipates that a pilot certificate would serve as the clearest indication that a person has the necessary knowledge of the NAS and safety issues. The FAA recognizes, however, that there may be other, less burdensome methods of demonstrating compliance and requests comment accordingly.

#### 4. Medical Standards for Crew

The FAA would require that each member of the flight crew and any remote operator possess and carry a second-class airman medical certificate issued in accordance with 14 CFR part 67 and issued within 12 months prior to launch or reentry. The physical and mental state of the flight crew has to be sufficient to perform safety-related roles.

Second-class airman medical certification standards have provided an acceptable level of safety for commercial pilots for many years. Commercial pilots are medically certificated to a level between a private pilot and an airline transport pilot; the former requiring less stringent vision standards and having longer certificate validity, and the latter requiring more stringent cardiovascular and certificate validity standards. An FAA second-class airman medical

certificate is issued to an applicant who may reasonably be expected, for the year-long duration of the certificate, to perform safely the duties required to exercise commercial pilot privileges.

Different aviation pilot certificates require different medical certificates. The validity of a particular airman medical certificate relates to the aviation privilege being exercised. For example, a first-class airman medical certificate is valid for 6 months for aviation privileges requiring a first-class airman medical certificate, for 12 months for those requiring a second-class airman medical certificate, and for 24 or 36 months for those requiring a third-class airman medical certificate. Because space operations are not defined in terms of privileges being exercised, the FAA does not need to set forth a particular validity structure. Furthermore, for purposes of space operations, the FAA does not need to describe a medical certificate by the aviation operations for which it is valid. In the space context, the FAA only requires that it be issued within the past 12 months, in keeping with the 12-month validity period used in aviation for pilots exercising commercial pilot privileges.

Applicants for any class of airman medical certificate must meet minimum vision, hearing, mental, neurological, and basic cardiovascular standards. Such standards are required to ensure that pilots are able to perform their aviation duties safely. For example, commercial pilots need adequate intermediate vision to monitor aircraft instruments, and other cockpit equipment, and adequate color vision to be able to distinguish aviation signal colors. They need an acceptable level of hearing to be able to communicate with Air Traffic Control, any flight crew, other crewmembers, or passengers. They require mental stability to exercise sound judgment.

Part 67 was developed for aviation. The FAA will, through licensing and permitting, acquire experience with medical certification of space flight crews. The FAA considers, however—at least during these early stages, primarily of suborbital space flight—that second-class airman medical certification standards would provide a minimum level of medical certification adequate for space flight crews to perform safety-critical roles.

In addition to requiring a second-class medical certificate, the FAA proposes a performance standard, which could be tailored to the different stresses caused by different vehicles. The performance standard would require each member of the crew to be able to withstand the

<sup>5</sup> The applicability depends, at least in part, on whether controlling the vehicle involves "stick-and-rudder" control inputs, or simply punching buttons to send commands to a vehicle autopilot.

stresses of space flight sufficiently to carry out his or her role on board so that the vehicle will not harm the public.

The FAA does not, at this early stage of development of the industry, presume to anticipate what environmental stresses any particular crew member may have to endure to operate a vehicle. Nonetheless, although different vehicles may impose different stresses, those stresses are likely to include microgravity, acceleration, and vibration. Different vehicles and flight profiles may subject those on board to different stresses. The FAA therefore would not want yet to impose requirements that apply across the board, preferring, instead, to evaluate each separately through the licensing or permitting process. For example, SpaceShipOne's pilots underwent training that included aerobatic maneuvers and unusual attitude recovery training to match the anticipated stresses of the eventual flight environment. Unusual attitudes may include high rates of roll and all-attitude spins. The FAA found that SpaceShipOne's pilot training demonstrated the ability to withstand the anticipated stresses, such as those due to vehicle acceleration and deceleration.

The FAA would implement this broad performance standard on a case-by-case basis. An operator would have to demonstrate satisfaction of this standard in the course of applying for a license, a permit or a modification to a license or permit. Grant of a license or permit would be conditioned, as it is now, on an operator abiding by the representations made in its application. The FAA anticipates that an operator may change crew members from time to time. Because the initial grant of a license or permit may have been conditioned on the acceptability of the original crew, the FAA would have to modify the license. Alternatively, the FAA could foresee an operator describing its testing process sufficiently to demonstrate that the operator would be able to ascertain whether an individual crew member could withstand the specific stresses of a given vehicle.

The case-by-case assessments of whether a flight crew member satisfied the proposed performance standard of withstanding the stresses of space flight would serve two purposes. The assessments would ensure that any particular member of the flight crew could perform his or her duties in whatever environment was proposed. Additionally, these assessments would provide data for the FAA to develop more concrete standards as the industry

progresses. The FAA does not expect orbital commercial human space flight to occur in the immediate future. Nonetheless, it does anticipate its eventual appearance, and recognizes that different standards may be required for orbital and suborbital flights. The FAA will gather data for the development of those standards over time.

#### 5. Crew Training

The FAA would require each member of a crew be trained to ensure that the vehicle will not harm the public. The crew would also be trained to respond to planned and anomalous events. The FAA would require an operator to develop a mission- and configuration-specific training program for a pilot and any remote operator and define standards by which the pilot and remote operator would be trained so that the vehicle would not harm the public. The operator's training program would include for each mission, either simulation training, training on a similar aircraft, flight testing, or another training method approved by the FAA.

The FAA would require an operator to ensure that any crew-training device used to meet the training program requirements realistically represented the vehicle's configuration and mission or the operator would have to inform the crew member being trained of the differences. XCOR through its comments on the FAA's February 11, 2005 draft guidelines on flight crew states that some early flight crew training devices will not be realistic. According to XCOR, this lack of realism will not mean they are useless as training devices because it may be better to train the flight crew on a simulator with known differences from the flight article than not to train them on a simulator at all. XCOR recommended that training devices with known dissimilarities be allowed but the dissimilarities should be minimized, and flight crew should be aware of the differences in behavior between the training device and the flight article.

The FAA would require crew training to include nominal (*i.e.*, normal) and non-nominal flight conditions. Training to respond to planned and unplanned events would allow the crew to better respond to emergencies. The crew would obtain a competent understanding of vehicle systems, vehicle characteristics, and vehicle capabilities, as well as operational, malfunction, and contingency procedures. The non-nominal situations would include aborts and emergencies.

The FAA would require additional training for a pilot and any remote

operator of a launch or reentry vehicle. A pilot would have to undergo training in procedures that direct the vehicle away from the public in the event the flight crew had to abandon the vehicle during flight. The pilot and any remote operator would also have to train in each mode of control or propulsion, including any transition between modes, so that the pilot would be able to control the vehicle throughout the flight regime. For example, the pilot and any remote operator would have to be able to maintain control of a vehicle during a transition from aerodynamic control surfaces to a reaction control system and vice versa. Likewise, training would be necessary for any transition from an air-breathing to a rocket propulsion system and vice-versa.

The FAA proposes a number of requirements for a training program. The FAA would require an operator to continually update its training program to ensure that training incorporated lessons-learned from both training and operational missions. This would be accomplished with a documented system to track revisions and updates. To that end, the FAA would require a training program to capture, in writing, lessons-learned as experience was gained. Experience will reveal additional events and anomalies to which a crew would have to respond. The flight crew should be prepared for events and anomalies discovered during training and mission operations. The FAA would require a licensee or permittee to document the training completed by each member of the crew and maintain the documentation for each active member of the crew. Accurate documentation is important for tracking and ensuring that crew are up-to-date with their training requirements.

The FAA would require an operator to establish a recurrent training schedule and ensure that all crew qualifications and training were current before starting to operate a vehicle with humans on board. This would ensure that all crew were qualified and had received the necessary training at the time of operation. The FAA's February 11, 2005 crew guidelines recommended that prior to each mission, the flight crew receive vehicle and mission-specific training. Rocketplane Limited, Inc. through its April 28, 2005 comments on the FAA's crew guidelines stated that retraining would be an important requirement if there were periods of inactivity between flights. Rocketplane Limited, Inc. recommended retraining be required when more than thirty days elapsed between flights rather than

requiring it prior to each mission. XCOR stated that common sense should determine the appropriate level of training necessary to safely conduct the flight. Hence, the FAA would require an operator to establish a recurrent training schedule.

#### 6. Crew Notification

The FAA would require an operator to inform, in writing, any individual serving as flight crew and each remote operator, that the United States Government has not certified the launch vehicle as safe for carrying crew or space flight participants. If someone is operating a vehicle remotely, the FAA believes that Congress intended that the operator advise the remote operator of the risks he or she is taking with the people on board.

#### 7. Environmental Control and Life Support System

The proper functioning of the crew is necessary to ensure protection of the public. The FAA would require an operator to provide atmospheric conditions adequate to sustain life and consciousness for all inhabited areas within a launch or reentry vehicle. The flight crew could perform the roles necessary to carry out this proposed requirement. Proper environmental control is essential for people and for the functioning of safety-critical equipment on board a vehicle.

There are many aspects to controlling the atmosphere of a vehicle that an operator would have to consider. The FAA proposes to require an operator to monitor and control the composition and any revitalization of the atmosphere to maintain safe levels for flight crew respiration during nominal and non-nominal operations. The atmosphere in inhabited areas should have safe levels of oxygen and carbon dioxide to allow normal respiration. Because of normal human metabolic effluent, carbon dioxide will accumulate and it may be necessary for it to be removed.<sup>6</sup>

The FAA would require a licensee, permittee or flight crew to monitor and control the pressure of the atmosphere to maintain safe levels for flight crew respiration. An essential aspect of the body's ability to absorb oxygen from the air is the atmospheric pressure, specifically the partial pressure of oxygen (pO<sub>2</sub>). Total pressure and the partial pressure of carbon dioxide should also be monitored and kept at

levels sufficient to ensure consciousness and proper functioning of the crew.

An operator would have to monitor and control the temperature of the atmosphere to maintain safe levels for the flight crew. Although humans can survive in a relatively wide range of temperatures, it is essential to regulate the temperature within a cabin or suit. Requiring proper temperature control would ensure the flight crew maintained a degree of situational awareness sufficient for these individuals to perform their job. An operator would also have to monitor and control the ventilation and circulation of the cabin atmosphere to maintain safe levels for the flight crew. Requiring proper ventilation would ensure the flight crew maintained situational awareness by reducing stagnant air, which could contain a high concentration of carbon dioxide.

The FAA proposes to require an operator to monitor and control the humidity of the cabin atmosphere to maintain safe levels for the flight crew. If a flight crew depended on visual information through a window, humidity control would be necessary to avoid windows fogging and condensation that can hinder the pilot's vision. The FAA proposes to require an operator to control contamination and particulate concentrations for the flight crew to prevent interference with the crew's ability to operate the vehicle. The atmosphere should be free from harmful or hazardous concentrations of gases, vapors, and particulates that can be inhaled.

The FAA proposes to require an operator to provide an adequate redundant or secondary oxygen supply for the flight crew due to the extreme importance of having sufficient oxygen to enable the flight crew to function. In the event of a failure of the primary atmospheric control system, the redundant or secondary system would supply oxygen for the flight crew.

Lastly, the operator would have to provide a redundant means of preventing cabin depressurization or prevent incapacitation of the flight crew in the event of a loss of cabin pressure. If a loss of pressure were to occur, it could have serious physiological effects on the flight crew, including hypoxia, decompression sickness, hypothermia, and vaporization of tissue fluids. This performance standard could be satisfied by different means. For example, in addition to conducting ground tests and prelaunch cabin leak checks, Scaled Composites used dual pane windows, dual seals on cabin pass-throughs, dual door seals, and dual pressurization systems for SpaceShipOne. Use of a

pressure suit to prevent incapacitation of the flight crew if there were a loss of cabin pressure could be another means to satisfy this performance standard.

#### 8. Smoke Detection and Fire Suppression

The FAA would require an operator or flight crew to have the ability to detect smoke and suppress a cabin fire to prevent incapacitation of the flight crew. Prior to a fire occurring, smoke can rapidly incapacitate a pilot or obscure the pilot's vision such that the vehicle cannot be flown safely. A crew should be able to respond to a vehicle fire so as not to risk the public.

#### 9. Human Factors

The FAA would require an operator to account for human factors so that the flight crew could perform safety-critical roles. Human factors engineering is a discipline that applies knowledge of human capabilities and limitations to the design of systems, machines, work environment, and operations. Human factors considerations draw on multiple disciplines such as psychology, physiology, engineering, ergonomics, and medicine. The design and layout of displays and controls and the amount of crew workload can affect the ability of the crew to perform safety-critical roles. Therefore, the FAA would require an operator to account for human factors that can affect the flight crew's ability to perform safety-critical roles.

Mockups, simulators, and human factors analyses such as functional and task analyses are examples of human factors-related applications to assess human-machine interfaces or human-in-the-loop functions and performance. "The Human Factors Design Standard" (HF-STD-001, FAA), "DOD Design Criteria Standard—Human Engineering" (MIL-STD-1472), "Flying Qualities of Piloted Aircraft" (MIL-HDBK-1797), and "Man-Systems Integration Standards" (NASA-STD-3000) may provide guidance on applying human factors engineering. Human-related factors account for the majority of fatal aircraft accidents. Conversely, aircraft system malfunctions are involved in a relatively small fraction of aircraft incidents and accidents. Some human factors-related lessons learned from aviation may apply to suborbital RLVs with a flight crew on board.

The FAA proposes to require an operator to make provisions for restraint or stowage of all individuals and objects in a cabin, so moving objects would not interfere with the flight crew's operation of the vehicle during flight. The FAA does not expect that this requirement would prevent an operator from

<sup>6</sup>Guidance on environmental control and life support systems may be found in "Designing For Human Presence in Space: An Introduction to Environmental Control and Life Support Systems" (NASA RP-1324) and "Man-Systems Integration Standards" (NASA-STD-3000).

allowing space flight participants to experience weightlessness during a part of the mission. In order to allow this experience, the FAA would look at whether the restraints on space flight participants would keep those participants from interfering with flight crew activities. For example, space flight participants separated by a bulkhead might be considered adequately restrained.

#### 10. Verification Program

The FAA proposes to require an operator to implement a verification program sufficient to verify the integrated performance of a vehicle's hardware and any software in an operational flight environment. The FAA would require this verification program to include flight testing and the program would have to be successfully completed before allowing any space flight participant on board during a flight. An operator needs to establish a safety record to disclose to a space flight participant as required by the CSLAA. Furthermore, a space flight participant could not be present during flight testing in order to avoid distracting the flight crew from its public safety mission. The FAA intends early, experimental flight testing to take place with the flight crew's entire attention dedicated to the vehicle, not to anyone else on board.

XCOR through its comments on the FAA's February 11, 2005 draft guidelines on space flight participants states that flight testing plays an integral role in the provision of informed consent. Without a flight test plan, and some number of flight tests, the RLV operator cannot provide the space flight participant with a valid number<sup>7</sup> for demonstrated reliability. XCOR further noted that if an operator cannot provide a valid number for demonstrated reliability, then the space flight participant cannot give informed consent, and the operator cannot fly the space flight participant.

In addition to avoiding distraction of the crew and establishing a safety record for disclosure to a space flight participant, flight testing provides other benefits. Flight testing provides data to validate analytical tools and models used to predict environments and responses. The initial flights and envelope expansion flights of a new vehicle typically pose the highest risk. Although flight testing does not eliminate risk, it does mitigate risk by potentially uncovering safety-related

problems that may go undetected if relying only on analysis and ground testing. Verification of performance by flight testing can provide more information than ground testing and analysis and should be conducted to the maximum extent possible. Ground testing and analysis are often based on estimates and approximations, and may not fully simulate possible subsystem interactions in flight environments or may not accurately simulate actual flight conditions.

The FAA will initially determine the amount of verification and, specifically, flight testing of launch or reentry vehicles on a case-by-case basis through the licensing or permitting process. The appropriate level of testing depends on many factors, including the vehicle's mission profile, operational restrictions, test and flight history, component and subsystem heritage, and design and operating margins.

#### 11. Crew and Space Flight Participant Waiver of Claims Against U.S. Government

The CSLAA requires crew and each space flight participant to execute a reciprocal waiver of claims with the FAA. 49 U.S.C. 70112(b)(2). This requirement would not apply to ground crew other than remote operators.

The CSLAA does not require crew and space flight participants to waive claims against each other or against a licensee or permittee. The CSLAA does not, however, prevent an operator from making a waiver of liability a condition of an agreement between it and a space flight participant or crew.

##### *B. Launch and Reentry With a Space Flight Participant*

This rulemaking would also establish informed consent and training requirements for a space flight participant on board a launch or reentry authorized by the FAA. Regardless of whether a space flight participant pays for a ride, the space flight participant must provide informed consent and be trained.<sup>8</sup>

<sup>8</sup> Although under the CSLAA a space flight participant may not provide compensation for a space flight on a launch authorized by an FAA permit, Congress did not foreclose the presence of a space flight participant on a permitted launch. Under the CSLAA, the FAA may issue a permit only for a reusable suborbital rocket that will be launched or reentered solely for research and development to test new design concepts, new equipment or new operating techniques; showing compliance with requirements as part of the process for obtaining a license under Chapter 701; or crew training prior to obtaining a license for a launch or reentry using the design of the rocket for which the permit would be issued. 49 U.S.C. 70105a(d)(1)–(3). Although a space flight participant could not pay to ride on a rocket operated under a permit, a space

#### 1. Risk to Space Flight Participants

The CSLAA characterizes what is commonly referred to as a passenger as a "space flight participant." The statute defines this person to mean "an individual, who is not crew, carried within a launch vehicle or reentry vehicle." 49 U.S.C. 70102(17). This characterization signifies that someone on board a launch vehicle or reentry vehicle is not a typical passenger with typical expectations of transport, but someone going on an adventure ride.

Space flight remains inherently risky. Testimony concerning a predecessor to the CSLAA highlights the situation. Michael S. Kelly, of Northrop-Grumman/Xon Tech, testified that "space flight is years from being routine, or even a mode of transportation per se. Transportation refers to reaching a desired destination. Space flight, for the foreseeable future, will be an end in itself." Commercial Space Act of 2003, H.R. 3245, 108th Cong., (Nov. 5, 2003) (statement of Michael Kelly). Mr. Kelly characterized the experience as an adventure ride. Others have compared it to mountain climbing, skydiving, not wearing a helmet while riding a motorcycle, and other risky endeavors.

New technologies carry new risks. Nonetheless, Congress recognizes that "private industry has begun to develop commercial launch vehicles capable of carrying human beings into space, and greater private investment in these efforts will stimulate the Nation's commercial space transportation industry as a whole." 49 U.S.C. 70101(11). To that end, the CSLAA finds that "the public interest is served by creating a clear legal, regulatory, and safety regime for commercial human space flight." 49 U.S.C. 70101(14). With an infant industry, Congress notes, "regulatory standards must evolve as the industry matures, so that regulations neither stifle technology development nor expose crew or space flight participants to avoidable risks as the public comes to expect greater safety for crew and space flight participants from the industry." 49 U.S.C. 70101(15). The CSLAA is structured to allow the same kind of risk that mountain climbers and other adventurers seek in the context of space flight.

The CSLAA provides the FAA authority to issue rules to protect space flight participants. 49 U.S.C. 70103. That authority, however, is limited. The FAA is only able to impose "additional

flight participant could be on board. Congress contemplated as much in section 70105(b)(5), when it imposed conditions on holders of a license or permit launching or reentering a space flight participant.

<sup>7</sup> The FAA interprets XCOR's use of the term "valid number" to mean a reliability number based on experience.

license requirements for a launch vehicle carrying a human being for compensation or hire, necessary to protect the health and safety of flight crew or space flight participants," if such requirements are imposed pursuant to final regulations. 49 U.S.C. 70105(b)(2)(D). This provision appears to limit the FAA's current approach of imposing requirements on a case-by-case basis through license terms and conditions. For purposes of protecting the public on the ground, when an applicant proposes an operation not covered by existing rules, the FAA has the ability to impose license restrictions to address new proposals. For purposes of protecting space flight participants and crew, however, Congress has limited the FAA's ability to impose safety requirements until the FAA passes regulations. Space flight participants should therefore have no expectations that the FAA is imposing individualized or tailored requirements designed to achieve their protection.

Those regulations, in turn, may only be promulgated under certain circumstances. 49 U.S.C. 70105(c). For eight years, the CSLAA only permits the FAA to issue regulations restricting or prohibiting design features or operating practices that result in a serious injury, fatality or a close call to those on board during an FAA authorized flight. This means that the FAA has to wait for harm to occur or almost occur before it can impose restrictions, even against foreseeable harm. Instead, Congress requires that space flight participants be informed of the risks. To that end, the FAA proposes notification requirements in subpart B of proposed part 460.

## 2. Informed Consent

Congress requires that a licensed or permitted operator inform a space flight participant in writing about the risks of the launch and reentry, including the safety record of the launch or reentry vehicle type. 49 U.S.C. 70105(b)(5)(A). The FAA's § 460.45 would implement this statutory provision. Additionally, the proposed regulations would require an operator to describe these hazards and risks in a manner that is understandable to the space flight participant. As with crew, the CSLAA requires an operator to inform each space flight participant that the United States Government has not certified the launch vehicle as safe for carrying crew or space flight participants. The FAA would also require a space flight participant to provide his or her consent in writing before boarding a vehicle.

More specifically, under § 460.45, an operator would have to provide the safety record of all launch or reentry

vehicles that have carried one or more persons on board, including both U.S. Government and private sector vehicles. The development of commercial launch vehicles to carry space flight participants is in the early stages. Consequently, newly developed launch vehicles will not have the extensive flight-test history or operational experience that exists for commercial airplanes. Because of the lack of flight-test and operational experience, the risks of the operator's particular launch vehicle and of vehicles like it should be disclosed. The House Committee on Science report, H. Rep. 108-429, clarifies that Congress intended all government and private sector vehicles to be included in this disclosure. Because most human space flight to date has taken place under government auspices, the government safety record currently provides the most data. The operator should provide a record of all vehicles that have carried a person because they are the most relevant to what the operators propose. Regardless of whether humans traveled to space on board a vehicle destined for a suborbital or orbital mission, those persons traveled on new and unproven vehicles based on technology as new then, as what may be developed now. The vehicle and technology were therefore as risky. Likewise, because those vehicles were intended for a human on board, greater care was likely to have been taken in its design and construction. The same should be expected for commercial human space flight. Accordingly, the historical record of human space flight provides an appropriate and reasonable basis for comparison of risks to current human space flight.

Additionally, this section would also require an operator to describe the safety record of its own vehicle to each space flight participant. The operator's safety record would have to include the number of vehicle flights, the number of safety-related anomalies or failures, including on the ground or in flight, and whether any corrective actions were taken to resolve these anomalies or failures. If a space flight participant requested more detail, the operator would have to provide a description of the safety-related anomalies or failures and what the corrective actions were. For the general public, this technical information will not likely be useful, and the FAA does not want the more dire possibilities obscured by a deluge of technical data. Nonetheless, there will be space flight participants who will be able to obtain useful information from this data and make better informed

choices as to whether they want to ride that particular vehicle. Accordingly, the FAA proposes to require an operator to inform each space flight participant that the safety-related data is available and provide the data upon request.

In its February 11, 2005, guidelines, the FAA recommended that an operator provide space flight participants an opportunity to ask questions orally to acquire a better understanding of the hazards and risks of the mission. An opportunity to ask questions allows a space flight participant a chance to get clarification on any information that may be confusing or unclear. Although the FAA does not now propose to require this recommendation, the FAA continues to consider this good practice, and believes such opportunities should be provided.

The CSLAA requires that before receiving compensation from a space flight participant or making an agreement to fly a space flight participant, an operator inform the space flight participant in writing that the U.S. Government has not certified the launch vehicle as safe for carrying crew or space flight participants. 49 U.S.C. 70105(b)(5)(B). Accordingly, the FAA proposes to implement this statutory requirement in proposed 460.45(b).

## 3. Physical Examination

In its February 11, 2005 guidelines, the FAA recommended that a space flight participant provide his or her medical history to a physician experienced or trained in the concepts of aerospace medicine. The physician would determine whether the space flight participant should undergo an appropriate physical examination before boarding a vehicle destined for space flight. 49 U.S.C. 70105(b)(6)(A).

Guidance for the medical assessment of space flight participants is provided in a memorandum, "Guidance for Medical Screening of Commercial Aerospace Space Flight Participants," (Mar. 31, 2003). The Federal Air Surgeon of the FAA's Office of Aerospace Medicine and the Director of the FAA's Civil Aerospace Medical Institute provided this guidance to the Associate Administrator for Commercial Space Transportation. Medical conditions that may indicate that an individual should not participate in a mission should be identified so that participation may be avoided where a space flight participant's involvement in a mission could aggravate or exacerbate a pre-existing medical condition that could put the flight crew or other space flight participants at risk. The FAA does not intend to propose that this

recommendation become a requirement, unless a clear public safety need is identified. It is, of course, in a space flight participant's own interest to obtain such medical advice for both suborbital and orbital missions, and the FAA will rely on that self-interest until a demonstrable need arises to mandate this through regulation. The FAA highly recommends that a space flight participant seek such medical advice if he or she plans to be on an orbital mission. Orbital missions are longer in duration than suborbital missions and space flight participants are exposed to flight conditions or environments such as microgravity and radiation for a longer period of time.

#### 4. Space Flight Participant Training

The FAA would require an operator to train each space flight participant before flight on how to respond to emergency situations, including loss of cabin pressure, fire, smoke, and emergency egress. If a space flight participant did not receive this training, he or she might interfere with the crew's ability to protect public safety.

#### 5. Security Requirements

The FAA proposes to require an operator to implement security requirements to prevent any space flight participant from jeopardizing the safety of the flight crew or the public. Security restrictions currently apply to passengers for airlines. Some of the restrictions prohibit a person carrying explosives, firearms, knives, or other weapons from boarding an airplane. Similar types of security restrictions for launch or reentry vehicles would contribute to the safety of the public by preventing a space flight participant from potentially interfering with the flight crew's operation of the vehicle. Any such interference might jeopardize the flight crew's ability to protect the public. The FAA notes that one means of satisfying part of this requirement would be for an operator to consult the "no-fly" list of the Transportation Security Administration.

#### *C. Financial Responsibility and Waiver of Liability*

Under Chapter 701, Congress establishes risk sharing for licensees by providing for the conditional payment of claims by the United States Government of those claims in excess of the required financial responsibility up to \$1,500,000,000 for third party liability. After those limits, the licensee is responsible for all claims. The U.S. Government waives its claims for Government range property damage in excess of required maximum probable

loss (MPL)-based property insurance. Under a permit, the Government is responsible for claims in excess of the required insurance amount for Government range property claims and the holder of the permit is responsible for all other claims. In short, the Government property provisions remain the same for both licensees and permittees. A licensee remains eligible for indemnification from third party claims, however a permittee is not.

The FAA proposes to combine and modify 14 CFR parts 440 and 450, which govern financial responsibility requirements for launch and reentry. These proposed changes indicate where the CSLAA includes permittees in the statutory scheme for financial and liability risk sharing. Combining the two parts is intended only to streamline the regulations, not to effect any substantive changes. In particular, licensees who operate expendable launch vehicles without humans on board should experience no change.

The CSLAA made changes to the financial responsibility and legal risk sharing regime of Chapter 701. In brief, the CSLAA requires crew and space flight participants to enter into reciprocal waiver of claims with the U.S. Government. Crew includes flight crew and any remote operator. The CSLAA expressly excludes space flight participants from indemnification eligibility against third party claims. Launches performed pursuant to a permit are also excluded from eligibility for indemnification against third party claims.

The Committee Report accompanying H.R. 3752 explains Congress' reasoning behind excluding space flight participants from eligibility for indemnification. Commercial Space Launch Amendments Act of 2004, H.R. 3752, H.R. Rep. 429, 11108th Cong., 2d Sess. (Mar. 1, 2004). The Science Committee notes that a space flight participant is not subject to any substantive government regulation. Additionally, a space flight participant can purchase insurance, or a licensee or permittee may purchase insurance that would cover claims against a space flight participant.

The Report also addresses indemnification and insurance for activities authorized by experimental permits. Again, because the Committee anticipates that permitted activities will be more lightly regulated and thus possess a correspondingly greater risk to the federal government, the CSLAA does not provide for the possibility of indemnification.

#### 1. Proposal To Combine Parts 440 and 450

The FAA proposes, for purposes of efficiency, to combine parts 440 and 450. This has advantages and disadvantages, and the FAA requests comment on the utility of this approach. When it first promulgated parts 440 and 450 as separate parts, the FAA did so in order to avoid confusing separate activities. It treated launch and reentry as separate activities.<sup>9</sup> A commercial equivalent to the U.S. Shuttle would likely be operated by a single operator rather than the two distinct operators currently contemplated under the approach to part 450. Accordingly, the FAA had to decide how to accommodate both the suborbital missions and those that may eventually take place to orbit. They each have a launch and reentry component. With a suborbital launch it is harder to tell where launch ends and reentry begins. Given that a suborbital flight is a single event with FAA jurisdiction covering the entire flight, the distinction does not matter. However, with a vehicle akin to the U.S. Space Shuttle, an operator would have to obtain separate maximum probable loss determinations for launch and reentry, and would enter into two sets of cross waivers with the government and any customers, under proposed parts 1 and 2 of appendix B to part 440.

#### 2. Customers of Permittee

The proposed requirements account for the possibility that a permittee may have a customer. This is so even in light of the statutory prohibition on a permittee offering to carry people or property for compensation or hire. Because a permittee may carry people or property for free, there may be situations where someone places property such as a research experiment on board a vehicle operating under a permit. This may, for example, include a student owned payload. The FAA would consider the owner of the experiment a customer required to sign a cross waiver under section 440.17. The FAA would not consider a space flight participant riding for free a customer under this requirement. A space flight participant remains subject to the rules governing space flight participants.

#### 3. Space Flight Participants and Crew

Proposed section 440.17 contains some differences from the current

<sup>9</sup> The 1998 legislation responded to a reentry vehicle called COMET—a reentry vehicle with different launch and reentry operators. Hence, there could be two licensees or permittees.

scheme for a space flight participant. The CSLAA does not require a space flight participant or crew to "flow down" to its contractors the waiver of claims as Chapter 701 otherwise requires of licensees and customers. Accordingly, the FAA does not propose to require that a space flight participant or crew implement a reciprocal waiver of claims with each of his or her customers, contractors or subcontractors. They are all free to do so, of course, if they choose.

Likewise, as mentioned earlier in this notice, the CSLAA does not require crew and space flight participants to waive claims against each other or against a licensee or permittee. The CSLAA does not, however, prevent an operator from making a waiver of liability a condition of an agreement between it and a space flight participant or crew.

#### 4. Waiver of Claims for U.S. Government Employees in Permittee Cross-Waivers

Congress excluded permittees from eligibility for indemnification against third party claims. The FAA treats employees of the U.S. Government as third parties for purposes of implementing the financial responsibility requirements of Chapter 701. 14 CFR 440.3(15)(ii). Accordingly, because permittees are not eligible for third party indemnification, the FAA does not propose that the U.S. Government waive claims for bodily injury or property damage sustained by U.S. Government personnel in excess of required insurance.

### III. Rulemaking Analyses and Notices

#### Paperwork Reduction Act

This proposal contains the following new information collection requirements. As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the FAA has submitted the information requirements associated with this proposal to the Office of Management and Budget for its review.

#### Title: Human Space Flight Requirements for Flight Crew and Space Flight Participants

**Summary:** This proposal requires the FAA to regulate private human space flight. President Bush signed into law on December 23, 2004, the Commercial Space Launch Amendments Act of 2004. The CSLAA promotes the development of the emerging commercial space flight industry and makes the DOT and the FAA responsible for regulating commercial human space flight under 49 U.S.C. Subtitle IX, Chapter 701. CSLAA required the FAA to: (1) Issue guidelines

or advisory circulars to guide the implementation of the CSLAA as soon as practical after the date of its enactment on December 23, 2004; (2) issue proposed regulations that include those relating to crew, space flight participants, and permits for launch or reentry of reusable suborbital rockets not later than December 23, 2005; and (3) issue final regulations not later than June 23, 2006.

**Use of:** This proposal would support the information needs of the FAA to protect public safety and notify individuals on board of the risks they face from launch or reentry.

**Respondents (including number of):** The likely respondents to this proposed information requirement are commercial operators planning to perform human space flight with crew and space flight participants. The FAA estimates that there will be five to six companies that would offer human space flight.

**Frequency:** The FAA finds that the frequency of information requirements is dependent on the number of space flights, and estimates that this number can range from one to more than 100 space flights annually.

**Annual Burden Estimate:** The FAA expects that this proposed rule would impose additional reporting and recordkeeping requirements on launch operators who are subject to its provisions; it would have the following impacts for each year over a 10-year period:

- For the high mission scenario, the FAA estimates that it would take 3,946.9 hours annually for the paperwork to inform flight crew and space flight participants of the launch risks and to prepare reciprocal waivers for flight crew and space flight participants. The estimated cost would be \$273,915.

- For the low cost scenario, the FAA estimates that it would take 2,003.2 hours annually for the paperwork to inform flight crew and space flight participants of the launch risks and to prepare reciprocal waivers for flight crew and space flight participants. The estimated cost would be \$139,023.

For purposes of this analysis, the FAA will assume the mid-point between these two scenarios in estimating total cost and time; thus, this proposed rulemaking would take 2,975.05 hours per year, costing \$206,469 annually.

The proposed regulation would cause increased paperwork for the Federal Government, as it would have to review each mission and ascertain compliance during oversight activities at commercial operator facilities. The proposed rule would have the following

impacts on the Federal Government over a 10-year period:

- For the high cost scenario, the FAA estimates that it would take 2,028.4 hours annually, costing \$105,558 in resources expended.

- For the low cost scenario, the FAA estimates that it would take 1,016.2 hours annually, costing \$52,883 in resources expended.

For purposes of this analysis, the FAA will assume the mid-point between these two scenarios in estimating Federal Government revenues expended; thus, this proposed rulemaking would take 1,522.3 hours per year, costing \$79,221 annually.

The agency is soliciting comments to—

(1) Evaluate whether the proposed information required is necessary for the proper performance of the roles of the agency, including whether the information will have practical utility;

(2) Evaluate the accuracy of the agency's estimate of the burden;

(3) Enhance the quality, utility, and clarity of the information to be collected; and

(4) Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology.

Individuals and organizations may submit comments on the information collection requirement by February 27, 2006, and should direct them to the address listed in the **ADDRESSES** section of this document. Comments also should be submitted to the Office of Information and Regulatory Affairs, OMB, New Executive Building, Room 10202, 725 17th Street, NW., Washington, DC 20053, Attention: Desk Officer for FAA.

According to the 1995 amendments to the Paperwork Reduction Act (5 CFR 1320.8(b)(2)(vi)), an agency may not collect or sponsor the collection of information, nor may it impose an information collection requirement unless it displays a currently valid OMB control number. The OMB control number for this information collection will be published in the **Federal Register**, after the Office of Management and Budget approves it.

#### Regulatory Evaluation

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs.

Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act, (19 U.S.C. 2531–2533), prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act requires agencies to consider international standards and, where appropriate, to use the international standards as the basis for U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Public Law 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of \$100 million or more annually as adjusted for inflation.

In conducting these analyses, FAA has determined this rule: (1) Has benefits that justify its costs, (2) is a “significant regulatory action” for non-economical reasons as defined in Executive Order 12866, and is “significant” as defined in DOT’s Regulatory Policies and Procedures; (3) will not have a significant economic impact on a substantial number of small entities; (4) will not reduce barriers to international trade; and (5) does not impose an unfunded mandate on state, local, or tribal governments, or on the private sector. These analyses are available in the docket.

1. Potentially Impacted Parties

Private Sector

- Commercial operators who will be operating launch or reentry vehicles with crew and space flight participants on board.
- Flight crew.
- Remote operator.
- Space flight participants.

Government

- Federal Aviation Administration.
2. Assumptions and Ground Rules Used in Analysis (Discount Rate, Period of Analysis, Value of Life, Cost of Injuries)

- All monetary values are expressed in 2004 dollars.
- The time horizon for the analysis is 10 years (2006 to 2016).
- Costs are discounted at 7%.
- Hourly Burdened Industry Rate is \$69.40
- Hourly Burdened Government Rate is \$52.04
- The high launch forecast used in the analysis is 10,142 over ten years.
- The low launch forecast used in the analysis is 5,081 over ten years.
- Proposed requirements that were fulfilled by the SpaceShipOne launches or that constitute prudent business practice do not impose costs.
- Preparation time expended by commercial entities for specific requirements that might cause industry to incur costs because the proposed requirements are not current practice is as follows:

Benefits

The proposed rule would offer some benefit impacts that are not readily quantified. The principal benefit would be to ensure that the human commercial

space flight industry understands and adheres to the current practices that have worked thus far to protect public safety. The proposed rule would help preserve the level of public safety already achieved by commercial operations. Additionally, informing space flight participants of mission hazards and risks may help mitigate any behavior or reaction during space flight that would jeopardize mission success and consequently public safety. For example, a surprise noise or abrupt vehicle motion during flight could frighten an “uninformed” space flight participant, causing that person to behave or act (e.g., panic) in a manner that could adversely impact mission performance and jeopardize public safety by causing a crash or falling debris from an airborne explosion. Informing candidate space flight participants of risks may deter an individual from participating in space flight who otherwise would panic during flight and possibly create a situation that would jeopardize public safety.

Total Costs

The proposed rule would result in a total cost impact ranging from \$1.9 to \$3.8 million over the ten-year period from 2006 through 2015 (undiscounted 2004 dollars). The human space flight industry would incur 72 percent of the total costs, ranging from \$1.4 million to \$2.7 million to comply with the proposed rule. The FAA would incur 28 percent of the total costs, ranging from \$529,000 to \$1.1 million to administer the proposed regulatory requirements. Costs are summarized in the following table.

SUMMARY OF INCREMENTAL COST IMPACTS ATTRIBUTABLE TO THE PROPOSED RULE OVER THE TEN-YEAR PERIOD, 2006 THROUGH 2015  
(In 2004 dollars)

Category	Undiscounted		Discounted <sup>a</sup>	
	Upper bound	Lower bound	Upper bound	Lower bound
Human Space Flight Industry Compliance Costs .....	\$2,739,149	\$1,390,221	\$1,728,231	\$876,863
Federal Aviation Administration Administrative Costs .....	1,055,579	528,830	656,445	328,890
<b>Total Costs Attributable to the Proposed Rule .....</b>	<b>3,794,728</b>	<b>1,919,051</b>	<b>2,384,676</b>	<b>1,205,753</b>

<sup>a</sup> Calculated using a discount factor of seven percent over a ten-year period.

Comparison of Benefits and Costs

The principal benefit of the proposed rule would be to ensure that the human commercial space flight industry understands and adheres to the current practices that have worked thus far to protect public safety. Additionally, by requiring an operator to inform the crew

and space flight participants of the risks of spaceflight, the proposed rule would protect the public from the hazards an uninformed crew member or space flight participants could pose to the mission. We have not quantified these benefits, but the FAA believes that the

benefits justify the costs of the proposed rule.

*Regulatory Flexibility Determination*

The Regulatory Flexibility Act of 1980 (RFA) establishes “as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective

of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation." To achieve that principle, the RFA requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations and small governmental jurisdictions. Agencies must perform a review to determine whether a proposed rule would have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the Act.

However, if an agency determines that a proposed rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The proposed rule would not have a significant economic impact on a substantial number of small entities. Because almost all the companies in the fledgling industry are small, the FAA concludes that a substantial number of small entities in the human space flight industry would be affected by the rule. However, we believe that the rule would not have a significant impact on these entities as explained below.

The proposed rule would require launch and reentry operators to perform certain actions that, although they may be considered prudent, may not be performed in current practice in all instances. These actions would cause a space transportation operator to incur minimal additional costs relative to current practice.

The North American Industry Classification System does not have a discrete code for commercial space transportation per se. However, it does have the following codes that collectively capture entities engaged in commercial space transportation: 336414, "Guided Missile and Space Vehicle Manufacturing," 336415, "Guided Missile and Space Vehicle Propulsion Unit and Parts Manufacturing," and 336419, "Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing." The Small Business Administration (SBA) has defined small

business entities engaged in the aforementioned activities as those employing no more than 1,000 employees. Further, the SBA does not apply a size standard based on maximum annual receipts to define small business entities engaged in the above industries.

A substantial number of firms entering the human space flight industry are very small. Because the industry is a nascent industry, it is difficult to state how many and which entities will succeed in the industry. There are two companies licensed to perform launches with humans on board: Scaled Composites with about 135 employees and XCOR with about 10 employees. Only Scaled Composites has actually launched as of the date of this report: The industry therefore currently consists of one company. There are about six more companies that the FAA considers serious candidates in the industry because they have committed financial resources and another twenty companies that have expressed interest in entering the human spaceflight industry. The number of employees of these companies ranges from 5 to 40. Based on the definition of small business for the launch industry of entities employing no more than 1,000 employees, all of the above mentioned companies are small businesses with the exception of one: Virgin Galactic which may be considered a large business because it is a subsidiary of Virgin Airways which has over 1,000 employees. One may therefore conclude that a substantial number of companies that are either in the industry or interested in entering the industry are small businesses with fewer than 136 employees.

The FAA estimates that five to six companies will successfully enter the human space flight industry in the next ten years. We cannot yet divide this small number into categories by size; we only know that the vast majority of companies interested in entering the industry are very small (from 5 to 135 employees). We expect that these companies will be about the size of Scaled Composites, the only company thus far to have launched humans, once they start launching. Given the information we currently have the firms offering launches are very small.

The FAA has determined that the impacts are not significant. In order to make this estimate, we compared the incremental cost per mission and the total cost to estimated revenue. It should be noted that all of these estimates are extremely speculative due to the difficulty of predicting the structure of such a nascent industry; however, our

projections of cost as a percent of revenue is extremely small.

The first input to the calculation is the number of expected missions, which FAA tentatively estimates is between 5,081 and 10,142 over the next 10 years, based on written proprietary information received from three companies expecting to offer launch services. To the extent that the industry develops more slowly than expected, these may be overestimates. The incremental cost per expected flight, however, is not affected by the estimated total number of flights.

The second input is the cost for the incremental safety activity required by this rulemaking. In the absence of this regulation, companies would certainly voluntarily engage in extensive testing and safety training, therefore the cost per mission of less than \$300 does not represent the total investment in safety expected in this industry, but rather the incremental increase in safety related activity expected as a result of this regulation. As it is difficult to speculate on the amount of safety improving behavior undertaken in the absence of this regulation, FAA invites specific comment on this issue.

Putting the two inputs together, we estimate costs to perform 10,142 missions (upper bound) over ten years are \$2,739,149 or an average of \$270 per mission. We estimate costs to perform 5,081 (lower bound) over ten years are \$1,390,221 or an average of \$274 per mission. Since the industry is in its infancy and has not yet begun offering commercial flights, per mission costs and revenues are not known. However, prospective companies have quoted ticket prices of \$102,000 to \$250,000 per seat for early flights (with some predicting prices could fall to about \$25,000 per seat after eight or nine years). If these prospective ticket prices and costs are accurate, then even under the lowest ticket prices quoted above, the regulatory cost per mission would be significantly less than 1% of revenues. The estimated \$270 per mission cost that the rule would impose would therefore not be economically significant.

The FAA invites comments on the validity of the FAA's information, assumptions and estimates and any potential impacts.

Accordingly, pursuant to the Regulatory Flexibility Act, 5 U.S.C. 605(b), the FAA Administrator certifies that the proposed rule would not have a significant economic impact on a substantial number of small entities.

*International Trade Impact Assessment*

The Trade Agreement Act of 1979 prohibits Federal agencies from establishing any standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. Because this rulemaking would be largely consistent with current or prudent practice, it would not create obstacles. The statute also requires consideration of international standards and where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential effect of this proposed rule and determined that it would impose the same costs on domestic and international entities, and thus has a neutral trade impact.

*Unfunded Mandates Assessments*

The Unfunded Mandates Reform Act of 1995 (the Act) is intended, among other things, to curb the practice of imposing unfunded Federal mandates on State, local, and tribal governments. Title II of the Act requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of \$100 million or more (adjusted annually for inflation) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a "significant regulatory action." The FAA currently uses an inflation-adjusted value of \$120.7 million in lieu of \$100 million. This proposed rule does not contain such a mandate. The requirements of Title II do not apply.

*Executive Order 13132, Federalism*

The FAA has analyzed this proposed rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action would not have a substantial direct effect on the States, on the relationship between the National Government and the States, or on the distribution of power and responsibilities among the various levels of government, and therefore would not have federalism implications.

*Environmental Analysis*

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this proposed rulemaking action qualifies for the categorical exclusion identified in

paragraph (4i) appendix F and involves no extraordinary circumstances.

*Regulations That Significantly Affect Energy Supply, Distribution, or Use*

The FAA has analyzed this NPRM under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). We have determined that it is not a "significant energy action" under the executive order because it is not a "significant regulatory action" under Executive Order 12866, and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

**List of Subjects***14 CFR Part 401*

Human space flight, Organization and functions (Government agencies), Space safety, Space transportation and exploration.

*14 CFR Part 415*

Human space flight, Rockets, Space safety, Space transportation and exploration.

*14 CFR Part 431*

Human space flight, Reporting and recordkeeping requirements, Rockets, Space safety, Space transportation and exploration.

*14 CFR Part 435*

Human space flight, Reporting and recordkeeping requirements, Rockets, Space safety, Space transportation and exploration.

*14 CFR Part 440*

Armed forces, Federal buildings and facilities, Government property, Indemnity payments, Insurance, Reporting and recordkeeping requirements, Space transportation and exploration.

*14 CFR Part 450*

Armed forces, Federal buildings and facilities, Government property, Human space flight, Indemnity payments, Insurance, Reporting and recordkeeping requirements, Space transportation and exploration.

*14 CFR Part 460*

Human space flight, Reporting and recordkeeping requirements, Rockets, Space safety, Space transportation and exploration.

**IV. The Proposed Amendment**

In consideration of the foregoing, the Federal Aviation Administration proposes to amend parts 401, 415, 431,

435, and 440; remove and reserve part 450 of Chapter III of title 14, Code of Federal Regulations; and add part 460 as follows—

**PART 401—ORGANIZATION AND DEFINITIONS**

1. The authority citation for part 401 continues to read as follows:

**Authority:** 49 U.S.C. 70101–70121.

2. Section 401.5 is amended by adding the following definitions in alphabetical order to read as follows:

**§ 401.5 Definitions.**

\* \* \* \* \*

*Crew* means any employee or independent contractor of a licensee, transferee, or permittee, or of a contractor or subcontractor of a licensee, transferee, or permittee, who performs activities in the course of that employment directly relating to the launch, reentry, or other operation of or in a launch vehicle or reentry vehicle that carries human beings. A crew consists of flight crew and any remote operator.

\* \* \* \* \*

*Flight crew* means crew that is on board a vehicle during a launch or reentry.

\* \* \* \* \*

*Operator* means a holder of a license or permit under 49 U.S.C. Subtitle IX, chapter 701.

\* \* \* \* \*

*Pilot* means a flight crew member who has the ability to control, in real time, a launch or reentry vehicle's flight path.

\* \* \* \* \*

*Remote operator* means a crew member who

(1) Has the ability to control, in real time, a launch or reentry vehicle's flight path, and

(2) Is not on board the controlled vehicle.

\* \* \* \* \*

*Space flight participant* means an individual, who is not crew, carried within a launch vehicle or reentry vehicle.

*Suborbital rocket* means a vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent.

*Suborbital trajectory* means the intentional flight path of a launch vehicle, reentry vehicle, or any portion thereof, whose vacuum instantaneous impact point does not leave the surface of the Earth.

\* \* \* \* \*

**PART 415—LAUNCH LICENSE****Subpart A—General**

3. The authority citation for part 415 continues to read as follows:

**Authority:** 49 U.S.C. 70101–70121.

4. Add § 415.8 to read as follows:

**§ 415.8 Human space flight.**

To obtain a launch license, an applicant proposing to conduct a launch with flight crew or a space flight participant on board must provide documentation demonstrating compliance with §§ 460.5, 460.7, 460.11, 460.13, 460.15, 460.17, 460.51 and 460.53 of this subchapter.

**PART 431—LAUNCH AND REENTRY OF A REUSABLE LAUNCH VEHICLE (RLV)**

5. The authority citation for part 431 continues to read as follows:

**Authority:** 49 U.S.C. 70101–70121.

6. Add § 431.8 to read as follows:

**§ 431.8 Human space flight.**

To obtain a license, an applicant proposing to conduct a reusable launch vehicle mission with flight crew or a space flight participant on board must provide documentation demonstrating compliance with §§ 460.5, 460.7, 460.11, 460.13, 460.15, 460.17, 460.51 and 460.53 of this subchapter.

**PART 435—REENTRY OF A REENTRY VEHICLE OTHER THAN A REUSABLE LAUNCH VEHICLE (RLV)**

7. The authority citation for part 435 continues to read as follows:

**Authority:** 49 U.S.C. 70101–70121.

8. Add § 435.8 to read as follows:

**§ 435.8 Human space flight.**

An applicant for a license to conduct a reentry with flight crew or a space flight participant on board the vehicle must provide documentation demonstrating compliance with §§ 460.5, 460.7, 460.11, 460.13, 460.15, 460.17, 460.51 and 460.53 of this subchapter.

**PART 450—[REMOVED]**

9. Revise part 440 and remove part 450 to read as follows:

**PART 440—FINANCIAL RESPONSIBILITY****Subpart A—Financial Responsibility for Licensed and Permitted Activities**

Sec.

440.1 Scope of part.

440.3 Definitions.

440.5 General.

440.7 Determination of maximum probable loss.

440.9 Insurance requirements for licensed or permitted activities.

440.11 Duration of coverage for suborbital and launch activities; modifications.

440.12 Duration of coverage for reentry; modifications.

440.13 Standard conditions of insurance coverage.

440.15 Demonstration of compliance.

440.17 Reciprocal waiver of claims requirements.

440.19 United States payment of excess third-party liability claims.

Appendix A to Part 440—Information requirements for obtaining a maximum probable loss determination for licensed or permitted activities.

Appendix B to Part 440—Agreement for waiver of claims and assumption of responsibility for licensed launch or reentry

Appendix C to Part 440—Agreement for waiver of claims and assumption of responsibility for permitted activities

Appendix D to Part 440—Agreement for waiver of claims and assumption of responsibility for a crew member

Appendix E to Part 440—Agreement for waiver of claims and assumption of responsibility for a space flight participant

**Authority:** 49 U.S.C. 70101–70119; 49 CFR 1.47.

**Subpart A—Financial Responsibility for Licensed and Permitted Activities****§ 440.1 Scope of part.**

This part establishes financial responsibility and allocation of risk requirements for any launch or reentry authorized by a license or permit issued under this subchapter.

**§ 440.3 Definitions.**

For purposes of this part—

*Bodily injury* means physical injury, sickness, disease, disability, shock, mental anguish, or mental injury sustained by any person, including death.

*Contractors and subcontractors* means those entities that are involved at any tier, directly or indirectly, in licensed or permitted activities, and includes suppliers of property and services, and the component manufacturers of a launch vehicle, reentry vehicle or payload.

*Customer* means

(1) Any person:

(i) Who procures launch or reentry services from a licensee or permittee;

(ii) To whom the customer has sold, leased, assigned, or otherwise transferred its rights in 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.

(2) A space flight participant, for the purposes of this part, is not a customer.

*Federal range facility* means a U.S. Government-owned installation at which a launch or reentry takes place.

*Financial responsibility* means statutorily required financial ability to satisfy a liability obligation as required by 49 U.S.C. Subtitle IX, chapter 701.

*Government personnel* means employees of the United States, its agencies, and its contractors and subcontractors, involved in launch or reentry services for an activity authorized by an FAA license or permit. Employees of the United States include members of the Armed Forces of the United States.

*Hazardous operations* means activities, processes, and procedures that, because of the nature of the equipment, facilities, personnel, environment involved or function being performed, may result in bodily injury or property damage.

*Liability* means a legal obligation to pay a claim for bodily injury or property damage resulting from a licensed or permitted activity.

*License* means an authorization the FAA issues under this subchapter to launch or reenter.

*Licensed activity* means the launch of a launch vehicle or the reentry of a reentry vehicle conducted under a license the FAA issues.

*Maximum probable loss (MPL)* means the greatest dollar amount of loss for bodily injury or property damage that is reasonably expected to result from a licensed or permitted activity;

(1) Losses to third parties, excluding Government personnel and other launch or reentry participants' employees involved in licensed or permitted activities, that are reasonably expected to result from a licensed or permitted activity are those having a probability of occurrence on the order of no less than one in ten million.

(2) Losses to Government property and Government personnel involved in licensed or permitted activities that are reasonably expected to result from licensed or permitted activities are those having a probability of occurrence on the order of no less than one in one hundred thousand.

*Permit* means an authorization the FAA issues under this subchapter for the launch or reentry of a reusable suborbital rocket.

*Permitted activity* means the launch or reentry of a reusable suborbital rocket conducted under a permit the FAA issues.

*Property damage* means partial or total destruction, impairment, or loss of tangible property, real or personal.

*Regulations* mean the Commercial Space Transportation Licensing Regulations codified at 14 CFR Ch. III.

*Third party* means

(1) 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.

(2) Government personnel, as defined in this section, are third parties.

*United States* means the United States Government, including each of its agencies.

(b) Except as otherwise provided in this section, any term used in this part and defined in 49 U.S.C. 70101–70121, or in § 401.5 of this chapter shall have the meaning contained therein.

#### **§ 440.5 General.**

(a) No person may commence or conduct any launch or reentry activity that requires a license or permit unless that person has demonstrated compliance with the requirements of this part.

(b) The FAA will prescribe the amount of financial responsibility a licensee or permittee is required to obtain and any additions to or modifications of the amount in a license or permit order issued concurrent with or subsequent to the issuance of a license or a permit.

(c) Demonstration of financial responsibility under this part shall not relieve a licensee of ultimate responsibility for liability, loss, or damage sustained by the United States resulting from a licensed activity, except to the extent that:

(1) Liability, loss, or damage sustained by the United States results from willful misconduct of the United States or its agents;

(2) Any covered claim of a third party for bodily injury or property damage arising out of any particular licensed activity exceeds the amount of financial responsibility required under § 440.9(c)

of this part and does not exceed \$1,500,000,000 (as adjusted for inflation occurring after January 1, 1989) above such amount, and are payable pursuant to 49 U.S.C. 70113 and § 440.19 of this part. A claim of an employee of any entity listed in subparagraphs (1)(ii) through (1)(iii) in the Third party definition in § 440.3 of this part for bodily injury or property damage is not a covered claim;

(3) A covered claim for property loss or damage exceeds the amount of financial responsibility required under § 440.9 (e) of this part and does not result from willful misconduct of the licensee; or

(4) The licensee has no liability for covered claims by third parties for bodily injury or property damage arising out of any particular launch or reentry that exceeds \$1,500,000,000 (as adjusted for inflation occurring after January 1, 1989) above the amount of financial responsibility required under § 440.9(c).

(d) Demonstration of financial responsibility under this part does not relieve a permittee of ultimate responsibility for liability, loss, or damage sustained by the United States resulting from a permitted activity, except to the extent that:

(1) Liability, loss, or damage sustained by the United States results from willful misconduct of the United States or its agents; or

(2) A covered claim for property loss or damage to the United States exceeds the amount of financial responsibility required under § 440.9(e) and does not result from willful misconduct of the permittee.

(e) A licensee's or permittee's failure to comply with any requirement of this part may result in suspension or revocation of a license or permit, and subject the licensee or permittee to civil penalties as provided in part 405 of this chapter.

#### **§ 440.7 Determination of maximum probable loss.**

(a) The FAA will determine the maximum probable loss (MPL) from covered claims by a third party for bodily injury or property damage, and the United States, its agencies, and its contractors and subcontractors for covered property damage or loss, resulting from a permitted or licensed activity. The maximum probable loss determination forms the basis for financial responsibility requirements issued in a license or permit order.

(b) The FAA issues its determination of maximum probable loss no later than ninety days after a licensee or permittee has requested a determination and submitted all information required by

the FAA to make the determination. The FAA will consult with Federal agencies that are involved in, or whose personnel or property are exposed to risk of damage or loss as a result of, a licensed or permitted activity before issuing a license or permit order prescribing financial responsibility requirements, and shall notify the licensee, or permittee, if interagency consultation may delay issuance of the MPL determination.

(c) Appendix A of this part contains information requirements for obtaining a maximum probable loss determination. Any person requesting a determination of maximum probable loss must submit the information required by Appendix A, unless the FAA has waived a requirement. In lieu of submitting required information, a person requesting a maximum probable loss determination may designate and certify certain information previously submitted for a prior determination as complete, valid, and equally applicable to its current request. The requester is responsible for the continuing accuracy and completeness of information submitted under this part and must promptly report any changes in writing.

(d) The FAA will amend a determination of maximum probable loss required under this section at any time prior to completion of licensed or permitted activities as warranted by supplementary information provided to or obtained by the FAA after the MPL determination is issued. Any change in financial responsibility requirements as a result of an amended MPL determination shall be set forth in a license or permit order.

(e) The FAA may make a determination of maximum probable loss at any time other than as set forth in paragraph (b) of this section upon request by any person.

#### **§ 440.9 Insurance requirements for licensed or permitted activities.**

(a) As a condition of each license or permit, a licensee or permittee must comply with all insurance requirements of this section and of a license or permit issued by the FAA, or otherwise demonstrate the required amount of financial responsibility.

(b) A licensee or permittee must obtain and maintain in effect a policy or policies of liability insurance, in an amount determined by the FAA under paragraph (c) of this section, that protects the following persons as additional insureds to the extent of their respective potential liabilities against covered claims by a third party for bodily injury or property damage

resulting from a licensed or permitted activity:

(1) The licensee or permittee, its customer, and their respective contractors and subcontractors, and the employees of each, involved in a licensed or permitted activity;

(2) The United States, its agencies, and its contractors and subcontractors involved in a licensed or permitted activity; and

(3) Government personnel.

(c) The FAA will prescribe for each licensee or permittee the amount of insurance required to compensate the total of covered third-party claims for bodily injury or property damage resulting from a licensed or permitted activity in connection with any particular launch or reentry. A covered third-party claim includes a claim by the United States, its agencies, and its contractors and subcontractors for damage or loss to property other than property for which insurance is required under paragraph (d) of this section. The amount of insurance required is based upon the FAA's determination of maximum probable loss; however, it will not exceed the lesser of:

(1) \$500 million; or

(2) The maximum liability insurance available on the world market at a reasonable cost, as determined by the FAA.

(d) The licensee or permittee must obtain and maintain in effect a policy or policies of insurance, in an amount determined by the FAA under paragraph (e) of this section, that covers claims by the United States, its agencies, and its contractors and subcontractors involved in a licensed or permitted activity for property damage or loss resulting from a licensed or permitted activity. Property covered by this insurance must include all property owned, leased, or occupied by, or within the care, custody, or control of, the United States and its agencies, and its contractors and subcontractors involved in a licensed or permitted activity, at a Federal range facility. Insurance must protect the United States and its agencies, and its contractors and subcontractors involved in a licensed or permitted activity.

(e) The FAA will prescribe for each licensee or permittee the amount of insurance required to compensate claims for property damage under paragraph (d) of this section resulting from a licensed or permitted activity in connection with any particular launch or reentry. The amount of insurance is based upon a determination of maximum probable loss; however, it will not exceed the lesser of:

(1) \$100 million; or

(2) The maximum available on the world market at a reasonable cost, as determined by the FAA.

(f) In lieu of a policy of insurance, a licensee or permittee may demonstrate financial responsibility in another manner meeting the terms and conditions for insurance of this part. The licensee or permittee must describe in detail the method proposed for demonstrating financial responsibility and how it ensures that the licensee or permittee is able to cover claims as required under this part.

**§ 440.11 Duration of coverage for suborbital and launch activities; modifications.**

(a) Insurance coverage required under § 440.9, or other form of financial responsibility, shall attach when a licensed or permitted launch activity starts, and remain in full force and effect as follows:

(1) Until completion of licensed or permitted launch activities at a launch site; and

(2) For orbital launch, until the later of—

(i) Thirty days following payload separation, or attempted payload separation in the event of a payload separation anomaly; or

(ii) Thirty days from ignition of the launch vehicle.

(3) For a suborbital launch, until the later of—

(i) Motor impact and payload recovery; or

(ii) The FAA's determination that risk to third parties and Government property as a result of licensed or permitted launch activities is sufficiently small that financial responsibility is no longer necessary. That determination is made through the risk analysis conducted before the launch to determine MPL and specified in a license or permit order.

(b) Financial responsibility required under this part may not be replaced, canceled, changed, withdrawn, or in any way modified to reduce the limits of liability or the extent of coverage, nor expire by its own terms, prior to the time specified in a license or permit order, unless the FAA is notified at least 30 days in advance and expressly approves the modification.

**§ 440.12 Duration of coverage for reentry; modifications.**

(a) For reentry, insurance coverage required under § 440.9, or other form of financial responsibility, shall attach upon commencement of licensed or permitted reentry activities, and remain in full force and effect as follows:

(1) For ground operations, until completion of licensed or permitted reentry activities at the reentry site; and

(2) For other licensed or permitted reentry activities, thirty days from initiation of reentry flight; however, in the event of an abort that results in the reentry vehicle remaining on orbit, insurance shall remain in place until the FAA's determination that risk to third parties and Government property as a result of licensed or permitted reentry activities is sufficiently small that financial responsibility is no longer necessary, as determined by the FAA through the risk analysis conducted to determine MPL and specified in a license or permit order.

(b) Financial responsibility required under this part may not be replaced, canceled, changed, withdrawn, or in any way modified to reduce the limits of liability or the extent of coverage, nor expire by its own terms, prior to the time specified in a license or permit order, unless the FAA is notified at least 30 days in advance and expressly approves the modification.

**§ 440.13 Standard conditions of insurance coverage.**

(a) Insurance obtained under § 440.9 must comply with each of the following terms and conditions of coverage:

(1) Bankruptcy or insolvency of an insured, including any additional insured, shall not relieve an insurer of any of its obligations under any policy.

(2) Policy limits shall apply separately to each occurrence and, for each occurrence to the total of claims arising out of a licensed or permitted activity in connection with any particular launch or reentry.

(3) Except as provided in this section, each policy must pay claims from the first dollar of loss, without regard to any deductible, to the limits of the policy. A licensee or permittee may obtain a policy containing a deductible amount if the amount of the deductible is placed in an escrow account or otherwise demonstrated to be unobligated, unencumbered funds of the licensee or permittee, available to compensate claims at any time claims may arise.

(4) No policy may be invalidated by any action or inaction of the licensee or permittee or any additional insured, even by nonpayment by the licensee or permittee of the policy premium, and each policy must insure the licensee or permittee and each additional insured regardless of any breach or violation of any warranties, declarations, or conditions contained in the policies by the licensee or permittee or any additional insured (other than a breach or violation by the licensee, permittee or

an additional insured, and then only as against that licensee, permittee or additional insured).

(5) Each exclusion from coverage must be specified.

(6) Insurance shall be primary without right of contribution from any other insurance that is carried by the licensee or permittee or any additional insured.

(7) Each policy must expressly provide that all of its provisions, except the policy limits, operate in the same manner as if there were a separate policy with and covering the licensee or permittee and each additional insured.

(8) Each policy must be placed with an insurer of recognized reputation and responsibility that either:

(i) Is licensed to do business in any State, territory, possession of the United States, or the District of Columbia; or

(ii) Includes in each of its policies or insurance obtained under this part a contract clause in which the insurer agrees to submit to the jurisdiction of a court of competent jurisdiction within the United States and designates an authorized agent within the United States for service of legal process on the insurer.

(9) Except as to claims resulting from the willful misconduct of the United States or any of its agents, the insurer shall waive any and all rights of subrogation against each of the parties protected by required insurance.

(b) [Reserved]

#### **§ 440.15 Demonstration of compliance.**

(a) A licensee or permittee must submit to the FAA evidence of financial responsibility and compliance with allocation of risk requirements under this part, as follows, unless a license or permit order specifies otherwise due to the proximity of the intended date for commencement of licensed or permitted activities:

(1) All reciprocal waiver of claims agreements required under § 440.17(c) must be submitted at least 30 days before the start of any licensed or permitted activity involving a customer, crew member, or space flight participant;

(2) Evidence of insurance must be submitted at least 30 days before commencement of any licensed or permitted activity, and for reentry no less than 30 days before commencement of launch activities involving the reentry licensee;

(3) Evidence of financial responsibility in a form other than insurance, as provided under § 440.9(f), must be submitted at least 60 days before commencement of a licensed or permitted activity; and

(4) Evidence of renewal of insurance or other form of financial responsibility

must be submitted at least 30 days in advance of its expiration date.

(b) Upon a complete demonstration of compliance with financial responsibility and allocation of risk requirements under this part, the requirements of this part shall preempt each and any provision in any agreement between the licensee or permittee and an agency of the United States governing access to or use of United States launch or reentry property or launch or reentry services for a licensed or permitted activity which addresses financial responsibility, allocation of risk and related matters covered by 49 U.S.C. 70112, 70113.

(c) A licensee or permittee must demonstrate compliance as follows:

(1) The licensee or permittee must provide proof of the existence of the insurance required by § 440.9 by:

(i) Certifying to the FAA that it has obtained insurance in compliance with the requirements of this part and any applicable license or permit order;

(ii) Filing with the FAA one or more certificates of insurance evidencing insurance coverage by one or more insurers under a currently effective and properly endorsed policy or policies of insurance, applicable to a licensed or permitted activity, on terms and conditions and in amounts prescribed under this part, and specifying policy exclusions;

(iii) In the event of any policy exclusions or limitations of coverage that may be considered usual under § 440.19(c), or for purposes of implementing the Government's waiver of claims for property damage under 49 U.S.C. 70112(b)(2), certifying that insurance covering the excluded risks is not commercially available at reasonable cost; and

(iv) Submitting to the FAA, for signature by the Department on behalf of the United States Government, the waiver of claims and assumption of responsibility agreement required by § 440.17(c), executed by the licensee or permittee and its customer.

(v) Submitting to the FAA, for signature by the Department on behalf of the United States Government, an agreement to waive claims and assume responsibility required by § 440.17(e), executed by each space flight participant.

(vi) Submitting to the FAA, for signature by the Department on behalf of the United States Government, an agreement to waive claims and assume responsibility required by § 440.17(f), executed by each member of the crew.

(2) Any certification required by this section must be signed by a duly

authorized officer of the licensee or permittee.

(d) Each certificate of insurance required by paragraph (c)(1)(ii) of this section must be signed by the insurer issuing the policy and accompanied by an opinion of the insurance broker that the insurance obtained by the licensee or permittee complies with all the requirements for insurance of this part and any applicable license or permit order.

(e) The licensee or permittee must maintain, and make available for inspection by the FAA upon request, all required policies of insurance and other documents necessary to demonstrate compliance with this part.

(f) In the event the licensee or permittee demonstrates financial responsibility using means other than insurance, as provided under § 440.9(f), the licensee or permittee must provide proof that it has met the requirements of this part and of a FAA issued license or permit order.

#### **§ 440.17 Reciprocal waiver of claims requirements.**

(a) As a condition of each license or permit, the licensee or permittee must comply with the reciprocal waiver of claims requirements of this section.

(b) The licensee or permittee shall implement a reciprocal waiver of claims with each of its contractors and subcontractors, each customer and each of the customer's contractors and subcontractors, under which each party waives and releases claims against all the other parties to the waiver and agrees to assume financial responsibility for property damage it sustains and for bodily injury or property damage sustained by its own employees, and to hold harmless and indemnify each other from bodily injury or property damage sustained by its employees, resulting from a licensed or permitted activity, regardless of fault.

(c) For each licensed or permitted activity in which the U.S. Government, any agency, or its contractors and subcontractors is involved or where property insurance is required under § 440.9(d), the Federal Aviation Administration of the Department of Transportation, the licensee or permittee, and its customer shall enter into a three-party reciprocal waiver of claims agreement. The three-party reciprocal waiver of claims shall be in the form set forth in Appendix B, for licensed activity, or Appendix C, for permitted activity, of this part or in a form that satisfies the requirements.

(d) The licensee or permittee, its customer, and the Federal Aviation Administration of the Department of

Transportation on behalf of the United States and its agencies but only to the extent provided in legislation, must agree in any waiver of claims agreement required under this part to indemnify another party to the agreement from claims by the indemnifying party's contractors and subcontractors arising out of the indemnifying party's failure to implement properly the waiver requirement.

(e) For each licensed or permitted activity in which the U.S. Government, any of its agencies, or its contractors and subcontractors are involved, the Federal Aviation Administration of the Department of Transportation and each space flight participant shall enter into or have in place a reciprocal waiver of claims agreement in the form of the agreement in Appendix E of this part or that satisfies its requirements.

(f) For each licensed or permitted launch or reentry in which the U.S. Government, any of its agencies, or its contractors and subcontractors is involved, the Federal Aviation Administration of the Department of Transportation and each crew member shall enter into or have in place a reciprocal waiver of claims agreement in the form of the agreement in Appendix D of this part or that satisfies its requirements.

**§ 440.19 United States payment of excess third-party liability claims.**

(a) The United States pays successful covered claims (including reasonable expenses of litigation or settlement) of a third party against a licensee, a customer, and the contractors and subcontractors of the licensee and the customer, and the employees of each involved in licensed activities, and the contractors and subcontractors of the United States and its agencies, and their employees, involved in licensed activities to the extent provided in an appropriation law or other legislative authority providing for payment of claims in accordance with 49 U.S.C. 70113, and to the extent the total amount of such covered claims arising out of any particular launch or reentry:

- (1) Exceeds the amount of insurance required under § 440.9(b); and
- (2) Is not more than \$1,500,000,000 (as adjusted for inflation occurring after January 1, 1989) above that amount.

(b) Payment by the United States under paragraph (a) of this section shall not be made for any part of such claims for which bodily injury or property damage results from willful misconduct by the party seeking payment.

(c) The United States shall provide for payment of claims by third parties for bodily injury or property damage that

are payable under 49 U.S.C. 70113 and not covered by required insurance under § 440.9(b), without regard to the limitation under paragraph (a)(1) of this section, because of an insurance policy exclusion that is usual. A policy exclusion is considered usual only if insurance covering the excluded risk is not commercially available at reasonable rates. The licensee must submit a certification in accordance with § 440.15(c)(1)(iii) of this part for the United States to cover the claims.

(d) Upon the expiration of the policy period prescribed in accordance with § 440.11(a), the United States shall provide for payment of claims that are payable under 49 U.S.C. 70113 from the first dollar of loss up to \$1,500,000,000 (as adjusted for inflation occurring after January 1, 1989).

(e) Payment by the United States of excess third-party claims under 49 U.S.C. 70113 shall be subject to:

(1) Prompt notice by the licensee to the FAA that the total amount of claims arising out of licensed activities exceeds, or is likely to exceed, the required amount of financial responsibility. For each claim, the notice must specify the nature, cause, and amount of the claim or lawsuit associated with the claim, and the party or parties who may otherwise be liable for payment of the claim;

(2) Participation or assistance in the defense of the claim or lawsuit by the United States, at its election;

(3) Approval by the FAA of any settlement, or part of a settlement, to be paid by the United States; and

(4) Approval by Congress of a compensation plan prepared by the FAA and submitted by the President.

(f) The FAA will:

(1) Prepare a compensation plan outlining the total amount of claims and meeting the requirements set forth in 49 U.S.C. 70113;

(2) Recommend sources of funds to pay the claims; and

(3) Propose legislation as required to implement the plan.

(g) The FAA may withhold payment of a claim if it finds that the amount is unreasonable, unless it is the final order of a court that has jurisdiction over the matter.

**Appendix A to Part 440—Information Requirements for Obtaining a Maximum Probable Loss Determination for Licensed or Permitted Activities**

Any person requesting a maximum probable loss determination shall submit the following information to the FAA, unless the FAA has waived a particular information requirement under 14 CFR 440.7(c):

**Part 1: Information Requirements for Licensed Suborbital and Launch Activities**

**I. General Information**

- A. Mission description.
1. A description of mission parameters, including:
    - a. Launch trajectory;
    - b. Orbital inclination; and
    - c. Orbit altitudes (apogee and perigee).
  2. Flight sequence.
  3. Staging events and the time for each event.
  4. Impact locations.
  5. Identification of the launch site facility, including the launch complex on the site, planned date of launch, and launch windows.
  6. If the applicant has previously been issued a license or permit to conduct licensed or permitted activities using the same vehicle from the same launch site, a description of any differences planned in the conduct of proposed activities.
- B. Launch vehicle description.
1. General description of the launch vehicle and its stages, including dimensions.
  2. Description of major systems, including safety systems.
  3. Description of rocket motors and type of fuel used.
  4. Identification of all propellants to be used and their hazard classification under the Hazardous Materials Table, 49 CFR 172.101.
  5. Description of hazardous components.
- C. Payload.
1. General description of the payload, including type (e.g., telecommunications, remote sensing), propellants, and hazardous components or materials, such as toxic or radioactive substances.
  2. Flight safety system.
    1. Identification of any flight safety system (FSS) on the vehicle, including a description of operations and component location on the vehicle.

**II. Pre-Flight Processing Operations**

A. General description of pre-flight operations including vehicle processing consisting of an operational flow diagram showing the overall sequence and location of operations, commencing with arrival of vehicle components at the launch site facility through final safety checks and countdown sequence, and designation of hazardous operations, as defined in 14 CFR 440.3. For purposes of these information requirements, payload processing, as opposed to integration, is not a hazardous operation.

B. For each hazardous operation, including but not limited to fueling, solid rocket motor build-up, ordnance installation, ordnance checkout, movement of hazardous materials, and payload integration:

1. Identification of location where each operation will be performed, including each building or facility identified by name or number.
2. Identification of facilities adjacent to the location where each operation will be performed and therefore exposed to risk, identified by name or number.
3. Maximum number of Government personnel and individuals not involved in licensed or permitted activities who may be exposed to risk during each operation. For Government personnel, identification of his or her employer.
4. Identification of launch site policies or requirements applicable to the conduct of operations.

### III. Flight Operations

A. Identification of launch site facilities exposed to risk during licensed or permitted flight.

B. Identification of accident failure scenarios, probability assessments for each, and estimation of risks to Government personnel, individuals not involved in licensed or permitted activities, and Government property, due to property damage or bodily injury. The estimation of risks for each scenario shall take into account the number of such individuals at risk as a result of lift-off and flight of a launch vehicle (on-range, off-range, and down-range) and specific, unique facilities exposed to risk. Scenarios shall cover the range of launch trajectories, inclinations and orbits for which authorization is sought in the license or permit application.

C. On-orbit risk analysis assessing risks posed by a launch vehicle to operational satellites.

D. Reentry risk analysis assessing risks to Government personnel and individuals not involved in licensed or permitted launch activities as a result of reentering debris or reentry of the launch vehicle or its components.

E. Trajectory data as follows: Nominal and 3-sigma lateral trajectory data in x, y, z and x (dot), y (dot), z (dot) coordinates in one-second intervals, data to be pad-centered with x being along the initial launch azimuth and continuing through impact for suborbital flights, and continuing through orbital insertion or the end of powered flight for orbital flights.

F. Tumble-turn data for guided vehicles only, as follows: For vehicles with gimbaled nozzles, tumble turn data with zeta angles and velocity magnitudes stated. A separate table is

required for each combination of fail times (every two to four seconds), and significant nozzle angles (two or more small angles, generally between one and five degrees).

G. Identification of debris lethal areas and the projected number and ballistic coefficient of fragments expected to result from flight termination, initiated either by command or self-destruct mechanism, for lift-off, land overflight, and reentry.

### IV. Post-Flight Processing Operations

A. General description of post-flight ground operations including overall sequence and location of operations for removal of vehicle components and processing equipment from the launch site facility and for handling of hazardous materials, and designation of hazardous operations.

B. Identification of all facilities used in conducting post-flight processing operations.

C. For each hazardous operation:

1. Identification of location where each operation is performed, including each building or facility identified by name or number.

2. Identification of facilities adjacent to location where each operation is performed and exposed to risk, identified by name or number.

3. Maximum number of Government personnel and individuals not involved in licensed or permitted launch activities that may be exposed to risk during each operation. For Government personnel, identification of his or her employer.

4. Identification of launch site facility policies or requirements applicable to the conduct of operations.

### Part 2: Information Requirements for Licensed Reentry

#### I. General Information

A. Reentry mission description.

1. A description of mission parameters, including:

a. Orbital inclination; and  
b. Orbit altitudes (apogee and perigee).

c. Reentry trajectories.

2. Reentry flight sequences.

3. Reentry initiation events and the time for each event.

4. Nominal landing location, alternative landing sites and contingency abort sites.

5. Identification of landing facilities, (planned date of reentry), and reentry windows.

6. If the applicant has previously been issued a license or permit to conduct reentry activities using the same reentry vehicle to the same reentry site facility,

a description of any differences planned in the conduct of proposed activities.

B. Reentry vehicle description.

1. General description of the reentry vehicle, including dimensions.

2. Description of major systems, including safety systems.

3. Description of propulsion system (reentry initiation system) and type of fuel used.

4. Identification of all propellants to be used and their hazard classification under the Hazardous Materials Table, 49 CFR 172.101.

5. Description of hazardous components.

C. Payload.

1. General description of any payload, including type (*e.g.*, telecommunications, remote sensing), propellants, and hazardous components or materials, such as toxic or radioactive substances.

D. Flight termination system or flight safety system.

1. Identification of any flight termination system or flight safety system on the reentry vehicle, including a description of operations and component location on the vehicle.

### II. Flight Operations

A. Identification of reentry site facilities exposed to risk during vehicle reentry and landing.

B. Identification of accident failure scenarios, probability assessments for each, and estimation of risks to Government personnel, individuals not involved in licensed or permitted reentry activities, and Government property, due to property damage or bodily injury. The estimation of risks for each scenario shall take into account the number of such individuals at risk as a result of reentry (flight) and landing of a reentry vehicle (on-range, off-range, and down-range) and specific, unique facilities exposed to risk. Scenarios shall cover the range of reentry trajectories for which authorization is sought.

C. On-orbit risk analysis assessing risks posed by a reentry vehicle to operational satellites during reentry.

D. Reentry risk analysis assessing risks to Government personnel and individuals not involved in licensed or permitted reentry activities as a result of inadvertent or random reentry of the launch vehicle or its components.

E. Nominal and 3-sigma dispersed trajectories in one-second intervals, from reentry initiation through landing or impact. (Coordinate system will be specified on a case-by-case basis).

F. Three-sigma landing or impact dispersion area in downrange ( $\pm$ ) and crossrange ( $\pm$ ) measured from the nominal and contingency landing or

impact target. The applicant is responsible for including all significant landing or impact dispersion constituents in the computations of landing or impact dispersion areas. The dispersion constituents should include, but not be limited to: Variation in orbital position and velocity at the reentry initiation time; variation in reentry initiation time offsets, either early or late; variation in the bodies' ballistic coefficient; position and velocity variation due to winds; and variations in re-entry retro-maneuvers.

G. Malfunction turn data (tumble, trim) for guided (controllable) vehicles. The malfunction turn data shall include the total angle turned by the velocity vector versus turn duration time at one second intervals; the magnitude of the velocity vector versus turn duration time at one second intervals; and an indication on the data where the reentry body will impact the Earth, or breakup due to aerodynamic loads. A malfunction turn data set is required for each malfunction time. Malfunction turn start times shall not exceed four-second intervals along the trajectory.

H. Identification of debris casualty areas and the projected number and ballistic coefficient of fragments expected to result from each failure mode during reentry, including random reentry.

### III. Post-Flight Processing Operations

A. General description of post-flight ground operations including overall sequence and location of operations for removal of vehicle and components and processing equipment from the reentry site facility and for handling of hazardous materials, and designation of hazardous operations.

B. Identification of all facilities used in conducting post-flight processing operations.

C. For each hazardous operation:

1. Identification of location where each operation is performed, including each building or facility identified by name or number.

2. Identification of facilities adjacent to location where each operation is performed and exposed to risk, identified by name or number.

3. Maximum number of Government personnel and individuals not involved in licensed or permitted reentry activities who may be exposed to risk during each operation. For Government personnel, identification of his or her employer.

4. Identify and provide reentry site facility policies or requirements applicable to the conduct of operations.

### Part 3: Information Requirements for Permitted Activities

In addition to the information required in part 437 subpart B, an applicant for an experimental permit must provide, for each permitted pre-flight and post-flight operation, the following information to the FAA:

A. Identification of location where each operation will be performed, including any U.S. Government or third party facilities identified by name or number.

B. Identification of any U.S. Government or third party facilities adjacent to the location where each operation will be performed and therefore exposed to risk, identified by name or number.

C. Maximum number of Government personnel and individuals not involved in permitted activities that may be exposed to risk during each operation. For Government personnel, identification of his or her employer.

### Appendix B to Part 440—Agreement for Waiver of Claims and Assumption of Responsibility for Licensed Launch or Reentry

#### Part 1—Waiver of Claims and Assumption of Responsibility for Licensed Launches

This agreement is entered into this \_\_\_\_\_ day of \_\_\_\_\_, by and among [Licensee] (the "Licensee"), [Customer] (the "Customer") and the Federal Aviation Administration of the Department of Transportation, on behalf of the United States Government (collectively, the "Parties"), to implement the provisions of section 440.17(c) of the Commercial Space Transportation Licensing Regulations, 14 CFR Ch. III (the "Regulations").

In consideration of the mutual releases and promises contained herein, the Parties hereby agree as follows:

#### 1. Definitions

*Customer* means the above-named Customer on behalf of the Customer and any person described in § 440.3 of the Regulations.

*License* means License No. \_\_\_\_\_ issued on \_\_\_\_\_, by the Associate Administrator for Commercial Space Transportation, Federal Aviation Administration, Department of Transportation, to the Licensee, including all license orders issued in connection with the License.

*Licensee* means the Licensee and any transferee of the Licensee under 49 U.S.C. Subtitle IX, ch. 701.

*United States* means the United States and its agencies involved in Licensed Launch Activities.

Except as otherwise defined herein, terms used in this Agreement and defined in 49 U.S.C. Subtitle IX, ch. 701—Commercial Space Launch Activities, or in the Regulations, shall have the same meaning as contained in 49 U.S.C. Subtitle IX, ch. 701, or the Regulations, respectively.

#### 2. Waiver and Release of Claims

(a) Licensee hereby waives and releases claims it may have against Customer and the United States, and against their respective Contractors and Subcontractors, for Property Damage it sustains and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Launch Activities, regardless of fault.

(b) Customer hereby waives and releases claims it may have against Licensee and the United States, and against their respective Contractors and Subcontractors, for Property Damage it sustains and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Launch Activities, regardless of fault.

(c) The United States hereby waives and releases claims it may have against Licensee and Customer, and against their respective Contractors and Subcontractors, for Property Damage it sustains, and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Launch Activities, regardless of fault, to the extent that claims it would otherwise have for such damage or injury exceed the amount of insurance or demonstration of financial responsibility required under sections 440.9(c) and (e), respectively, of the Regulations.

#### 3. Assumption of Responsibility

(a) Licensee and Customer shall each be responsible for Property Damage it sustains and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Launch Activities, regardless of fault. Licensee and Customer shall each hold harmless and indemnify each other, the United States, and the Contractors and Subcontractors of each Party, for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Launch Activities, regardless of fault.

(b) The United States shall be responsible for Property Damage it sustains, and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Launch Activities, regardless of fault, to the extent that claims it would otherwise have for such damage or injury exceed the amount of insurance

or demonstration of financial responsibility required under sections 440.9(c) and (e), respectively, of the Regulations.

#### *4. Extension of Assumption of Responsibility and Waiver*

(a) Licensee shall extend the requirements of the waiver and release of claims, and the assumption of responsibility, hold harmless, and indemnification, as set forth in paragraphs 2(a) and 3(a), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against Customer and the United States, and against the respective Contractors and Subcontractors of each, and to agree to be responsible, for Property Damage they sustain and to be responsible, hold harmless and indemnify Customer and the United States, and the respective Contractors and Subcontractors of each, for Bodily Injury or Property Damage sustained by their own employees, resulting from Licensed Launch Activities, regardless of fault.

(b) Customer shall extend the requirements of the waiver and release of claims, and the assumption of responsibility, hold harmless, and indemnification, as set forth in paragraphs 2(b) and 3(a), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against Licensee and the United States, and against the respective Contractors and Subcontractors of each, and to agree to be responsible, for Property Damage they sustain and to be responsible, hold harmless and indemnify Licensee and the United States, and the respective Contractors and Subcontractors of each, for Bodily Injury or Property Damage sustained by their own employees, resulting from Licensed Launch Activities, regardless of fault.

(c) The United States shall extend the requirements of the waiver and release of claims, and the assumption of responsibility as set forth in paragraphs 2(c) and 3(b), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against Licensee and Customer, and against the respective Contractors and Subcontractors of each, and to agree to be responsible, for any Property Damage they sustain and for any Bodily Injury or Property Damage sustained by their own employees, resulting from Licensed Launch Activities, regardless of fault, to the extent that claims they would otherwise have for such damage or injury exceed the amount of insurance or demonstration of financial

responsibility required under sections 440.9(c) and (e), respectively, of the Regulations.

#### *5. Indemnification*

(a) Licensee shall hold harmless and indemnify Customer and its directors, officers, servants, agents, subsidiaries, employees and assignees, or any or them, and the United States and its agencies, servants, agents, subsidiaries, employees and assignees, or any or them, from and against liability, loss or damage arising out of claims that Licensee's Contractors and Subcontractors may have for Property Damage sustained by them and for Bodily Injury or Property Damage sustained by their employees, resulting from Licensed Launch Activities.

(b) Customer shall hold harmless and indemnify Licensee and its directors, officers, servants, agents, subsidiaries, employees and assignees, or any or them, and the United States and its agencies, servants, agents, subsidiaries, employees and assignees, or any or them, from and against liability, loss or damage arising out of claims that Customer's Contractors and Subcontractors, or any person on whose behalf Customer enters into this Agreement, may have for Property Damage sustained by them and for Bodily Injury or Property Damage sustained by their employees, resulting from Licensed Launch Activities.

(c) To the extent provided in advance in an appropriations law or to the extent there is enacted additional legislative authority providing for the payment of claims, the United States shall hold harmless and indemnify Licensee and Customer and their respective directors, officers, servants, agents, subsidiaries, employees and assignees, or any of them, from and against liability, loss or damage arising out of claims that Contractors and Subcontractors of the United States may have for Property Damage sustained by them, and for Bodily Injury or Property Damage sustained by their employees, resulting from Licensed Launch Activities, to the extent that claims they would otherwise have for such damage or injury exceed the amount of insurance or demonstration of financial responsibility required under sections 440.9(c) and (e), respectively, of the Regulations.

#### *6. Assurances Under 49 U.S.C. 70112(e)*

Notwithstanding any provision of this Agreement to the contrary, Licensee shall hold harmless and indemnify the United States and its agencies, servants, agents, employees and assignees, or any of them, from and against liability, loss

or damage arising out of claims for Bodily Injury or Property Damage, resulting from Licensed Launch Activities, regardless of fault, except to the extent that: (i) As provided in section 7(b) of this Agreement, claims result from willful misconduct of the United States or its agents; (ii) claims for Property Damage sustained by the United States or its Contractors and Subcontractors exceed the amount of insurance or demonstration of financial responsibility required under section 440.9(e) of the Regulations; (iii) claims by a Third Party for Bodily Injury or Property Damage exceed the amount of insurance or demonstration of financial responsibility required under section 440.9(c) of the Regulations, and do not exceed \$1,500,000,000 (as adjusted for inflation after January 1, 1989) above such amount, and are payable pursuant to the provisions of 49 U.S.C. 70113 and section 440.19 of the Regulations; or (iv) Licensee has no liability for claims exceeding \$1,500,000,000 (as adjusted for inflation after January 1, 1989) above the amount of insurance or demonstration of financial responsibility required under section 440.9(c) of the Regulations.

#### *7. Miscellaneous*

(a) Nothing contained herein shall be construed as a waiver or release by Licensee, Customer or the United States of any claim by an employee of the Licensee, Customer or the United States, respectively, including a member of the Armed Forces of the United States, for Bodily Injury or Property Damage, resulting from Licensed Launch Activities.

(b) Notwithstanding any provision of this Agreement to the contrary, any waiver, release, assumption of responsibility or agreement to hold harmless and indemnify herein shall not apply to claims for Bodily Injury or Property Damage resulting from willful misconduct of any of the Parties, the Contractors and Subcontractors of any of the Parties, and in the case of Licensee and Customer and the Contractors and Subcontractors of each of them, the directors, officers, agents and employees of any of the foregoing, and in the case of the United States, its agents.

(c) In the event that more than one customer is involved in Licensed Launch Activities, references herein to Customer shall apply to, and be deemed to include, each such customer severally and not jointly.

(d) This Agreement shall be governed by and construed in accordance with United States Federal law.

*In Witness Whereof*, the Parties to this Agreement have caused the Agreement to be duly executed by their respective duly authorized representatives as of the date written above.

Licensee

By: \_\_\_\_\_

Its: \_\_\_\_\_

Customer

By: \_\_\_\_\_

Its: \_\_\_\_\_

Federal Aviation Administration of the Department of Transportation on Behalf of the United States Government

By: \_\_\_\_\_

Its: \_\_\_\_\_

Associate Administrator for Commercial Space Transportation

## **Part 2—Waiver of Claims and Assumption of Responsibility for Licensed Reentries**

This Agreement is entered into this \_\_\_\_ day of \_\_\_\_, by and among [Licensee] (the “Licensee”), [Customer] (the “Customer”), and the Federal Aviation Administration of the Department of Transportation, on behalf of the United States Government (collectively, the “Parties”), to implement the provisions of § 440.17(c) of the Commercial Space Transportation Licensing Regulations, 14 CFR Ch. III (the “Regulations”).

In consideration of the mutual releases and promises contained herein, the Parties hereby agree as follows:

### *1. Definitions*

*Contractors and Subcontractors* means entities described in § 440.3 of the Regulations.

*Customer* means the above-named Customer on behalf of the Customer and any person described in § 440.3 of the Regulations.

*License* means License No. \_\_\_\_\_ issued on \_\_\_\_\_, by the Associate Administrator for Commercial Space Transportation, Federal Aviation Administration, Department of Transportation, to the Licensee, including all license orders issued in connection with the License.

*Licensee* means the Licensee and any transferee of the Licensee under 49 U.S.C. Subtitle IX, ch. 701.

*United States* means the United States and its agencies involved in Licensed Activities.

Except as otherwise defined herein, terms used in this Agreement and defined in 49 U.S.C. Subtitle IX, ch. 701—Commercial Space Launch

Activities, or in the Regulations, shall have the same meaning as contained in 49 U.S.C. Subtitle IX, ch. 701, or the Regulations, respectively.

### *2. Waiver and Release of Claims*

(a) Licensee hereby waives and releases claims it may have against Customer and the United States, and against their respective Contractors and Subcontractors, for Property Damage it sustains and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Activities, regardless of fault.

(b) Customer hereby waives and releases claims it may have against Licensee and the United States, and against their respective Contractors and Subcontractors, for Property Damage it sustains and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Activities, regardless of fault.

(c) The United States hereby waives and releases claims it may have against Licensee and Customer, and against their respective Contractors and Subcontractors, for Property Damage it sustains, and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Activities, regardless of fault, to the extent that claims it would otherwise have for such damage or injury exceed the amount of insurance or demonstration of financial responsibility required under sections 440.9(c) and (e) of the Regulations.

### *3. Assumption of Responsibility*

(a) Licensee and Customer shall each be responsible for Property Damage it sustains and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Activities, regardless of fault. Licensee and Customer shall each hold harmless and indemnify each other, the United States, and the Contractors and Subcontractors of each Party, for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Activities, regardless of fault.

(b) The United States shall be responsible for Property Damage it sustains, and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Activities, regardless of fault, to the extent that claims it would otherwise have for such damage or injury exceed the amount of insurance or demonstration of financial responsibility required under §§ 440.9(c) and (e) of the Regulations.

### *4. Extension of Assumption of Responsibility and Waiver*

(a) Licensee shall extend the requirements of the waiver and release of claims, and the assumption of responsibility, hold harmless, and indemnification, as set forth in paragraphs 2(a) and 3(a), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against Customer and the United States, and against the respective Contractors and Subcontractors of each, and to agree to be responsible, for Property Damage they sustain and to be responsible, hold harmless and indemnify Customer and the United States, and the respective Contractors and Subcontractors of each, for Bodily Injury or Property Damage sustained by their own employees, resulting from Licensed Activities, regardless of fault.

(b) Customer shall extend the requirements of the waiver and release of claims, and the assumption of responsibility, hold harmless, and indemnification, as set forth in paragraphs 2(b) and 3(a), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against Licensee and the United States, and against the respective Contractors and Subcontractors of each, and to agree to be responsible, for Property Damage they sustain and to be responsible, hold harmless and indemnify Licensee and the United States, and the respective Contractors and Subcontractors of each, for Bodily Injury or Property Damage sustained by their own employees, resulting from Licensed Activities, regardless of fault.

(c) The United States shall extend the requirements of the waiver and release of claims, and the assumption of responsibility as set forth in paragraphs 2(c) and 3(b), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against Licensee and Customer, and against the respective Contractors and Subcontractors of each, and to agree to be responsible, for any Property Damage they sustain and for any Bodily Injury or Property Damage sustained by their own employees, resulting from Licensed Activities, regardless of fault, to the extent that claims they would otherwise have for such damage or injury exceed the amount of insurance or demonstration of financial responsibility required under §§ 440.9(c) and (e) of the Regulations.

### 5. Indemnification

(a) Licensee shall hold harmless and indemnify Customer and its directors, officers, servants, agents, subsidiaries, employees and assignees, or any or them, and the United States and its agencies, servants, agents, subsidiaries, employees and assignees, or any or them, from and against liability, loss or damage arising out of claims that Licensee's Contractors and Subcontractors may have for Property Damage sustained by them and for Bodily Injury or Property Damage sustained by their employees, resulting from Licensed Activities.

(b) Customer shall hold harmless and indemnify Licensee and its directors, officers, servants, agents, subsidiaries, employees and assignees, or any of them, and the United States and its agencies, servants, agents, subsidiaries, employees assignees, or any of them, from and against liability, loss or damage arising out of claims that Customer's Contractors and Subcontractors, or any person on whose behalf Customer enters into this Agreement, may have for Property Damage sustained by them and for Bodily Injury or Property Damage sustained by their employees, resulting from Licensed Activities.

(c) To the extent provided in advance in an appropriations law or to the extent there is enacted additional legislative authority providing for the payment of claims, the United States shall hold harmless and indemnify Licensee and Customer and their respective directors, officers, servants, agents, subsidiaries, employees and assignees, or any of them, from and against liability, loss or damage arising out of claims that Contractors and Subcontractors of the United States may have for Property Damage sustained by them, and for Bodily Injury or Property Damage sustained by their employees, resulting from Licensed Activities, to the extent that claims they would otherwise have for such damage or injury exceed the amount of insurance or demonstration of financial responsibility required under §§ 440.9(c) and (e) of the Regulations.

### 6. Assurances Under 49 U.S.C. 70112(e)

Notwithstanding any provision of this Agreement to the contrary, Licensee shall hold harmless and indemnify the United States and its agencies, servants, agents, employees and assignees, or any of them, from and against liability, loss or damage arising out of claims for Bodily Injury or Property Damage, resulting from Licensed Launch Activities, regardless of fault, except to

the extent that: (i) As provided in section 7(b) of this Agreement, claims result from willful misconduct of the United States or its agents; (ii) claims for Property Damage sustained by the United States or its Contractors and Subcontractors exceed the amount of insurance or demonstration of financial responsibility required under § 440.9(e) of the Regulations; (iii) claims by a Third Party for Bodily Injury or Property Damage exceed the amount of insurance or demonstration of financial responsibility required under § 440.9(c) of the Regulations, and do not exceed \$1,500,000,000 (as adjusted for inflation after January 1, 1989) above such amount, and are payable pursuant to the provisions of 49 U.S.C. 70113 and § 440.19 of the Regulations; or (iv) Licensee has no liability for claims exceeding \$1,500,000,000 (as adjusted for inflation after January 1, 1989) above the amount of insurance or demonstration of financial responsibility required under § 440.9(c) of the Regulations.

### 7. Miscellaneous

(a) Nothing contained herein shall be construed as a waiver or release by Licensee, Customer or the United States of any claim by an employee of the Licensee, Customer or the United States, respectively, including a member of the Armed Forces of the United States, for Bodily Injury or Property Damage, resulting from Licensed Activities.

(b) Notwithstanding any provision of this Agreement to the contrary, any waiver, release, assumption of responsibility or agreement to hold harmless and indemnify herein shall not apply to claims for Bodily Injury or Property Damage resulting from willful misconduct of any of the Parties, the Contractors and Subcontractors of any of the Parties, and in the case of Licensee and Customer and the Contractors and Subcontractors of each of them, the directors, officers, agents and employees of any of the foregoing, and in the case of the United States, its agents.

(c) In the event that more than one customer is involved in Licensed Activities, references herein to Customer shall apply to, and be deemed to include, each such customer severally and not jointly.

(d) This Agreement shall be governed by and construed in accordance with United States Federal law.

In Witness Whereof, the Parties to this Agreement have caused the Agreement to be duly executed by their respective duly authorized representatives as of the date written above.

Licensee

By: \_\_\_\_\_

Its: \_\_\_\_\_

Customer

By: \_\_\_\_\_

Its: \_\_\_\_\_

Federal Aviation Administration of the Department of Transportation on Behalf of the United States Government

By: \_\_\_\_\_

Its: \_\_\_\_\_

Associate Administrator for Commercial Space Transportation

### Appendix C to Part 440—Agreement for Waiver of Claims and Assumption of Responsibility for Permitted Activities

THIS AGREEMENT is entered into this \_\_\_\_\_ day of \_\_\_\_\_, by and among [Permittee] (the "Permittee"), [Customer] (the "Customer") and the Federal Aviation Administration of the Department of Transportation, on behalf of the United States Government (collectively, the "Parties"), to implement the provisions of section 440.17(c) of the Commercial Space Transportation Licensing Regulations, 14 CFR Ch. III (the "Regulations").

In consideration of the mutual releases and promises contained herein, the Parties hereby agree as follows:

#### 1. Definitions

*Customer* means the above-named Customer on behalf of the Customer and any person described in § 440.3 of the Regulations.

*Permit* means Permit No. \_\_\_\_\_ issued on \_\_\_\_\_, by the Associate Administrator for Commercial Space Transportation, Federal Aviation Administration, Department of Transportation, to the Permittee, including all permit orders issued in connection with the Permit.

*Permittee* means the holder of the Permit issued under 49 U.S.C. Subtitle IX, ch. 701.

*United States* means the United States and its agencies involved in Permitted Permit Activities.

Except as otherwise defined herein, terms used in this Agreement and defined in 49 U.S.C. Subtitle IX, ch. 701—Commercial Space Launch Activities, or in the Regulations, shall have the same meaning as contained in 49 U.S.C. Subtitle IX, ch. 701, or the Regulations, respectively.

#### 2. Waiver and Release of Claims

(a) Permittee hereby waives and releases claims it may have against Customer and the United States, and

against their respective Contractors and Subcontractors, for Property Damage it sustains and for Bodily Injury or Property Damage sustained by its own employees, resulting from Permitted Activities, regardless of fault.

(b) Customer hereby waives and releases claims it may have against Permittee and the United States, and against their respective Contractors and Subcontractors, for Property Damage it sustains and for Bodily Injury or Property Damage sustained by its own employees, resulting from Permitted Activities, regardless of fault.

(c) The United States hereby waives and releases claims it may have against Permittee and Customer, and against their respective Contractors and Subcontractors, for Property Damage it sustains resulting from Permitted Activities, regardless of fault, to the extent that claims it would otherwise have for such damage exceed the amount of insurance or demonstration of financial responsibility required under section 440.9(e) of the Regulations.

### 3. Assumption of Responsibility

(a) Permittee and Customer shall each be responsible for Property Damage it sustains and for Bodily Injury or Property Damage sustained by its own employees, resulting from Permitted Activities, regardless of fault. Permittee and Customer shall each hold harmless and indemnify each other, the United States, and the Contractors and Subcontractors of each Party, for Bodily Injury or Property Damage sustained by its own employees, resulting from Permitted Activities, regardless of fault.

(b) The United States shall be responsible for Property Damage it sustains, resulting from Permitted Activities, regardless of fault, to the extent that claims it would otherwise have for such damage exceed the amount of insurance or demonstration of financial responsibility required under section 440.9(e) of the Regulations.

### 4. Extension of Assumption of Responsibility and Waiver

(a) Permittee shall extend the requirements of the waiver and release of claims, and the assumption of responsibility, hold harmless, and indemnification, as set forth in paragraphs 2(a) and 3(a), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against Customer and the United States, and against the respective Contractors and Subcontractors of each, and to agree to be responsible, for Property Damage

they sustain and to be responsible, hold harmless and indemnify Customer and the United States, and the respective Contractors and Subcontractors of each, for Bodily Injury or Property Damage sustained by their own employees, resulting from Permitted Activities, regardless of fault.

(b) Customer shall extend the requirements of the waiver and release of claims, and the assumption of responsibility, hold harmless, and indemnification, as set forth in paragraphs 2(b) and 3(a), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against Permittee and the United States, and against the respective Contractors and Subcontractors of each, and to agree to be responsible for Property Damage they sustain and to be responsible, hold harmless and indemnify Permittee and the United States, and the respective Contractors and Subcontractors of each, for Bodily Injury or Property Damage sustained by their own employees, resulting from Permitted Activities, regardless of fault.

(c) The United States shall extend the requirements of the waiver and release of claims, and the assumption of responsibility as set forth in paragraphs 2(c) and 3(b), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against Permittee and Customer, and against the respective Contractors and Subcontractors of each, and to agree to be responsible for any Property Damage they sustain, resulting from Permitted Activities, regardless of fault, to the extent that claims they would otherwise have for such damage exceed the amount of insurance or demonstration of financial responsibility required under section 440.9(e) of the Regulations.

### 5. Indemnification

(a) Permittee shall hold harmless and indemnify Customer and its directors, officers, servants, agents, subsidiaries, employees and assignees, or any or them, and the United States and its agencies, servants, agents, subsidiaries, employees and assignees, or any or them, from and against liability, loss or damage arising out of claims that Permittee's Contractors and Subcontractors may have for Property Damage sustained by them and for Bodily Injury or Property Damage sustained by their employees, resulting from Permitted Activities.

(b) Customer shall hold harmless and indemnify Permittee and its directors, officers, servants, agents, subsidiaries,

employees and assignees, or any or them, and the United States and its agencies, servants, agents, subsidiaries, employees and assignees, or any of them, from and against liability, loss or damage arising out of claims that Customer's Contractors and Subcontractors, or any person on whose behalf Customer enters into this Agreement, may have for Property Damage sustained by them and for Bodily Injury or Property Damage sustained by their employees, resulting from Permitted Activities.

### 6. Assurances Under 49 U.S.C. 70112(e)

Notwithstanding any provision of this Agreement to the contrary, Permittee shall hold harmless and indemnify the United States and its agencies, servants, agents, employees and assignees, or any of them, from and against liability, loss or damage arising out of claims for Bodily Injury or Property Damage, resulting from Permitted Activities, regardless of fault, except to the extent that it is provided in section 7(b) of this Agreement, except to the extent that claims (i) result from willful misconduct of the United States or its agents and (ii) for Property Damage sustained by the United States or its Contractors and Subcontractors exceed the amount of insurance or demonstration of financial responsibility required under section 440.9(e) of the Regulations.

### 7. Miscellaneous

(a) Nothing contained herein shall be construed as a waiver or release by Permittee, Customer or the United States of any claim by an employee of the Permittee, Customer or the United States, respectively, including a member of the Armed Forces of the United States, for Bodily Injury or Property Damage, resulting from Permitted Activities.

(b) Notwithstanding any provision of this Agreement to the contrary, any waiver, release, assumption of responsibility or agreement to hold harmless and indemnify herein shall not apply to claims for Bodily Injury or Property Damage resulting from willful misconduct of any of the Parties, the Contractors and Subcontractors of any of the Parties, and in the case of Permittee and Customer and the Contractors and Subcontractors of each of them, the directors, officers, agents and employees of any of the foregoing, and in the case of the United States, its agents.

(c) In the event that more than one customer is involved in Permitted Activities, references herein to Customer shall apply to, and be deemed

to include, each such customer severally and not jointly.

(d) This Agreement shall be governed by and construed in accordance with United States Federal law.

*In witness whereof*, the Parties to this Agreement have caused the Agreement to be duly executed by their respective duly authorized representatives as of the date written above.

Permittee

By: \_\_\_\_\_

Its: \_\_\_\_\_

Customer

By: \_\_\_\_\_

Its: \_\_\_\_\_

Federal Aviation Administration of the Department of Transportation on Behalf of the United States Government

By: \_\_\_\_\_

Its: \_\_\_\_\_

Associate Administrator for Commercial Space Transportation

#### **Appendix D to Part 440—Agreement for Waiver of Claims and Assumption of Responsibility for a Crew Member**

This agreement is entered into this \_\_\_\_\_ day of \_\_\_\_\_, by and among [crew member] (the "Crew Member") and the Federal Aviation Administration of the Department of Transportation, on behalf of the United States Government (collectively, the "Parties"), to implement the provisions of section 440.17(f) of the Commercial Space Transportation Licensing Regulations, 14 CFR Ch. III (the "Regulations"). In consideration of the mutual releases and promises contained herein, the Parties hereby agree as follows:

##### *1. Definitions*

*Crew member* means the above-named crew member.

*License/Permit* means License/Permit No. \_\_\_\_\_ issued on \_\_\_\_\_, by the Associate Administrator for Commercial Space Transportation, Federal Aviation Administration, Department of Transportation, to the Licensee/Permittee, including all license/permit orders issued in connection with the License/Permit.

*Licensee/Permittee* means the Licensee/Permittee and any transferee of the Licensee under 49 U.S.C. Subtitle IX, ch. 701.

*United States* means the United States and its agencies involved in Licensed/Permitted Activities.

Except as otherwise defined herein, terms used in this Agreement and

defined in 49 U.S.C. Subtitle IX, ch. 701—Commercial Space Launch Activities, or in the Regulations, shall have the same meaning as contained in 49 U.S.C. Subtitle IX, ch. 701, or the Regulations, respectively.

##### *2. Waiver and Release of Claims*

(a) Crew member hereby waives and releases claims it may have against the United States, and against their respective Contractors and Subcontractors, for Bodily Injury or Property Damage sustained, resulting from Licensed/Permitted Activities, regardless of fault.

(b) The United States hereby waives and releases claims it may have against the crew member for Property Damage it sustains, and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed/Permitted Activities, regardless of fault.

##### *3. Assumption of Responsibility*

(a) The crew member shall be responsible for Bodily Injury or Property Damage sustained, resulting from Licensed/Permitted Activities, regardless of fault. The crew member shall hold harmless and indemnify the United States, and the Contractors and Subcontractors of each Party, for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed/Permitted Activities, regardless of fault.

(b) The United States shall be responsible for Property Damage it sustains, and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Activities, regardless of fault, to the extent that claims it would otherwise have for such damage or injury exceed the amount of insurance or demonstration of financial responsibility required under sections 440.9(c) and (e), respectively, of the Regulations.

(c) The United States shall be responsible for Property Damage it sustains, resulting from Permitted Activities, regardless of fault, to the extent that claims it would otherwise have for such damage exceed the amount of insurance or demonstration of financial responsibility required under section 440.9(e) of the Regulations.

##### *4. Extension of Assumption of Responsibility and Waiver*

(a) The United States shall extend the requirements of the waiver and release of claims, and the assumption of responsibility as set forth in paragraphs 2(b) and 3(b), respectively, to its Contractors and Subcontractors by

requiring them to waive and release all claims they may have against the crew member and to agree to be responsible for any Property Damage they sustain and for any Bodily Injury or Property Damage sustained by their own employees, resulting from Licensed Activities, regardless of fault.

(b) The United States shall extend the requirements of the waiver and release of claims, and the assumption of responsibility as set forth in paragraphs 2(b) and 3(c), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against the crew member and to agree to be responsible for any Property Damage they sustain, resulting from Permitted Activities, regardless of fault.

##### *5. Assurances Under 49 U.S.C. 70112(e)*

Notwithstanding any provision of this Agreement to the contrary, the crew member shall hold harmless the United States and its agencies, servants, agents, employees and assignees, or any of them, from and against liability, loss or damage arising out of claims for Bodily Injury or Property Damage, resulting from Licensed/Permitted Activities, regardless of fault, except to the extent that, as provided in section 6(b) of this Agreement, claims result from willful misconduct of the United States or its agents.

##### *6. Miscellaneous*

(a) Nothing contained herein shall be construed as a waiver or release by the United States of any claim by an employee of the United States, respectively, including a member of the Armed Forces of the United States, for Bodily Injury or Property Damage, resulting from Licensed/Permitted Activities.

(b) Notwithstanding any provision of this Agreement to the contrary, any waiver, release, assumption of responsibility or agreement to hold harmless and indemnify herein shall not apply to claims for Bodily Injury or Property Damage resulting from willful misconduct of any of the Parties, the Contractors and Subcontractors of any of the Parties, and in the case of the United States, its agents.

(c) This Agreement shall be governed by and construed in accordance with United States Federal law.

*In witness whereof*, the Parties to this Agreement have caused the Agreement to be duly executed by their respective duly authorized representatives as of the date written above.

Crew Member

Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Federal Aviation Administration of the  
Department of Transportation on Behalf  
of the United States Government

By: \_\_\_\_\_

Its: \_\_\_\_\_

Associate Administrator for Commercial  
Space Transportation

**Appendix E to Part 440—Agreement for  
Waiver of Claims and Assumption of  
Responsibility for a Space Flight  
Participant**

THIS AGREEMENT is entered into this \_\_\_\_\_ day of \_\_\_\_\_, by and among [Space Flight Participant] (the "Space Flight Participant") and the Federal Aviation Administration of the Department of Transportation, on behalf of the United States Government (collectively, the "Parties"), to implement the provisions of section 440.17(e) of the Commercial Space Transportation Licensing Regulations, 14 CFR Ch. III (the "Regulations").

In consideration of the mutual releases and promises contained herein, the Parties hereby agree as follows:

*1. Definitions*

*Space Flight Participant* means the above-named Space Flight Participant, who is not crew, and is carried within a launch or reentry vehicle.

*License/Permit* means License/Permit No. \_\_\_\_\_ issued on \_\_\_\_\_, by the Associate Administrator for Commercial Space Transportation, Federal Aviation Administration, Department of Transportation, to the Licensee/Permittee, including all license/permit orders issued in connection with the License/Permit.

*Licensee/Permittee* means the Licensee/Permittee and any transferee of the Licensee under 49 U.S.C. Subtitle IX, ch. 701.

*United States* means the United States and its agencies involved in Licensed/Permitted Activities.

Except as otherwise defined herein, terms used in this Agreement and defined in 49 U.S.C. Subtitle IX, ch. 701—Commercial Space Launch Activities, or in the Regulations, shall have the same meaning as contained in 49 U.S.C. Subtitle IX, ch. 701, or the Regulations, respectively.

*2. Waiver and Release of Claims*

(a) Space Flight Participant hereby waives and releases claims it may have against the United States, and against its respective Contractors and Subcontractors, for Bodily Injury or Property Damage resulting from Licensed/Permitted Activities, regardless of fault.

(b) The United States hereby waives and releases claims it may have against Space Flight Participant for Property Damage it sustains, and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed/Permitted Activities, regardless of fault.

*3. Assumption of Responsibility*

(a) Space Flight Participant shall each be responsible for Bodily Injury or Property Damage sustained resulting from Licensed/Permitted Activities, regardless of fault. Space Flight Participant shall hold harmless and indemnify the United States, and its Contractors and Subcontractors, for Bodily Injury or Property Damage sustained from Licensed/Permitted Activities, regardless of fault.

(b) The United States shall be responsible for Property Damage it sustains, and for Bodily Injury or Property Damage sustained by its own employees, resulting from Licensed Activities, regardless of fault, to the extent that claims it would otherwise have for such damage or injury exceed the amount of insurance or demonstration of financial responsibility required under sections 440.9(c) and (e), respectively, of the Regulations.

(c) The United States shall be responsible for Property Damage it sustains, resulting from Permitted Activities, regardless of fault, to the extent that claims it would otherwise have for such damage exceed the amount of insurance or demonstration of financial responsibility required under section 440.9(e) of the Regulations.

*4. Extension of Assumption of  
Responsibility and Waiver*

(a) The United States shall extend the requirements of the waiver and release of claims, and the assumption of responsibility as set forth in paragraphs 2(b) and 3(b), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against Space Flight Participant, and to agree to be responsible, for any Property Damage they sustain and for any Bodily Injury or Property Damage sustained by their own employees, resulting from Licensed Activities, regardless of fault.

(b) The United States shall extend the requirements of the waiver and release of claims, and the assumption of responsibility as set forth in paragraphs 2(b) and 3(c), respectively, to its Contractors and Subcontractors by requiring them to waive and release all claims they may have against the crew

member and to agree to be responsible, for any Property Damage they sustain, resulting from Permitted Activities, regardless of fault.

*5. Assurances Under 49 U.S.C. 70112(e)*

Notwithstanding any provision of this Agreement to the contrary, Space Flight Participant shall hold harmless the United States and its agencies, servants, agents, employees and assignees, or any of them, from and against liability, loss or damage arising out of claims for Bodily Injury or Property Damage, resulting from Licensed/Permitted Activities, regardless of fault, except to the extent that, as provided in section 6(b) of this Agreement, claims result from willful misconduct of the United States or its agents.

*6. Miscellaneous*

(a) Nothing contained herein shall be construed as a waiver or release by Space Flight Participant or the United States of any claim by an employee of the Space Flight Participant or the United States, respectively, including a member of the Armed Forces of the United States, for Bodily Injury or Property Damage, resulting from Licensed/Permitted Activities.

(b) Notwithstanding any provision of this Agreement to the contrary, any waiver, release, assumption of responsibility or agreement to hold harmless and indemnify herein shall not apply to claims for Bodily Injury or Property Damage resulting from willful misconduct of any of the Parties, the Contractors, Subcontractors, and agents of the United States, and Space Flight Participant.

(c) This Agreement shall be governed by and construed in accordance with United States Federal law.

*In witness whereof*, the Parties to this Agreement have caused the Agreement to be duly executed by their respective duly authorized representatives as of the date written above.

Space Flight Participant

Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Federal Aviation Administration of the  
Department of Transportation on Behalf  
of the United States Government

By: \_\_\_\_\_

Its: \_\_\_\_\_

Associate Administrator for Commercial  
Space Transportation

10. Add part 460 to read as follows:

## PART 460—HUMAN SPACE FLIGHT REQUIREMENTS

### Subpart A—Launch and Reentry With Crew

Sec.

- 460.1 Scope.
- 460.3 Applicability.
- 460.5 Crew qualifications and training.
- 460.7 Operator training of crew.
- 460.9 Informing crew of risk.
- 460.11 Environmental control and life support systems.
- 460.13 Smoke detection and fire suppression.
- 460.15 Human factors.
- 460.17 Verification program.
- 460.19 Crew waiver of claims against U.S. Government.
- 460.20–460.40 [Reserved]

### Subpart B—Launch and Reentry With a Space Flight Participant

- 460.41 Scope.
- 460.43 Applicability.
- 460.45 Operator informing space flight participant of risk.
- 460.47 [Reserved]
- 460.49 Space flight participant waiver of claims against U.S. Government.
- 460.51 Space flight participant training.
- 460.53 Security.

**Authority:** 49 U.S.C. 70105

#### § 460.1 Scope.

This subpart establishes requirements for crew of a vehicle whose operator is licensed or permitted under this chapter.

#### § 460.3 Applicability.

- (a) This subpart applies to:
  - (1) An applicant for a license or permit under this chapter who proposes to have flight crew on board a vehicle or proposes to employ a remote operator of a vehicle with a human on board.
  - (2) An operator licensed or permitted under this chapter who has flight crew on board a vehicle or who employs a remote operator of a vehicle with a human on board.
  - (3) A crew member participating in an activity authorized under this chapter.
- (b) Each member of the crew must comply with all requirements of the laws of the United States that apply.

#### § 460.5 Crew qualifications and training.

- (a) Each crew member must—
  - (1) Possess and carry an FAA second-class airman medical certificate issued in accordance with 14 CFR part 67 and issued within 12 months prior to launch or reentry;
  - (2) Complete training on how to carry out his or her role on board or on the ground so that the vehicle will not harm the public; and
  - (3) Train for his or her role in nominal and non-nominal conditions. The conditions must include—
    - (i) Abort scenarios; and

(ii) Emergency operations.

(b) Each member of a flight crew must demonstrate an ability to withstand the stresses of space flight, sufficiently to carry out his or her role on board so that the vehicle will not harm the public. The stresses of space flight may include high acceleration or deceleration, microgravity, and vibration.

(c) A pilot and a remote operator must—

- (1) Possess and carry an FAA pilot certificate
  - (i) With an instrument rating; and
  - (ii) That demonstrates the knowledge of the National Airspace System (NAS) necessary to operate the vehicle.
- (2) Possess aeronautical experience and skills necessary to pilot and control the vehicle for any launch or reentry vehicle that will operate in the NAS. Aeronautical experience may include hours in flight, ratings, and training.
- (3) Receive vehicle and mission-specific training for each phase of flight by using one or more of the following—
  - (i) A method or device that simulates the flight;
  - (ii) An aircraft whose characteristics are similar to the vehicle or any phase of its flight;
  - (iii) Flight testing; or
  - (iv) An equivalent method of training as approved by the FAA through the licensing or permitting process.
- (4) Train in procedures that direct the vehicle away from the public in the event the flight crew abandons the vehicle during flight; and
- (5) Train for each mode of control or propulsion, including any transition between modes, such that the pilot or remote operator is able to control the vehicle.

#### § 460.7 Operator training of crew.

(a) *Implementation of training.* An operator must train each member of its crew and define standards for successful completion in accordance with § 460.5.

(b) *Training device fidelity.* An operator must ensure that any crew-training device used to meet the training requirements realistically represents the vehicle's configuration and mission or the operator must inform the crew member being trained of the differences.

(c) *Maintenance of training records.* An operator must continually update the crew training to ensure that it incorporates lessons learned from training and operational missions. An operator must—

- (1) Track each revision and update in writing; and
- (2) Document the completed training for each crew member and maintain the documentation for each active crew member.

(d) *Current qualifications and training.* An operator must establish a recurrent training schedule and ensure that all crew qualifications and training required by § 460.5 are current before launch or reentry.

#### § 460.9 Informing crew of risk.

An operator must inform in writing any individual serving as crew that the United States Government has not certified the launch vehicle as safe for carrying flight crew or space flight participants. An operator must provide this information—

(a) Before entering into any contract or other arrangement to employ that individual; or

(b) For any crew member employed as of December 23, 2004, as early as possible and prior to any launch in which that individual will participate as crew.

#### § 460.11 Environmental control and life support systems.

(a) An operator must provide atmospheric conditions adequate to sustain life and consciousness for all inhabited areas within a vehicle. The operator or flight crew must monitor and control the following atmospheric conditions in the inhabited areas—

- (1) Composition of the atmosphere, which includes oxygen and carbon dioxide, and any revitalization;
- (2) Pressure, temperature and humidity;
- (3) Contaminants that include particulates and any harmful or hazardous concentrations of gases, or vapors; and

(4) Ventilation and circulation.

(b) An operator must provide an adequate redundant or secondary oxygen supply for the flight crew.

(c) An operator must

- (1) Provide a redundant means of preventing cabin depressurization; or
- (2) Prevent incapacitation of any of the flight crew in the event of loss of cabin pressure.

#### § 460.13 Smoke detection and fire suppression.

An operator or crew must have the ability to detect smoke and suppress a cabin fire to prevent incapacitation of the flight crew.

#### § 460.15 Human factors.

An operator must take the precautions necessary to account for human factors that can affect a crew's ability to perform safety-critical roles, including in the following safety critical areas—

(a) Design and layout of displays and controls;

(b) Mission planning, which includes analyzing tasks and allocating functions between humans and equipment;

(c) Restraint or stowage of all individuals and objects in a vehicle; and

(d) Vehicle operation, so that the vehicle will be operated in a manner that flight crew can withstand any physical stress factors, such as acceleration, vibration, and noise.

**§ 460.17 Verification program.**

An operator must successfully verify the integrated performance of a vehicle's hardware and any software in an operational flight environment before allowing any space flight participant on board during a flight. Verification must include flight testing.

**§ 460.19 Crew waiver of claims against U.S. Government.**

Each member of a flight crew and any remote operator must execute a reciprocal waiver of claims with the Federal Aviation Administration of the Department of Transportation in accordance with the requirements of part 440.

**§§ 460.20–460.40 [Reserved]**

**Subpart B—Launch and reentry with a space flight participant**

**§ 460.41 Scope.**

This subpart establishes requirements for space flight participants on board a vehicle whose operator is licensed or permitted under this chapter.

**§ 460.43 Applicability.**

This subpart applies to:

(a) An applicant for a license or permit under this chapter who proposes to have a space flight participant on board a vehicle;

(b) An operator licensed or permitted under this chapter who has a space flight participant on board a vehicle; and

(c) A space flight participant participating in an activity authorized under this chapter.

**§ 460.45 Operator informing space flight participant of risk.**

(a) Before receiving compensation or making an agreement to fly a space flight participant an operator must

satisfy the requirements of this section. An operator must inform each space flight participant in writing about the risks of the launch and reentry, including the safety record of the launch or reentry vehicle type. An operator must present this information in a manner that is understandable to the space flight participant and must disclose in writing—

(1) For each mission, the known hazards and risks that could result in a serious injury, death, disability, total or partial loss of physical and mental function; and

(2) That participation in space flight may result in death, serious injury or total or partial loss of physical or mental function.

(b) An operator must inform each space flight participant that the United States Government has not certified the launch vehicle as safe for carrying crew or space flight participants.

(c) An operator must inform each space flight participant of the safety record of all launch or reentry vehicles that have carried one or more persons on board, including both U.S. government and private sector vehicles. This information must include—

(1) The total number of people who have been on a suborbital or orbital space flight and the total number of people who have died or been seriously injured on these flights; and

(2) The total number of launches and reentries conducted with people on board and the number of catastrophic failures of those launches.

(d) An operator must describe the safety record of its vehicle to each space flight participant. The operator's safety record must include—

(1) The number of vehicle flights;

(2) The number of safety-related anomalies or failures that occurred on the ground and in flight on all past launches and reentries of that vehicle; and

(3) Whether any corrective actions were taken to resolve these safety-related anomalies or failures.

(e) An operator must inform a space flight participant that he may request

additional information as described in (f) of this section.

(f) If a space flight participant asks, an operator must describe the safety-related anomalies or failures that occurred on the ground and in flight and what corrective actions were taken, if any.

(g) Before flight, each space flight participant must provide informed consent in writing to participate in a launch or reentry. The written informed consent must—

(1) Identify the specific launch vehicle the consent covers;

(2) State that the space flight participant understands the risk, and his or her presence on board the launch vehicle is voluntary;

(3) Be signed and dated by the space flight participant.

**§ 460.47 [Reserved]**

**§ 460.49 Space flight participant waiver of claims against U.S. Government.**

Each space flight participant must execute a reciprocal waiver of claims with the Federal Aviation Administration of the Department of Transportation in accordance with the requirements of part 440.

**§ 460.51 Space flight participant training.**

An operator must train each space flight participant before flight on how to respond to emergency situations, including smoke, fire, loss of cabin pressure, and emergency exit.

**§ 460.53 Security.**

An operator must implement security requirements to prevent any space flight participant from jeopardizing the safety of the flight crew or the public. A space flight participant may not carry on board any explosives, firearms, knives, or other weapons.

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**Patricia G. Smith,**

*Associate Administrator for Commercial Space Transportation.*

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