

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

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

[Docket No. FAA-2005-23449]

RIN 2120-AI57

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

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

**ACTION:** Final rule.

**SUMMARY:** The FAA is establishing requirements for human space flight as required by the Commercial Space Launch Amendments Act of 2004, including rules on crew qualifications and training, and informed consent for crew and space flight participants. The requirements should provide an acceptable level of safety to the general public and ensure individuals on board are aware of the risks associated with a launch or reentry. The rule also applies existing financial responsibility and waiver of liability requirements to human space flight and experimental permits. Experimental permits are the subject of a separate rulemaking.

**DATES:** *Effective Date:* These amendments become effective February 13, 2007.

*Compliance Date:* Affected parties, however, do not have to comply with the information collection requirements in §§ 460.5, 460.7, 460.9, 460.19, 460.45, and 460.49 until the FAA publishes in the **Federal Register** the control number assigned by the Office of Management and Budget (OMB) for these information collection requirements. Publication of the control number notifies the public that OMB has approved these information collection requirements under the Paperwork Reduction Act of 1995.

**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:****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 FAA's Regulations and Policies Web page at [http://www.faa.gov/regulations\\_policies/](http://www.faa.gov/regulations_policies/); 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 amendment number or docket number of this rulemaking.

Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted 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 (Volume 65, Number 70; Pages 19477-78) or you may visit <http://dms.dot.gov>.

**Small Business Regulatory Enforcement Fairness Act**

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires the FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. If you are a small entity and you have a question regarding this document, you may contact your local FAA official, or the person listed under **FOR FURTHER INFORMATION CONTACT**. You can find out more about SBREFA on the Internet at [http://www.faa.gov/regulations\\_policies/rulemaking/sbre\\_act/](http://www.faa.gov/regulations_policies/rulemaking/sbre_act/).

**Authority for This Rulemaking**

The FAA's authority to issue rules on commercial space transportation safety is found in Title 49 of the United States Codes, section 322(a), which authorizes the Secretary of Transportation to carry out Subtitle IX, Chapter 701, 49 U.S.C. 70101-70121 (Chapter 701). The Commercial Space Launch Amendments Act of 2004 (the CSLAA) provides additional 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 satisfied medical or other

conditions specified in a license or permit, all in accordance with FAA regulations. This rulemaking imposes crew qualification and training requirements and implements the statutory requirement that an operator advise the flight crew and any space flight participant that the U.S. Government has not certified the launch vehicle as safe. Section 70105(b)(5) directs the FAA to promulgate regulations requiring that the holder of a license or permit inform each space flight participant in writing about the risks of launch or reentry.

**Table of Contents**

- I. Background
- II. Description of Final Rule and Discussion of Comments
  - A. Equivalent Level of Safety
  - B. Launch and Reentry With Crew
    1. Definitions
      - a. Cabin Crew Suggestion
      - b. Recommendations Regarding Personnel on the Ground
      - c. Carrier Aircraft Personnel
      - d. Payment for Pilot or Remote Operator Training
    2. Authority
    3. Pilot Qualifications
    4. Remote Operator Qualifications
    5. Medical Standards for Crew
      - a. Objections to Requiring Medical Certification of Crew Who Do Not Have a Safety-Critical Role
      - b. Recommendations for More Stringent Medical Standards
    6. Crew Training
    7. Crew Notification
    8. Environmental Control and Life Support System
      - a. Requiring Both Monitoring and Control of Atmospheric Conditions or Requiring Only Control
      - b. Open-Loop System Versus Closed-Loop System
      - c. Other Environmental Control and Life Support System Related Comments
      - d. Guidance Plans
    9. Smoke Detection and Fire Suppression
    10. Human Factors
    11. Verification Program
    12. Crew Waiver of Claims Against U.S. Government
    13. Professional Engineer
  - C. Launch and Reentry With a Space Flight Participant
    1. Risk to Space Flight Participants
    2. Informed Consent
      - a. Space Flight Participant's Ability To Be Informed
    3. Physical Examination
    4. Space Flight Participant Waiver of Claims Against U.S. Government
    5. Space Flight Participant Training
    6. Security Requirements
    - D. Financial Responsibility and Waiver of Liability
      1. Changes From What the FAA Proposed in the NPRM
      2. Waivers of Claims
      3. Federal Preemption
      4. Insurance
      5. Maximum Probable Loss

III. Rulemaking Analyses  
IV. The Amendment

## I. Background

On December 23, 2005, the FAA published a notice of proposed rulemaking (NPRM), "Human Space Flight Requirements for Crew and Space Flight Participants" 70 FR 77261 (Dec. 29, 2005), which discusses the background of the CSLAA and the nascent human space flight industry. The NPRM also discusses the safety considerations underlying the FAA's proposed requirements and each alternative that the agency considered.

In the CSLAA, Congress also directed the FAA to issue guidelines or advisory materials to guide the implementation of the law as soon as practical, and to promulgate requirements governing experimental permits. 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." On March 31, 2006, the FAA published an NPRM, "Experimental Permits for Reusable Suborbital Rockets." 71 FR 16251.

## II. Description of Final Rule and Discussion of Comments

In this final rule, the FAA changes parts 401, 415, 431, 435 and 440 of Title 14 of the Code of Federal Regulations and establishes a new part 460 in response to the CSLAA's requirement to issue regulations governing crew and space flight participant, by June 23, 2006. Revisions in part 440 codify the financial responsibility and risk allocation regime for activities authorized by a permit and for crew and space flight participants. These requirements supplement other launch and reentry regulations, including those in parts 415, 431, and 435. For example, part 431 governs reusable launch vehicle operations, and contains system safety and risk requirements and operational constraints. An operator of a reusable launch vehicle with a person on board must comply with this rule and part 431.

Part 460 applies to anyone applying for or having a license or permit under Title 14 Code of Federal Regulation (CFR) Chapter III, who conducts a flight with crew or space flight participants on board a vehicle, or employs a remote operator of a vehicle with a human on board.<sup>1</sup> This part also applies to a space

flight participant or crew member participating in an activity authorized under 14 CFR Chapter III. Part 460 defines crew and flight crew and imposes notification, medical, qualification, and training requirements. It also promulgates informed consent and training requirements for space flight participants.

The FAA received comments from forty-two entities, including aerospace companies, associations, service providers, individuals and other agencies of the U.S. Government. Operators of launch and reentry vehicles who provided comments include Blue Origin, LLC (Blue Origin), the Personal Spaceflight Federation<sup>2</sup> (Federation), Rocketplane Limited, Inc. (Rocketplane), TGV Rockets, Inc., and XCOR Aerospace (XCOR). The following associations, individuals and service providers also commented: Airline Pilots Association International (ALPA); Association of Space Explorers-USA (ASE), International Association of Space Entrepreneurs and Institute for Space Law and Policy (IASE and ISLAP); Knutson & Associates, Attorneys at Law (Knutson); Nickolaus Leggett (Leggett); Planehook Aviation Services, LLC (Planehook); Predesa, LLC (Predesa) and James Snead.

In general, the commenters supported the proposed requirements, but with several suggested changes.

### A. Equivalent Level of Safety

The Federation recommended that the FAA consider allowing means of compliance other than those identified in the regulations. In part 460, the FAA will allow an operator to demonstrate that an alternative method of compliance for certain requirements provides an equivalent level of safety and satisfies the rule. The FAA notes that many of the requirements of this part are performance standards that already offer operators a great deal of flexibility. Where a requirement is prescriptive, such as when the FAA requires a pilot certificate, the FAA does not contemplate approving alternatives through the license or permit process unless the requirement explicitly allows alternatives. As the Federation noted, the FAA also has the ability to grant waivers under 14 CFR 404.3. If an

operator wishes to pursue a course that is not consistent with the requirements of part 460, the operator must apply for a waiver.

### B. Launch and Reentry With Crew

Subpart A of part 460 applies to the flight crew and any remote operator. The only ground crew covered is a remote operator.

#### 1. Definitions

The FAA is retaining the definition of crew required by the CSLAA, that is, any employee 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. As proposed in the NPRM, a crew consists of flight crew, crew on board a vehicle during a launch or reentry, and any remote operator. Also, crew members may be independent contractors as well as employees. As it explained in the NPRM, the FAA defines crew to include all personnel on board, namely the flight crew, as part of the crew, and thus give a broader meaning to crew than one consisting only of 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. Limiting ground crew to remote operators avoids providing notice to personnel on the ground about the dangers of a vehicle they are not going to board. Were the FAA to include more ground personnel as crew, the CSLAA would require an operator to inform those persons that the U.S. Government has not certified the vehicle as safe for carrying crew or space flight participants, 49 U.S.C. 70105(b)(4)(B), which seems an exercise of no benefit.

Commenters raised a number of questions regarding the definition of crew. With the exception of those related to the requirement for a second-class airman medical certificate, they are addressed here.

*a. Cabin Crew.* The IASE and ISLAP suggested that distinguishing between "cabin crew" and "flight crew" would ensure that the fundamental difference between them—direct involvement in

<sup>1</sup> For a vehicle with no one on board that is controlled by a remote operator part 460 does not apply. Instead, an operator will be governed by other parts, such as parts 431 and 435.

<sup>2</sup> The Federation is a non-profit trade association consisting of companies whose business involves or will involve commercial human space flight. They provided consensus comments on the NPRM and consist of the following: Air Launch, Armadillo Aerospace, Bigelow Aerospace, Mojave Spaceport, RocketPlane Limited, Inc., Scaled Composites, Space Adventures, SpaceDev, Space Explorations Technologies Corporation (SpaceX), The SpaceShip Company, XCOR Aerospace, X PRIZE Foundation, and Virgin Galactic.

vehicle operation as opposed to passenger safety and comfort—would be recognized in future regulations while facilitating clearer discussion of the regulatory responsibilities of each crew member. This suggestion is premature. The FAA will address the recommendation when those circumstances arise.

*b. Personnel on the Ground.* The FAA, as it proposed in the NPRM, defines a remote operator as a crew member who has the ability to control, in real time, a launch or reentry vehicle's flight path, and is not on board the vehicle. This means that a remote operator is the only member of the ground crew.<sup>3</sup>

Blue Origin requested that the FAA clarify the definition of remote operator to ensure the exclusion of persons on the ground from the definition of crew. Blue Origin recommended that the FAA clarify that "control" means navigation and control of the vehicle, rather than merely being in the chain of command. Blue Origin's clarification would preclude someone who initiated a launch or an abort from being considered part of the crew. Blue Origin reasoned that launch decisions will often be made by a launch director after receiving input from all groups, including air traffic control.

As explained in the NPRM, a remote operator is someone who actively controls the vehicle, and does more than initiate or abort a launch in progress. Active control encompasses navigation as well as control. A mission flight control officer in charge of terminating the flight of an errant expendable launch vehicle would not be treated as a remote operator because he or she does not have the ability to control, in real time, the vehicle's flight path. Accordingly, the FAA does not need to adopt Blue Origin's suggestion.

Prelesa suggested expanding ground crew to include "specialists who monitor and maintain vehicle systems via telemetry" as they may assist a remote operator or pilot, and provide information or modify the operations of vehicle systems during flight. Prelesa recommended that these personnel possess FAA flight engineer certification or FAA pilot certification. Prelesa does not believe that persons who are not on

board should be subjected to lesser standards merely because of their location.

The FAA has decided against expanding the definition because the personnel, even though not covered under part 460 if not on board the launch or reentry vehicle, will be subjected, during the license or permit process, to the standards appropriate to their roles. For example, an applicant proposing a reusable launch vehicle mission would have to meet part 431, which requires that a licensed operator implement a system safety process and operational restrictions and satisfy risk requirements. As part of the system safety process, personnel on the ground will receive training to carry out their roles safely, and it is through this training that the personnel on the ground will be held to standards appropriate to their roles. As part of the proposed requirements for obtaining an experimental permit, the FAA intends to require an applicant conduct a hazard analysis. Human error issues and training of ground personnel would be addressed through this analysis. Also, part 431 requirements address the readiness of vehicle safety operations personnel to support flight under nominal and non-nominal conditions.

*c. Carrier Aircraft Personnel.* Dassault Aviation and Spaceport Associates asked whether the crew of a carrier aircraft<sup>4</sup> would be included as crew under part 460. Spaceport Associates pointed out that, in one sense, crew of a carrier aircraft are effectively providing the first stage of the launch although not themselves subject to extraordinary biomedical stresses. Planehook commented that adopting the term "spacecraft pilot" would reduce confusion when distinguishing between the pilot of an aircraft and the pilot of a launch vehicle. According to Planehook, the training of crew on a carrier aircraft should be addressed in 14 CFR part 61 because the vehicle is most likely to remain an air-breathing aircraft. This rulemaking does not treat

crew on board a carrier aircraft as crew under part 460.

The FAA defines flight crew to mean crew that is on board a vehicle during a launch or reentry. The crew aboard the aircraft are already covered by existing FAA regulations. Thus, new terms such as spacecraft pilot are not necessary to distinguish between aviation and space flight crew.

*d. Payment for Pilot or Remote Operator Training.* Under this final rule, the FAA will not allow a space flight participant to act as a pilot or remote operator of a launch or reentry vehicle. ASE noted that it is possible that a qualified, medically-certified person may wish to pay an operator to pilot the operator's vehicle. The FAA notes that someone paying to fly, whether as a passenger or at the controls, is a space flight participant rather than an employee.

For public safety reasons, the FAA will not allow space flight participants to pilot launch or reentry vehicles at this time. A space flight participant who wants to pilot a launch or reentry vehicle would have to become an employee or independent contractor of the operator to acquire vehicle and mission-specific training. The operator will be in a better position to evaluate the skills of an employee or independent contractor than of a space flight participant, particularly as those skills relate to the requirements of the operator's particular vehicle. The FAA acknowledges that this restriction may create a dilemma for someone who wishes to acquire training in order to become employed, but, while the technology is so new, it is important for public safety that pilots be highly skilled at the outset.

## 2. Authority

The FAA has the authority to protect crew. Spaceport Associates questioned the FAA's authority to protect crew when it commented that the FAA should not implement design requirements to protect crew, particularly in light of the requirement to notify crew members that a vehicle has not been certified as safe. The commenter observed, in effect, that the FAA was limited to protecting the general public. Under the CSLAA, the FAA has the authority to protect the crew because they are part of the flight safety system that protects the general public.<sup>5</sup>

<sup>3</sup> ASE commented that it believes the portion of the definition of crew "A crew consists of flight crew and any remote operator" to mean if a person is not a flight crew member or a remote operator, then that person is not crew. ASE recommended that the definition read "A crew consists *only* of flight crew and any remote operator" to avoid any misinterpretation. The FAA does not incorporate the suggested change because it is unnecessary but confirms in this document that if a person is not a flight crew member or a remote operator, then that person is not crew.

<sup>4</sup> Some licensees have used aircraft to assist in space launch. Orbital Sciences Corporation's Pegasus launch vehicle is air-launched from an L-1011 carrier aircraft. Scaled Composites' SpaceShipOne was air-launched from a White Knight carrier aircraft. The L-1011 was issued a supplemental type certificate and operates under two FAA airworthiness certificates: A standard airworthiness certificate for operation without Pegasus and a restricted airworthiness certificate for operations with the Pegasus launch vehicle. White Knight operated under a special airworthiness certificate in the experimental category when it was operating alone or carrying SpaceShipOne. The FAA did not impose requirements on the crew of the carrier aircraft other than those required by the FAA's aviation requirements.

<sup>5</sup> Even before the passage of the CSLAA, this has been the case. In April 2004 the FAA issued two RLV mission specific licenses: one to Scaled Composites and one to XCOR. These licenses apply to suborbital RLV missions with a pilot on board, where the FAA addressed the safety of the crew in

### 3. Pilot Qualifications

As proposed in the NPRM, § 460.5 requires a pilot of a launch or reentry vehicle to possess and carry an FAA pilot certificate with an instrument rating. The FAA invited public comment on the proposed requirement and received differing views.

Some commenters considered the requirement too lenient. TGV suggested that a pilot certificate might only partially address the knowledge, skills, and abilities necessary for safety. TGV recommended that, in addition to a pilot certificate, the FAA require test pilot credentials or military supersonic experience for single piloted suborbital and orbital vehicles. Because having a pilot certificate may not be sufficient, § 460.5(c)(2) requires aeronautical experience and skills necessary to pilot and control the vehicle.

The Federation and Planehook agreed with the requirement for a pilot to have an instrument rating because, as Planehook commented, the trajectory of a vehicle will pass through Class A airspace at least twice. ALPA also agreed that the pilots or flight crew, including any remote operators acting under part 460, should be certificated.

Focusing on a possible exception to the utility of requiring a pilot certificate, Mr. Nickolaus Leggett recommended against requiring pilots and remote operators of launch vehicles that do not have aircraft characteristics to possess an FAA pilot certificate with an instrument rating. He pointed out that a strictly ballistic suborbital vehicle consisting of a capsule and parachute does not require conventional piloting skills at all. Similarly, Starchaser recommended not requiring a pilot certificate at all and relying only on the performance requirement that a pilot possess the necessary skills and experience for the vehicle. An Air Force member of the Common Standards Working Group (CSWG)<sup>6</sup> recommended that the FAA not require that a pilot be certified when a vehicle is unique and lacks any similarity to an airplane.<sup>7</sup> The commenter suggested that a properly trained engineer may be a better choice as a pilot for the vehicles that do not resemble aircraft. If the key criterion is to protect the public, an individual intimately familiar with the unique

vehicle design, capabilities, and properly trained in the operation and recovery of such vehicles could be a better choice to operate the vehicle than a pilot.

The FAA requires a pilot certificate so that a pilot of a reusable launch vehicle has a basic level of aeronautical experience, an understanding of the National Airspace System (NAS), and an understanding of the regulatory requirements under which aircraft in the NAS operate, including cloud clearance requirements and airspace restrictions. This awareness will enhance overall safety of the NAS, regardless of whether a vehicle has wings. An instrument rating should ensure that pilots of launch and reentry vehicles have acquired the skills of scanning cockpit displays, correctly interpreting the instruments, and responding with correct control inputs. The FAA expects that regardless of the kind of vehicle used, there will be times when a pilot will be relying on instrument skills and competency. 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.

Planehook commented that a pilot or remote operator of a vehicle should have a commercial pilot certificate appropriate to the type of vehicle flown. The FAA's guidelines contain such a recommendation. The FAA did not, however, propose in the NPRM to implement this guideline as a requirement. The FAA did not 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. The pilot certification is not directly transferable from aircraft to launch or reentry vehicles. Rocket-powered vehicles do not operate as aircraft. As Mr. Leggett noted, even for a more manually controlled ballistic vehicle, the skills required differ from those of an aircraft pilot.

The FAA recognizes the validity of these comments. Accordingly, the agency is adopting a performance requirement, § 460.5(c)(2), that requires a pilot and remote operator to possess aeronautical experience and skills necessary to pilot and control the vehicle for any launch or reentry vehicle that will operate in the NAS. To avoid overly burdening the industry, and in recognition of the diverse range of vehicles proposed, the FAA does not

require an RLV pilot to hold a pilot certificate for a specific category of aircraft or to have a specific instrument rating on that certificate.

### 4. Remote Operator Qualifications

Section 460.5 requires a remote operator to possess and carry a pilot certificate with an instrument rating. Section 460.5(c)(1)(iii), however, allows an operator to demonstrate through the license or permit process that an alternative approach provides an equivalent level of safety. In the NPRM, the FAA invited public comment on the proposed requirement that a remote operator of a launch or reentry vehicle with a human on board possess an FAA pilot certificate with an instrument rating and that he or she demonstrate the knowledge of the NAS necessary to operate the vehicle.

Predesa questioned whether it was safe to allow remote operators at all. Predesa pointed out that remote operation of a vehicle could lead to concerns over the security and integrity of telemetry from the vehicle and of the commands sent to control the vehicle. Predesa recommended redundancy in the communications channel or on-board back up in the form of a trajectory controller or, preferably, a pilot on board. James Snead also recommended that a pilot be on board because there is no precedent for flight without one.

The FAA notes that there is precedence for permitting remote operators to control a vehicle. Unmanned aerial vehicles (UAVs) are already operated by the National Aeronautics and Space Administration (NASA) and the military services, and authorized by the FAA. The FAA will address whether the operators can sufficiently control a vehicle through the license or permit process on a case-by-case basis. The safety issues, such as those raised by Predesa, will also be addressed in that process.

The Federation and Starchaser recommended against requiring remote operators to possess pilot certificates at all, let alone with an instrument rating. The Federation recommended that remote operators still demonstrate knowledge, albeit with wide latitude, of the NAS and the deconfliction of airspace necessary to safely operate the vehicle. The Federation claimed the variety of possible vehicles and control schemes renders unnecessary a requirement that remote operators possess a pilot's certificate. According to the Federation, operators can and should be allowed to demonstrate their knowledge of the NAS in other ways, such as by written test. The Federation noted that John Carmack of Armadillo

order to protect the public. See also, *Notice of Policy*, 68 FR 56039, 56040 (Sept. 29, 2003).

<sup>6</sup> The CSWG consists of Air Force, FAA, and other government agencies. The CSWG develops, documents, and maintains common safety standards for public safety of the launch and reentry of launch and reentry vehicles.

<sup>7</sup> The commenter agreed with requiring pilot certification where a vehicle has many characteristics in common with an airplane.

Aerospace successfully operated a vertical takeoff, vertical landing vehicle remotely at the 2005 X PRIZE Cup, without the use of a pilot's license or instrumentation resembling that of an aircraft cockpit.<sup>8</sup>

One commenter, t/Space, suggested that in some instances, remote operation of a launch or reentry vehicle with a human on board may provide backup command and control of the vehicle if the pilot or flight crew is incapacitated or otherwise unable to function. When not intended for nominal flight operations, remote operation from the ground is likely to be limited to execution of pre-planned flight, reentry, or abort scenarios. According to t/Space, the remote operator in these situations would not require the same level of knowledge and experience as a pilot with an instrument rating.

The FAA acknowledges that there may be a variety of vehicle types and control schemes, such as back up remote operators that may be used. Accordingly, for a remote operator, the FAA will allow an operator to demonstrate that something other than a pilot certificate provides an equivalent level of safety.

#### 5. Medical Standards for Crew

Section 460.5(e) requires that each crew member with a safety-critical role possess and carry an FAA second-class airman medical certificate issued in accordance with 14 CFR part 67<sup>9</sup> and issued no more than 12 calendar months prior to the month of launch and reentry. For example, this means that if a launch were to take place on May 1, 2007, or May 31, 2007, a medical certificate issued anytime in May 2006 would satisfy the requirement. Because the requirement applies to both launch and reentry, operators who plan on a reentry in a different month than the launch should ensure that their crews' medical certificates are still timely for the reentry.

Requiring a medical certificate only for crew with a safety-critical role marks a change from the NPRM, where the FAA proposed that all crew members, regardless of whether they were safety-

critical, possess and carry such a certificate.

*a. Objections to Requiring Medical Certification of Crew Who Do Not Have a Safety-Critical Role.* Rather than creating a separate class of crew who are not safety critical or modifying the definition of crew as some commenters suggested, the FAA can better address medical risk to the mission by more precisely identifying what triggers the need for a medical certification. In section 460.5(e), the FAA distinguishes between crew members with a safety-critical and non-safety-critical role to determine whether they must satisfy the medical requirements.

Several commenters, including ALPA, generally concurred with the FAA that requiring medical certification is appropriate, particularly for those crew members whose duties are associated with operation of the launch or reentry vehicles. Several suggested that it may not be necessary for all crew members. Planehook and David J. Sullivan-Nightengale commented that a second-class medical certificate was appropriate for the pilot but unnecessary for other crew members. The Federation, t/Space, and XCOR asked the FAA to reconsider requiring a second-class medical certificate for non-safety-critical crew on the grounds that it would be impractical and unnecessary. The Federation claimed that where a regulatory requirement does not respond to a real need, it can negatively impact a flight test. XCOR commented that members of a rocket engine development team will likely serve as flight test engineers on some test flights to permit them to observe engine operation in real time and possibly to adjust parameters of the propulsion system in flight. According to XCOR, these operations are not safety-critical because the flight is aborted if the flight test engineer is incapacitated, and the worst case effect is the loss of some data from that flight.

Blue Origin commented that a person should not be required to have a second-class medical certificate if he or she is only involved in pushing an ignition button or initiating an abort of a vehicle experiencing non-nominal telemetry. TGV Rockets recommended against medical certification for remote operators.

Under today's rule, crew members must complete training on how to perform their duties on board or on the ground so that the vehicle will not harm the public. They also must complete training to be able to perform duties in emergency operations or abort scenarios. Crew members who are not medically stable likely would not be

able to meet training or performance requirements.

The FAA agrees that requiring second-class medical certification for crew members who do not perform safety-critical functions is unnecessary. There may be missions when a flight attendant or flight test engineer has duties that would not affect public safety. The FAA, however, anticipates that there may be missions when a flight attendant or flight test engineer does have a safety critical role. Rather than specifying which crew members must have a medical certificate, the FAA requires that only crew members who have a safety-critical role must possess and carry a second-class airman medical certificate.

Jonathan Goff suggested that alternatives to the second-class medical be accepted if they demonstrate an equivalent level of safety. The FAA has decided against this approach because a demonstration of equivalence would likely require the same level of examination and information as a medical certificate. The most straightforward approach is to obtain a second-class medical certificate.

*b. Recommendations for More Stringent Medical Standards.* Several commenters recommended the FAA adopt more stringent medical standards. The Aerospace Medical Association commented that a second-class medical certificate is acceptable for suborbital flight but more stringent physical standards should be applied to orbital missions. It further posited that the examination should be conducted by a physician with aerospace medicine training and include screening tests consistent with prudent aeromedical practice and recommendations of the U.S. Preventive Services Task Force. Dii Aerospace Laboratories commented that different standards should apply to space flight because the effects of weightlessness and reentry are vastly different for space flight than for standard commercial air travel. If a candidate for a medical certificate had significant medical issues, he or she would not receive certification. The physician would refer that person to a specialist for further evaluation. TGV Rockets commented that a first-class medical certificate should be required for pilots carrying space flight participants.

The FAA proposed requiring a second-class medical certificate so that crew members would demonstrate a basic level of health within 12 months of launch or reentry. Recognizing that second-class medical certification is insufficient for spaceflight, the FAA is also establishing a performance

<sup>8</sup> It should be noted that Armadillo's vertical-take off vehicle, which hovered about 25 feet above the ground for a few seconds and had no human on board, was not an FAA licensed launch. Nor did the vehicle have an impact on the NAS.

<sup>9</sup> In the NPRM, the FAA proposed to require that the medical certificate be issued within 12 months of launch or reentry as opposed to 12 months prior to the month of launch or reentry. The proposed time limit might have created confusion because a second-class medical certificate expires at the end of the last day of the twelfth month after the month of the date of examination. 14 CFR 61.23(d)(2). The requirement now provides the same expiration date as part 61.

standard that requires the flight crew to demonstrate an ability to withstand the stresses of space flight sufficiently so that the vehicle will not harm the public. This requirement may be more stringent than the suggested first-class medical certificate for pilots. The stresses experienced in space flight may include high acceleration or deceleration, microgravity, and vibration. The performance standard provides an additional level of safety beyond basic medical certification because flight crew members will have to demonstrate an ability to perform duties in the spaceflight environment in which they plan to operate. As discussed in the NPRM, the FAA 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 and they may be implemented on a case-by-case basis or through future rulemaking.

#### 6. Crew Training

As proposed in the NPRM, § 460.5(a)(1) requires each member of a crew to 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. Section 460.7 requires an operator to train each member of its crew and define standards for successful completion in accordance with § 460.5. The FAA received comments on hours of training, simulator training, and the training standard itself.

Starchaser recommended a minimum number of hours of training, but did not provide its reasons for this suggestion. Depending on the role the crew members will have, different amounts of training will be necessary for a crew member to learn his or her role. The FAA will evaluate this need on a case-by-case basis during the license and permit process.

Section 460.5(c)(3) requires a pilot and a remote operator to receive vehicle and mission-specific training for each phase of flight by using a simulator, a similar aircraft, flight testing, or an equivalent method. Mr. Leggett commented that because development of a vehicle would likely include a significant amount of simulation, the FAA should require simulator training. The benefit would be that training could take place in a safe environment. Dii commented that simulator training should be mandatory because realism is critical. Dii noted that a pilot needs to be able to deal with simulator sickness and spatial disorientation.

The FAA does not require the use of simulators in all circumstances because simulators may not exist for all the

proposed vehicles. While the use of simulators is recommended, the FAA intends to maximize the training approaches that are acceptable by allowing methods of training other than simulators.

The FAA notes that some simulators intended for aircraft may be used for different launch or reentry vehicles. Section 460.7(b) requires that an operator ensure that either the crew-training device used to meet the training requirements realistically represents the vehicle's configuration and mission or the operator has informed the crew member being trained of the differences. Predesa took issue with this proposed requirement, noting that just because an operator knows of differences between the systems, does not mean that the operator can describe those differences and train crew accordingly. Such training may be possible with data available from vehicle flight tests, but, without such data, Predesa recommended that operators remind the crew of the experimental nature of flight. This is sound guidance that is already encompassed within the requirement.

Alteon Training, L.L.C. (Alteon) observed that requiring that "an operator must train each member of its crew and define standards for successful completion" could be interpreted to mean that only the operator could conduct the required training. According to Alteon, an operator should have the ability to arrange with an approved training provider for the development of training programs. Alteon further commented that the operator would have the responsibility for oversight of the training provider to ensure that the training satisfied the FAA's regulatory requirements. The FAA agrees that an operator can have a contractor provide training, a concept that is already encompassed by § 460.7(a). Ultimately, however, it will be the responsibility of the operator to ensure that crew members are trained properly.

Section 460.7(d) also requires that an operator ensure that all required crew qualifications and training are current before launch and reentry. The NPRM proposed that an operator ensure currency prior to launch or reentry, but, as Predesa pointed out, this language incorrectly implied that an operator could postpone its currency check on a suborbital mission to just prior to reentry. Accordingly, the regulatory text has been changed to specify that currency checks be complete prior to a suborbital launch.

At various points in the crew training requirements, the FAA requires

operators to meet certain requirements. For example, as discussed above, an operator must ensure training currency. Ms. Knutson commented that requiring an operator to "ensure" something may create a warranty at odds with the risky nature of space travel at this stage in its evolution. The FAA notes that requiring an operator to ensure to the FAA that an event does or does not take place identifies the purpose of a requirement in order to impose a flexible yet enforceable performance standard. When the regulations require an operator to satisfy a performance standard, the FAA requires that an operator demonstrate the means by which it would satisfy that standard in its application for a license or permit. Grant of authorization constitutes approval of that approach as one that the FAA thinks will ensure satisfaction of the intent of the performance requirement. It is then up to the operator to carry out its method of compliance as described in its application. Because a license requires that an operator amend its application when it would no longer be accurate, the method an operator describes in its application has the same legal effect as a prescriptive requirement.

#### 7. Crew Notification

As proposed in the NPRM, § 460.9 requires an operator to inform, in writing, any individual serving as crew that the United States Government has not certified the launch or reentry vehicle as safe for carrying flight crew or space flight participants.<sup>10</sup> An operator must provide this notification prior to employing someone as crew or, if the individual is already employed by the operator, as soon as possible and prior to any launch in which that person will serve as crew.

Blue Origin commented on the logistical difficulties associated with the timing requirements. Blue Origin is concerned that the rule makes no provision for lawful notification when an existing employee is promoted or reassigned to a flight crew position. Section 460.9 requires that an operator provide the notification before entering into any contract or other arrangement to employ an individual. A promotion or reassignment would constitute such "other arrangement," and the FAA expects an operator to inform the prospective crew member of the required notice prior to the person accepting the new assignment.

<sup>10</sup> The Federation requested that the FAA create a form by which operators could provide this notice. The FAA will not adopt this suggestion in order to preserve flexibility. The required notifications are described in § 460.9.

Predeva also commented that the FAA does not require the experience and background necessary for crew to identify design or operational flaws that would stop them from participating in a mission. Predeva appears to base this comment on a belief that the CLSAA asks the crew to accept the risk of space flight with full information. The FAA does not interpret the statute in this manner. Rather, the CSLAA and the FAA's attendant regulations impose a duty on a launch operator to inform crew of the absence of U.S. Government certification. Just as with a space flight participant, a crew member may not have the schooling and experience required to discern operational or design flaws. Part of the risk associated with the flights anticipated by this rule is the presence of unknown hazards. The notification requirement requires only that an operator inform the crew that risks exist, not that it identify all potential operational and design hazards.

#### 8. Environmental Control and Life Support System (ECLSS)

Section 460.11 requires that an operator 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 specific atmospheric conditions in inhabited areas or demonstrate through the license or permit process that an alternative means of compliance provides an equivalent level of safety. This requirement reflects a change from what the FAA proposed in the NPRM in that the FAA will now allow an alternative means of compliance.

Blue Origin suggested that the ECLSS requirements not be applied to short suborbital flights, such as those that are ten to twenty minutes. The FAA notes that the vehicle's atmospheric conditions have to last from the time the cabin is sealed from the external environment until it is opened. When humans are in a closed environment and dependent upon manmade life support systems, a failure to monitor or control the environment even for a short duration could lead to a loss of life or injury. The FAA also understands, however, that some of the atmospheric constituents and conditions may not change significantly in a short duration flight, and the ECLSS for a suborbital mission typically will not be as complex as one for an orbital mission. Therefore, the FAA will continue to require the operator or flight crew to monitor and control atmospheric conditions in inhabited areas but will allow the operator to show an alternate means of

compliance that demonstrates an equivalent level of safety.

*a. Requiring Both Monitoring and Control of Atmospheric Conditions or Requiring Only Control.* The Federation commented that not every life support system must be both monitored and controlled. For example, it is asserted that a dehumidification system may not require monitoring because a proper verification test, which may be performed on the ground, may show that the system has ample capacity to keep humidity below acceptable limits.<sup>11</sup> Additionally, the Federation noted some atmospheric conditions need only be monitored without constant, active controls. Similarly, Blue Origin suggested that the FAA clarify that "control" can include passive measures rather than active instrumentation. According to the Federation, if followed literally, the requirement to monitor and control every life support system would drive up the cost and complexity of space vehicles and, as a consequence, possibly drive down reliability with adverse public safety implications. Paragon commented that the requirement to monitor and control contaminants that include particulates and any harmful or hazardous concentrations of gases or vapors should be restricted to those that reasonably can be expected to build up during the course of the spaceflight due to metabolic or other processes occurring in the cabin, or to those potential contaminants for which a source is present in the cabin.

The FAA agrees with the Federation and Paragon that only control may be needed in some cases. Control of particulate contaminants in the atmosphere of inhabited areas is an example where the FAA would consider control without requiring monitoring. The passive control method commonly employed is to provide filters, especially high efficiency particulate air filters, for the cabin air return duct inlets. When used with a recirculation fan, filters effectively maintain low concentrations of particulate contaminants in the atmosphere for extended times, with neither rapid nor large changes during spaceflight operation. Consequently, monitoring of the atmospheric concentration of particulate contaminants may not be necessary, especially for a suborbital mission. In order to address these types of systems, the FAA will require the

operator or flight crew to monitor and control atmospheric conditions in the inhabited areas as proposed in the NPRM, but will allow the operator to show an alternate means of compliance that will demonstrate an equivalent level of safety. This alternate means of compliance must be approved by the FAA through the license or permit process.

*b. Open-Loop System Versus Closed-Loop System.* According to the Federation and Blue Origin, any undesirable atmospheric condition can be controlled with an open-loop, rather than closed-loop system.<sup>12</sup> The FAA agrees that in some cases an atmospheric condition can be controlled with an open-loop system rather than a closed-loop system with automatic feedback from the monitoring device.

For example, carbon dioxide concentrations in the atmosphere in inhabited areas should be monitored and controlled. A carbon dioxide (CO<sub>2</sub>) control device, however, may operate without automatic feedback from the monitoring device. Without controls, CO<sub>2</sub> from human respiration would accumulate in the cabin atmosphere. The resulting increase in the concentration of CO<sub>2</sub> would depend upon the habitable volume of the vehicle, the number of persons on board, and the overall mission duration. To avoid elevated CO<sub>2</sub> concentrations, an operator must provide controls to remove CO<sub>2</sub> from the atmosphere at a rate comparable to the respiration rate of the crew members and space flight participants. CO<sub>2</sub> may be removed by using lithium hydroxide (LiOH) canisters. The LiOH canisters could be replaced on a schedule based on the number of persons on board. Under this scenario, an operator would monitor the carbon dioxide concentration in the cabin atmosphere, to verify in flight that the CO<sub>2</sub> control devices are operating and are effective in avoiding elevated CO<sub>2</sub> concentrations. Because any increase in CO<sub>2</sub> concentration would occur slowly, and because there is a considerable margin between the expected concentration with controls and the threshold concentration where chronic physiological changes begin to appear, a closed-loop control would not be required. Should the crew observe increasing CO<sub>2</sub> concentrations, there

<sup>11</sup> The FAA notes that in a condensing heat exchanger, the separation of liquid condensate from air, and the collection of liquid condensate, are difficult processes in the expected microgravity environment, and so ground testing may not necessarily provide adequate verification.

<sup>12</sup> A closed loop system is a control system with an active feedback loop. A typical example of a closed loop system is one that uses a thermostat to control temperature. The thermostat compares the actual temperature with the desired temperature; if the actual temperature is less than the desired temperature an actuating signal causes the control elements to supply more heat. An open loop system does not have active feedback that compares the controlled variable with the desired input.



should be sufficient time to diagnose and remedy any abnormal operation of the control device, or if that fails, to safely terminate the mission.

Oxygen concentration in the atmosphere is another example of what must be monitored and controlled. Very low oxygen partial pressure constitutes a severe hazard, results in impaired judgment and ability to concentrate, shortness of breath, nausea, and fatigue, affecting the proper functioning of the crew, and so potentially results in catastrophic consequences. Control of oxygen concentration must be closed loop, with the automatic addition of oxygen depending upon the oxygen-measuring device indication.

*c. Other ECLSS-related Comments.* ASE noted that the FAA did not propose to require protecting safety-critical equipment, such as heat-generating avionics. ASE commented that vehicle designers must recognize the need to cool avionics, which may be in the space-unique environment of low, or no pressure. The FAA agrees on the need to design for adequate thermal control of safety-critical equipment, but the suggested requirement would not be appropriate in the context of a performance based rule. Design requirements for spacecraft avionics equipment are outside the scope of this rule. However, the FAA will evaluate the design, including thermal control, of safety-critical equipment when it reviews a license application.

Predeva requested that the ECLSS requirements be specifically applied to all normal, non-normal and emergency operations, to emphasize the need for secondary or backup environment systems or other means to preserve the atmospheric conditions for the crew. The FAA may find that redundancy is necessary on a case-by-case basis, depending on a particular design, to ensure the crew's ability to protect public safety. At this point, the only redundancies the FAA anticipates requiring for all designs are specified in the regulations, including the requirement for an adequate redundant or secondary oxygen supply for the flight crew.

ASE commented that the space environment offers unique environmental challenges, such as micro-meteorites and orbital debris. It noted dual seals will not address a hull breach by orbital debris. Although a low probability during suborbital flight, a hull breach is not impossible, and the risk dramatically increases during orbital flight due to the increased exposure time. ASE recommended that this and other space-unique hazards be addressed, at least during the licensing

or permitting phase. The FAA acknowledges the potential for micro-meteorites and orbital debris, and notes that these details will surface through an applicant's hazard analysis and be resolved during the license or permit process.

*d. Guidance Plans.* The FAA recognizes and anticipates that there will be many ECLSS designs. The ECLSS requirements are performance based rather than design based with prescriptive requirements. The following factors should be considered in determining if both monitoring and control of an atmospheric condition is needed and whether an open-loop system or closed-loop system with automatic feedback from the monitoring device is necessary:

- Severity of the hazards presented to humans;
- Likelihood for catastrophic or critical consequences of exposure;
- Potential for rapid changes in conditions;
- Potential for changes in conditions of large magnitude;
- Availability of practicable in-flight measurement techniques and devices;
- Access to emergency breathing equipment; and
- Mission duration.

The FAA plans to develop an ECLSS advisory circular or guidance document. This document will address some of the concerns and suggestions of the IASE and ISLAP. The IASE and ISLAP believe that it is premature for the FAA to issue regulations pertaining to ECLSS at this time. Instead, they believe it would make more sense for the FAA to issue guidelines and to refine such guidelines with industry input over time as operators gain experience. According to the IASE and ISLAP, at this time there is simply too much untested diversity of design and proposed operation for "one size fits all" regulation in environmental control and life support areas.

#### 9. Smoke Detection and Fire Suppression

Section 460.13 requires an operator or crew to have the ability to detect smoke and suppress a cabin fire to prevent incapacitation of the flight crew. This requirement is adopted as proposed in the NPRM. Predeva inquired whether the FAA meant to imply that an operator could employ remote systems for fire detection and suppression. Predeva raised operational safety concerns regarding the security and integrity of telemetry to and from the vehicle. The FAA will address these issues during the license and permit process.

#### 10. Human Factors

Section 460.15 requires an operator to take necessary precautions to account for human factors that can affect a crew's ability to perform safety-critical roles. The FAA received no comments on this requirement, and it is adopted as proposed in the NPRM.

#### 11. Verification Program

Section 460.17 requires an operator to 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. Predeva requested clarification of this requirement, observing that the NPRM appeared to allow a space flight participant to be carried during first time flight testing in a different operational environment than what was tested. For example, an operator might flight test a reentry from a high altitude. Predeva inquired whether a space flight participant could board for the first flight test into a suborbital micro-gravity environment. The FAA expects that more than a single flight test will be required to verify the integrated performance of a vehicle. Because the FAA did not identify how much flight testing would be required, Starchaser commented that the requirement was open to subjective judgment and potential manipulation. The FAA believes that it would be premature at this time to specify the number of hours of flight testing needed given the variety of launch and reentry vehicle designs and concepts. 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. 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 license or permit process.

A space flight participant would not be allowed on an envelope expansion flight, that is, a space flight participant would not be allowed to be carried during first time flight testing in a different operational environment than what was tested.

#### 12. Crew Waiver of Claims Against U.S. Government

Section 460.19 requires each member of a flight crew and any remote operator to execute a reciprocal waiver of claims with the Federal Aviation Administration of the Department of



Transportation in accordance with the requirements of part 440. The FAA received no comments on this requirement, and it is adopted as proposed.

### 13. Professional Engineer

James Snead commented that the FAA should require a professional engineer to prepare and approve an application for an FAA license to launch or reenter. Mr. Snead recommended this requirement as an alternate means to protect public safety where there is no government certification.<sup>13</sup> Opposing the recommendation, XCOR commented that FAA's oversight function should not be transferred to a private party because of the potential for conflicts of interest. A professional engineer would be paid by the applicant and thus be under subtle pressure to make decisions in favor of the vehicle developer. The FAA notes that applicants may choose to engage professional engineers, but will not require them.

### C. Launch and Reentry With a Space Flight Participant

Subpart B establishes requirements for space flight participants on board a vehicle whose operator is licensed or permitted under this chapter. The subpart applies to a license or permit applicant, licensed or permitted operators and space flight participants.

#### 1. Risk to Space Flight Participants

Several commenters urged that the FAA establish requirements to protect space flight participants. Nicholas Leggett recommended that a pilot have at least one solo flight before transporting passengers. Starchaser advocated pressure suits for space flight participants. As the FAA noted in the NPRM, the CSLAA does not provide the authority to protect space flight participants except in certain circumstances. 49 U.S.C. 70105(c); 70 FR at 77270. The CSLAA only allows the FAA to issue regulations restricting or prohibiting design features or operating practices that result in a human space flight incident or a fatality or serious injury to space flight participants during an FAA authorized flight until December 23, 2012. For the next six years, the FAA has to wait for harm to occur or almost occur before it can impose restrictions. Instead, Congress requires that space flight participants be informed of the risks. To that end, the FAA is establishing notification requirements.

#### 2. Informed Consent

Section 460.45 requires that before receiving compensation or agreeing to fly a space flight participant, 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. For each mission, an operator must inform a space flight participant, in writing, of the known hazards and risks that could result in a serious injury, death, disability, or total or partial loss of physical and mental function. Although the FAA did not propose to require the identification of unknown hazards as a risk in the NPRM, the FAA is now requiring notice of unknown hazards in response to Ms. Knutson's comment that an operator should inform a space flight participant that there are also unknown hazards. The operator also must disclose that participation in space flight may result in death, serious injury, or total or partial loss of physical or mental function. An operator must inform each space flight participant that the United States Government has not certified the launch vehicle and any reentry vehicle as safe for carrying crew or space flight participants. If there is a separate operator for each vehicle, each operator must provide this statement for the space flight participants on its vehicle.

Predeva commented that the FAA should also require disclosure of the fact that the law only permits the FAA to issue regulations for the safety of crew and space flight participants relating to vehicle design and operations if a serious injury or fatality occurs or nearly occurs. The FAA will leave it up to the operator to choose whether to disclose this information. The FAA does not see a need to require additional disclosure because the statutorily required disclosure encompasses this information.

Predeva also commented that it is the duty of the space flight participant to research and recognize design features or operating practices that elevate personal risk. The FAA does not agree. A space flight participant may not have the training and background to conduct such research and analysis. The FAA expects space flight participants to come from all walks of life, with varying degrees of technical expertise and understanding. Congress requires that a space flight participant be informed of the risks, not that he or she acquire an understanding of basic engineering principles in order to understand that risk.

A commenter from NASA Headquarters Office of Safety and

Mission Assurance recommended requiring that an operator prepare a hazard analysis with a specific focus on keeping the crew and any participants alive and functioning and that defines each hazard and how it is mitigated. According to the commenter, a space flight participant would likely want to see such an analysis. The FAA notes that hazard analyses will be conducted by an applicant during the license or permit process. For example, during the license process, Scaled Composites conducted hazard analyses pertaining to the SpaceShipOne pilot. The analyses identified and characterized the potential hazards and assessed the risks to the pilot because his performance had implications for public safety given that the pilot was part of the flight safety system. Because § 460.45(1) requires that an operator inform each space flight participant of the known hazards and risks that could result in a serious injury, death, or disability, the FAA anticipates that a hazard analysis focusing on keeping the space flight participant alive will be conducted by the operator to identify these hazards.

The FAA also requires, under § 460.45, that an operator provide the safety record of all launch or reentry vehicles that have carried one or more persons on board, including U.S. government and private sector vehicles. The FAA will not, as suggested by the Federation, require that all foreign government vehicles be included in this disclosure. The Federation recommended that "all government vehicles" be clarified to specifically include Soviet/Russian and Chinese government vehicles, and suggested that the FAA include non-U.S. Government vehicles in its list of vehicle accidents in order to expand the knowledge base. The FAA did not propose to require disclosure of foreign launch or reentry accidents because the information may not always be publicly available and its accuracy will be difficult to verify. However, if an operator is able to obtain accurate data regarding foreign launch accidents, the operator may use that data as part of the safety record.

Blue Origin, the Federation, Predeva, and t/Space all suggested that the FAA provide a standardized summary of the historical safety record of all launch or reentry vehicles that have carried one or more persons on board for all U.S. Government vehicles for use by all applicants, and that the FAA maintain a standard summary of the safety record of all private sector vehicles on behalf of the public. The Federation and t/Space commented that the FAA needed to provide the operator with the safety record in order to ensure an

<sup>13</sup> Although the licensing process differs from certification, the licensing process also protects public safety.

accurate and impartial list, used equally by all operators. Blue Origin commented that this approach would help avoid litigation.

The FAA is exploring available options. The agency is considering developing a database on the safety record of U.S. Government and private sector space transport with one or more persons on-board. If it were possible to do so, the FAA could include foreign data. Although a database, whether developed by the FAA or commercially, may eventually be used by an operator to help fulfill the requirements of § 460.45, ultimately it is the responsibility of the launch vehicle operator to inform each space flight participant of that safety record.

Section 460.45 also requires an operator to describe the safety record of its own vehicle to each space flight participant. The operator's safety record must include the number of vehicle flights, the number of launch and reentry accidents and human space flight incidents (including on the ground or in flight), and whether any corrective actions were taken to resolve the causes of the accident or human space flight incident. The FAA is revising its definitions of launch and reentry accident and adding the definition of human space flight incident to ensure that all relevant information is included in this safety record. For a launch that takes place with a person on board, launch and reentry "accidents" as defined in section 401.5 now include a fatality or serious injury to a space flight participant or crew. "Human space flight incident" means an unplanned event that poses a high risk of causing a serious or fatal injury to a space flight participant or crew.

In the NPRM the FAA proposed to require disclosure of "anomalies" and "failures." The Federation recommended that the FAA require disclosure of accidents rather than failures or anomalies because the FAA does not define anomaly or failure by regulation, and the Federation thought that the definitions proposed in the May 2005 experimental permit guidelines were overly broad. According to the Federation, under these definitions operators could be required to provide an unreasonably large amount of data to space flight participants, and such "information overload" could actually decrease the ability of a prospective space flight participant to properly evaluate the risk involved.

Likewise, t/Space commented that the terms "anomalies" and "failures" are not adequately defined. According to t/Space, different operators are likely to

use different definitions, with competitive pressures possibly influencing these definitions. It recommended clearer definitions to ensure a level playing field between operators. In response, rather than requiring the disclosure of failures and anomalies as proposed, paragraphs 460.45(d) and (f) require an operator to describe accidents and human space flight incidents, and the FAA now defines launch and reentry accidents to include a fatality or serious injury to a space flight participant or crew. Without these revisions, the definitions of launch and reentry accidents would fail to require an operator to disclose all relevant information.<sup>14</sup> Under the current definition of reentry accident, if an RLV crashed inside a designated landing site, the FAA's definition would not encompass that event and an operator would not have to disclose it to a space flight participant. Another example of an instance where relevant information would be left undisclosed is if someone associated with a flight, such as a space flight participant or crew member, were injured or killed. That event would not be characterized as an accident. All of these events must now be disclosed under section 460.45.

The Federation commented that the FAA should restrict disclosure to the vehicle verification and commercial operations phases only, and should not require the disclosure of accidents occurring on the ground. Blue Origin requested that the FAA clarify that disclosures relate only to the licensed model vehicle and not to earlier developmental iterations of that model. It noted that, in developing a vehicle, most operators plan on successive versions or models. Thus, safety performance related to an earlier, experimental model is not directly relevant to a final, passenger-carrying model. Requiring disclosure of earlier

<sup>14</sup> Section 401.5 currently defines launch accident to mean a fatality or serious injury (as defined in 49 CFR 830.2) to any person who is not associated with the flight; any damage estimated to exceed \$25,000 to property not associated with the flight that is not located at the launch site or designated recovery area; an unplanned event occurring during the flight of a launch vehicle resulting in the known impact of a launch vehicle, its payload or any component thereof: (i) For an expendable launch vehicle (ELV), outside designated impact limit lines; and (ii) for an RLV, outside a designated landing site. Section 401.5 states that a reentry accident means any unplanned event occurring during the reentry of a reentry vehicle resulting in the known impact of the reentry vehicles, its payload, or any component thereof outside a designated reentry site; a fatality or serious injury (as defined in 49 CFR 830.2) to any person who is not associated with the reentry; any damage estimated to exceed \$25,000 to property not associated with the reentry and not located within a designated reentry site.

models would discourage operators from iterative experimenting and testing of non-passenger models, which would undermine the goal of developing safer vehicles.

The FAA agrees that an operator need only disclose its safety record created during and after vehicle verification performed in accordance with § 460.17. This includes all subsequent launches and reentry. Earlier models that predate the verification of the vehicle are not part of the safety record. The FAA is including accidents occurring on the ground because those are relevant to the risks a space flight participant faces. Accordingly, if a launch vehicle exploded upon ignition while on the ground, the explosion would have to be included as part of the vehicle safety record.

Under § 460.45(e), an operator must inform a space flight participant that he or she may request additional information. Under § 460.45(f) if a space flight participant asks, an operator must describe each accident and human space flight incident at a system level. Blue Origin and the Federation commented that the proposed requirement would effectively stop companies from being hired by foreign space flight participants because of conflicts with International Traffic in Arms Regulations (ITAR). The Federation urged the FAA to consider the ITAR ramifications of any proposed requirement for describing corrective actions to space flight participants. Blue Origin, the Federation and the New Mexico Office for Space Commercialization were all concerned that an operator would have to disclose information that is restricted by the ITAR.

Blue Origin suggested a clarification to prevent a potential conflict between the FAA's regulations, which require disclosure to a space flight participant who is a foreign national, and the ITAR, which would restrict or prohibit disclosure to the same foreign national. Blue Origin suggested that the FAA establish the same standard for disclosure to a U.S. and a foreign national, and limit that disclosure obligation to only "general systems descriptions." This would conform to the ITAR's exclusion of "general systems descriptions" from "Technical Data" as defined in ITAR 22 CFR 120.10(a)(5). The FAA agrees and will require only a general system description. An operator only needs to disclose, for example, that a propulsion system exploded, not the details of how the explosion occurred.

Blue Origin and the Federation commented that describing corrective

actions could require the disclosure of proprietary data and company secrets. The Federation commented that the intellectual property of its members could be placed at risk. Competitors could seek to fly on one another's vehicles for the purpose of obtaining data.

The FAA agrees with the commenters that requiring a description of any system in detail or any corrective action could require the disclosure of proprietary data or technical sensitive information to space flight participants; therefore, the FAA will require an operator to disclose only accidents and human space flight incidents if a space flight participant asks and then only at the system level; it will not, as originally proposed, require an operator to also describe what corrective actions were taken.

*a. Space Flight Participant's Ability To Be Informed.* Section 460.45(f) requires each space flight participant to provide written informed consent. The consent must state that the space flight participant understands the risk associated with being a space flight participant aboard the specific vehicle and that his or her presence on board is voluntary. In response to comments, the FAA does not consider a person under the age of 18 someone who can provide informed consent.

Commenters claimed that persons under the age of 21 do not have a basis for making an informed consent. James Snead pointed to age limitations on drinking, driving, operating heavy construction equipment and selling liquor. Mr. Snead felt that persons under 21 could be more likely to view space flight as a thrill ride and not appreciate the risks or have the mental capacity to act responsibly during the excitement of flight. For the same reasons, a parent or guardian should not be able to provide the consent for the minor. Dii recommended a minimum age of 18.

Societally, the United States has acknowledged that it is reasonable to place restrictions on individuals under the age of 18, including restrictions on their ability to legally consent. In the United States, a person may vote in federal elections at the age of 18. A person may not enlist for military service without parental consent until the age of 18. While some states classify a person as a minor until the age of 21, in many states the age of majority is 18. In no state is the age of majority less than 18.

The FAA is aware that most persons under the age of 18 will not be able to afford the price of a ride on a rocket at the prices currently being discussed.

Prices, however, drop over time, and the FAA agrees with the commenters that a minor could not be adequately informed. Given the risks involved, parental consent may not substitute for the minor's inability to be informed.

Although not proposed in the NPRM, under § 460.45(g) the FAA requires operators to provide each space flight participant an opportunity to ask questions orally to acquire a better understanding of the hazards and risks of the mission. 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. In the NPRM, the FAA stated that 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. XCOR agreed both with the desirability of this practice and with the FAA's decision not to require it at this time. According to XCOR, it is difficult to phrase a regulation in such a way that achieves the desired effect without being burdensome, and therefore it should be left in the guidelines. XCOR further added that responsible operators, with insurance companies, will doubtless pay close attention to such guidelines.

After further consideration and review of other informed consent practices such as those in the medical profession, the FAA believes that an opportunity to ask questions allows a space flight participant a chance to get clarification on any information that may be confusing or unclear. Therefore, § 460.45(g) now requires that an operator provide each space flight participant an opportunity before flight to ask questions orally. In addition to receiving informed consent in writing from a space flight participant, this requirement serves as another "cognizance test" or affirmation that the space flight participant understands what he or she is getting into before embarking on a mission. An operator must provide an opportunity for an oral discussion; the discussion does not have to occur if the space flight participant declines it.

### 3. Physical Examination

The FAA is not requiring that a space flight participant obtain a physical examination. The Federation agreed with this decision in its comments. As it discussed in the guidelines and the NPRM, the FAA recommends such an examination.

### 4. Space Flight Participant Waiver of Claims Against U.S. Government

Section 460.49 requires each space flight participant to execute a reciprocal waiver of claims with the Federal Aviation Administration of the Department of Transportation in accordance with the requirements of part 440. The FAA received no comments, and adopts this requirement as proposed in the NPRM, with some modifications which are discussed in the context of part 440.

### 5. Space Flight Participant Training

Section 460.51 requires an operator to train each space flight participant before flight on how to respond to emergency situations, including smoke, fire, and loss of cabin pressure. This remains unchanged from what was proposed in the NPRM. Mr. Snead commented that all space flight participants should be tested to ensure that each space flight participant could respond properly in emergencies. Because the FAA requires an applicant proposing to conduct a launch or reentry with a space flight participant on board to demonstrate compliance with this section, the FAA will review the adequacy of the operator's training plan, which may include testing, during the license or permit process.

### 6. Security Requirements

The FAA requires an operator to implement security requirements to prevent any space flight participant from jeopardizing the safety of the flight crew or the public. As in the NPRM, under § 460.53, a space flight participant may not carry on board any explosives, firearms, knives, or other weapons.

XCOR inquired whether the FAA had the authority to impose security requirements under its statute and the U.S. Constitution. The Second Amendment to the Constitution provides that "[a] well regulated Militia, being necessary to the security of a free State, the right of the people to keep and bear Arms, shall not be infringed." This right is not unfettered. Nearly every statute restricting the right to bear arms has been upheld. For example, in 1958, Congress made it a criminal offense to knowingly carry a firearm onto an airplane engaged in air transportation. 49 U.S.C. 46505. Additionally, nearly all courts have also held that the Second Amendment is a collective right, rather than a personal right. Therefore, despite the Second Amendment collective right to bear arms, the FAA has the authority to prohibit firearms on launch and

reentry vehicles for safety and security purposes.

Planehook commented that the Transportation Security Administration (TSA) is charged with the responsibility for aviation security as well as other modes of transportation within the U.S. Therefore, according to Planehook, security regulations should come from the TSA. Under Chapter 701, the FAA is responsible for security as well as safety, and thus shares jurisdiction on this issue with TSA.

The FAA will work with and rely on the expertise of the Transportation Security Administration and the intelligence community at large. Threat assessments will be conducted to determine the sufficiency of an operator's security plans. Although the threats may be the same, different vehicles may require different security plans. The FAA will look to the security community for developing guidelines in reviewing the different plans. The FAA plans to coordinate initial guidelines with the TSA. As the commercial activity in this sector expands, the TSA will likely take a larger role in developing standards and monitoring compliance. In the meantime, the FAA intends its security requirements to provide a foundation that is both effective and flexible.

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

The FAA implements the financial responsibility requirements and waiver of claims required by Chapter 701 through part 440.<sup>15</sup> With the exception of clarifications to the crew and space flight participant waivers of claims discussed below, the FAA only made editorial changes from what it proposed in the NPRM. The FAA received comments concerning the cross-waivers between space flight participants, the operators and the U.S. Government. It also received comments regarding insurance requirements.

#### *1. Changes From What the FAA Proposed in the NPRM*

Tracey Knutson, Esq. commented that the FAA should clearly specify that claims arising out of the death of crew or space flight participants are part of what is covered by the cross-waivers. The FAA notes that its definition of "bodily injury," 14 CFR 440.3, includes death, but is adopting the suggestion in the waivers of claims that will be signed by space flight participants and crew members. The courts have stressed the importance of individuals understanding what they are waiving. Thus, to avoid confusion, the FAA will make clear that the waivers encompass claims arising out of an individual's own death.

Mr. James Snead commented that the reciprocal waivers of claims required by part 440 should identify a particular operator, the vehicle being flown and the manner of its use. Mr. Snead pointed out that the proposed appendices omitted information necessary to describe that to which the waivers apply. The FAA now requires that the operator, the vehicle, any payload, and the location of the licensed or permitted flight be included in the reciprocal waivers of claims. This change clarifies the subject of the waiver.

This final rule contains a provision in the waivers of claims for crew and space flight participant that the FAA did not propose in the NPRM, but is necessary to carry out Congress' intent that crew and space flight participants not bring claims against the U.S. Government. The waivers require that crew members and space flight participants hold harmless and indemnify 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 brought by anyone for property damage or bodily injury, including death, sustained by a crew member or space flight participant, resulting from licensed or permitted activities.

The crew and space flight participant must agree to this indemnification in order to prevent claims brought by others as well as on their own behalf. For example, if a crew member or space flight participant were to die during a licensed launch, the waivers will prevent that individual or his estate from bringing claims against the U.S. Government. Some states, however, allow a surviving spouse to bring separate wrongful death claims for his or her own losses arising out of the death of the spouse. Accordingly, the indemnification requirement under this

final rule provides that the estate of the crew member or space flight participant must indemnify the U.S. Government for claims arising out of the bodily injury, including death, of the individual. This indemnification will cover all costs and fees incurred by the U.S. Government in defending itself against claims by the individual, his or her family, or estate.

Also of note, although not proposed in the NPRM, the waivers of claims for crew and space flight participants now define these individuals to include not only themselves, but all the heirs, administrators, executors, assignees, next of kin, and estate of the individuals, and anyone who attempts to bring a claim on behalf of the crew member or space flight participant or for damage or harm arising out of that person's bodily injury, including death.

#### *2. Waivers of Claims*

As the FAA proposed in the NPRM, § 440.17(e) and (f) requires a space flight participant and each crew member to waive any claims he or she may have against the U.S. Government for participation in a launch or reentry in which the U.S. Government, any of its agencies, or its contractors and subcontractors is involved.

Mr. James Snead commented that for the U.S. Government to require a crew member or space flight participant to waive claims against an operator could deprive the space flight participant or crew member of a normal expectation of customary behavior on the part of the operator by virtue of the normal potential for legal liability. As noted in the NPRM, the CSLAA and the FAA regulations do not require either a space flight participant or a crew member to agree to waive claims against an operator of a launch or reentry vehicle. The waiver is with the U.S. Government for its participation in a launch or reentry. In the NPRM, the FAA only noted that nothing in the CSLAA prevents an operator from making a waiver of liability a condition of an agreement between it and a space flight participant or crew member. 70 FR 77272 (Dec. 29, 2005). Neither Congress nor the FAA mandated waivers of claims against an operator.

Blue Origin commented that the FAA should clarify the nature of government involvement triggering the need for waivers of claims. Blue Origin commented that FAA oversight in the form of authorizing a launch or reentry would not constitute government "involvement." The FAA agrees. In that context, the FAA would be acting in its regulatory capacity, and would not be involved. Blue Origin also suggested,

<sup>15</sup> This rulemaking makes effective the FAA decision to combine parts 440 and 450 in light of the fact that they were almost identical, except that part 440 only applied to launch and part 450 addressed reentry of reentry vehicles. The FAA requested comments on whether this would cause any concerns for those persons having to abide by these requirements. In supporting the FAA decision to combine the parts to reduce the regulatory burden on service providers, t/Space observed that a single part, would simplify the process of establishing maximum probable loss and implementing reciprocal waivers of claims. Rocketplane, on the other hand, commented that reentry conditions from orbit are more severe than those from a suborbital RLV launch. The FAA agrees with this observation, but notes that this part imposes no technical requirements.

however, that coordination with local FAA air traffic control and issuance of notices to airmen would not constitute the kind of U.S. Government involvement requiring crew to sign a waiver of claims. Instead, Blue Origin suggested, U.S. Government involvement requiring cross-waivers would be limited to when an operator transports a U.S. Government payload or personnel acting in their official capacities, or when launching from a U.S. Government facility. Adopting this suggestion would constitute a change from what the law currently requires. Where the U.S. Government is involved in a launch or reentry by providing services, the requirements of part 440 apply. For example, the federal launch ranges currently provide launch safety services for the launch of expendable launch vehicles, and the Air Traffic Organization manages the NAS to ensure the safety of all participants. Congress intended the statutory revisions of 1988 and of 2004 to reduce litigation expenses by requiring launch participants to assume responsibility for their own losses, except in cases of gross negligence. See *Report of the Committee on Science, Space, and Technology*, Sen. Rep. No. 639, 100th Cong., 2d Sess., 14 (1988); *Report*, H.R. Rep. No. 429, 108th Cong., 2d Sess., VII (2004). Accordingly, the FAA cannot adopt the interpretation suggested by Blue Origin.

Sections 440.15(c)(1)(iv) and (v), and 440.17(b) and (e) require a licensee or permittee to submit reciprocal waivers of claims to the FAA for signature. Mr. Garrett Smith commented that a launch should not be held up because of the delay that could be caused by waiting for the U.S. Government to sign a reciprocal waiver of claims. To date, a launch has never been delayed on account of waiting for a signature from the U.S. Government on a cross-waiver. Timely submission of a cross-waiver that complies with part 440 will avoid unnecessary delay.

### 3. Federal Preemption

Ms. Tracey Knutson submitted additional material to the docket in response to a request for clarification regarding her comments on the waivers of claims to be signed by crew and space flight participants. The materials highlight the differences in state law, including that many states view waivers of claims as contrary to public policy. Accordingly, the FAA now emphasizes that the waivers required by the CSLAA and part 440 are not to be construed under state law. As proposed in the NPRM and adopted now, the waivers provide that federal law applies. Chapter 701 provides, in relevant part,

that a state or political subdivision of a state “may not adopt or have in effect a law, regulation, standard, or order inconsistent with this chapter; \* \* \*.” 49 U.S.C. 70117(c)(1). In its 2004 amendments to 49 U.S.C. 70112, Congress required crew and space flight participants to sign waivers of claims against the U.S. Government. Accordingly, in order to avoid conflicts with any state law to the contrary, federal law must apply.

### 4. Insurance

Mr. James Snead commented that the FAA should require an operator to provide pre-paid health and accidental death insurance for space flight participants. The FAA does not have authority to impose such requirements under its statute. Chapter 701 requires the FAA to impose insurance requirements for damage or harm to third parties, that is, the general public, and to U.S. Government property and personnel. Legislative history shows that Congress expected space flight participants to purchase insurance on their own.

### 5. Maximum Probable Loss

Space Adventures and XCOR commented that the probability threshold for the determination of liability insurance requirements for commercial launch sites should be changed from  $1 \times 10^{-7}$  to  $1 \times 10^{-5}$ . Space Adventures commented that under the FAA’s definition of maximum probable loss (MPL), a different probability threshold is applied for the determination of liability insurance requirements for government property (primarily government property at a government launch site) exposed to risk from a commercial launch ( $1 \times 10^{-5}$ ) than is applied for third party property ( $1 \times 10^{-7}$ ). Space Adventures noted that this can have a very real effect on the insurance costs to an operator operating from a government launch site as opposed to one operating from a commercial launch site. This is because the current third party threshold encompasses more potential for harm, likely requiring the purchase of more insurance.

Space Adventures believes that a commercial launch site’s property should also fall under the higher  $1 \times 10^{-5}$  threshold, and that the same threshold should extend to all other property located on a commercial launch site. The FAA will not adopt this suggestion because it is outside the scope of this rulemaking. The FAA did not propose this change in the NPRM, and others have not had an opportunity to comment. The economic effect of

such a change could be significant and would merit a more thorough study than is available now.

## III. Rulemaking Analyses

### *Paperwork Reduction Act*

As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the FAA submitted a copy of the new information collection requirements in this final rule to the Office of Management and Budget (OMB) for its review. Affected parties, however, do not have to comply with the information collection requirements in §§ 460.5, 460.7, 460.9, 460.19, 460.45, and 460.49 until the FAA publishes in the **Federal Register** the control number assigned by the OMB for these information collection requirements. Publication of the control number notifies the public that OMB has approved these information collection requirements under the Paperwork Reduction Act of 1995.

### *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 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) 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, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 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 (adjusted for inflation with the base year of 1995). This portion of the preamble summarizes the FAA’s analysis of the economic impacts of this final rule.

In conducting these analyses, FAA has determined this rule: (1) Has benefits that justify its costs, (2) is a “significant regulatory action” as defined in Executive Order 12866 because it raises novel policy issues under the legal mandate of the CSLAA,

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 have a neutral impact on international trade; and (5) will 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

- 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 Wage Rate is \$69.40
- Hourly Burdened Government Wage 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
- 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 new requirements are not current practice is as follows:

| Requirement                                                                                     | Hrs/operator | Hrs/mission |
|-------------------------------------------------------------------------------------------------|--------------|-------------|
| § 460.9: Informing Crew of Risk .....                                                           | 4            | 1           |
| § 460.19 (§ 440.17(i)): Crew Waiver of Claims Against U.S. Government .....                     | 4            | 1           |
| § 460.45: Operator Informing Space Flight Participant of Risk .....                             | 120          | 2           |
| § 460.49 (§ 440.17(e)): Space Flight Participant waiver of claims against U.S. Government ..... | 4            | 1           |

#### Benefits

The rule will offer some benefit impacts that are not readily quantified. The principal benefit will be the assurance that the human commercial space flight industry understands and adheres to the current practices that have worked thus far to protect public safety. The rule will 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 rule will 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 will incur 72 percent of the total costs, ranging from \$1.4 million to \$2.7 million to comply with the rule. The FAA will incur 28 percent of the total costs, ranging from \$529,000 to \$1.1 million to administer the regulatory requirements. Costs are summarized in the following table.

#### SUMMARY OF INCREMENTAL COST IMPACTS ATTRIBUTABLE TO THE 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     |
| Total Costs Attributable to the Rule .....                 | 3,794,728    | 1,919,051   | 2,384,676               | 1,205,753   |

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

#### Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) (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 consider flexible regulatory proposals, to explain the rationale for their actions, and to solicit comments. 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 or final

rule will 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 RFA.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 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 final rule will 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 will be affected by the rule. However, we believe that the rule will not have a significant impact on these entities as explained below.

The rule will 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 will 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 it is a nascent industry, it is difficult to state how many and which entities will succeed. 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 rule; therefore, the industry currently consists of one company. There are about six more companies that the FAA considers serious candidates 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 may be considered a large business because it is a subsidiary of Virgin Airways which has over 1,000 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.

The FAA has determined that the impacts are not significant. In order to make this determination, 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 the 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 significantly 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.

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 missions (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). Regardless of seat prices, the estimated \$270 per mission incremental compliance cost that the rule will impose will be a very small percentage of the revenues of a commercial operator entity offering human space flight and is not economically significant.

Therefore as the FAA Administrator, I certify that this rule will not have a significant economic impact on a substantial number of small entities.

#### *International Trade Impact Assessment*

The Trade Agreements Act of 1979 (Pub. L. 96–39) 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 will be largely consistent with current or prudent practice, it will 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 rule and determined that it will impose the same costs on domestic and international entities, and thus has a neutral trade impact.

#### *Unfunded Mandates Assessments*

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) 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 with the base year 1995) 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 final rule does not contain such a mandate.

#### *Executive Order 13132, Federalism*

The FAA has analyzed this rule under the principles and criteria of Executive Order 13132, Federalism. We have 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 will 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 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 rule 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, although it is a "significant regulatory action" under Executive Order 12866, 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 Amendment**

■ In consideration of the foregoing, the Federal Aviation Administration will 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 revising the definitions of "Launch Accident" and "Reentry Accident" and 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 or contract 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.

\* \* \* \* \*

*Human space flight incident* means an unplanned event that poses a high risk of causing a serious or fatal injury to a space flight participant or crew.

\* \* \* \* \*

*Launch accident* means

(1) An event that causes a fatality or serious injury (as defined in 49 CFR 830.2) to any person who is not associated with the flight;

(2) An event that causes damage estimated to exceed \$25,000 to property not associated with the flight that is not

located at the launch site or designated recovery area;

(3) An unplanned event occurring during the flight of a launch vehicle resulting in the impact of a launch vehicle, its payload or any component thereof;

(i) For an expendable launch vehicle, outside designated impact limit lines; and

(ii) For a reusable launch vehicle, outside a designated landing site.

(4) For a launch that takes place with a person on board, a fatality or serious injury to a space flight participant or crew member.

\* \* \* \* \*

*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.

\* \* \* \* \*

*Reentry accident* means

(1) Any unplanned event occurring during the reentry of a reentry vehicle resulting in the impact of the reentry vehicle, its payload, or any component thereof, outside a designated reentry site;

(2) An event that causes a fatality or serious injury (as defined in 49 CFR 830.2) to any person who is not associated with the reentry;

(3) An event that causes damage estimated to exceed \$25,000 to property not associated with the reentry and not located within a designated reentry site; and

(4) For a reentry that takes place with a person on board, a fatality or serious injury to a space flight participant or crew member.

\* \* \* \* \*

*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 aboard 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

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

**Authority:** 49 U.S.C. 70101–70121.

### Subpart A—General

■ 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 demonstrate 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 demonstrate 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 demonstrate compliance with §§ 460.5, 460.7, 460.11, 460.13, 460.15, 460.17, 460.51 and 460.53 of this subchapter.

■ 9. Revise part 440 to read as set forth below:

## 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 licensed launch, including suborbital launch, or permitted activities; modifications.

440.12 Duration of coverage for licensed 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 activities.

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.

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. 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 level, 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) With 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 capable of satisfying 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 a launch or reentry vehicle.

*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 that have a probability of occurrence 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 that have a probability of occurrence 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 issued by the FAA.

*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.

#### **§ 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 must obtain and any adjustments 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) 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 paragraphs (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) 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 licensed launch, including suborbital launch, or permitted activities; modifications.**

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

(1) Until completion of licensed launch or permitted activities at a launch or reentry 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 launch or permitted 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 licensed reentry; modifications.**

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

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

(2) For other licensed reentry activities, 30 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 reentry 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 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 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 of 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 launch or permitted activity, and for licensed 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 of this part, for licensed activity, or Appendix C of this part, 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 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 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 Launch, Including Suborbital Launch**

##### **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 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.
- D. Flight safety system.
  1. Identification of any flight safety system 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 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 flight.

B. Identification of accident failure scenarios, probability assessments for each, and estimation of risks to Government personnel, individuals not involved in licensed 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 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 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 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 Safety System.

1. Identification of any 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 reentry, 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 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 re-entry 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 re-entry 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 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 Activities**

*Part 1—Waiver of Claims and Assumption of Responsibility for Licensed Launch, including Suborbital Launch*

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"). This agreement applies to the launch of [Payload] payload on a [Launch Vehicle] vehicle at [Location of Launch Site]. 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), 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 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 sections 440.9(c) and (e), respectively, of the Regulations.

4. Extension of Assumption of Responsibility and Waiver and Release of Claims

(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 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 of 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 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 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 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 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 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 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

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

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”). This agreement applies to the reentry of the [Payload] payload on a [Reentry Vehicle] vehicle.

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 and Release of Claims

(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 of 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 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 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"). This agreement applies to [describe permitted activity].

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 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 and Release of Claims

(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, 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 of 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 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 of 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 [name of 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"). This agreement applies to the Crew Member's participation in activities that the FAA has authorized by license or permit during the Crew Member's employment with [Name of licensee or permittee].

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

### 1. Definitions

*Crew Member* means

(a) The above-named Crew Member,

(b) All the heirs, administrators, executors, assignees, next of kin, and estate of the above-named Crew Member, and

(c) Anyone who attempts to bring a claim on behalf of the Crew Member or for damage or harm arising out of the Bodily Injury, including Death, of the 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 its respective Contractors and Subcontractors, for Bodily Injury, including Death, or Property Damage sustained by Crew Member, 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, including Death, 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, including Death, or Property Damage sustained by Crew Member, resulting from Licensed/Permitted Activities, regardless of fault. The Crew Member shall hold harmless the United States, and the Contractors and Subcontractors of each Party, for Bodily Injury, including Death, or Property Damage sustained by Crew Member, resulting from Licensed/Permitted Activities, regardless of fault.

(b) The United States shall be responsible for Property Damage it sustains, and for Bodily Injury, including Death, 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 and Release of Claims

(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 Crew Member and to agree to be responsible, for any Property Damage the Contractors and Subcontractors sustain and for any Bodily Injury, including Death, 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 the Contractors and Subcontractors may have against Crew Member and to agree to be responsible, for any Property Damage they sustain, resulting from Permitted Activities, regardless of fault.

## 5. Indemnification

Crew Member shall hold harmless and indemnify 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 brought by anyone for Property Damage or Bodily Injury, including Death, sustained by Crew Member, resulting from Licensed/Permitted Activities.

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

Notwithstanding any provision of this Agreement to the contrary, 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, including Death, or Property Damage, sustained by Crew Member, 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.

## 7. 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 herein shall not apply to claims for Bodily Injury, including Death, 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.

I [name of Crew Member] have read and understand this agreement and agree that I am bound by it.

## 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 [name of 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"). This agreement applies to Space Flight Participant's travel on [name of launch or reentry vehicle] of [name of Licensee or Permittee]. In consideration of the mutual releases and promises contained herein, the Parties hereby agree as follows:

## 1. Definitions

*Space Flight Participant* means

(a) The above-named Space Flight Participant,

(b) All the heirs, administrators, executors, assignees, next of kin, and estate of the above-named Space Flight Participant, and

(c) Anyone who attempts to bring a claim on behalf of the Space Flight Participant or for damage or harm arising out of the Bodily Injury, including Death, of the Space Flight Participant.

*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, including Death, or Property Damage sustained by Space Flight Participant,

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

(b) The United States shall be responsible for Property Damage it sustains, and for Bodily Injury, including Death, 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 and Release of Claims

(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, including Death, 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 Space Flight Participant, and to agree to be responsible, for any Property Damage the Contractors and Subcontractors sustain, resulting from Permitted Activities, regardless of fault.

### 5. Indemnification

Space Flight Participant shall hold harmless and indemnify 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 brought by anyone for Property Damage or Bodily Injury, including Death, sustained by Space Flight Participant, resulting from Licensed/Permitted Activities.

### 6. 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, including Death, or Property Damage, sustained by Space Flight Participant, 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.

### 7. 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 herein shall not apply to claims for Bodily Injury, including Death, 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.

I [name of Space Flight Participant] have read and understand this agreement and agree that I am bound by it.

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

### PART 450—[REMOVED]

■ 10. Remove part 450.

■ 11. 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.

#### Subpart A—Launch and reentry with crew

##### § 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 to crew.

##### § 460.5 Crew qualifications and training.

(a) Each crew member must—

(1) 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

(2) 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, which may include high acceleration or deceleration, microgravity, and

vibration, in sufficient condition to safely carry out his or her duties so that the vehicle will not harm the public.

(c) A pilot and a remote operator must—

(1) Possess and carry an FAA pilot certificate with an instrument rating.

(2) Possess aeronautical knowledge, experience, and skills necessary to pilot and control the launch or reentry vehicle that will operate in the National Airspace System (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 that has similar phases of flight to the vehicle ;

(iii) Flight testing; or

(iv) An equivalent method of training approved by the FAA through the license or permit 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.

(d) A remote operator may demonstrate an equivalent level of safety to paragraph (c)(1) of this section through the license or permit process.

(e) Each crew member with a safety-critical role must possess and carry an FAA second-class airman medical certificate issued in accordance with 14 CFR part 67, no more than 12 months prior to the month of launch and reentry.

#### **§ 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

(1) Ensure that any crew-training device used to meet the training requirements realistically represents the vehicle's configuration and mission, or

(2) Inform the crew member being trained of the differences between the two.

(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 and 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 and any reentry 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 or demonstrate through the license or permit process that an alternate means provides an equivalent level of safety—

(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 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 can be readily understood by a space flight participant with no specialized education or training, and must disclose in writing—

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

(2) That there are hazards that are not known; and

(3) 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 and any reentry 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 and reentries.

(d) An operator must describe the safety record of its vehicle to each space flight participant. The operator's safety record must cover launch and reentry accidents and human space flight incidents that occurred during and after vehicle verification performed in accordance with § 460.17, and include—

(1) The number of vehicle flights;

(2) The number of accidents and human space flight incidents as defined by section 401.5; and

(3) Whether any corrective actions were taken to resolve these accidents and human space flight incidents.

(e) An operator must inform a space flight participant that he or she may request additional information regarding any accidents and human space flight incidents reported.

(f) Before flight, an operator must provide each space flight participant an opportunity to ask questions orally to acquire a better understanding of the hazards and risks of the mission, and each space flight participant must then provide consent in writing to participate in a launch or reentry. The 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; and

(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 of this chapter.

#### **§ 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.

Issued in Washington DC on December 1, 2006.

**Marion C. Blakey,**  
*Administrator.*

[FR Doc. E6-21193 Filed 12-14-06; 8:45 am]

**BILLING CODE 4910-13-P**