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Part II

Department of Transportation

Federal Aviation Administration

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14 CFR Parts 400, 401, 404, et al.

Commercial Space Transportation Reusable Launch Vehicle and Reentry Licensing Regulations; Final Rule

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 400, 401, 404, 405, 406, 413, 415, 431, 433, and 435

[Docket No. FAA-1999-5535; Amdt. Nos. 400-1, 401-1, 404-1, 405-1, 406-1, 413-1, 415-1, 431-1, 433-1 and 435-1]
RIN 2120-AG71

Commercial Space Transportation Reusable Launch Vehicle and Reentry Licensing Regulations

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: The FAA amends the commercial space transportation licensing regulations by establishing operational requirements for launches of reusable launch vehicles (RLVs) and the authorized conduct of commercial space reentry activities. The final rules implement the FAA's reentry licensing authority by prescribing requirements for obtaining a license to launch and reenter an RLV, to reenter a reentry vehicle, and to operate a reentry site. Issuance of licensing rules is necessary to respond to advancements in the development of commercial RLV and reentry capability. The final rules fulfill the FAA's safety mandate by limiting risk to the public from RLV and reentry operations.

DATES: Effective November 20, 2000.

FOR FURTHER INFORMATION CONTACT: Mr. Stewart W. Jackson, AST-100, Space Systems Development Division, Office of the Associate Administrator for Commercial Space Transportation, Federal Aviation Administration, U.S. Department of Transportation, 800 Independence Avenue SW., Washington, DC 20591, (202) 267-7903; or Ms. Esta M. Rosenberg, Attorney-Advisor, Regulations Division, Office of the Chief Counsel, Federal Aviation Administration, U.S. Department of Transportation, (202) 366-9320.

SUPPLEMENTARY INFORMATION:

Availability of Final Rules

You can get an electronic copy using the Internet by taking the following steps:

(1) Go to the search function of the Department of Transportation's electronic Docket Management System (DMS) Web page (http://frwebgate.access.gpo.gov/cgi-bin/leaving.cgi?from=leavingFR.html&log=linklog&to=http://dms.dot.gov/search).

(2) On the search page type in the last four digits of the Docket number shown at the beginning of this final rule. Click on ``search.''

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You can also get an electronic copy using the Internet through FAA's web page at http://frwebgate.access.gpo.gov/cgi-bin/leaving.cgi?from=leavingFR.html&log=linklog&to=http://www.faa.gov/avr/arm/nprm/nprm.htm or the Federal Register's web page at http://www.access.gpo.gov/su_docs/aces/aces140.html.

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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 final rule.

Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. Therefore, any small entity that has a question regarding this document may contact their local FAA official, or the person listed under FOR FURTHER INFORMATION CONTACT. You can find out more about SBREFA on the Internet at our site, http://frwebgate.access.gpo.gov/cgi-bin/leaving.cgi?from=leavingFR.html&log=linklog&to=http://www.gov/avr/arm/sbrefa.htm. For more information on SBREFA, e-mail us 9-AWA-SBREFA@faa.gov.

Background

General

The Commercial Space Act of 1998 (CSA), Public Law 105-303, extends the Secretary of Transportation's licensing authority under 49 U.S.C. Subtitle IX, chapter 701 (known as the Commercial Space Launch Act or CSLA) to reentry vehicle operators and operation of reentry sites by non-Federal entities. In addition to launch of a launch vehicle and the operation of a non-Federal launch site, the Secretary licenses reentry of a reentry vehicle and the operation of a reentry site when those activities are conducted within the United States or by U.S. citizens abroad. The Secretary's licensing authority has been delegated to the Administrator of the Federal Aviation Administration (FAA) and further assigned to the Associate Administrator for Commercial Space Transportation (AST). AST carries out the Secretary's regulatory responsibilities and safety mandate under the CSLA to ensure that public health and safety and the safety of property are not jeopardized by licensed operations. AST exercises its licensing authority consistent with national security and foreign policy interests, as well as treaty obligations, of the United States.

Reentry vehicles, as defined by the recently amended CSLA, include reusable launch vehicles, or RLVs, that are designed to return from Earth orbit or outer space to Earth, substantially intact. Not all reentry vehicles are RLVs, although all of the reentry concepts currently identified to the FAA by prospective operators involve RLVs. RLV development by U.S. commercial space launch providers responds to increasing demand for lower cost and reliable access to space. Reduced cost of space access will facilitate greater commercial use of the space environment along with research and exploration that would otherwise remain unaffordable. Benefits from medical and microgravity research would be realized at potentially greater rates, and commercial services such as telecommunications and data relay would become increasingly available to the world market at lower cost. New markets in consumer services, including same day international package delivery as well as space tourism, could quickly develop with reliable reusable space vehicles.

In the mid 1990's, prospective RLV operators identified absence of adequate regulatory oversight over RLV operations, particularly their reentry, as an impediment to technology development. The need for a stable and predictable regulatory environment in which reusable launch vehicles could operate was considered critical to the ultimate ability of the emerging RLV industry to obtain the capital investment necessary for research and development and ultimately vehicle operations. Limitations on the Secretary's licensing authority and ability to adequately regulate reentry activities was identified by the House of Representatives Subcommittee on Space as early as 1992, accompanied by continuing commitment of each successive Congress to enactment of authorizing legislation addressing reentry operations. The 1998 Commercial Space Act (CSA), signed into law on October 28, 1998, provides a crucial first step in removing regulatory obstacles to RLV development. This final rule provides yet another step by establishing the framework and basis for licensing the next generation of reusable launch vehicles, as well as other types of reentry vehicles.

Another factor critical to commercial RLV development is the commitment expressed by the U.S. Government in

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the CSA to share in the risks of RLV and reentry technology and to extend to operators of those vehicles the financial responsibility and risk sharing regime that has proven crucial to commercial operators of expendable launch vehicles (ELVs) in achieving a dominant share of the U.S. launch market and increasing international competitiveness. Since 1988, ELV launch providers and the U.S. Government have mutually enjoyed the substantial benefits of statutory risk allocation requirements. Through enactment of the CSA, a comparable regime would extend to RLV operators who are expected to enjoy benefits comparable to those currently enjoyed by ELV launch services providers. The Reentry Financial Responsibility final rules implement the FAA's regulatory program for assuring financial responsibility and risk allocation for licensed reentry operations, including those performed by RLVs, and remove yet another potential hindrance to RLV developers. Taken together, the comprehensive RLV and Reentry Licensing Regulations and Reentry Financial Responsibility final rules provide a stable, yet flexible, regulatory environment in which commercial RLV and reentry technology may reside. The FAA remains committed to designing air and space regulations to accommodate all of its customers, including the regulated space transportation industry, traveling public, persons on the ground, and users of air and space resources.

In furtherance of its commitment, the FAA has been working towards development of an integrated concept of operations involving the National Airspace System, or NAS, that contemplates shared use of airspace by aircraft and commercial space vehicles. In addition, the FAA has formed an integrated product team to examine issues of common heritage and concern to various FAA business sectors. Working with industry partners, the FAA plans to further evolve its regulatory approach to RLVs by defining operations and maintenance plans that assure safe, continued use of reusable space vehicles and by identifying human factors that will affect crew and passenger-bearing RLVs. Addressing those aspects of RLV operations and space flight are beyond the scope of this rulemaking. A working group of the FAA's

Commercial Space Transportation Advisory Committee (COMSTAC) dedicated to RLV operational issues provides advice, information and recommendations at the request of the FAA Administrator and AST for use in support of further development of the agency's regulatory and standards development program for RLV operations.

Following enactment of the CSA, the FAA initiated this rulemaking to define and implement the licensing process, inclusive of safety standards, that would apply to authorized RLV missions (launch and reentry) and other reentry operations. For an RLV, both its launch and reentry require licensing under the amended CSLA and although the FAA has had a regulatory program in place for years governing launch licensing, the FAA determined that licensing regulations developed to address existing ELV commercial launch capability were not adequate to address the unique safety issues posed by launch vehicles that are reusable. ELVs rely upon destructive flight termination systems (FTS) that assure flight safety by destroying a vehicle traveling beyond approved limits. Timely activation of an FTS assures that vehicle debris will impact within a designated and unpopulated area so as to avoid all injury to the public. Unlike an ELV, an RLV may rely upon non-destructive means of ending vehicle flight, such as returning to the launch site or use of an alternative landing site, in the event of a vehicle malfunction or anomalous circumstance affecting the ability to conclude a mission as planned. Non-destructive means of terminating flight contemplate the ability to correct a problem and, if possible, reuse the vehicle in future flight. Although a number of factors influencing public safety are common to both ELV and RLV launches, the FAA determined it preferable to commence rulemaking dedicated to RLVs. Accordingly, on April 21, 1999, the FAA issued a notice of proposed rulemaking (NPRM) (64 FR 19626) proposing licensing requirements for the conduct of RLV missions as well as reentry of reentry vehicles that are not RLVs. In addition, on the same day, the FAA issued final launch licensing rules addressing, for the most part, launches of ELVs from Federal launch ranges (64 FR 19586, April 21, 1999).

Notice and comment rulemaking can take months, and sometimes years, to complete because of the need to consider carefully public input on an agency proposal before issuance of final rules. To accommodate those RLV developers requiring regulatory guidance before rulemaking would be completed, the FAA engaged the space transportation industry and the interested public in the development of draft interim safety guidance for RLV operators. In the absence of final rules, interim guidance would serve to inform the emerging RLV industry of safety issues identified by the FAA that would require resolution by an applicant before a license would be granted. The FAA would work closely with each applicant in constructing an application that would ensure safety issues presented by an RLV mission proposal were adequately addressed. Interim guidance has been utilized effectively and efficiently by prospective launch site operators in the absence of detailed licensing requirements.

As noted in the supplementary information portion of the NPRM, the FAA convened a meeting with industry representatives in May 1998, with participation by each RLV developer and prospective operator then known to the FAA. A spokesperson from each entity was invited to provide feedback to the FAA on the draft guidance and its effects on mission design for the purpose of refining mutual understanding of safety considerations presented by RLVs. As a result of this effort, the FAA

released revised draft interim safety guidance and convened a public meeting in February 1999, to solicit oral and written comments from all interested persons on the revised guidance material. Written comments and a transcript of the meeting are available for public review in the FAA Docket Office under Docket No. 29140.

The NPRM issued on April 21, 1999 (64 FR 19626), differs in some respects from the revised draft interim safety guidance. Where safety criteria included in the draft interim safety guidance differ materially from that proposed in the NPRM, the FAA utilized comments on the draft guidance document as one means of assessing alternative approaches to achieving RLV mission safety.

In May 1999, the COMSTAC adopted a consensus-based report of the RLV working group addressing the draft interim safety guidance for RLV operators. The COMSTAC report was likewise considered by the FAA in developing the regulatory framework applicable to RLVs and is contained in the public docket under docket number 29140. It may also be obtained by accessing AST's web site, located at http://frwebgate.access.gpo.gov/cgi-bin/leaving.cgi?from=leavingFR.html&log=linklog&to=http://ast.faa.gov.

NPRM Overview: Three-Pronged Public Safety Strategy for RLV and Other Reentry Missions

The public accepts a certain amount of risk when utilizing or being exposed to various modes of transportation. For example, the traveling public accepts certain risks from air travel or when driving a car. The public is also exposed to transportation risk resulting from

aircraft flying overhead or when crossing the street. Safety regulations are intended to assure that public risk is maintained at an acceptable level. For purposes of this rulemaking, the FAA is concerned with risk posed to the public on the ground or in airspace, as well as to property on the ground or on orbit, as a result of space launch and reentry events. Passenger and crew safety standards are beyond the scope of this rulemaking.

In the NPRM, the FAA proposed a three-pronged approach, outlined below, to assure that public health and safety and the safety of property would not be jeopardized by the conduct of an RLV mission, defined to include ascent and descent flight of an RLV that has been authorized under an FAA license. Safety standards proposed by the FAA were intended to ensure that RLVs would not pose greater risk to public safety in accomplishing a flight mission than would be posed by more conventional ELV technology. Consistent application of the FAA's three-pronged approach to RLVs would mean that all RLVs would be treated similarly in terms of allowable risk to the public, with no distinction between vehicles that achieve and reenter from Earth orbit or outer space and those intended to operate suborbitally inasmuch as they never enter a closed path or complete an orbit in a closed path. Accordingly, it has not been necessary to define or delimit outer space. Consistent application to RLVs of FAA safety requirements would also ensure that launch concepts involving multi-stage vehicles, comprised of wholly or partially reusable stages, would not expose the public to greater risk than that defined as acceptable by the FAA in other commercial space transportation regulations.

The three safety-related elements reflected in the FAA's safety strategy for RLV mission and reentry vehicle licensing are: establishing limitations on the measure of acceptable public risk, use of a system safety process to identify hazards and mitigate risk and imposition of operational restrictions. These three elements are interrelated and together ensure that risks are sufficiently contained at an acceptable level. Just as system redundancy compensates for failure or flawed design or performance, interrelated safety elements assure that actual hazards from vehicle operation, whether anticipated in analytical assessments or unforeseen, will not increase risk to the public beyond an acceptable level. The following chart appeared in the NPRM to illustrate the interrelationship of the three elements of the agency's public safety strategy and is repeated in this rulemaking to reflect the FAA's final rule approach to RLV mission and reentry safety.

[GRAPHIC] [TIFF OMITTED] TR19SE00.000

1. Calculation of Ec (Acceptable Public Risk)

The FAA proposed a collective risk measure, known as expected number of casualties or Ec, commonly used within the aerospace community. A collective risk calculation yields the consequences, measured in terms of human casualties, of the probability or frequency of occurrence of all events multiplied by the severity of impacts on public safety. Ec is a statistical estimation of risk used in the absence of empirical performance data.\1\ Because launches are still relatively infrequent events, this probabilistic assessment is used to measure acceptable risk.

\1\ To the extent it is available, empirical data on safety systems, materials and components may be used as an input in determining Ec.

Federal ranges employ an Ec standard of 0.00003 casualties per ELV launch or Ec 30 x 10^{-6}. Through application of this requirement as well as other range safety requirements and practices, Federal ranges have enjoyed 40 years of ELV launch experience with no public casualty. Under 14 CFR 415.91, the FAA would issue a safety approval for a launch from a non-Federal launch site if equivalent safety is demonstrated.

The FAA proposed to apply to RLV missions and other missions involving reentry of a reentry vehicle the same risk threshold as that used by Federal launch ranges in approving ELV launches and endorsed by the National Academy of Sciences Study on Federal Ranges: Ec 30 x 10^{-6}. The FAA proposed to adopt a single Ec risk threshold applicable to all portions of licensed RLV flight for a particular mission. For other licensed reentries, the FAA proposed to assess reentry risk of a reentry vehicle in combination with its associated launch risk, that is, the launch that placed the reentry vehicle in space. As described in the NPRM, the FAA had also considered whether to apply Ec risk thresholds separately to each licensed flight phase of an RLV mission such that there would be an Ec allowance for launch or ascent flight

and another Ec allowance for reentry or descent flight. The FAA determined that doing so would (or could depending upon the risk thresholds selected) expose the public to greater risk per mission without sufficient justification for doing so. In the FAA's view, neither the commercial objective of placing a payload in space nor scientific and technological goals of other commercial RLV ventures would justify increased jeopardy to the public as a general rule. Accordingly, the FAA proposed to apply the ELV launch risk threshold of Ec 30 x 10^{-6} to RLVs on a per mission basis, and would allow an applicant for an RLV mission license to apportion or allocate flight risk among flight phases without regulatory direction from the FAA. An advisory circular, AC No. 431.35-1, provides guidance on an acceptable means of calculating the Ec that would result from debris dispersion upon explosion or other vehicle break-up and is available from the FAA.

2. System Safety Process and Risk Analysis

A system safety process relies upon methods and techniques for identifying: (i) Hazards that result from vehicle operation, (ii) effects on or consequences to public safety as a result of identified hazards, (iii) means of controlling or mitigating effects on or consequences to public safety, and (iv) means of verifying the effectiveness of risk mitigation measures. A system safety process and calculation of expected casualties are interrelated because the former is used to determine potential failure events, the probabilities of failures, and to estimate consequences of those failures, all of which affect the expected casualty rate.

The system safety process is used to define the operating envelope that ensures a proposed mission will remain within the acceptable risk threshold and also to define operating rules and constraints for remaining within that envelope. The FAA maintains guidance material describing an acceptable system safety process; however, an applicant may employ another process as long as it accomplishes the intended purpose. Examples of acceptable failure identification techniques are identified in the NPRM and include: Preliminary Hazards Analysis, Failure Mode and Effect Analysis, and Fault Tree Analysis Methodology for Hazard Assessment.

3. Operational Restrictions

Commercially operated RLVs will pose technological challenges and unique safety issues to the government and industry. Other than the partially reusable Space Transportation System (STS), of which the Shuttle is the best known and reusable part, there is no vehicle known to the FAA currently capable of entering Earth orbit and returning, substantially intact, to Earth. Once commercial RLVs are fully designed and ``metal is bent,'' operational concepts may undergo significant ground testing and some may undergo incremental and experimental flight testing in controlled airspace and possibly the upper atmosphere. However, absent any real world launch and reentry experience with the emerging generation of reusable launch vehicles, and until sufficient

experience is gained, system data recorded and performance verified, the analytical processes that comprise system safety and that generate the calculation of Ec do not provide a sufficient basis to conclude that public risk is sufficiently contained and mitigated. Given uncertainties of performance, the FAA proposed to impose operating restrictions on RLV flight and other reentry missions pending proof of reliability and system performance, either through operational use or conduct of a flight test program.

Operating restrictions are intended to limit the consequences of a failure where vehicle reliability cannot be ascertained with a sufficient level of confidence. Risk is a function of the probability of a failure and the magnitude of its consequences. Where the probability of a failure cannot be accurately determined but merely assumed using engineering judgment and analytical techniques, risk is appropriately managed by limiting consequences. Hazard analysis and other quantitative risk analyses are extremely important to vehicle design and operating concepts; however, absent real time flight performance data the FAA cannot rely exclusively on analytical constructs when public safety is at stake. Moreover, thousands of hours of flight data may be required to prove system reliability, particularly when the effects of the space environment and launch stress on continued use through re-flight of a reusable vehicle are not yet fully identified and understood. In this regard, the FAA notes that industry representatives have acknowledged that the STS is still undergoing a flight test program. Accordingly, the FAA proposed in the NPRM to impose operational restrictions based on probable system failures and to require adherence to those restrictions for all RLVs. Some additional restrictions would apply to vehicles that remain unproven, at least until such time as sufficient vehicle performance data is obtained to justify relief from restrictions.

The NPRM highlighted four categories of operational restrictions applicable to RLV flight and reentry of a reentry vehicle other than an RLV, as follows: (i) Restricting flight over populated areas; (ii) requirements for monitoring critical systems; (iii) positive enabling of fail-safe reentry; and (iv) use of a sufficiently large reentry site as to contain the vehicle upon landing. Each of these restrictions is discussed in greater detail below.

Proposed Scope of RLV Mission and Reentry Licensing

Although the FAA proposed to incorporate both launch and reentry authorizations in a single license that would authorize an RLV mission, it remains necessary to differentiate between activities that are licensed by the FAA and those that are not covered by FAA licensing authority. Delimiting the extent of licensed activity is particularly important because activities that are not licensed by the FAA would not be covered by the statutory financial responsibility and risk allocation regime and liability risks resulting from those activities must be managed privately as a matter of business judgment rather than Federal regulation.

Definitions of the terms ``launch'' and ``reentry'' are proposed and discussed in the RLV and Reentry Licensing Regulations NPRM; however, as signaled in the NPRM, the notice of proposed rulemaking, 64 FR 54448-54472, issued October 6, 1999, concerning reentry financial responsibility addresses in greater detail the scope of launch and

reentry authorizations that would be contained in an RLV mission license because of the direct relationship between the scope of licensed RLV activity and applicability of risk sharing devices, including indemnification, under the CSLA. Accordingly, although some comments submitted to the NPRM docket addressed the appropriate scope of launch and reentry licensing, more extensive discussion and analysis of this issue appears in comments submitted in response to the Reentry Financial Responsibility NPRM. Final rules governing reentry financial responsibility are likewise accompanied by more extensive analysis and discussion by the FAA of the appropriate extent of FAA licensing authority over RLV missions and the interested public is referred to the rulemaking governing financial responsibility for licensed reentry

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activities for a more comprehensive treatment of the issue.

The NPRM described the need to define the extent of FAA launch licensing authority over launch of an RLV differently from that used to define launch of an ELV. Launch licenses for ELV launches authorize activities beginning upon arrival of a launch vehicle (or a major component) at a U.S. launch site and ending, for purposes of ground operations, once the launch vehicle leaves the ground. In terms of flight activity, launch ends at the point after payload separation when the last action of control over the launch vehicle is exercised by the licensee. For liquid fueled vehicle stages, the last action of control is typically exercised when the vehicle's upper stage is rendered inert or safe from explosive risk. For a solid rocket motor, that point may occur when upper stage fuel is exhausted or the stage is otherwise rendered inert.

The FAA proposed no change with respect to commencement of licensed launch of an RLV from that of an ELV because pre-flight hazards expose the public to risk and must be regulated regardless of the one-time use or reusable nature of the vehicle. However, the FAA pointed out that defining the end of a licensed launch based upon the last act of control over the vehicle would not be appropriate for an RLV because doing so would suggest that launch continues through vehicle reentry and landing. This is an illogical result, in the FAA's view, in light of congressional direction that reentry of an RLV is subject to, and in fact requires, reentry licensing by the agency. Instead, the FAA proposed to use payload deployment as the point at which launch concludes for those RLVs having that as their mission. At the time the NPRM was issued, the FAA considered that in defining the end of launch in this manner it was addressing the vast majority of RLV concepts and launch missions under consideration. Market projections in support of RLV development focused on deployment and replenishment of satellite constellations, chiefly in low Earth orbit. Although this distinction was discussed in the Supplementary Information portion of the NPRM, the proposed definition of the term ``launch'' that appears in the regulatory text failed, due to an oversight, to include this regulatory distinction between ELV and RLV launches.

Reentry licensing, as proposed in the NPRM, would commence upon initiation of operations necessary to assure reentry readiness and safety, that are uniquely associated with reentry and that are critical to ensuring public health and safety and the safety of property during reentry. The NPRM addressed the absence of licensing authority over on

orbit operation of an RLV but noted that most of the RLV concepts briefed by developers to the FAA would deploy a payload and spend minimal time on orbit in order to minimize risk to the vehicle and to take advantage of rapid turnaround for the next mission. Therefore, for most RLVs under development or contemplation, there would be minimal, or no, on-orbit activity not subject to FAA licensing.

Under the proposed mission approach to RLV licensing, only vehicle flight would be evaluated against the mission risk criterion of Ec 30 x 10-\6\. Licensed ground operations preceding ascent flight and following reentry landing would not be factored into the Ec analysis. Unlicensed on-orbit operations also would not enter into the equation.

The FAA proposed an application process and structure similar to that traditionally applied to requests for ELV launch licenses, and the section-by-section analysis of the proposed regulatory text explains the purpose and content of each of the reviews performed by the FAA before a license may be issued. Policy and safety reviews and approvals are necessary elements of RLV mission licensing, as well as the satisfactory completion of any required payload review. A payload review may be required for launch and also for reentry of a payload. An environmental review of the impacts associated with proposed operation of an RLV, including activities to be performed at a planned reentry site, is also an element of RLV mission licensing and requirements for conducting the review are described in the NPRM. Where the reentry vehicle is not an RLV, the same kinds of reviews would be required to support a reentry licensing determination; however, the information required of the applicant would be limited to that pertaining to the reentry or descent flight. Rather than reiterating all of the application requirements applicable to reentry flight, the NPRM proposed a new part limited to reentry of a reentry vehicle that is not an RLV. That part refers an applicant for reentry licensing to reentry-related elements of RLV mission licensing requirements and contains additional regulatory requirements that are unique to reentry vehicles other than RLVs.

Public Response to Three-Pronged Public Safety Strategy for RLV and Reentry Safety

Twenty entities submitted comments to the docket during the 90-day comment period provided by the FAA. Comments were submitted chiefly by developers of RLVs and entities involved in technology development intended for use in reentry concepts. In general, the comments commended the FAA for swift issuance of a clear, yet flexible, regulatory framework in response to a statutory mandate and the growing need for a predictable licensing regime for RLVs.

A number of observations or general themes can be discerned from the comments. Among them is the sense of some RLV developers that the FAA adheres too closely to ELV-based regulations in its proposed approach to mission safety and that aircraft regulation, including the FAA's certification authority, provides a better model for RLVs. This view was espoused by developers of passenger-bearing concepts, in particular. Some suggest commencing FAA licensing of flight test operations under an experimental certification, use of a transport category certification having design criteria and flight test standards for passenger and cargo bearing vehicles, and the equivalent of

flightworthiness certification once design reliability has been established. Several comments pointed out the need to begin addressing, through regulations, safety criteria for RLVs that will transport passengers in addition to a payload or cargo and the need for operations and maintenance (O&M) standards that will facilitate re-flight approval. The FAA has already begun examining human factors in space, as previously noted, and is engaged with the RLV working group of the COMSTAC on O&M considerations that may facilitate future rulemaking on these important matters.

Where an RLV incorporates aircraft technology, some comments recommend use of existing Federal Aviation Regulations codified at 14 CFR parts 1-198, either exclusively during subsonic or low supersonic flight, or in combination with FAA licensing under the CSLA. Although the FAA does not intend to impose certification requirements on RLVs for a number of reasons, the agency agrees that aircraft certification may play a role in approving certain vehicle systems for launch. For example, although it is an ELV, the Pegasus launch system which is subject to 14 CFR 1-198 certification requirements contained in the Federal Aviation Regulations referenced above governing operation of the L-1011 aircraft, and FAA licensing of flight operations commencing upon take-off of the L-1011, in accordance with the Commercial Space Transportation

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Regulations, 14 CFR Ch. III, illustrates how the two regulatory programs may be combined to assure public safety.

Certification suggests design approval based on compliance with standards developed after years of flight history and experience. Given that RLVs are still in conceptual and developmental stages, the FAA considers it premature to impose standards other than those necessary to protect the safety of persons and property on the ground, in airspace or on orbit. With additional knowledge of RLV technology, the FAA may utilize newly granted authority to issue safety approvals for vehicles or safety systems in order to gain the economic benefits and efficiencies of standardizing approvals. A safety approval would signify that a vehicle, when operated within a defined envelope, may be operated in a manner that does not expose the public to unreasonable risk. However, unique characteristics of a mission, such as the proposed launch site, reentry site and trajectories for each flight phase, would have to be examined for impacts on public safety resulting from vehicle flight. The FAA anticipates that several years of experience in licensing RLV missions would be required before it is prepared to issue proposed safety approval standards.

Kistler Aerospace Corporation (Kistler) commented that licensing requirements proposed in the NPRM may be used as a regulatory framework from which the FAA and the applicant would, in essence, negotiate a licensing plan consisting of requirements tailored to the applicant's proposed operations. Documentation, analyses, methodologies and tests, along with a schedule, would be agreed upon by the applicant and the agency, leaving the applicant free to propose an assessment methodology and criteria. This licensing arrangement was identified in the COMSTAC Report on RLVs. Although the FAA does not embrace the notion of binding license negotiation, per se, the agency intends to engage in pre-application consultation with license applicants to accomplish a number

of the objectives outlined in Kistler's proposal. For example, elements of a license application would be identified during pre-application consultation to address the unique aspects of a proposed RLV or reentry mission.

The FAA agrees in principle with Space Access's comments suggesting use of an incremental licensing approval plan whereby the FAA would approve or provide formal feedback to an applicant on its submissions. Pre-application consultation is designed to accomplish the objectives outlined in Space Access's comments. It also provides an applicant early indication as to whether a proposed mission is eligible for licensing or poses unreasonable risk that may never be sufficiently mitigated as to warrant safety approval. As detailed more extensively in the section-by-section analysis, a number of different approvals comprise a licensing determination by the FAA, and these may be requested by an applicant in any order. In this manner, an applicant may obtain early indication from the FAA as to whether obstacles to a favorable licensing determination exist because of national security or foreign policy interests of the U.S. Government, safety concerns, or environmental considerations.

In addition, the licensing approach outlined in the NPRM and codified in this final rule would allow an applicant to utilize a methodology of the applicant's choosing as long as it satisfies the performance goals stated in the rule. For example, an acceptable system safety process is one that identifies and assesses the probability and consequences of reasonably foreseeable hazardous events and safety-critical system failures during a mission. The FAA has issued an advisory circular illustrating an acceptable system safety process in addition to an advisory circular on expected casualty calculation. Advisory circulars are available from the FAA and, where applicable to activities licensed under the CSLA, may be obtained by accessing the AST web site at http://frwebgate.access.gpo.gov/cgi-bin/leaving.cgi?from=leavingFR.html&log=linklog&to=http://ast.faa.gov. An applicant could follow the advisory circular guidance or propose another equivalent methodology. One comment applauded the use of advisory circulars in RLV mission licensing and the flexibility it affords an applicant. Another suggested that the FAA continue to refine them.

Taken together, these elements of the FAA's licensing program afford an applicant great flexibility in seeking a license and optimize opportunities for fashioning an acceptable application.

One comment not incorporated by the FAA in this final rule would require the FAA to license an RLV mission unless the FAA could document reasons to believe the reentry would be unsafe. Shifting the burden in this manner would reduce costs and paperwork burdens for an applicant, as the comment points out. Nevertheless, the FAA maintains that the burden of demonstrating safe operating capability remains on the applicant and makes no change in its licensing procedure on the basis of the comment.

The aircraft analogy previously discussed regarding the L-1011 aircraft used as part of the Pegasus launch system informs comments objecting to FAA's proposed flight phase approach to licensing an RLV mission whereby the FAA would assess ascent and descent flight risk without regulation of on-orbit activity. Vela Technology Development, Inc. (Vela) plans a passenger-bearing vehicle and objected to the FAA's proposed licensing approach. Vela stated that licensing launch and reentry is akin to licensing take-off and landing of an aircraft

without regard to en route flight operations. According to Vela, this philosophy is an inappropriate hold-over from ELV-based regulations and that only entry into and operations within controlled airspace require FAA licensing.

Unlike the statutory authority over aircraft granted to the FAA, the CSLA limits FAA licensing jurisdiction to the launch of a launch vehicle and reentry of a reentry vehicle. For this reason, the FAA is unable to abandon the flight phase approach to calculating and regulating mission risk. The FAA's flight phase approach to assessing mission risk is explained in greater detail below. Also summarized in this supplementary information under the heading, ``Scope of RLV Mission and Reentry Licensing Under the Final Rule,'' is the legal basis upon which the FAA has determined that it does not license all RLV operations, wherever conducted.

Vela further commented that only an unpredictable or uncontrolled reentry poses a risk to public safety requiring safety regulation and yet Vela understands that ELV ``reentry'' is not subject to FAA licensing. The FAA agrees with Vela's comments that suggest an uncontrolled reentry poses certain risk to public safety; however, unless an object has been designed to survive reentry in substantially intact condition, risks to public safety should be non-significant if not negligible and its reentry need not be regulated.\2\ For this reason, the FAA's licensing jurisdiction is limited to reentry of a reentry vehicle. ``Reentry,'' as defined by the CSLA, means to return or attempt to return, purposefully, a reentry vehicle and its payload, if any, from Earth orbit

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or from outer space to Earth. 49 U.S.C. 70102(12). A ``reentry vehicle'' means a vehicle designed to return from Earth orbit or outer space to Earth, or an RLV likewise designed to return, substantially intact. 49 U.S.C. 70102(13). In other words, when survivability by design is combined with the purposeful act of reentry, risks to public safety rise to a sufficient level as to warrant regulatory oversight. Most debris is expected to burn up due to heating caused by movement through the atmosphere during descent; however, on occasion, pieces of debris such as the Delta II second stage may survive in deteriorated condition and land on Earth. Although the return to Earth of vehicle debris is not a licensable event under the CSLA, the FAA does consider vehicle staging impacts as part of the mission review for a launch license and their associated risks in assessing financial responsibility requirements when licensing a launch involving vehicle stages that may impact populated areas during a nominal launch or in the event of catastrophic failure and vehicle break-up.

\2\ As noted in the NPRM, risk to public safety from a reentry that is essentially random or otherwise non-nominal would be assessed as part of the licensing process and an applicant would have to demonstrte that reentry will not exceed aceptable risk criteria for the mission. Assessing the risk of non-nominal reentry using mission risk criteria avoids the need for a regulatory requirement that an operator incapacitate its vehicle in the event of an abort to orbit situation. (See 46 FR 19639).

The Experimental Rocket Propulsion Society (ERPS) commented that licensing should be based on vehicle design, not operator intent, so that a vehicle designed to reenter substantially intact would require reentry licensing by the FAA whether or not its operator intended it to reenter. Doing so would avoid potential abuse by vehicle operators, according to ERPS. Presumably, this abuse would be failure to obtain a reentry license claiming lack of intent to reenter. For reasons related to concerns cited by ERPS, the FAA noted in the notice of proposed rulemaking governing financial responsibility requirements for licensed reentry activities that the term ``purposefully'' in the statutory definition of ``reentry'' would not necessarily exclude a premature reentry or suborbital activities from reentry licensing coverage merely because reentry occurs through physical forces or ballistically. Designed-in capability and intent to reenter would subject an operator to reentry licensing as long as other statutory thresholds triggering FAA licensing authority are met. (See ``Financial Responsibility Requirements for Licensed Reentry Activities;'' October 6, 1999, 64 FR 54448-54472, at p. 54454, n.8.)

1. Comments on Mission Risk and Ec Calculation

The NPRM proposed a single, per mission risk criterion of Ec $= 30 \times 10^{-6}$ for an RLV mission. The combined risk of RLV flight covered by a license for a single mission, both ascent and descent, would have to satisfy this criterion in order for the FAA to issue a favorable safety approval, a necessary ingredient for an RLV mission license. A general explanation of how casualty expectation is formulated is provided in the NPRM at 64 FR 19634, and an FAA Advisory Circular, AC No. 431.35-1, offers guidance on an acceptable methodology for calculating the expected number of casualties. Although the methodology addresses debris dispersion and its contribution to expected casualty estimation, the NPRM notes that the casualty area of a vehicle used in calculating Ec must also account for casualties related to secondary explosions, hazardous material exposure such as toxic substances, and lateral debris movement following impact.

Under the final rule, acceptable per mission risk for an RLV launch and reentry may not exceed 30 in a million missions or .00003 casualties per mission. The FAA adopts the Federal range standard applied to ELV launches on a per launch basis to ensure risk to the public is maintained at an acceptable level and not increased by virtue of a vehicle's return flight capability. Although licensed activity includes pre-flight ground operations and reentry-readiness operations conducted in space before vehicle descent, only ascent and descent flight during which an instantaneous impact point, or instantaneous impact point (IIP) debris footprint, exists on Earth is considered in calculating expected casualty.\3\ Pre-flight hazards and operations conducted on orbit, whether or not subject to FAA licensing, would not contribute to the expected casualty calculation.

\3\ Existence of an IIP creates risk to public safety inasmuch as it reflects the projected impact point on the surface of the

Earth where the vehicle or vehicle debris would land in the event the vehicle fails or breaks up. Generally, the IIP is located ahead of the vehicle because momentum and atmospheric forces cause the vehicle to impact in a downrange location rather than directly underneath the vehicle at the moment of failure or break-up.

Several comments endorsed use of expected casualty in assessing mission risk and the FAA's determination not to allocate, or define, the total risk ``budget,'' applicable to each flight phase. United Space Alliance (USA) disagreed with imposition of a single risk criterion on all RLV mission flights particularly when launch and reentry events are separated by an extended length of time. TGV Rockets, Inc. (TGV) argued that use of the single Ec criterion of .00003 for an RLV mission is too stringent and urged application of an Ec limit of .00003 for launch and another Ec limit of .00003 for reentry.

Kistler opposed use of a casualty expectation criterion stating that it is unjustifiable, too subjective, and would stifle innovation. Instead, Kistler urged the FAA to utilize a more system-oriented approach to RLV licensing focused more upon hardware and engineering. That said, Kistler suggested that a combined risk assessment criterion may be justified for a suborbital RLV because, once created, the instantaneous impact point (IIP) of the vehicle exists continuously, whereas for reentry from orbit, an IIP exists during launch, ceases upon achieving orbit, and is recreated during reentry flight. In support of its position, Kistler notes that attaining orbit suggests that launch resulted in zero risk exposure to the public. Hence, combining launch and reentry risk is a mathematical abstract with no bearing on public safety, according to Kistler. Lang Engineering, Regulatory and Program Support (Lang) stated that casualty expectation should be used as a guiding principle for now but that the FAA should explore use of accepted practices and empirical data that can be used to support a safety demonstration as the regulatory program for RLVs evolves.

The FAA disagrees with Kistler and has determined to retain use of casualty expectation, determined in advance of the conduct of a mission, as a means of limiting RLV mission risk to public safety to an acceptable level. The level of acceptable risk, defined as not exceeding 30 casualties in a million missions or .00003 casualties per mission, has been successful in preserving public safety as evidenced by Federal range history. The final rules do not allocate a risk quota for RLV flight phases but allows an applicant maximum flexibility to design an RLV and operational plan that satisfies the single risk criterion for mission flight. Limiting mission risk, in combination with other elements of the FAA's safety strategy, will foster confidence in RLV operations among the general public as well as ensure that licensing determinations are made in a manner that is consistent with the paramount public safety concerns of the agency.

2. Comments on System Safety Process and Risk Analysis

In the NPRM, the FAA invited public comment on proposed use of a system safety process and risk analysis as part of the FAA's overall public safety strategy for RLV and reentry vehicle licensing. No

opposition to use of a system safety process appears in the

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comments and some affirmatively endorse its benefits. A number of comments expressed appreciation for the flexible approach to system safety outlined in the NPRM and use of an advisory circular to provide guidance on an acceptable methodology. Consistent with remarks made by Kistler at the February 11, 1999 public meeting, the FAA would not require all of the studies listed in the draft interim safety guidance as examples of system safety analyses but would allow industry flexibility to select a system safety process appropriate for its vehicle and concept of operations.

Kelly Space & Technology, Inc. (Kelly) commented that the documentation used for vehicle development should be used to support the system safety process to the maximum extent possible to reduce costs and burdens on the applicant. The FAA agrees and notes that use of a system safety process much like that embodied in 14 CFR 25.1309 for aircraft should not impose an additional regulatory burden on an applicant because it is substantially similar to the engineering analysis a vehicle developer would utilize in assessing vehicle performance for its own developmental purposes.

Kistler and Applied Science & Technology, Inc. (ASTi) objected to a statement in the NPRM Supplementary Information to the effect that a conservative risk assessment is appropriate for a vehicle lacking an adequate flight history and therefore risk analysis must assume one hundred percent probability of failure. Kistler commented that the FAA should define adequacy of flight history based upon experience gained within the system's design envelope, as opposed to statistical analysis of launch history, such that a system that demonstrates integrity in some acceptable portion of its design envelope would qualify as having an adequate flight history.

The FAA responds to Kistler's and ASTi's comments in two parts. First, the FAA does not mandate, without provision for relief from the requirement, that risk analysis assume a one hundred percent probability of a catastrophic failure. Under an alternative noted in the NPRM, an applicant could prepare a detailed risk analysis using traditional system safety methodologies as described in the system safety process advisory circular. Acceptable risk assessment techniques for determining failure conditions include Preliminary Hazards Analysis, Failure Mode and Effect Analysis, Event Tree Analysis, and Fault Tree Analysis Methodology for Hazard Assessment. Methodologies such as those listed here include failure modes and probability rates affecting risk to public safety and safety of property without necessarily assuming a one hundred percent failure rate. Under this regulation, an applicant may select any system safety analysis methodology that assesses the probability and consequences of reasonably foreseeable hazardous events and safety-critical system failures that could cause a casualty to the public. It is therefore not a requirement that an applicant's risk analysis assume the probability of a catastrophic failure of 1.0 for purposes of the hazard identification and risk assessment required under the final rule, Sec. 431.35(c). Rather, probabilistic tools may be utilized by an applicant as long as they address nominal and non-nominal vehicle operation during flight. Second, with regard to adequacy of flight

history, the FAA is not prepared to define in this regulation the criteria by which a vehicle may be deemed ``proven'' as opposed to ``unproven.'' \4\ However, the FAA will accept a record of past performance of a safety system under comparable operating circumstances as an indication of reliability and will accept the use of historical reliability data in an applicant's risk assessment.

\4\ A distinction between ``unproven'' RLVs and all others appears in regulatory text governing operational restrictions.

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3. Comments on Operational Restrictions for RLV and Other Reentry Missions

Operational restrictions, particularly those imposed on vehicles without a proven flight safety record, proved to be the most controversial aspect of this rulemaking. ACTA, Inc. (ACTA) commented that the FAA should expect opposition to proposed requirements from the RLV industry because they are inconsistent with RLV operational concepts. The Rotary Rocket Company (Rotary Rocket) stated that the proposed operational restrictions have no factual or analytical basis and are therefore arbitrary. According to Rotary Rocket, vehicle reliability and satisfaction of the expected casualty criterion for a mission are sufficient to limit public risk. Rotary Rocket further stated that the proposed operational restrictions will distort operating concepts and are detrimental to the RLV industry.

Comments on each of the four categories of operational restrictions are summarized and addressed below.

A. Restricting Flight Over Populated Areas.

Proposed restrictions, but not a ban, on population overflight would apply to all RLV missions and reentries; however, additional restrictions were proposed for unproven vehicles. In the NPRM, the FAA proposed that for any RLV mission or reentry, the projected IIP of the vehicle shall not have substantial dwell time over densely populated areas during flight. Seven comments objected to the restriction on any RLV or reentry that the IIP of the vehicle must not have substantial dwell time over a densely populated area. Some comments expressed concern that, unless defined more specifically, the terms ``substantial'' and ``densely'' remain vague and ambiguous and will complicate mission planning for operators. Others objected on the basis that this additional requirement is overly restrictive and that remaining within the permissible limits of the expected casualty threshold should be the sole criterion by which the FAA would allow or disallow population overflight because the criterion takes into consideration population density, casualty area and probability of failure. One comment noted that the proposed regulation would place more value on the lives of persons living in densely populated areas since overflight of such areas is limited, whereas overflight of merely populated areas is not so limited. Another comment stated that the FAA should dispense with the restriction arguing that an adequate flight history is sufficient to allow such overflight as long as the vehicle will remain within its demonstrated flight envelope.

For the following reason, in this final rule as in the NPRM, the FAA declines to define the terms in issue using quantitative measures

opting instead to apply a qualitative measure on a case-by-case basis. In response to the comments regarding the projected IIP associated with substantial dwell time over densely populated areas, the FAA believes that substantial dwell time applies in a cumulative manner, such that multiple instances of dense population overflight of the IIP during a mission could amount to substantial dwell time. Substantial dwell time is a relative term when applied as a qualitative measure because the consequences of failure early in flight when the IIP passes slowly over a densely populated area are far greater than the consequences would be later in flight just before the vehicle attains orbital velocity. It is the consequences of failure that prompts the FAA to

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forbid substantial dwell time of the IIP over a densely populated area.\5\ When failure consequences may be too great to be tolerated then population overflight would be barred. The approach utilized by the FAA in the NPRM and retained in the final rule regarding population overflight by any vehicle resembles that applied to ELV launches from Federal ranges. The IIP of ELVs launched from Cape Canaveral Air Force Station may, for example, fly over portions of Africa for a few seconds. Some population overflight is tolerated in such circumstances because it contributes little to the expected casualty calculation. It is perhaps with that in mind that some comments advocated that the Ec criterion alone should be sufficient to safeguard public safety interests. However, unlike ELVs, RLV trajectories may cover inland areas where population centers may be affected early in flight. For this reason, the FAA considers it necessary to make explicit in the regulations a restriction against dense population overflight when the consequences of failure, regardless of how remote the risk of its occurrence, would be intolerably severe.

\5\ Similarly, Sec. 91.319(c) of the Federal Aviation Regulations provides that unless otherwise authorized by the Administrator in special operating limitations, no person may operate an aircraft under an experimental certificate over a densely populated area or in a congested airway. Generally speaking a minimum of 1,000 hours of flight testing would be performed before the FAA would issue a type certification for new aircraft and remove flight restrictions.

The FAA further notes that, unlike aircraft, there is no operational experience with commercial RLVs or reentry vehicles on which to assess actual risk from population overflight of a vehicle's IIP. With experience in RLV regulation and operation, the FAA anticipates that it may re-examine the need for an absolute restriction of this nature.

Restrictions proposed in the NPRM in Sec. Sec. 431.43(d)(1) and (2) on the planned flight trajectory of an unproven vehicle proved even more controversial than those affecting all RLV and reentry vehicle flight. Under the first alternative, flight operations would be limited such that IIP of the vehicle does not have substantial dwell time over a populated area. Under the second alternative, some population

overflight would be tolerated as long as the expected average number of casualties to the public would not exceed 30×10^{-6} assuming a vehicle failure at any time the IIP is over a populated area.

The two alternatives are not mutually exclusive. The FAA clarifies in this final rule that in planning a mission an applicant may plan a trajectory that satisfies one restriction during some portion of flight and the other restriction during other portions of flight. Applied in combination, operational restrictions for unproven vehicles will not preclude vehicles from utilizing inland launch and reentry sites as long as the vehicle flight trajectory is carefully planned and controlled to comply with rule requirements.

One commenter asked for clarification as to whether the term ``IIP'' used in this context refers to an intact vehicle or the debris pattern that would result from vehicle breakup. The FAA intends the term ``IIP'' to refer to the debris footprint of the vehicle, or casualty area, inclusive of the debris dispersion pattern that would result, depending on the catastrophic failure mode.

In addition to comments seeking more precise definition of the term ``substantial'' dwell time or proposing quantitative measures, some comments noted that a restriction of this nature unfairly burdens RLVs in favor of ELV technology because unproven ELVs are not held to comparable restrictions. The FAA disagrees. Restrictions on unproven RLVs were developed to ensure that operators of unproven RLVs are granted similar latitude to that afforded ELV operators. ELVs typically are not operated such that there exists substantial dwell time of a vehicle's IIP over any populated area.

As with proven vehicles, the term ``substantial'' is applied on a case-by-case basis using a qualitative approach to risk assessment. Expected casualty is a function of the probability of a failure event and its consequences. If both the probability of failure and the consequences of vehicle failure are high, then it is reasonable to envision a high expected casualty rate. By reducing either the probability of failure or the consequences of failure, the resulting expected casualty determination is lowered. Because unproven vehicles have an unknown or uncertain failure rate, the FAA considers it reasonable to ensure that risk is most effectively mitigated by controlling the consequences of a failure. The FAA does so by limiting opportunities for high consequence events and therefore retains flexibility to determine on a case-by-case basis whether dwell time over a populated area is too significant to allow because the consequences of a failure would be unacceptably high.

Alternatively, an applicant may assume a vehicle failure while the IIP is over a populated area and obtain approval for flight as long as the Ec threshold of 30 x 10-6 is not exceeded. Rotary Rocket commented that it would be impossible to design a flight trajectory that would satisfy this criterion. In addition, Rotary Rocket protested in its comment that a regulatory authority could conjure up failure scenarios that, in combination, would make it impossible to fly over any populated area. Lockheed Martin Corporation (Lockheed Martin) suggested replacing the absolute probability of failure with a 1/250 probability of failure for RLVs that are substantially aircraft-like.

In contrast, ERPS suggests that the proposed criterion be used during all phases of flight because the allowable population density

under the IIP is inversely proportional to the casualty area of the vehicle and the result would be that no RLV would be allowed to fly over a large population center.

The FAA disagrees with comments suggesting that unproven ELVs are unfairly subject to more lenient regulations than tolerated under this rule. As described above, the IIP of ELVs, proven and unproven, are allowed over some populated areas late in flight when the probability of failure and its consequences are relatively low.

The FAA also disagrees with those comments opposed to proposed operational restrictions on unproven vehicles that argue that the restrictions could only be satisfied by the smallest of vehicles launching from coastal sites and reentering to coastal areas. With the restrictions on population overflight by the IIP of an unproven vehicle, an applicant would be able to plan a flight path that allows for overflight of a sparsely populated area early in flight when vehicle failure would not exceed the allowable expected casualty criterion of 30 x 10 -\6\ and overflight of a populated area for a brief period later in flight when the contribution to Ec of failure consequences during that stage of flight are sufficiently small such that the mission Ec does not exceed the mission risk criterion of Ec 30 x 10-\6\. Also, as pointed out by Space Access, upon firing of retrorockets to deorbit an RLV, the vehicle's IIP is expected to pass rapidly over about half the circumference of the Earth, perhaps passing over populated areas for mere seconds. Population overflight under such circumstances is not likely to contribute significantly to the Ec calculation and is not necessarily prohibited under the final rule.

Unproven vehicles may fail for any number of reasons and aircraft history suggests that some failure-causing events may be unforeseen or unpredicted during risk analysis. Therefore, the FAA determines it prudent to apply conservative

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operational limits on unproven vehicles in order to limit risk to public safety.

For these reasons, the FAA retains the operational restrictions pertaining to population overflight of the IIP of an unproven vehicle in the final rule with the clarification offered above regarding the combined applicability of the two restrictions. An applicant need not limit itself to one or the other operational restriction for the duration of an RLV or reentry mission. An applicant may plan a flight trajectory for the mission that utilizes both restrictions as long as allowable mission risk (Ec 30 x 10-\6\) is not exceeded.

B. Monitoring Critical Systems.

Under the proposed rules, an operator would be required to monitor and verify the status of launch and reentry safety-critical systems both before and during launch flight as well as before initiating reentry flight, and must maintain procedures for doing so. Because the FAA also proposed that reentry flight from orbit could not be initiated without issuance of a command enabling the vehicle's descent to Earth, the ability to monitor safety-critical systems before initiating reentry flight is a necessary component of the FAA's public safety

strategy. Monitoring capability would ensure that both launch and reentry flight would be initiated only under nominal conditions or under non-nominal conditions assessed in accordance with the licensee's system safety process and demonstrated to be within acceptable risk criteria. The proposed rules would not require real-time monitoring of data used for other purposes, such as system validation, system reuse or post-flight anomaly investigation. Under the NPRM, an applicant for an RLV mission license would be required to submit procedures for monitoring and verifying the status of safety-critical systems immediately before and during mission operations.

At the February 11, 1999 public meeting, concerns were raised that requiring real-time data may be cost prohibitive or impossible to obtain. In response to industry concerns, the NPRM did not include a requirement that data be obtained in real-time fashion. Rather, some delay in data relay would be acceptable as long as an applicant's procedures are adequate to accomplish the regulatory objective of ensuring reentry flight is initiated only under nominal conditions or non-nominal circumstances evaluated and approved for safety impacts. However, the FAA cautions that, as for ELVs, should data be lost due to an event before it can be recovered, it will be more difficult to address and resolve potential safety issues before the next flight may be conducted.

Some misunderstanding appears in the comments because the terms ``launch'' and ``reentry'' by definition include operations other than flight. However, the regulatory text reflecting the requirement to monitor safety-critical systems, proposed Sec. 431.43(a)(4) and (e)(1), refers to the ``mission'' and to flight, respectively. Under Sec. 431.35(a) of this final rule, the FAA defines the term ``mission'' for purposes of part 431 to mean licensed flight. For purposes of clarity, the monitoring requirements that appear in Sec. 431.43 of the final rule are modified to reflect mission flight and not pre-or post-flight ground operations.

A number of comments objected to the perceived requirement that the ability to monitor safety-critical systems necessarily means that telemetry must be fed to a manned control center, and the attendant costs of such a requirement. The COMSTAC report also indicates that the FAA should not assume that RLVs will be limited to ground control systems. Prospective operators of piloted RLVs questioned whether monitoring must be performed on the ground or whether crew members on the vehicle could function as data monitors and fulfill the regulatory requirement. The FAA does not specify in the final rule the precise means or the form in which data is received by a vehicle operator in order to remain compliant with the regulations, nor where data must be received. Although telemetry is the typical means of accessing data, particularly for unmanned systems, the FAA would consider acceptable other means of monitoring data that satisfy the regulation. For example, the crew of an RLV may be an adequate means of monitoring status of safety-critical systems and the applicant's procedures, submitted in accordance with Sec. 431.43(a)(4), must demonstrate that using on board personnel will be adequate to perform the intended purpose of the requirement. However, the crew would also be a safety-critical system inasmuch as their performance would be essential to safe operation and, through the system safety process, an applicant would need to show that risks to public safety are sufficiently mitigated in the event the crew became incapacitated. An applicant's

system safety process would address the adequacy of medical qualifications of crew members in the performance of safety-related responsibilities. Advisory guidance offered by the agency, Advisory Circular AC No. 431.35-2, refers to 14 CFR part 67, first-class airman medical certification requirements, in providing guidance on medical qualifications of crew members that, if satisfied, may be relied upon by an applicant as part of its system safety process. The results of hazard identification and risk assessment analyses would determine whether, and the extent to which, deviations from such medical qualifications would contribute to mission risk, and whether those contributions are acceptable because risk criteria for the mission are not exceeded or are sufficiently mitigated.

One commenter noted that there may exist safety-critical systems whose integrity and performance cannot be monitored when an RLV is on orbit. For example, the vehicle's heat shield may have been impaired or compromised during launch flight or while the vehicle is on orbit. The FAA acknowledges that there are some systems that may be critical to safe reentry flight of an RLV for which it is impossible to gather flight data prior to initiating the descent from orbit to Earth. For those systems, the applicant would seek relief from the requirement, or a waiver, to conduct monitoring of such systems after the RLV has been launched. A grant of relief from the requirement would be conditioned upon a determination by the FAA that public safety is not compromised as a result. For example, if an applicant has performed testing and analysis during development and before launch of an RLV that supports a finding that a system, not otherwise subject to monitoring, is sufficiently reliable then the requirement to monitor that system may be removed or waived.

Another comment questioned the requirement to monitor safety-critical system status ``immediately'' before enabling reentry flight. The FAA revises this requirement in the final rule to reflect the need for monitoring of such systems, proximate in time to initiation of reentry flight, in order to verify readiness and capability to accomplish safe return to Earth. For some vehicles, data obtained one or perhaps more than one orbit before de-orbit burn is initiated will be sufficient to achieve the regulatory objective of mitigating risk to public safety.

C. Positive Enabling of Fail-Safe Reentry

The proposed rules require an operator to issue a command enabling reentry of an RLV from orbit. The rationale provided in the NPRM explains that positive control over reentry flight is necessary to ensure that reentry occurs under the conditions necessary to ensure that risks to public safety do not exceed acceptable levels.

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Safety-critical systems must be verified for status and proper configuration, airspace may need to be cleared in the reentry corridor, and vehicle operational constraints must be satisfied, among other things, before reentry flight may be initiated. An applicant would be required to submit procedures as part of an application that ensure conformance with this restriction.

The operational restriction prohibiting a totally autonomous reentry of an RLV from orbit generated numerous comments and objections. Kistler, in particular, objected to requirements that

expressly require a person in the loop stating that such requirements would amount to a design, rather than a performance, standard and that autonomous systems should be assessed on a case-by-case basis. The FAA disagrees with Kistler's characterization of the requirement. Although positive enabling is required, the FAA does not dictate how enabling would be accomplished.

At the February 11, 1999 public meeting and as reflected in the COMSTAC report, industry representatives argue that on board autonomous systems can be made equally effective and reliable as systems relying on personnel on the ground. The FAA agrees that this may be so and does not intend to preclude or inhibit development of RLVs incorporating innovation in autonomous control. Current ELV functions utilize autonomy in the separation and ignition of upper stages, fairing separation and payload deployment, and for non-nominal situations where human response is inadequate, such as autonomous engine shutdown to avoid imminent catastrophic failure. The FAA supports continued use and development of autonomous systems.

One comment observed that placing a human in the loop creates opportunities for other systems to fail. Even so, the FAA maintains that it is preferable from a safety validation standpoint to assure an opportunity exists to confirm conditions for safe reentry. Kelly suggested that each developer be allowed to propose a reentry initiation approach that ensures public safety while enabling the vehicle developer to capitalize on the unique operational characteristics of the developer's concept of operations. Notwithstanding the benefits of Kelly's proposed approach to ensuring safe reentry, the FAA has great concern over the complexity of autonomous RLV systems and their reaction to a nearly infinite number of system failure combinations that may occur.

The FAA is aware that even with a positive enabling command problems may still occur, particularly if the command is based on poor quality or inaccurate information. For example, a Chinese reentry capsule was commanded to fire its descent motor at the proper time; however, it was in reality pointing about 90 degrees off of its planned attitude. As a result, the vehicle did not reenter but instead went into an orbit from which it decayed about two and a half years later. The FAA's regulatory approach to reentry safety is intended to avoid problems of this nature, to the extent they are foreseeable and predictable.

Lockheed Martin commented that the proposed rule appears contrary to current expendable launch vehicle practice where many critical activities, such as ignition of an upper stage, may be controlled autonomously within the vehicle. In place of the proposed requirement, Lockheed Martin recommended changing the requirement such that a positive command disabling an RLV would be required instead of a positive enabling command. The FAA declines to adopt the recommendation because it would not allow for the positive control that the FAA considers necessary. Lockheed Martin's suggestion would not adequately address a situation where, for example, a communications failure results causing the vehicle to begin reentry without an opportunity to independently check and verify the status of safety-critical systems.

The FAA retains the requirement for positive enabling of reentry flight in the final rule. and does so In the final rule, the FAA imposes a requirement for positive enabling of reentry for public safety assurance purposes in fulfillment of its statutory

responsibility for safety. The FAA believes that there must be an opportunity to abort reentry flight and leave an RLV on orbit when conditions for safe reentry cannot be verified. Sole reliance by an operator on an autonomous system would not be sufficient from a public safety standpoint where safe limits on public risk exposure cannot otherwise be assured and public safety could be compromised. The final rule does not prohibit some autonomous operation of an RLV or reentry vehicle. Rather, the FAA requires that an operator verify the status of safety-critical systems prior to enabling the reentry process. Human intervention to issue a command enabling reentry of a vehicle is not limited to initiating de-orbit burn. The reentry process that is enabled may, in fact, be an autonomous one. Human intervention may be accomplished by flight crew, as Pioneer Rocketplane (Pioneer) intends. The FAA envisions that the requirement for a person in the loop to positively enable reentry might possibly be relaxed in the future as RLV performance and flight history develops. By establishing regulatory requirements for human control for functions critical to public safety at this early stage of RLV development, the FAA does not intend to exclude or inhibit development and use of autonomous control systems for RLV nominal flight.

Comments pointed out the corresponding need to assure safe return to Earth of vehicle stages, other than RLVs from orbit, such as an expendable upper stage of a vehicle where a multi-stage vehicle is used. The FAA agrees. Where a vehicle stage operates ballistically as part of an RLV launch system, but is not itself a reentry vehicle, the flight trajectory for launch must be designed such that expected casualty criteria for the mission are not exceeded. Despite Vela's objection, this requirement is not qualitatively different than that applicable to an ELV. Although the de-orbit of an ELV upper stage is not a licensed event, its contribution to expected casualty, historically an extremely small amount, is considered as part of an FAA licensing determination.

D. Reentry Sites

To further mitigate risk to public safety, the FAA proposed a size suitability restriction on the landing area designated for an RLV or other reentry vehicle. The size suitability restriction would apply to those areas designated by a license applicant for a vehicle landing under nominal and non-nominal circumstances. It would also be used to determine whether a reentry site operated under an FAA license could be designated by an RLV or reentry vehicle operator as a proposed location for reentry of its vehicle.

The size of the site selected as the landing area would have to be sufficiently large such that the vehicle would land within its boundaries with a .997 probability rate, assuming no major system failure that would make reentry essentially an entirely random event. The NPRM referred to the three-sigma dispersion of a vehicle as the basis upon which to calculate the necessary size of the landing area. The term ``three-sigma'' refers to three standard deviations from the mean, or average point, assuming a standard normal distribution. Atmospheric, meteorologic and other external conditions assumed in calculating the three-sigma dispersion of a vehicle would become conditions of the

authorization granted to reenter at that location. Alternatively, the area designated could be adjusted to accommodate different conditions or variables.

Reference to the three-sigma dispersion of an RLV appears in two provisions of the regulatory text governing launch and reentry of an RLV (Secs. 431.35(d)(8) and 431.43(b)(1)). Additionally, a licensed operator of a reentry site would be limited to offering its site for use in support of vehicle reentries for which the three-sigma dispersion footprint of the vehicle would be wholly contained within the site. For an RLV mission license, an applicant would be required as part of the system safety process that includes hazard identification and risk assessment to provide flight trajectory analyses for launch flight through orbital insertion and reentry flight through landing. Flight trajectory analyses must include the three-sigma dispersion of the vehicle. An applicant for an RLV mission license would also have to designate the area in which its vehicle and any vehicle stage would land under nominal circumstances, and if an applicant relied upon the use of pre-designated contingency abort locations to satisfy acceptable risk criteria for the mission then those locations would also need to be identified. A designated landing location, whether for nominal operations or in the event of reliance by an applicant upon contingency abort capability, would be of suitable size under the proposed restriction if 997 times out of 1,000 attempts, vehicle or vehicle stage landing would be wholly contained within the designated location and if the location is sufficiently large that it would contain all landing impacts, including debris dispersion, any toxic release, and overpressure resulting from an explosion. The latter requirement means that a location designated to support reentry of an RLV or other reentry vehicle must be far enough away from a populated area such that debris, toxic release, and overpressure effects from an explosion would not jeopardize public safety if splatter or wind effects cause hazardous materials to pass beyond the boundary of the designated location, even though a vehicle's landing point was within its boundary. As an example, for a reentry site that utilizes a runway for vehicles that land horizontally, the three-sigma landing footprint includes the point of touchdown and the vehicle rollout. In all cases, based on the three-sigma footprint, any toxic fumes released from the vehicle after landing, in the case of normal operations (e.g., at end of rollout) or in the event of vehicle failure, should remain within the reentry site as well as any debris or adverse overpressure effects from an explosion.

The supplementary information provided in the NPRM to explain the three-sigma site suitability criterion referred to vehicle maneuverability in defining the area that comprises a designated reentry location. In doing so, the FAA improperly referred to an elliptical contour, rather than a footprint, prompting comments on the accuracy of the .997 probability rate utilized by the FAA. The FAA did not intend to refer to within-track and cross-track error, necessarily a bivariate calculation of the probability of landing accuracy. Rather, the FAA intends to apply a univariate measure of acceptability under which a reentry location may be of suitable size if the vehicle will land within it at a .997 probability rate. Statistically, the three-sigma dispersion limitation means that no more than 3 out of 1000 landings from an RLV reentry would lie outside of the designated location.

Kistler commented that the FAA needs to identify the contributors to the three-sigma dispersion of a vehicle or agree to negotiate them with an applicant. Dispersion factors may vary for different vehicles; therefore, the FAA declines to list them in this regulation. Instead, dispersion factors would be identified by an applicant as part of its hazard identification and risk assessment and evaluated by the FAA through the licensing process. As part of that process, the FAA would determine whether all significant contributors to a vehicle's three-sigma dispersion have been identified.

From the perspective of ensuring aeronautical operations are not jeopardized by RLVs, the Aircraft Owners and Pilots Association (AOPA) observed that RLV controllability during launch flight is much better than during reentry flight and that vehicle design and technology should accommodate the impacts of meteorological conditions on a vehicle's three-sigma dispersion. The FAA understands that RLVs will be of varying controllability during reentry flight, depending upon the technology employed. RLVs that can be controlled more precisely should exhibit smaller dispersion patterns along their trajectory because of the operator's ability to maneuver them and lessen the effects of perturbing atmospheric forces. Vehicles need not have wings to be maneuverable. A capsule that is a reentry vehicle could act as a lifting body during reentry flight and gain some degree of maneuverability.

AOPA commented and NorthStar Spaceport Corporation (NorthStar) echoed concern that meteorologic forces may affect three-sigma trajectory dispersion. The FAA agrees and notes that other contributors to trajectory dispersion must also be identified as part of an applicant's hazard identification and risk assessment. These may include the duration and angle of de-orbit burn, as well as the accuracy with which dispersion modeling is performed. Variables such as those listed in this paragraph may become part of the conditions under which reentry would be authorized. For example, if vehicle operational characteristics were assessed assuming certain wind conditions, reentry would not be allowed at a time when those conditions did not exist.

Trajectory dispersion modeling for RLVs and other reentry vehicles during nominal and non-nominal flight may also be useful to the FAA in determining appropriate airspace clearances. Comments to the NPRM suggested that use of a reentry corridor or box within which an RLV reenters controlled airspace, and the three-sigma dispersion of a vehicle would assist in defining that area. Vela commented that aircraft-like RLVs that are controlled through reentry flight would require clearance comparable to similar aircraft, whereas a ballistic reentry of a capsule-like vehicle would likely require a larger clearance zone.

Operation of RLVs within the national airspace system is under review by the FAA as the agency develops its concept of operations for an integrated air and space traffic management system. It is beyond the scope of this rulemaking to stipulate how airspace clearances will be designed and implemented by the FAA to accommodate emerging RLV and reentry vehicle traffic.

Kistler expressed concern over the three-sigma dispersion size suitability requirement of a reentry site, as expressed in the draft interim safety guidance, noting the cost of preparing an entire site for vehicle landing. The FAA imposes no requirement that an entire location be leveled or otherwise prepared to ``host'' the landing of an

RLV or other reentry vehicle. The manner in which a landing site is prepared may affect mission success in terms of the ability of a vehicle to withstand landing impacts but is not dictated by the FAA in this rule. The size requirement imposed upon a landing site is determined for the

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purpose of protecting the public, not the vehicle, from landing effects.

In summary, and in response to AOPA's and Kistler's comments, the FAA's concern with respect to the three-sigma dispersion of an RLV or other reentry vehicle is two-fold. First, the risk of a non-nominal trajectory and the resultant dispersion of a vehicle in the event of failure must be addressed as part of the system safety process employed by an applicant, typically through hazard identification and risk assessment, to ensure that risk to public safety is contained at an acceptable level. Second, risk of an errant, off-site landing must be limited in the interest of public safety. Accordingly, an applicant must designate an appropriate location at which its vehicle will land with a sufficient degree of predictability, established by this final rule as 997 out of 1,000 landing attempts. Size of the location is not the sole determinant of suitability. The consequences of a vehicle landing in a designated location must also be contained within the site or sufficiently removed from public exposure for the site to be suitably located. As illustrated above, an RLV that lands on a runway touches down in one spot but continues to roll. The area required for continuing roll of the vehicle must be controlled area that does not expose the public to risk or it must be part of the designated location itself. Similarly, a narrow landing location may not be appropriate if toxic fumes released upon landing could be blown outside of the location or a controlled area such that the public is exposed to them. The final rules retain the operational restrictions proposed with respect to suitability of a location designated for an RLV or other reentry vehicle landing, including contingency abort locations in the event a licensee designates one or more such locations as part of its application.

Scope of RLV Mission and Reentry Licensing Under the Final Rule

The FAA's proposed approach to combining launch and reentry authorization in a single license covering an RLV mission was endorsed by a number of comments. However, the scope of licensed activity, as described in the NPRM, prompted a good deal of discussion in the comments. Many more detailed comments on the appropriate scope of FAA licensing authority were received in response to proposed rules governing reentry financial responsibility. Accordingly, a more complete discussion of RLV launch and reentry licensing coverage appears in the companion rulemaking.

1. Comments on Scope of RLV Launch Authorization.

The NPRM proposed to continue inclusion of pre-flight ground operations beginning with the arrival of a launch vehicle or payload at a U.S. launch site in the definition of launch, as codified at 14 CFR

401.5, for purposes of licensing an RLV mission. USA took issue with the definition of ``launch'' codified in final rules at 14 CFR 401.5, despite statutory direction that the term ``launch'' includes activities involved in the preparation of a launch vehicle and payload for launch, when those activities take place at a launch site in the United States. 49 U.S.C. 70102(3). USA recommended that launch begins when an operator places a vehicle at the launch pad with the intent to launch the vehicle. B-G commented against licensing of pre-flight ground operations before the launch vehicle is loaded with propellants or other hazardous materials because worker safety during the conduct of such operations is otherwise regulated by the Occupational Safety Health Administration (OSHA). Moreover, including such operations as part of a launch would subject them to additional environmental scrutiny, according to B-G. B-G recommended that launch begins when the vehicle is loaded with propellants or other hazardous materials.

Lockheed Martin and NorthStar specifically endorsed inclusion of ground operations, before and after RLV flight, as part of licensed launch activity; however, NorthStar would not be particular about whether post-flight ground operations and vehicle remediation, if any, would be considered part of licensed reentry or the next licensed launch. ERPS similarly viewed pre-flight operations and post-flight operations after an RLV returns to Earth as properly within the FAA's licensing authority; however, maintenance unrelated to a particular flight would not be licensed activity in its view.

In this final rule, the FAA does not intend to redefine the commencement of a licensed launch for purposes of an RLV mission. Pre-flight operations at a launch site are regulated by the FAA as part of launch, consistent with the CSLA definition, because of the risks posed to public safety and the safety of property. For purposes of pre-flight safety and risk, the FAA makes no distinction between an RLV and an ELV launch.

Comments on the definition of launch included a number of recommendations governing the end of launch flight for purposes of FAA licensing jurisdiction. B-G suggested retaining the licensee's last exercise of control over its launch vehicle for a suborbital launch vehicle. For an orbital vehicle, B-G suggested that launch ends when a vehicle is placed in a long-lived orbit, defined as 30 days or more or the last exercise of control, whichever comes first. Vela commented that using the ELV definition of launch is inappropriate for an RLV because an RLV may rely upon autonomous systems, such that the vehicle is no longer under the operator's control although flight continues, and because an RLV would be ``launched'' when it lands as part of a reentry because it has arrived at the launch site.\6\ ERPS recommends a three-phased approach to an RLV mission consisting of a launch, on orbit and reentry phase. The launch phase would be defined as ending at the conclusion of powered flight, when the vehicle has attained its intended initial orbit, or its intended suborbital trajectory. Under the ERPS definition of launch, payload deployment, the event proposed by the FAA as marking the end of licensed launch of a typical RLV, would be an on-orbit operation not subject to FAA licensing.

\6\ The companion rulemaking governing reentry financial differentiates between vehicle landing at a reentry site and arrival of a launch vehicle at the gate of a launch site for purposes of

implementing FAA launch licensing authority.

The FAA disagrees with B-G's and Vela's comments and agrees to some extent with the phased approach suggested by ERPS for an RLV mission. However, as explained in greater detail in the companion rulemaking governing reentry financial responsibility, the FAA explains that the end of an orbital RLV launch is defined at payload deployment for RLVs having payload deployment as a mission objective. For other RLV missions, the launch phase concludes upon completion of one orbit in steady-state condition at the location intended by the licensee.

TGV sought clarification of the definition of the term launch such that it would exclude low energy test flights that remain within the atmosphere below an altitude of 50,000 feet. The FAA will not prejudge whether a flight test requires FAA licensing or may be accomplished under an experimental airworthiness certificate. Such decisions will be made on an individual basis to ensure consistency with FAA statutory authority and direction.

2. Comments on Scope of Reentry Authorization.

The NPRM proposed to define ``reentry'' to include those on-orbit

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activities conducted to determine reentry readiness and that are unique to reentry and critical to ensuring public health and safety and the safety of property during reentry.

Kistler commented that the definition of reentry is unnecessarily broad and could lead to licensing of all on-orbit activities. Kistler proposes two alternative definitions. The first would define reentry to begin upon creation of an IIP. The second alternative would include checkout for the deorbit maneuver. ERPS commented that for an RLV in low Earth orbit, reentry begins at preparation for retrofire. For other vehicles, reentry begins at preparation for atmospheric interface. Examples of such other vehicles include those on suborbital trajectories that do not require retrofire to reenter, vehicles in geosynchronous orbit for which retrofire occurs hours before atmospheric interface, and vehicles returning from the Moon for which retrofire would occur days before atmospheric interface.

To summarize the FAA's response to comments on the appropriate scope of FAA reentry licensing, the FAA has determined that its licensing authority must cover reentry readiness activities conducted on orbit in order to ensure that the FAA fulfills its public safety mandate. The definition of reenter codified in this final rule includes those activities and the licensing process would be utilized to identify when those activities begin for a particular vehicle or reentry proposal. A more complete discussion of FAA licensing authority over reentry appears in the companion rulemaking governing reentry financial responsibility.

The FAA understands that there are activities conducted on orbit that are part of reentry readiness and would fall within the definition of reentry except that they may also be performed for other mission purposes and are therefore not ``unique'' to reentry. Accordingly, as explained in greater detail in the companion rulemaking, the FAA

modifies the definition of reentry in the final rule to more accurately delimit those activities that may be comprehended by the FAA's licensing authority and has removed reference to ``unique'' activities.

The FAA requested public comment on the appropriate commencement of licensed reentry when reentry has been delayed by design for an extended duration. For delayed reentry by design, Kelly suggested that reentry begins with initiation of procedures for reentry preparation. The FAA considers that Kelly's suggestion is qualitatively consistent with the definition proposed in the NPRM under which reentry includes activities conducted in space to determine reentry readiness.

Kelly urged that licensed reentry ends when an RLV touches down on Earth. However, the FAA has determined that ground operations performed to secure a vehicle upon its return to Earth would properly be part of licensed activity to ensure that public safety is not jeopardized by an RLV that has landed. Securing a vehicle would include activities performed to ensure that hazardous materials on board the vehicle will not be inadvertently released and expose the public to risk. Propellants may need to be removed from the vehicle and other hazardous or toxic substances must be contained. The definition of the term ``reenter'' is clarified in the final rule to include post-flight ground operations necessary to render an RLV or other reentry vehicle safe to the public.

Section-by-Section Analysis and Summary of Additional Comments

Summarized in this section are comments addressing particular provisions of the proposed rule and additional analysis of some alternatives considered by the FAA in issuing final rules. Additional explanation and clarification of certain provisions of the rule is are also provided. Sections are described and discussed in numerical order; however, nonsubstantive changes in the regulatory text of the final rule are not specifically identified.

Section 400.2 Scope

Section 400.2 identifies the scope of regulations presented in 14 CFR Chapter III as commercial space transportation activities subject to 49 U.S.C. Subtitle IX, chapter 701. As proposed, Sec. 400.2 would exclude ``exempted-class rocket activities'' from coverage under 14 CFR Chapter III. Reference to ``exempted-class'' was intended to mean those activities not subject to FAA licensing. Since 1988, activities not subject to FAA licensing under 14 CFR 400.2 have been identified as amateur rocket activities and space activities carried out by the United States Government on behalf of the United States Government. Instead of adding a new term to the regulations, the final rule reverts to the 1988 formulation of activities for which an FAA license is not required.

Section 401.5 Definitions

These following new terms are the same as those introduced in the NPRM in Sec. 401.5. They are ``contingency abort,'' ``emergency abort,'' ``flight safety system,'' ``operation of a reentry site,'' ``reenter,'' ``reentry accident,'' ``reentry incident,'' ``reentry operator,'' ``reentry site,'' ``reentry vehicle,'' ``reusable launch

vehicle,'' ``safety-critical,'' and ``vehicle safety operations personnel.'' The term ``mishap'' is revised to include reentry events.

The NPRM inadvertently failed to make a distinction in the definition of ``launch'' between the end of ELV flight and RLV flight, although it was described in the supplementary information. In the final rule, the FAA clarifies that for purposes of an ELV launch, flight ends after the licensee's last exercise of control over its launch vehicle. For purposes of an orbital RLV launch, flight ends after deployment of a payload for an RLV having payload deployment as a mission objective. For other orbital RLVs, flight ends upon completion of the first sustained, steady-state orbit, at the intended location of the RLV.

The final rule defines the term ``reenter'' differently from that proposed. For purposes of clarity, the term defined also includes the noun form, ``reentry.'' ``Reenter; reentry'' includes activities conducted to determine reentry readiness that are critical to ensuring public health and safety and the safety of property during reentry flight. However, reentry readiness activities need not be unique to reentry in order to be included as part of a licensed reentry. They must, however, be performed for the express purpose of initiating reentry and must be safety-critical from a public safety perspective to be included as licensed activity. ``Reenter; reentry'' consists of those on-orbit activities just described, reentry or descent flight and certain ground operations after landing on Earth to ensure a reentry vehicle will not pose a threat to public health and safety and the safety of property. The definition of ``reenter; reentry'' is clarified to remove reference to activities unique to reentry and include specific reference to post-landing ground operations. The interested public is referred to the comprehensive discussion of activities comprehended by the term ``reentry'' that appears in the companion rulemaking governing reentry financial responsibility.

``Flight safety system'' is a defined term, abbreviated as FSS for ease of reference in the supplementary information portion of the NPRM. The AOPA recommends use of another abbreviation to avoid confusion with ``flight service station,'' a term used in the Federal Aviation Regulations codified at 14 CFR parts 1-198. The FAA makes no change to the final rule on the basis of the comment because no confusion in terminology has been evidenced to date. The FAA will

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reconsider this terminology if a problem becomes apparent.

``Hazardous materials'' is defined to mean those identified as hazardous materials in 49 CFR 172.101. B-G commented that the definition should be limited to hazardous materials under 49 CFR 172.101, as applied to cargo aircraft. 49 CFR 172.101 contains a table of hazardous materials for the purpose of transportation of those materials. Materials are identified by hazard class and the table further references requirements applicable to labeling, packaging, and quantity limits of those materials aboard aircraft. However, any materials listed in the table are considered hazardous for purposes of 14 CFR chapter III and no change is made to the definition in the final rule.

The NPRM defined ``operation of a reentry site'' in a manner similar to ``operation of a launch site.'' NorthStar suggested removing

reference to ``safety operations'' from both definitions and replacing it with the phrase ``licensed operations.'' The FAA uses the term ``safety operations'' to denote those activities conducted at a launch or reentry site that may pose a risk to public health and safety and the safety of property and for which licensing is therefore required. Other activities, although conducted at a launch or reentry site, may not require regulatory oversight by the FAA. Reference to ``safety operations'' is therefore retained in the final rule definitions.

ACTA suggested that the term ``safety-critical'' in the context of demonstrating acceptable RLV mission risk should be limited to that which has a direct potential effect on public safety. The FAA agrees and has adjusted the definition to clarify that safety-critical means critical to public safety.

Kelly and ERPS proposed additional terms for possible inclusion in Sec. 401.5. Kelly suggested adding a definition of ``exempted-class rocket activities.'' The FAA has removed reference to exempted class rocket activities that appeared in proposed Sec. 400.2 and there is no longer a need to define the term. Kelly also suggested adding definitions for ``expectation of casualty'' and ``impacted landmass.'' The final rule refers to acceptable risk, which is measured in terms of the expected average number of casualties to the collective members of the public exposed to debris impact hazards. An FAA Advisory Circular, AC No. 431.35-1, provides detailed guidance on how casualty expectation may be calculated for purposes of operating a launch or reentry vehicle. Accordingly, the FAA does not agree that further definition of the term ``expectation of casualty'' is required. The FAA also does not find a need to define ``impacted landmass,'' as that term appears only in explanatory information and not the regulatory text.

ERPS, Orbital Sciences Corporation (Orbital Sciences) and Pioneer Rocketplane suggested delimiting where ``outer space'' begins. The CSLA defines ``launch'' as ``to place or try to place a launch vehicle or reentry vehicle and any payload from Earth--(A) in a suborbital trajectory; (B) in Earth orbit in outer space; or (C) otherwise in outer space, * * *'' 49 U.S.C. 70102(3). ``Reenter'' and ``reentry'' means to return or attempt to return, purposefully, a reentry vehicle and its payload, if any, from Earth orbit or from outer space to Earth. 49 U.S.C. 70102(10). The reference to ``otherwise, in outer space'' may include interplanetary missions or travel to the Moon. A suborbitally operated RLV may be regarded solely as launch of a launch vehicle, although for licensing and regulatory purposes the FAA has determined to license suborbital RLVs under the RLV mission licensing regulations in order to ensure a consistent approach to safety issues presented by intact landing of a vehicle designed to survive atmospheric forces. Thus, for purposes of safety regulation and licensing, the difference between an RLV reentry that is conducted suborbitally from one that begins on Earth orbit is a distinction without a difference. As RLVs develop, the FAA would evolve a regulatory program that accommodates deep space exploration and transportation. For the near term, RLV missions chiefly target low Earth orbit and the final rule focuses principally on safety issues posed by such mission. Accordingly, it is not necessary to propose a delimitation of outer space in the final rule.

In a similar vein, NorthStar suggested defining ``payload'' to mean an object that a person undertakes to place in space, rather than outer space. Although the FAA may agree with the suggestion, the agency

retains the current definition of ``payload'' in the final rule simply to reflect the statutory definition that appears at 49 U.S.C. 70102(8).

Orbital Sciences pointed out that because the definition of ``reentry site'' refers to reentry vehicles, the landing site of booster stages of an RLV that do not reach Earth orbit are not regulated. The final rule does, in fact, provide criteria for suitable and attainable locations for vehicle staging impacts under Sec. 431.43(b). Therefore, a separate license is not required for a person to offer use of a location at which a vehicle stage may land although the location must satisfy safety and environmental criteria under RLV mission or reentry licensing criteria.

Section 404.1 Scope

As in Sec. 400.2 of the final rule, the FAA replaces reference to ``launch'' with ``transportation'' in describing the extent of activities to which part 404 applies. Part 404 provides the agency's procedures for issuing implementing regulations.

Section 404.3 Filing of Petitions to the Associate Administrator

Section 404.3 is revised to include rulemaking petitions regarding reentry and operation of a reentry site.

Section 405.1 Monitoring of Licensed and Other Activities

Section 405.1 provides that reentry sites and reentry vehicle manufacturing, testing, assembly and production facilities are subject to FAA monitoring and observation. The FAA may monitor licensee or contractor facilities at which a payload is integrated with a launch or reentry vehicle. NorthStar objected to FAA monitoring authority with respect to payloads otherwise unlicensed by a Federal agency and for which a favorable payload determination has been granted. NorthStar's comments focused on how monitoring and observation of payloads would affect the launch industry in terms of economy, fairness, and privacy.

Under the CSLA, the FAA retains certain responsibility with respect to payloads to ensure that their launch or reentry does not jeopardize public health and safety, the safety of property or national interests of the United States. To fulfill this safety responsibility, the CSLA expressly grants the Secretary of Transportation legal authority to place a government officer or other observer at a site at which a payload is integrated with a launch or reentry vehicle and directs the licensee to cooperate with the observer. The final rule reflects the agency's statutory authority with respect to monitoring activities involving payloads and no change is made to this provision in the final rule.

USA commented that information learned as a result of monitoring activities be subject to the confidentiality and non-disclosure requirements accorded a license application under Sec. 413.9. The FAA agrees that trade secrets or proprietary commercial or financial data disclosed to the agency under its statutory authority shall be accorded confidential treatment upon request. The CSLA allows disclosure of such information only where its non-disclosure is

determined by the Secretary to be in contrary to the public or national interest. 49 U.S.C. 70114. Given the statutory limitation on disclosure of such information, the FAA does not agree that it is necessary to include additional confidentiality and non-disclosure restrictions in the final rule governing monitoring of licensed activity.

Section 405.5 Emergency Orders

Section 405.5 is amended by adding reentry and operation of a reentry site to the agency's authority to terminate, prohibit or suspend licensed activity.

Section 406.1 Hearings

Section 406.1, as revised, reflects the rights of an owner or operator of a reentry payload, as well as any licensee, to a hearing.

Section 413.1 Scope

The application procedures of part 413 of 14 CFR Chapter III also apply to applications for a license, or transfer or an existing license, to reenter a reentry vehicle or to operate a reentry site, as reflected in the final rule.

Section 413.3 Who Must Obtain a License

Section 413.3 specifies that any person must obtain a license to reenter a reentry vehicle or operate a reentry site in the United States and that a U.S. citizen, as defined in 14 CFR 401.5, must obtain a license to reenter a reentry vehicle or operate a reentry site outside of the United States. Reentry and reentry site licensing requirements for foreign entities in which a U.S. citizen has a controlling interest are also specified and are comparable to those currently applicable to a launch and operation of a launchsite by such entities.

USA sought clarification of the licensing requirement for reentry of a reentry vehicle launched by using a foreign owned or controlled launch vehicle. Section 413.3, as proposed in the NPRM and codified in the final rule, adequately covers such situations. An FAA license is required for any person to reenter a reentry vehicle in the United States and an FAA license is required for a U.S. citizen to reenter a reentry vehicle anywhere in the world, regardless of the location at which its launch occurred. Under part 435 of the final rule, acceptable risk for such a reentry would take into account the risk associated with its launch. Where a reentry vehicle is launched abroad by a foreign entity and its operator seeks a license to reenter in the United States, the FAA would require certain data of the launch provider upon which the FAA may determine acceptable risk for the proposed reentry is not exceeded, even though the launch would not be subject to FAA licensing. The launch provider would not be subject to FAA regulatory authority and cannot be compelled to cooperate with the FAA, however. As a practical matter, absent a sufficient basis upon which the FAA may determine acceptable risk is not exceeded, the FAA would be unwilling to license the reentry.

Section 413.5 Pre-Application Consultation

No change was proposed to Sec. 413.5 in the NPRM; however, USA suggested a more detailed statement in the regulation as to the data the launch operator should have available when consulting with the FAA. The FAA uses pre-application consultation as an important means of identifying the data that will be required as part of an application for a license. The ``flesh on the bones'' sought by USA in its comment is derived through this informal consultative process which has worked successfully in identifying issues and data requirements associated with individual licensing proposals.

Section 415.1 Scope

Section 415.1 of the final rule limits the scope of part 415 to requirements pertaining to licenses for launch of an ELV or other launch vehicle that is not an RLV. It refers the reader to part 431 of 14 CFR Chapter III, subchapter C, ``Licensing,'' for RLV mission license requirements.

Part 431 Launch and Reentry of a Reusable Launch Vehicle (RLV)

Part 431 of the final rule sets forth comprehensive requirements applicable to obtaining an RLV mission license and requirements for remaining in compliance with the license. A licensing determination for an RLV mission is based upon a number of approvals that must be granted by the FAA before it can issue a license. Requirements for obtaining approvals are contained in subpart B (Policy Review and Approval for Launch and Reentry of a Reusable Launch Vehicle), subpart C (Safety Review and Approval for Launch and Reentry of a Reusable Launch Vehicle), subpart D (Payload Reentry Review and Determination), and subpart F (Environmental Review). Requirements for obtaining approval to launch a payload appear in 14 CFR part 415. A licensee authorized to conduct an RLV mission must remain in compliance with certain ongoing terms of the license and terms and conditions of a license appear in subpart E (Post-Licensing Requirements--RLV Mission License Terms and Conditions).

Section 431.1 Scope

Section 431.1 of the final rule provides that part 431 covers requirements for obtaining and remaining in compliance with an RLV mission license. An applicant for an RLV mission license is referred to part 413 of 14 CFR Chapter III, subchapter C, for application preparation requirements.

Section 431.3 Types of Reusable Launch Vehicle Mission Licenses

An RLV mission for which a license may be granted under part 431 consists of launch and reentry of an RLV. The two authorizations required for RLV launch and reentry are combined under a single license authorizing an RLV mission. An RLV mission license is also required to initiate authorized ascent and descent of a suborbital RLV.

Consistent with launch licenses issued for ELVs, the FAA includes

in the final rule provisions for granting two types of RLV mission licenses. The two types of licenses that may be issued are mission-specific and operator licenses.

A mission-specific license is used to authorize a licensee to launch and reenter, or land, one model or type of RLV from one approved site to the same or another approved site. One site would be approved for purposes of launch and one site would be approved for purposes of vehicle reentry or landing; however, the same site may be used to support both events. The NPRM omitted reference to a launch site approved for the mission and the omission is corrected in the final rule. The license would also authorize use of a contingency abort location for a particular RLV mission where an applicant has identified the location in order to satisfy risk criteria applicable to the mission.

A mission-specific license is not limited by its terms to the conduct of a single RLV mission. Multiple missions may be authorized by the license; however, each mission is identified in the license. A mission-specific license may be used to authorize a flight test program involving one type of RLV for which launch and reentry or landing take place at the sites identified in the license. The license terminates upon completion of the missions authorized by its terms or the expiration date of the license, whichever first occurs.

USA commented that the authorization granted by a mission-specific license ought not be limited to use of a single reentry site. The FAA

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notes that a mission-specific license may also authorize use of a contingency abort location. However, the broader authorization suggested by USA would typically be granted by the FAA under the terms of an operator license. An operator license is issued to operators that have demonstrated their safety capability on an ongoing basis. An operator license authorizes RLV missions involving any one of a family of RLVs and identifies approved parameters, such as launch and reentry trajectories and any of a number of approved launch and reentry sites that may support the RLV missions authorized by the license. Based on historical experience with operator licenses for ELV launches, the final rule provides for a two-year renewable term of an operator license. NorthStar did not object to a two-year license term but suggested expedited renewal procedures. The FAA agrees that license renewals may rely upon existing documentation as long as it remains valid and complete and that the FAA should utilize procedures for expediting license renewals. The FAA has in fact employed this approach to renewing ELV operator licenses without compromising its safety mandate and intends to do so for RLV mission licenses.

USA suggested that RLV operators with proven experience be able to ``graduate'' to longer term licenses. The FAA agrees that, with experience, it may consider issuing longer term operator licenses, as was recently approved for ELV launches. Initially, the FAA granted two-year renewals of ELV launch licenses and as a result of rulemaking proceedings determined last year to issue five-year operator licenses.

Section 431.5 Policy and Safety Approvals

Section 431.5 establishes the requirement that an applicant for an

RLV mission license must obtain policy and safety approvals. An applicant may seek the approvals in any order and may do so in advance of submitting a complete license application. Generally speaking, submission of an application for policy review of an RLV mission requires less technical information from the applicant and may be less burdensome to prepare. Based upon the FAA's experience in licensing ELV launches, early submission of information to support a policy review is useful to determine whether the FAA would disapprove a proposed mission for policy reasons before the applicant and the FAA undertake the considerable effort required for safety review and approval. The FAA believes that the same principle would apply to RLV mission licensing and therefore allows an applicant to apply for a license in parts.

Section 431.7 Payload and Payload Reentry Determinations

Payloads proposed for launch on an RLV and/or for reentry are subject to FAA review unless exempt. Government payloads are exempt from FAA review and payloads subject to review for launch and/or reentry purposes by another Federal agency would not be subject to duplicative review by the FAA. However, notwithstanding approval by another Federal agency, the FAA would evaluate safety of vehicle flight involving a payload and the particular hazards it may present.

For purposes of launching a payload, the requirements contained in part 415 governing payload review and determination remain applicable to an RLV mission. However, there may be different safety and policy issues arising out of reentry of a payload although it has been approved for launch and, accordingly, a payload reentry review and determination is a component of RLV mission licensing. Where one purpose of an RLV mission or other reentry is to retrieve a space object for the purpose of returning it to Earth, a payload reentry determination would be required. The FAA need not review on an individual basis each payload proposed for launch or reentry but may issue a favorable determination for a class of payloads that share similar characteristics. Similarly, the FAA may issue a favorable determination for reentry of a payload based upon a review performed for another RLV mission license, where the payloads are similar and pose comparable safety and policy issues previously considered by the FAA. Whereas only the license applicant for an RLV mission license may apply for policy and safety reviews necessary to support a license determination, a payload owner or operator may apply for a payload and payload reentry determination separate from the license application.

Comments submitted by the X PRIZE Foundation recommended that where passengers are the payload, a single review should suffice for all RLV operations involving passengers. As already noted, this final rule does not address the unique policy and safety issues presented by passenger-bearing RLVs. In the future, the FAA will examine human factors associated with crewed and passenger-bearing vehicles and, through rulemaking, may determine whether certain criteria affecting crew and passenger health and safety are appropriate.

Section 431.9 Issuance of a Reusable Launch Vehicle Mission License

Section 431.9 provides that the FAA will issue either type of RLV mission license to an applicant who has obtained all of the required approvals and determinations required for that license. It further

provides that the licensee's authorization to conduct an RLV mission is subject to its continued compliance with terms and conditions of the license. Terms and conditions include requirements for demonstrating financial responsibility for the mission. A companion rulemaking explains what a licensee must do to demonstrate compliance with reentry financial responsibility requirements.

Section 431.11 Additional License Terms and Conditions

The proposed RLV mission licensing rules included a provision whereby the FAA may amend an RLV mission license by adding or modifying license terms and conditions to ensure compliance with the CSLA and applicable regulations. NorthStar commented that the proposal would allow for harassment and capricious intervention with a licensee's activities. USA commented that modifications of law of which a licensee is not aware may place a licensee in violation of law and that a procedure for implementing such modifications would be beneficial.

FAA authority to modify a license is essential to its ability to fulfill its safety responsibility under the CSLA and to respond to changes in circumstances affecting public safety. Legal remedies and recourse are available to a licensee who believes its license amendment is arbitrary or capricious, including a right to a hearing as stated in 14 CFR 406.1. The FAA does not negotiate license terms, contrary to NorthStar's suggestion, where public safety is at peril but does agree with USA that the FAA and a licensee can cooperate in defining means of implementing necessary modifications to operations to reflect safety needs or changes in law.

Section 431.13 Transfer of a Reusable Launch Vehicle Mission License

Section 431.13 of the final rule states that only the FAA may transfer an RLV mission license and would do so where an applicant for transfer of the license has obtained all of the necessary approvals and determinations for the license. Findings already made by the FAA in issuing the license to the original licensee may be used to support a license transfer determination, to the

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extent the findings remain valid and equally applicable to the transferee.

Section 431.15 Rights Not Conferred by a Reusable Launch Vehicle Mission License

Section 431.15 of the final rule provides that issuance of an RLV mission license does not relieve the licensee of its obligations to comply with other legal requirements applicable to its activities.

Section 431.21 General

This section of the final rule provides that the FAA will issue a policy approval to an applicant when the FAA has completed its review with favorable results.

Section 431.23 Policy Review

Section 431.23 of the final rule describes the scope of the required policy review and the basis upon which a policy approval would be granted. The FAA reviews the information required by the agency as part of the review to determine whether the proposed mission would present any issues, other than issues evaluated as part of the formal safety review, that would adversely affect U.S. national security or foreign policy interests, including its international obligations, or that would jeopardize public health and safety or the safety of property. The FAA consults with other Federal agencies whose mandate may be affected by a proposed RLV mission. The FAA provides written notification to an applicant of any issue raised during the review that could hinder the agency's ability to issue a policy approval. The applicant then has an opportunity to respond to concerns raised as a result of the policy review or may modify its proposal and seek approval of the mission as modified.

Space Access requested clarification of the role of other Federal agencies in the policy review conducted for a commercial mission. The following is offered as an example of the role other federal agencies may play in a policy review. A proposed RLV mission may include trajectories that could interfere with Shuttle operations. Through interagency consultation performed during the policy review, NASA would have an opportunity to examine proposed mission parameters with its missions in mind and note any potential conflicts. Overflight, during ascent or descent flight, of a foreign nation by an RLV may raise foreign policy concerns within the purview of the State Department. And, the Department of Defense would evaluate a proposed RLV mission from a national security perspective.

USA pointed out the difference in policy review parameters for an RLV mission license from that undertaken with respect to an ELV launch. For an RLV mission, the FAA reserves authority to identify safety considerations from a policy, rather than a strictly technical or engineering perspective, similar to the policy review process utilized by the FAA during the initial ten years of ELV launch licensing. Commercialization of reentry capability may present safety considerations other than those identified as part of a safety review and subject to risk assessment and technical criteria. The FAA considers that early identification of such concerns through a policy analysis would better serve the prospective RLV industry than awaiting the results of a more technical safety review. As was done during the first ten years of ELV launch licensing, license applicants would have the benefit of obtaining a determination from the FAA at an early stage in mission planning as to whether ``show stopper'' safety considerations would present an obstacle to mission licensing even if safety review criteria were satisfied. For example, if a proposed flight trajectory for reentry flight of an RLV were designed such that the IIP for the three-sigma trajectory passes over a facility for which the consequences of collision or unplanned impact would be extreme, such as a chemical or petroleum storage facility, the FAA may conclude that, as a matter of policy, it is unacceptable to approve the proposed mission even though it would satisfy mission risk and other safety criteria of part 431. When used as an early warning device, the policy review has proved a useful and efficient means of identifying impediments to licensing due to general safety considerations. Because

RLV technology, other than Shuttle, remains in a developmental stage, the FAA is not able to catalogue the safety considerations that may attend proposed RLV mission operations. For this reason, the FAA believes it reasonable and prudent to expressly reserve the authority provided by a policy review to consider safety implications of proposed RLV flight. Having gained the benefit of twelve years of licensing experience with respect to ELV launches, the FAA no longer considers it necessary to expressly include safety policy considerations under the policy review performed in support of an ELV launch license.

ERPS asked when the FAA would advise an applicant of issues that would impede issuance of a policy approval and the FAA responds that it would do so upon obtaining responses from other Federal agencies reviewing a proposed mission or when the FAA, itself, identifies impediments to policy approval.

Section 431.25 Application Requirements for Policy Review

Section 431.25 of the final rule lists, in detail, the information requirements necessary for the FAA to perform the required policy review for an RLV mission license. Requirements include basic technical data concerning the pro posed RLV as well as foreign ownership interests in the applicant.

TGV commented that certain requirements seem more germane to a safety review than a policy review. Although the FAA agrees with TGV that technical data is needed as part of the safety review, the FAA requires certain basic information about a proposed mission in order to identify policy considerations that may result from use of vehicle systems, propellants, proposed flight trajectories and mission design.

USA expressed concern over the requirement to identify reentry sites, including planned contingency abort locations, if any. USA stated that provision for use of emergency landing sites should follow an aircraft operation model such that a vehicle could land at an alternate site within a prescribed range of safety parameters. The FAA agrees with USA insofar as a flight plan for an RLV mission may identify locations at which a vehicle may land in an emergency situation in a manner that poses minimal risk to public safety. For such emergency situations, reference is commonly made to ``landing in a cornfield'' or other unpopulated area. However, the requirement identified in the final rule is for identification of locations, if any, that would be used for a contingency abort. Such sites are pre-planned and their potential use may be identified as part of an application in order to meet mission risk criteria and are therefore separate and distinct from emergency abort landing situations.

Section 431.27 Denial of Policy Approval

The FAA would notify an applicant in writing if it has determined that it cannot issue a policy approval and provide the reasons for denial. The applicant may respond with additional information and request reconsideration of the FAA's determination.

Kelly suggested placing a time limit upon the policy approval process and early notification of issues. The FAA

disagrees with Kelly. The FAA anticipates that it would provide to an applicant early identification of issues that may impede issuance of a policy approval. However, other than the 180-day review period imposed by statute for agency review of an application, the FAA does not elect to impose additional time requirements upon processes for which it is often dependent upon other Federal agencies. The FAA reminds applicants that the 180-day time period for agency review of an application commences upon acceptance of an application and that an application is not accepted unless it is sufficiently complete in its entirety to enable the FAA to initiate the reviews and evaluations required for a licensing determination.

Section 431.31 General

This section of the final rule describes in a general manner the safety review performed by the FAA to determine whether an applicant is capable of launching and reentering, or landing, an RLV and payload, if any, from and to a designated site without jeopardizing public health and safety and the safety of property. A safety review entails a technical, engineering analysis of launch and reentry flight risks and is necessarily tailored to the unique capabilities of a proposed vehicle and characteristics of a proposed RLV mission. Safety approval is a necessary element of a licensing determination and the FAA informs an applicant, in writing, of any issue raised during a safety review that may result in denial of safety approval. The applicant has an opportunity to respond and revise its application rather than waiting for a final determination on its application.

ERPS and Kelly raised timing concerns comparable to those registered with regard to subpart B--policy review and approval. The FAA has, historically, consulted with an applicant on an ongoing basis when the agency requires additional information or clarification of a technical data submission in support of the safety review. A cooperative process, during pre-application consultation and while reviews are ongoing, is critical to ensuring the FAA has sufficient information to perform the reviews necessary for safety approval. The FAA intends to continue its interactive approach to technical reviews to facilitate licensing but does not impose a deadline upon itself for completion of the safety review other than the 180-day deadline imposed by statute for agency review of an application. Commencement of the 180-day timeframe is defined in the discussion of the policy review and approval necessary for an RLV mission license.

Section 431.33 Safety Organization

The NPRM proposed detailed requirements for an independent safety infrastructure maintained by an RLV operator in response to National Transportation Safety Board (NTSB) reports and the Rodgers Commission report that indicated independence is critical to an effective safety organization and safe transportation operations.

Under Sec. 431.33(a), an applicant is required to document lines of communication and approval authority for public safety-related decisions. The common objective of maintaining lines of communication and approval authority is to ensure disciplined and appropriate communications and decisions during real-time to address public safety considerations. Compliance with regulations governing an applicant's

communications plans is therefore a requirement for obtaining and maintaining an RLV mission license. As explained in the NPRM, decision authority over various aspects of an RLV mission, including authority to make a ``hold'' or ``go/no-go'' decision, may be dispersed among individuals and the personnel involved in executing an RLV mission must understand the role of each.

Section 431.33(b) directs an applicant to designate a person responsible for the conduct of all licensed RLV mission activities.

Section 431.33(c) mandates that an applicant identify a qualified safety official responsible for monitoring independently compliance by vehicle safety operations personnel with safety policies and procedures identified by the applicant in compliance with safety review requirements. The safety official must report directly to the person responsible under Sec. 431.33(b) for RLV mission activities who, in turn, must ensure that the safety official's concerns are resolved before initiating the mission and before initiating return flight of the vehicle to Earth. In addition, the safety official would be responsible for conducting monitoring and evaluating operational dress rehearsals to ensure readiness of certain personnel and completing a mission readiness determination. The safety official is also responsible for compliance with mission readiness requirements, operational requirements and restrictions, and adherence by a licensee with representations made in its application.

Although the safety official bears great responsibility for safety-related decisions, as described above, the safety official need not perform that function solely. To relieve concerns over cost burdens, particularly for smaller companies, the FAA notes that the rules do not require that the safety official perform only those functions. The rules do require, however, that the safety official remain independent of other safety personnel.

NorthStar disagrees with the FAA dictating the internal organizational structure of an entity. NorthStar recommended that the reporting structure presented in the NPRM become a recommendation, rather than a requisite to licensing. The FAA does not accept NorthStar's recommendation. Based upon its experience in regulating aviation and launch operations, as well as NTSB safety recommendations, the FAA finds that an independent safety official that has direct access to the person responsible for the conduct of licensed activities can positively influence safety. Also, Federal Aviation Regulations codified at 14 CFR parts 1-198 require a part 121 certificate holder to have a qualified director of safety serving in a full-time capacity. See, e.g., 14 CFR 119.65(a)(1). For comparable safety reasons, the FAA requires in the RLV mission licensing rules that an applicant identify a safety official who will report directly to the person responsible for the conduct of licensed activities to ensure that management adequately considers and addresses public safety concerns before initiating vehicle launch or reentry flight. Maintaining an organizational structure whereby safety issues will be raised to the attention of the responsible person enables safety-related decisions to be made at an appropriately high level rather than being submerged.

TGV sought a definition of the term ``qualified'' when used to describe the safety official. The FAA declines to impose specific educational and training requirements for an individual to function as a safety official under the final rule. Instead, an applicant would have to show that the individual is qualified to perform the required

functions based upon the relationship between the individual's experience and responsibilities, which in turn may vary depending upon the operator's vehicle and operational concept.

The X PRIZE Foundation commented that for piloted vehicles, ultimate responsibility for operational safety decisions should reside with the pilot in command. The FAA has not ruled out the possibility that the safety official could be the pilot of the vehicle. Much like a mission flight safety officer for an ELV launch, the pilot would have

authority to make a decision to abort a mission or continue planned flight. As long as that individual maintains independence from other safety operations personnel in terms of decision-making, and is qualified to perform the designated responsibilities, the FAA accords an applicant discretion to determine which individual within its safety organization shall function as the safety official under requirements of Sec. 431.33.

ERPS commented that the safety official identified in the NPRM should not be responsible for conducting dress rehearsals, but rather for ensuring that they occur and then monitoring them. The FAA agrees and the regulatory text is modified in the final rule to reflect the safety official's responsibility for monitoring and evaluating dress rehearsals to ensure that they are conducted in accordance with procedures identified in the license application. ERPS further stated that reentry readiness determinations should be the responsibility of the flight director, not the safety official. The FAA is concerned with functions, not titles, and will accept as compliant with the requirement the designation of an official qualified and authorized to perform the functions of the individuals described in Sec. 431.33(b) and (c).

Section 431.35 Acceptable Reusable Launch Vehicle Mission Risk

Ensuring that acceptable mission risk is not exceeded is one of the principal means the FAA employs to fulfill its public safety mandate in licensing RLV missions. For purposes of satisfying mission risk criteria, only those risks to the public that may result during authorized vehicle flight, that is, launch or ascent and reentry or descent flight to Earth, are included as part of the risk calculation. For purposes of assessing mission risk, pre-flight ground operations and post-landing activities are not included in determining the expected average number of casualties, on a collective risk or individual risk basis, to the public exposed to vehicle and vehicle debris even though these are licensed activities.

The NPRM proposed two acceptable risk criteria that must be satisfied for an RLV mission as defined in Sec. 431.35(a), that is, during authorized flight of an RLV. Under Sec. 431.35(a), to qualify for safety approval, acceptable risk for the mission may not exceed a risk level of .00003 casualties per mission, or Ec criterion of Ec = 30 x 10^{-6}, to members of the public.

The agency response to comments regarding application of a single risk measure to all licensed flight comprising an RLV mission is presented under the heading, ``Public Response to Three-Pronged Public

Safety Strategy for RLV and Reentry Missions.'' In summary, Kelly endorsed the FAA's approach to combining launch and reentry risk associated with RLV flight thereby allowing an applicant to allocate risk to flight phases in its discretion. USA objected to a combined risk measure stating that launch and reentry should be treated as separate events. TGV also commented that launch and reentry should be licensed as separate events; however, TGV would apply an Ec of .00003 to each flight phase. Kistler objected to use of Ec altogether arguing that it is an unjustifiable assessment criterion, subjective and would stifle innovation.

In response to the comments previously noted in the discussion of mission risk and Ec calculation, the FAA has determined to limit RLV mission risk to public safety to a level considered acceptable for current launch capability, that is, Ec 30 x 10-\6\, and allows an applicant flexibility to design a mission that satisfies the criterion.

In addition, the NPRM included a provision to ensure persons located in areas near a reentry site are not exposed to unacceptable risk. Under proposed Sec. 431.35(b)(2), acceptable collective risk to persons within a 100-mile distance from the border of a designated reentry site, including a pre-planned contingency abort location, shall not exceed a risk level of .000001 casualties per mission, or Ec criterion of 1 x 10-\6\. The FAA included the additional criterion in the interest of limiting public risk exposure should a minor system failure cause an off-site, but not random, landing on Earth. A similar standard was applied to the COMET/ METEOR reentry vehicle proposal to ensure that risk exposure of the population within the vicinity of a landing site would not exceed normal background risk as a result of planned reentry.

Eight entities commented in opposition to the proposed requirement that would impose additional restrictions upon reentry. Included among the objections were complaints that the criterion would not be feasible to satisfy, is not necessary or appropriate for guided RLVs or reentry vehicles, appears to place greater value on population near a reentry site than elsewhere, and imposes separate standards for launch and reentry when a single expected casualty criterion for the mission would suffice. Space Access offered, as an alternative, that the additional restriction on RLV reentry be applied only to unproven RLVs. ERPS suggested that designation of a 100-mile area is an arbitrary measure and that when applied in combination with population overflight criteria for an unproven vehicle that assumes an absolute probability of failure while the IIP is over a populated area, would disqualify the Shuttle from licensing assuming existing Shuttle landing strips are the designated reentry sites.

The FAA has reconsidered the proposed requirement limiting collective risk to persons located within 100 miles of the border of a reentry site. As an alternative, the FAA considered acceptable risk measures utilized by Federal ranges to ensure that population within the vicinity of a Federal launch range are not exposed to unacceptable risk. Federal ranges apply an individual risk standard to address this safety concern. Under Air Force Eastern and Western Range Safety Requirements, EWR 127-1, the risk of a casualty to any individual cannot exceed one in a million launches, or Ec 1 x 10^{-6} for the mission. Individual risk is different than collective risk. Individual risk measures the risk to a single person

in the exposed population, whereas collective risk measures the sum total risk, or the probability of injury or death, to that part of the public exposed to an event. An individual risk measure is utilized to address circumstances under which certain people may be exposed to risk, such as where a single dwelling exists along a vehicle trajectory. Application of an individual risk measure for persons residing within the dwelling would dictate whether or not it must be evacuated for launch or reentry activity along that trajectory to occur safely.

Upon reconsideration of the additional safety requirement, the FAA has determined that application of the Air Force standard for individual risk, in combination with the final rule criterion for acceptable collective risk for the mission (Ec 30×10^{-6}) accomplishes the regulatory objective of ensuring that persons in the vicinity of a reentry site or designated landing location for an RLV or reentry vehicle are not exposed to greater than normal background risk. Accordingly, Sec. 431.35(b)(2) is revised in the final rule by removing all reference to a 100-mile distance from the designated reentry site. In its place, the final rule limits individual risk of a casualty to 1×10^{-6} for any person not involved in the licensed activity.

Section 431.35(c) requires that an applicant demonstrate acceptable risk using a system safety process to identify hazards and mitigate risks to public

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health and safety and the safety of property. To be acceptable, the system safety process employed must identify and assess reasonable reasonably foreseeable hazardous events and failures of safety-critical systems during nominal and non-nominal launch and reentry that could result in a casualty to the public, that is, someone not involved in the mission. ACTA commented that the term safety-critical is potentially quite broad and should be limited to identifying those systems that have direct potential effects on public safety. The FAA agrees and has modified the regulatory definition of the term ``safety-critical'' in the final rule. By referring to failures that could result in a casualty to the public, the FAA intends to refer to public safety-critical systems. FAA Advisory Circular, AC No. 431.35-2 , defines a safety-critical system as one whose performance or reliability can affect public health and safety and the safety of property.

Other comments regarding use of a safety system process are discussed above under the discussion of the FAA's three-pronged strategy for RLV mission safety.

Section 431.35(d) lists the requirements that must, at a minimum, be covered by an applicant's demonstration of acceptable risk using a system safety process. These include a description of physical characteristics of an RLV, identification of hazardous materials on the vehicle, a description of safety-critical systems and safety-critical failure modes and consequences, and a timeline identifying safety-critical events. Section 431.35(d)(7) of the proposed regulations would require an applicant to provide data that validates its system safety analyses. USA commented that validation requirements and the methods and standards used for such validations should be defined by the FAA.

To some extent, the data that would be used to validate a particular analysis is dependent upon the system safety process selected by an applicant and is therefore not dictated by regulations. FAA Advisory Circular, AC No. 431.35-2, provides additional guidance on the nature of the documentation that would be required. For example, it provides that documentation must show adequate design, proper assembly, and vehicle control during all flight phases, and is expected to consist of design information and drawings, analyses, test plans and reports, previous program experience, and quality assurance plans and records. As part of the licensing process, the FAA would consider the nature of the system safety process selected by an applicant, which in turn would determine the methods of validation and documentation that flow from the process. For this reason, the FAA does not define, in the final rule, particular methods and standards that must be utilized to validate system safety analyses.

ERPS commented that the section-by-section analysis of the NPRM refers to empirical data for purposes of validating the required system safety analyses, which in turn would require a flight test program, according to ERPS. The regulatory text of the NPRM contains no reference to empirical data. However, the FAA would welcome empirical data if it exists, such as that acquired through ground testing of systems, but would not require a flight test program under the final rule. No change is made in the final rule on the basis of the ERPS comment.

Section 431.35(d)(8) requires flight trajectory analyses covering launch or ascent and reentry or descent flight of an RLV through landing, including three-sigma dispersion of the vehicle along its trajectory. Comments addressing the three-sigma dispersion of an RLV are addressed above in the discussion of public comments addressing operational restrictions proposed for RLV mission licensing. The FAA further notes the value of trajectory dispersion modeling for purposes of analyzing the consequences on the ground or to aircraft in flight of vehicle failure. For this reason, the FAA anticipates that prospective RLV operators would perform the modeling contemplated by the final rule and include risk-producing events and consequences within the three-sigma limits along a nominal flight trajectory to the designated reentry site or landing location and would likewise do so for any non-nominal trajectories identified in advance of an RLV mission.

Section 431.37 Mission Readiness

Section 431.37 specifies procedures for verifying mission readiness for the conduct of an RLV mission. Mission readiness procedures must be employed before initiating launch or ascent flight and before reentry or descent flight, as applicable. Procedures for determining readiness of safety operations personnel for the vehicle as well as personnel and services at the launch and reentry site must be covered. Procedures must also ensure that mission rules and abort procedures are consolidated in a single location and approved by the individual responsible for the conduct of the RLV mission, checklists maintained by the licensee and the launch and reentry site operator are current and consistent so that all involved participants share common understanding of the mission, dress rehearsals will verify crew readiness and readiness of other participants in the RLV mission and that criteria for dispensing with or adding dress rehearsals are

specified, as well as adherence to crew rest rules.

TGV expressed agreement with the intent of mission readiness requirements and procedures, as proposed; however, to relieve industry of the resulting burden TGV proposed that the FAA supply a designated engineering representative (DER) as a substitute for submission of procedures and reports. An on-site DER could also approve modifications to procedures and checklists without the need and the time required for formal submission of changes to the FAA, according to TGV. DERs have been used successfully by the FAA in aircraft certification.

The FAA does not agree that use of a DER would relieve an applicant of paperwork and reporting burdens because the applicant, not the FAA, must develop the procedures by which it will determine and verify mission readiness. Although on-site approval authority is an appealing means of facilitating license application modifications, the FAA believes that experience in RLV operations should be gained by the FAA and industry before employing such concepts. That said, the FAA is considering the best means of identifying and applying processes that will facilitate licensing, including RLV mission and reentry licensing, and does not rule out future use of proven, successful concepts in doing so.

Kelly and ASTi objected to continuing requirements for the conduct of dress rehearsals. Kelly expressed the view that rehearsals should only be required as a special circumstance, such as during a flight test phase or after a significant vehicle modification. ASTi commented that the requirement should be reduced to a recurring training requirement as a system matures. ERPS commented that the requirement to provide a basis for doing away with a dress rehearsal was intrusive and that a licensee should be allowed to rehearse every mission at its own election.

Based upon experience, the FAA considers that dress rehearsals are valuable tools for identifying lack of individual or system readiness and therefore requires that mission readiness procedures cover them. However, dress rehearsals may not be necessary for all missions. The criteria by which an applicant proposes to dispense with a dress rehearsal must be identified as part of an application and reviewed by the FAA for sufficient consideration of potential effects on public safety, as part

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of the FAA's safety review. Through this requirement, the FAA and applicant would share a common understanding of the number and complexity of dress rehearsals to be conducted in support of a particular mission and that understanding would become a stated condition of an RLV mission license. ERPS's concern is misplaced, however, in that the FAA would not object to the conduct of one or more dress rehearsals before every mission proposed by an applicant.

Section 431.39 Mission Rules, Procedures, Contingency Plans, and Checklists

The FAA's experience in licensing and regulating ELV launches has demonstrated the importance to public safety of requiring that an applicant compile missions rules, procedures, checklists, and contingency plans, in a single volume, to ensure safe conduct of

mission operations. Because RLV missions are comprised of launch or ascent flight and reentry or descent flight, additional personnel may be involved in a mission than those typically required for an ELV launch, such as a reentry site operator that is not necessarily the launch site operator for the mission. Accordingly, the requirement to assure consistency in and common understanding of such safety-critical elements as mission rules, procedures and checklists among involved participants for nominal and non-nominal flight takes on heightened importance from a public safety perspective. The FAA requires submission of such rules and plans to ensure a licensee's procedures are carried out as proposed in an application and reviewed and approved by the FAA as part of the safety review.

USA expressed concern that such documents as mission rules and procedures would not be finalized at the time an RLV mission license application is submitted to the FAA. Given that material changes in an application must be reported to and approved by the FAA for a licensee to retain its authorization, USA requested clarification of what would constitute a material change in such submissions.

The FAA recognizes that launch plans evolve during pre-application consultation, throughout the application review period, and after a license has been issued. As an applicant constructs its application, the FAA may require additional information pertaining to a data submission or the applicant may revise its vehicle or mission design and submit revised information. An analysis previously considered by the agency may require further refinement later in the review process if, for example, test results challenge assumptions that form the basis of the analysis. Ongoing consultation is necessary to build the complete application upon which the agency's licensing determination is based and it is therefore not unusual for an application to be finally deemed complete at the point at which the agency's review is nearly concluded. Throughout this process, the FAA is able to review and act upon proposed modifications promptly and efficiently as long as it has been kept informed and involved during the development of the final application.

Once a license has been issued, the licensee has a continuing obligation to report proposed changes from representations contained in an application that are material, that is, that may affect public safety. For RLVs, the FAA expects that an applicant would make changes to mission rules and procedures and the like from that initially submitted as part of an RLV mission license application because its operational concept as well as mission hardware may undergo continuing modification until proven or mature. Mission rules, checklists and other plans and procedures identified in Sec. 431.39 are required under the final rule because of their potential effect on public safety. It is therefore reasonable for an applicant or licensee to anticipate that any change to such documents would be deemed a material change by the agency. The FAA encourages applicants and licensees to consult with the FAA to determine whether a proposed change may affect public safety and would therefore be considered a material change.

Section 431.41 Communications Plan

Section 431.41of the final rule requires submission of a communications plan binding upon vehicle safety operations personnel during the conduct of an RLV mission. It must contain procedures for

issuance of safety-critical information during the mission and describe the authority of vehicle safety operations personnel to issue commands. Personnel may be identified by name or position. The required communications plan resembles that currently required for licensed ELV launches in the following ways. Communication networks must be assigned such that safety operations personnel have direct access to real-time and safety-critical information required for making safety-related decisions during the mission and issuing commands. Safety-critical communications are monitored by vehicle safety operations personnel on one, pre-determined common intercom channel during launch and reentry including the countdown for launch and reentry flight. Also, a terminology protocol must be utilized. Safety-critical communications during the mission must be recorded.

Boeing commented that the requirements for a communications plan proposed in the NPRM did not address interface with air traffic controllers. The final rule includes a provision for coordination with air traffic control regional offices but does so as a condition of an RLV mission license. Section 431.75(b)(2) of the final rule requires that the licensee and the FAA regional office with jurisdiction over the airspace through which a launch and reentry will take place establish procedures for issuance of notices to airmen prior to flight, closing of air routes and other measures deemed necessary by the FAA regional office.

ERPS sought clarification as to whether communications plan requirements apply to an RLV while it operates on orbit. The requirements listed in Sec. 431.41 apply to licensed operation of an RLV and would apply to launch and reentry of the vehicle inclusive of pre-flight activities such as countdown or preparation for launch flight and countdown or reentry readiness operations before reentry flight. They would not apply to on-orbit operation of an RLV that is not part of launch or reentry.

ERPS also sought clarification on the form of recording that would be acceptable to the FAA. The reason for recording communications is to have the ability to recreate or play back transmissions in the event of an anomalous circumstance requiring investigation or prevention analysis. The NPRM did not specify how that may be accomplished, or the format for doing so, as long as the intended purpose can be achieved. A single recording device may be used or an applicant may propose to use multiple devices or tracks with synchronized time signals. The FAA understands that it is common practice in the launch industry to rely upon several communications channels, each of which is dedicated to a particular subject area, and the FAA would find it acceptable practice to record channels separately as long as the timing and sequence of communications can be reconstructed. For example, where multiple channels are utilized, recording practices are adequate if individual channels are recorded separately and synchronized time coding is employed. Time coding and adherence to the communication

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protocol would also be particularly important where a single recording is made of all communications on various channels. The final rule clarifies the requirement. Adequacy of an applicant's proposed method of assuring that safety-critical communications are recorded accurately and in a meaningful manner will be evaluated by the FAA as part of the

safety review.

NorthStar commented upon the need for communications system reliability and backup systems if needed. System reliability will be a factor considered by the FAA in evaluating the adequacy of an applicant's proposed method of recording communications to accomplish its intended purpose. However, where a communications system is integral to proper performance of a flight safety system and therefore safety-critical, reliability will be evaluated through hazard identification and risk assessment required under Sec. 431.35(c). Also, mission rules and procedures would address non-nominal performance of safety-critical systems and implementation of contingency plans.

ASTi sought clarification of the reference in Sec. 431.41 to safety operations personnel because it suggests the responsibilities of a ``pilot in command.'' ``Vehicle safety operations personnel'' is a defined term under Sec. 401.5. It means those persons whose job performance is critical to public health and safety or the safety of property during RLV or reentry operations. Therefore, it is not limited to a pilot or crew on board a vehicle although it may include them. Vehicle safety operations personnel would include persons monitoring, enabling and otherwise controlling vehicle performance during licensed activity from ground stations.

Section 431.43 Reusable Launch Vehicle Mission Operational Requirements and Restrictions

Section 431.43 contains the operational restrictions imposed by the FAA on RLV mission flight. An applicant for an RLV mission license must submit procedures that ensure conformance by an RLV operator with those restrictions once a license has been issued. Upon issuance of a license, a licensee is responsible for conducting authorized RLV missions in accordance with procedures it submitted as part of the safety review.

In addition to operational restrictions highlighted in the discussion of the FAA's three-pronged public safety strategy for RLV missions, Sec. 431.43 of the final rule requires a collision avoidance analysis to prevent contact with any inhabitable orbiting object during launch and reentry, such as the Shuttle or International Space Station. It also prescribes crew rest requirements which may be increasingly significant for RLV operators whose personnel may support multiple flight phases of a mission and long duration missions, unlike ELV launches. The work and rest standards adopted in the final rule are similar to those currently used at Federal launch ranges and imposed on commercial ELV launch operators by FAA regulation.

Section 431.43(a) requires submission of procedures that ensure acceptable mission risk, as defined in Sec. 431.35, is not exceeded for nominal and non-nominal operations. The FAA does not prescribe design-based standards for ensuring operations remain within the acceptable risk criteria. An applicant may design procedures best suited to its operational concept and technology for doing so. Operator procedures would be derived from the system safety process utilized by an applicant and, in particular, the hazard identification and risk analysis performed in accordance with Sec. 431.35(c) to address nominal and non-nominal operation and flight of an RLV. Under Sec. 431.43, an applicant must submit procedures that ensure conformity with system safety process results. Procedures must also ensure conformance with

operational restrictions identified in Sec. 431.43, including collision avoidance analysis, debris mitigation, crew rest requirements, limitations on overflight of populated areas, monitoring safety-critical systems for safe reentry and enabling of reentry.

Section 431.43(a)(4) of the NPRM is revised in response to comments received concerning monitoring of safety-critical systems. The proposed requirement would compel procedures for monitoring and verifying the status of safety-critical systems immediately before and during missions operations.

For some RLVs, it will not be practicable to monitor systems throughout licensed operation of an RLV. Some RLVs and reentry vehicles will confront black-out periods during reentry flight during which it will not be feasible to obtain telemetry data. For some orbital RLV concepts, the FAA envisions that telemetry would be available only at certain times or for certain orbital positions during an orbit. Design and performance factors for specific RLVs will necessarily determine which systems are safety-critical and can influence monitoring and verification procedures. The FAA modifies the proposed requirement in the final rule to more effectively accommodate individualized procedures. Nevertheless, procedures requiring monitoring and verification of safety-critical systems must ensure safe reentry and an applicant's procedures must therefore make provision for performing such public-safety related functions prior to enabling launch and again prior to enabling reentry flight of a vehicle.

Section 431.43(a)(5) of the final rule retains the requirement proposed in the NPRM and reflected in draft interim safety guidance for RLV operators for human activation or initiation of a flight safety system that safely aborts an RLV launch if the vehicle is not operating as approved and acceptable risk standards for an RLV mission would be exceeded. A flight safety system is broadly defined in Sec. 401.5 of the final rule to mean a system designed to limit or restrict the hazards to public health and safety and the safety of property presented by a launch or reentry vehicle in flight through controlled ending to vehicle flight. It may be destructive, such as a flight termination system (FTS) traditionally employed on ELVs to terminate flight by breaking the vehicle apart, or nondestructive, such as an engine thrust termination system that enables intact landing.

Vela disagreed with a statement in the supplementary information in the NPRM to the effect that the RLV industry has agreed that some type of flight safety system (FSS) would be necessary to satisfy Federal range safety requirements. Vela commented that an FTS would never be used on an RLV and believes that RLVs will launch from locations other than a Federal range. The FAA disagrees with Vela. The FAA reiterates that the regulatory requirement in issue is for use of an FSS that may or may not be destructive. Vela plans a passenger-bearing vehicle and, in all likelihood, would employ an FSS that allows for controlled landing in the event of an aborted launch. Other RLVs may employ multiple stages, including an expendable booster that may indeed rely upon a destructive FTS, much like the solid rocket boosters of the Shuttle.

A number of comments were submitted addressing the proposed requirement for a ``human-in-the-loop'' and the FAA proposal to foreclose total dependence on a fully autonomous abort system. Kistler and ACTA objected that requiring a human-in-the-loop and disallowing autonomous systems would limit innovation and increase costs of

development. Autonomous systems should be considered on an individual basis, they stated. Lockheed Martin pointed out that current ELV practice allows for autonomous control of some

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critical activities, such as ignition of an upper stage. Comments offered by industry on the draft interim safety guidance for RLVs and in the COMSTAC report of the RLV working group varied on the degree of human control that should be required and whether human intervention may only be required during flight testing. Space America pointed out, in response to the draft interim safety guidance for RLVs, that human intervention does not necessarily decrease risk. Space Access also stated that human intervention is required but that qualifications should be better defined. Several RLV developers planning crewed vehicles suggested that a requirement for human intervention would be fulfilled by a pilot in command of the vehicle.

In response to the comments, the FAA acknowledges that autonomous flight safety systems are technically feasible and has allowed total reliance on an autonomous FTS where risk to public safety is extremely low. In requiring human intervention capability for activation of an FSS the FAA does not intend to foreclose development or use of autonomous systems. The FAA also does not intend that autonomous decision-making would be foreclosed. However, the FAA does consider that total reliance on a fully autonomous system to assure RLV safety to the public is unwarranted until a greater level of confidence in such systems can be obtained and accordingly requires that capability exist for a person to intervene and make decisions for FSS activation. Two recent studies by the National Research Council Committee on Space Launch Range Safety and a Lockheed Martin technology demonstration for a new range safety system substantiate the technical feasibility of autonomous flight safety systems. However, concern remains within the government that the demonstration of such systems at the requisite level of confidence remains some time away. A 1999 failure of autonomous flight return and flight safety systems on a Perseus B drone aircraft illustrates the benefits of human intervention capability in the event an autonomous system does not perform as intended. When the autonomous flight return system and manually commanded FSS failed, having human control allowed the Perseus B's controllers to move the vehicle away from a densely populated area before total command was lost during the last few thousand feet of descent through landing on Interstate 40 in California. For such reasons, NASA and its industry partners involved in X-33 and X-34 technology demonstration programs use human-in-the-loop flight termination systems to ensure public safety, even though the vehicles are autonomous during nominal flight.

The FAA supports the continued development of autonomous flight safety systems but does require, for the present, human intervention capability to assure public safety and in doing so makes no distinction in the final rule between test flights and operational flights. Autonomous navigation of RLVs combined with human intervention capability to verify safety-critical system status and override or redirect automated functions would be allowed under the final rule. No change is made in Sec. 431.43(a)(5) of the final rule from that proposed in the NPRM.

Section 431.43(b) of the final rule imposes the requirement that an

applicant for an RLV mission license identify nominal landing and vehicle staging impact or landing areas, if any. Also, if an applicant relies upon the ability to attain one or more contingency abort locations during launch or reentry in order to satisfy acceptable risk criteria of the final rule, they must be identified as part of the safety review process as well.

For each location identified, the FAA would deem it suitable for purposes of launch or reentry safety if, in addition to any environmental consequences that must be assessed, the three-sigma dispersion of the vehicle or vehicle stage can be contained entirely within the designated location and it is sufficiently large as to contain landing impacts, including debris and toxic release. The applicant would also have to demonstrate to the FAA that a designated location is attainable by its vehicle. ACTA commented that based on X-33 and other RLV designs, the availability of excess energy that would be needed to maneuver cross-range to attain a contingency abort location is usually limited making aborts on azimuth more likely. If that is so, an applicant could show capability to perform on-azimuth aborts through analyses, simulation or testing. Other contingency abort scenarios may include a return to the launch site, an abort to orbit although not the intended final orbit, and abort to an unpopulated downrange location, such as a broad ocean area. An applicant would therefore have to demonstrate that its vehicle can be maneuvered to a designated landing area given the set of three-sigma bounded trajectories for a proposed mission and under the failure modes for which that location would be utilized. Vehicle stages, including those that fail to ignite or that otherwise operate in non-nominal fashion, must also satisfy the three-sigma dispersion criterion contained in Sec. 431.43(b) upon impact or landing and the risks that attend staging impacts would be considered part of the mission assessed against acceptable mission risk criteria set forth in Sec. 431.35(b). Comments on size suitability of a landing location designated under Sec. 431.43(b) were addressed in the discussion of public comments on the FAA's three-pronged public safety strategy in RLV mission licensing.

Draft interim safety guidance for RLVs issued by the FAA and made the subject of the February 11, 1999 public meeting included as a safety objective the notion that an RLV operator would necessarily designate pre-planned, pre-approved abort landing sites that avoid air traffic areas along the intended flight corridor for the vehicle during all flight phases. Industry voiced objections to the requirement based upon feasibility and cost of compliance particularly if each such site had to be evaluated for environmental impacts, and stressed that meeting the expected casualty criteria for acceptable risk to public safety should be sufficient. Careful consideration by the FAA of industry concerns resulted in the approach proposed in the NPRM and adopted in the final rule, requiring designation by an applicant of contingency abort locations only if it is necessary to do so in order to satisfy the acceptable risk criteria of the rule. Consistent with the NPRM, the final rule does not require designation of a contingency abort location for all missions or for all phases of a proposed mission; however, an applicant would have to show that an uncontrolled random reentry (e.g., due to orbital decay) will not exceed acceptable risk criteria for the mission. Except where reliance on a contingency abort location is necessary to demonstrate that acceptable risk

criteria for the mission will not be exceeded, discretion is left to an applicant for an RLV mission license to determine whether to select, in advance of a mission, an alternative location within which to land a vehicle during ascent or descent flight.

Orbital Sciences asked for clarification of the reference in Sec. 431.43(b) to a contingency abort location and whether it would be regulated as a reentry site. The final rule defines a contingency abort to mean cessation of vehicle flight during ascent or descent, in a manner that does not jeopardize public health and safety and the safety of property, in accordance with mission rules and procedures. Cessation of vehicle flight may be done

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through destructive or non-destructive means. The definition further provides that contingency abort includes landing at an alternative location that has been designated as a contingency abort location in advance of vehicle flight. A contingency abort location may be a reentry site operated by a non-Federal entity under an FAA license or a location for which an RLV operator is allowed access, by agreement with the owner, as long as its suitability for use by an applicant is evaluated as part of RLV mission licensing. A contingency abort is not limited to reentry and may occur during any flight phase of an RLV mission. A pre-selected contingency abort location would be evaluated as part of the environmental review required for a proposed mission, as explained in the discussion pertaining to Sec. 431.93 of the final rule.

Similarly, Space Access commented on the need to differentiate between a reentry site and a landing site. Although commenters may refer to a landing site in commenting upon the location at which a reentry vehicle may land, this final rule uses the term ``reentry site'' as defined in Sec. 401.5.

Vela also asked for clarification of what is meant by a landing site asking, hypothetically, whether it would be all area within the restricted boundary of Los Angeles International Airport. The designated location for landing an RLV, whether it be a reentry site or designated contingency abort location, would cover all restricted area within which the three-sigma dispersion of a vehicle may occur for purposes of assessing size suitability. Where, for example, debris or toxic fumes may be dispersed upon landing, an applicant would also have to show that the restricted area is sufficiently large and removed from public access as to contain the three-sigma dispersion area for the vehicle at all landing points. To accomplish this result at an airport, an applicant may demonstrate that its vehicle can land on a designated runway with the required level of predictability and that the restricted area of the airport is sufficiently large as to contain the vehicle and any toxic emissions within its boundary should the vehicle touch down at any point within the three-sigma dispersion area of the vehicle.

Section 431.43(c)(1) requires a collision avoidance analysis to assure a 200-kilometer separation of an RLV from any inhabitable orbiting object during launch and reentry and defines launch window closure requirements. Some questions were raised in the comments as to who would perform the analysis and how it would be performed. Timing of the analysis was also raised in the comments to address dynamic

scheduling demands of RLV launches and reentries.

The FAA maintains a memorandum of agreement with U.S. Space Command to facilitate the conduct of collision avoidance analyses required for launch activities. Currently, only ELV launches require a collision avoidance analysis which can generally be performed in advance of a launch based upon a stable, scheduled date or dates for launch. The FAA understands that for RLVs, there is greater uncertainty in scheduling a reentry event because of the potential need to complete additional orbits before reentry readiness is confirmed. Yet, just as aircraft file a flight plan to operate in the National Airspace System and avoid collision with other aircraft, RLV reentries must be coordinated to assure no collision occurs on orbit with inhabited orbiting objects. The FAA is engaged in discussions with U.S. Space Command on how best to accomplish collision avoidance analyses and has specified in this and other regulations only that it be performed, without designating the point of contact for an applicant. The collision avoidance requirement is included in this final rule to alert RLV operators to the need for such an analysis for every launch and reentry. Means of complying with the collision avoidance requirement may be supplied in advisory material prepared by the agency or through future rulemaking.

Lockheed Martin noted in its comments that it intends to address space station servicing as part of its commercial launch services market and may require the ability to do so on a first orbit, contrary to rule restrictions. Lockheed Martin recommends adding an exception to this final rule to address circumstances in which the inhabited orbiting object is the intended destination for a launch. A docking maneuver would not be considered licensed activity under this final rule. Although the requirement for a collision avoidance analysis is directed at avoiding such contact during licensed launch and reentry operations, the FAA declines to adopt Lockheed Martin's recommendation for the time being preferring instead to consider granting a waiver to the restriction on an individual basis to assure that safety considerations are not compromised.

Section 431.43(c)(2) prohibits, for any RLV, substantial dwell time by its IIP over densely populated area during any segment of mission flight. Comments directed at this restriction were addressed in the discussion of public comment on the FAA's three-pronged public safety strategy for RLV missions and the interested public is referred to that discussion.

A requirement to minimize debris generation in the space environment has been part of FAA launch licensing regulations for the past year. Despite a comment from Kelly that the rule is too directive, the final rule imposes a comparable requirement on RLV missions to ensure that debris risks are mitigated. Debris propagation would interfere with other RLV missions, as well as ELV launches and satellite operations in space. To minimize that possibility, Sec. 431.43(c)(3) prohibits unplanned physical contact between a vehicle and its components and payload after payload separation. The final rule also prohibits debris generation from conversion of energy sources into energy that would fragment the vehicle or its payload. ELV operators are capable of complying with this requirement and the FAA finds it prudent to extend it to RLV operators as well, although RLV operators may utilize means other than those typically applied to ELVs to comply with the requirement. The final rule alerts prospective RLV operators to the debris mitigation requirement sufficiently early in

RLV design and mission planning as to minimize any burden of compliance with its terms.

The crew rest requirements presented in Sec. 431.43(c)(4) of the NPRM prompted two comments. B-G stated that it would not object to applying the proposed requirements to the crew on a piloted vehicle if it were made clear that the rest required could take place aboard the vehicle. The FAA intends the crew rest requirements proposed in the NPRM to apply to all vehicle safety operations personnel wherever located and does not specify in the final rule where required rest must take place. The FAA concurs with B-G's observation that rest may take place while on board a vehicle. ASTi suggested using aircraft crew rest requirements for ground and flight crew. Crew rest requirements contained in the rule are similar to those imposed by the Air Force for Federal launch ranges and have proven effective in accomplishing their public safety objective. Accordingly, the FAA adopts those requirements for RLV operations in the interest of public safety preservation. As already noted, the FAA will separately consider additional human factors for crewed and passenger-bearing vehicles in a future rulemaking.

Section 431.43(d) provides population overflight restrictions applicable only to

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unproven vehicles.\8\ In an October 8, 1998 letter from AST's Associate Administrator to the COMSTAC, the FAA requested input from the RLV working group on, among other things, criteria for defining the types of test flight programs required to allow over-flight of populated areas by RLVs during launch and landing and criteria for transitioning from a flight test program to an operational program. Subsequently, the FAA issued draft interim safety guidance for RLVs and convened a public meeting to address safety objectives that included avoidance of overflight of densely populated areas and a test flight demonstration program demonstrating abort and recovery capability before allowing substantial overflight of populated areas.

\8\ Comments on these restrictions are addressed above in the analysis of public comment on the agency's three-pronged public safety strategy for RLV missions.

Intended as a starting point for development of an RLV licensing process between government and industry, the April 29, 1999 ``Draft Final Report on RLV Licensing Approaches'' (COMSTAC report) adopted by the COMSTAC at its May 1999 meeting reflects some working group areas of consensus; however, additional views expressed by individual working group members were included in the report. With regard to a test flight program, the COMSTAC report defined a test flight, supported RLV mission licensing involving overflight of a populated area following successful completion of a flight test program and demonstration of acceptable risk in accordance with a licensing plan, and would allow multiple flights comprising a flight test program under a single license. The COMSTAC report also reflects the RLV working group view that a system may be declared operational after successful completion

of its flight test program in accordance with the licensing plan and that prudent exploration of the design envelope ultimately yields a fully operational system approved for flight in all regions of its design envelope. The COMSTAC report is included in the docket for this rulemaking.

Objections voiced by RLV developers at the February 1999 public meeting regarding requirements for flight testing prompted the FAA to exclude from proposed regulatory requirements the need to conduct a flight test or demonstration program before commencing operational missions. Supplementary information accompanying the NPRM explains that the FAA considered but discarded the requirement for a flight test regime, a distinct change from the approach considered in draft interim safety guidance. However, the NPRM distinguishes between flight restrictions for ``unproven'' RLVs and all RLVs. Among other things, an ``unproven'' RLV would not be allowed to fly over a densely populated area.

The term ``proven'' does not appear in the regulatory text. The agency explained that it was not proposing criteria, such as the number of flights required, to determine the point at which a vehicle transitions from ``unproven'' to ``proven'' noting that the point of demarcation may depend upon unique characteristics of a vehicle. In the NPRM, the FAA explained that flight data would be necessary in order to validate an operator's risk analysis and show that the vehicle performed as assumed in the risk analysis. The FAA further explained that the number of flights necessary to validate a vehicle's risk analysis would depend, at least in part, on the severity of risks to public safety posed by the nature of operations the vehicle would be expected to perform under an applicant's proposal. The example cited in the NPRM addressed reliance upon abort capability as a basis upon which the FAA would allow flight by a ``proven'' vehicle over a populated area. Because the consequences of failure would, in all likelihood, violate acceptable risk criteria for the mission, the applicant would be required to demonstrate a sufficiently low probability of failure to satisfy the criteria. It should be noted, however, that the final rule does not require demonstration of abort and recovery maneuvers.

An operator may find it desirable to conduct a flight test program, to gain confidence in system performance and reliability that may not be attainable through ground testing and simulations. Even those operators and RLV developers whose designs include subsystems and components for which there exists some performance data may determine that it is useful to perform test flights in order to gain data regarding use of components in a new flight environment or in combination.

The FAA requested views on appropriate means of validating new vehicle performance and criteria for determining the point at which a vehicle may be considered ``proven.'' Unfortunately, no specific criteria were offered in the docketed comments to assist the FAA in differentiating a ``proven'' RLV from an ``unproven'' one. Instead, industry comments focused upon the difficulty of satisfying the operational restrictions proposed for RLV flight over populated areas. Several suggested that satisfying acceptable risk criteria for an RLV mission should be sufficient. Others suggested using FAA regulations covering experimental aircraft as the basis upon which flight tests may be authorized, that is, without reference to expected casualty criteria.

The FAA continues to maintain that it is inappropriate to draw a bright line between ``unproven'' and ``proven'' RLVs for purposes of defining operating restrictions. Without flight data, the FAA does not believe that sufficient confidence can be placed in the results of risk analyses to warrant exclusive reliance upon an analytical demonstration of acceptable risk criteria or a system safety assessment. The FAA retains flexibility in the final rule to evaluate RLV concepts on an individual basis and consider flight data submitted by an applicant to validate risk analyses performed as part of the system safety process required under the regulations. Moreover, proven performance within an approved flight envelope would not signify that an RLV is ``proven'' for all flight purposes. Modifications in design and expansion of the performance envelope for successive RLV missions must be considered by the FAA in issuing a safety approval and possibly relieving operational restrictions.

The FAA maintains restrictions on ``unproven'' RLVs as distinct from all other RLVs in the final rule. The FAA does so with the understanding that there currently exists no commercial RLV eligible for ``proven'' status because commercial RLVs have yet to be tested, much less operated. The agency anticipates that future rulemaking may modify these distinct requirements as RLV concepts become operational. In the near-term, the FAA would evaluate, on an individual basis, whether an RLV's performance is sufficiently reliable to allow flight over a densely populated area because risk to public safety is sufficiently remote.

Although a flight test program is not required in the final rules, an applicant may utilize a flight test program as part of its proposed plan of operation and, through consultation with the FAA, obtain safety approval to operate within, or up to, a specified performance limit and also to make adjustments in non-safety-critical vehicle systems without requiring advance approval from the FAA beyond that already granted by the license. Adjustments that do not affect public safety or the safety of property would not require amendment of an application or of a license. A more complete discussion of matters requiring more formalized FAA approval appears in the discussion of

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Sec. 431.73--``Continuing accuracy of license application; application for modification of license.'' Further demonstrations of performance and validating data would contribute to the basis upon which the FAA may approve increases in the approved flight envelope for successive missions.

Comments regarding restricted population overflight by RLVs are addressed in the discussion of the agency's three-pronged public safety strategy for RLV missions.

For RLVs that reenter from Earth orbit, Sec. 431.43(e) of the final rule directs that for reentry to occur, the operator or licensee must be able to monitor the status of safety-critical systems before enabling reentry flight and thereby verify that the vehicle can reenter safely and issue a command to enable reentry. Comments regarding monitoring requirements and human intervention to enable reentry are also addressed above as part of the operational restrictions on RLVs that the FAA imposes to assure RLV mission safety to the public. As noted above, it may not be necessary to monitor safety-critical systems

immediately before reentry flight commences in order to assure reentry safety. Verification of vehicle status and position one or more orbits before reentry flight is planned may be sufficient to assure safe reentry. Accordingly, the FAA modifies this section of the final rule by removing the word ``immediately'' from the requirement in Sec. 431.43(e)(1) of the final rule and has made nonsubstantive changes for clarity.

Section 431.45 Mishap Investigation Plan and Emergency Response Plan

Section 431.45 requires submission of a mishap investigation plan (MIP) that satisfies reporting requirements and provides procedures for cooperating with an FAA and National Transportation Safety Board (NTSB) investigation, and an emergency response plan (ERP) for notification of local officials and information dissemination to the public. As crafted in the NPRM, launch-related information for a MIP covering an RLV mission was outlined in Sec. 415.41 of the FAA Licensing Regulations, 14 CFR 415.41, and an applicant was referred to that section for additional requirements in preparing a sufficient MIP. In this manner, the MIP would include the accident investigation plan applicable to launches under 14 CFR part 415 and additional requirements addressing accidents, incidents or other unplanned events during the reentry portion of an RLV mission. Upon reconsideration, the FAA has determined to include stand-alone accident, incident and mishap investigation requirements covering all phases of an RLV mission and to remove reference to part 415 from its requirements. References to part 415 that appeared in proposed Sec. 431.45 are removed from Sec. 431.45 in the final rule and the data requirements for purposes of immediate notification and submission of a written preliminary report to the FAA are listed in Sec. 431.45. Additional modifications have been made for the purpose of ensuring consistency in notification and reporting requirements for ELV and RLV mishaps.

NorthStar requested clarification of the term ``immediate'' for purposes of accident notification and requested that a time interval, such as one hour, be specified. Due to the severe nature of an accident, the FAA requires notification as soon as an event occurs, not within an hour or more. Therefore, the FAA will not include a time interval in the final rule. The FAA understands that immediate notification will not include all of the relevant details. More detailed information would be provided in the follow-up preliminary written report required within 5 days of the event. ERPS expressed concern over the requirement imposed upon the MIP that it provide for immediate notification that includes potential consequences for other vehicles or systems of similar type and proposed operations. ERPS states that this information would not be available until research and analysis is performed. The FAA agrees and notes that this requirement is now an element of the written report. ERPS further suggests that the written preliminary report identify the cause of the mishap. The FAA disagrees because accurate information concerning the cause of a mishap will not necessarily be available until an investigation is conducted. Identification of the cause of a mishap is an investigation report requirement under Sec. 431.45 of the final rule.

Section 431.47 Denial of Safety Approval

Section 431.47 of the final rule provides that the FAA notifies an applicant in writing if safety approval is denied and provides the reasons for the denial. Safety considerations addressed through performance-based criteria included in the final rule may nevertheless result in denial of safety approval where the FAA determines that a proposed mission would jeopardize public health and safety and the safety of property even though an applicant has addressed the elements required for safety review in its application. The applicant can respond and correct any deficiencies identified by the FAA and request reconsideration. An applicant is notified directly by the FAA.

The Aircraft Owners and Pilots Association (AOPA) expressed concern that others affected by issuance of an RLV mission license, such as users of the National Airspace System, should have an opportunity to voice concerns over issuance of the approvals leading to a license. The FAA does not envision an open licensing process that would allow competing concerns to prevent issuance of a license. Rather, the FAA is designing a concept of operations for use of the national airspace system to ensure that all users can be accommodated safely and without unreasonable disruption.

Kelly and ERPS inquired as to the timing of a denial of safety approval. The FAA envisions that individualized aspects of the safety review process would require feedback, on an ongoing basis, from the FAA to an applicant as additional data needs are identified. Impediments to issuance of a safety approval would result from either deficient information, which would be identified to an applicant in the course of the FAA's review, or inability by an applicant to satisfy safety criteria outlined in subpart C of the final rule, part 431. The FAA would not withhold its conclusion if it determines that a proposed mission cannot be approved for safety reasons, but would provide such indications to an applicant who could modify its proposal to satisfy safety criteria. By statute, the FAA is committed to a 180-day review period for review of an accepted application and is also statutorily bound to notify an applicant not later than 120 days after receiving an accepted application of any pending issue. The combination of statutory deadlines, pre-application consultation to facilitate preparation of an acceptable application, and FAA commitment to an interactive and consultative licensing program should relieve any concern among applicants that the FAA would delay in making the determinations required for an RLV mission license.

Subpart D--Payload Reentry Review and Determination

Reentry of a payload may present policy and safety issues different from those presented when a payload is launched. Accordingly, a determination separate from a payload determination is required to reenter a payload, whether it is one that was reviewed for launch or an object retrieved from space for return to Earth.

ERPS did not object to the requirement for a payload reentry determination but questioned where responsibility lies for obtaining one. An owner or operator of the payload proposed for reentry may request the determination in place of an RLV operator; however, an RLV mission or licensee desiring to reenter a payload on its vehicle must

ensure that a favorable determination has been made by the FAA. Accordingly, it is ultimately the responsibility of an RLV mission licensee to ensure that a payload reentry determination has been requested, if necessary, and that a favorable determination is made before proceeding with the mission.

Section 431.51 General

Section 431.51 states the requirement for a payload reentry review and determination. It may be requested as part of, or separate from, an RLV mission license application review but must be completed favorably for a payload to be reentered to Earth.

Section 431.53 Classes of Payloads

In the interest of facilitating RLV mission licensing, payloads sharing common characteristics may be reviewed as a general class and determined appropriate for reentry. Unique characteristics of payloads within the class, such as hazardous materials contained within the payload, may subject a particular payload to individual review. Because a payload reentry determination may be issued far in advance of an RLV mission, current information regarding each payload to be reentered must be reported to the FAA at least 60 days before a scheduled RLV mission involving the payload. The FAA can then ensure that a payload approved generally as part of a class does not pose unique hazards or policy considerations that must be separately addressed.

TGV considers that 60 days notification should be replaced with 24 hours, particularly for payloads similar to those previously launched and reentered, to facilitate rapid response time by an RLV operator. The FAA extends to RLV missions the existing 60-day notification period applicable to ELV-launched payloads for the time being but notes that only updated information not previously reported to the FAA and reviewed as part of the payload reentry review would require submission. An applicant for a payload reentry determination would be well-served to anticipate the types of payloads and their contents that it envisions reentering.

Section 431.55 Payload Reentry Review

Other Federal agencies are consulted in performance of a payload reentry review, as is done in the payload review process, to determine whether reentry of a proposed payload poses any issues that would adversely affect U.S. national security or foreign policy interests or would jeopardize public health and safety or the safety of property. As in a payload review, as well as other reviews required for an RLV mission license, the FAA informs the applicant in writing of impediments to issuance of a favorable determination, allowing the applicant an opportunity to respond or revise its application. Kelly, ERPS and NorthStar expressed the same concerns over timing issues already addressed as part of the policy and safety review process outlined above. The agency response is the same as previously stated with regard to such concerns.

ASTi inquired as to whether a payload that is launched and subsequently reenters without leaving an RLV requires a payload reentry review. The agency does require a favorable determination for a payload

to be launched and subsequently reentered, whether or not it is first deployed from the vehicle and then reentered aboard the same or other RLV. Changes in payload characteristics must be evaluated to ensure reentry is appropriate. Moreover, a payload that is not hazardous or problematic in terms of U.S. policy for launch purposes may pose concerns to public safety or the U.S. Government upon reentry. Accordingly, a prudent RLV or payload operator may seek a payload reentry determination if there is a possibility that a payload, once launched on an RLV, cannot be deployed and would remain on-board the vehicle for reentry.

Section 431.57 Information Requirements for Payload Reentry Review

Specific information requirements for a payload reentry determination are listed in this section of the final rule. NorthStar suggests that a means of assuring confidentiality of proprietary information be provided. As specified in 14 CFR 413.9, any person furnishing information or data to the FAA may request, in writing, that its trade secret or proprietary commercial or financial data be treated in a confidential manner.

Section 431.59 Issuance of Payload Reentry Determination

Section 431.59 provides the bases upon which the FAA issues a favorable payload reentry determination. If an unfavorable determination is issued, the applicant is notified by the FAA in writing, and has an opportunity to respond to the reasons for denial and request reconsideration. In response to a request from ERPS for clarification, the FAA states that a person denied a favorable payload reentry determination may respond and request reconsideration immediately upon obtaining written notice from the FAA or may wish to do so at a future time.

Section 431.61 Incorporation of Payload Reentry Determination in License Application

As previously stated, a favorable payload reentry determination is required for an RLV mission that includes a reentering payload. If information on which a favorable determination is based changes before the conduct of an RLV mission, the FAA must be provided with updated data and may perform an additional review including coordination with other Federal agencies. The FAA would do so if changed information signals possible effects on the FAA's safety mandate or on U.S. Government interests safeguarded through the licensing process. These requirements are consistent with current practice with respect to payloads proposed for launch on ELVs. Section 431.61 of this final rule extends this practice to RLV missions.

ERPS commented that the responsibility for complying with Sec. 431.61 requirements should be imposed upon the payload owner or operator and not the RLV mission licensee. The FAA disagrees with ERPS. The privilege granted to a licensee by an RLV mission license is conditioned upon the FAA having current information that is material to public health and safety and safeguarding U.S. national security and foreign policy interests. Because the FAA does not license payloads or their owners and operators, the RLV mission licensee is in the best

position to ensure that its customer, the payload owner or operator, reports changes in information to the licensee and to the FAA. By doing so, the licensee can feel confident that it is in compliance with the license. This responsibility is properly assigned by the final rule to the RLV mission licensee.

Section 431.71 Public Safety Responsibility

Consistent with current practice for ELV launch licenses, Sec. 431.71 of the final rule states the basic principle that a licensee is responsible for ensuring

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safe conduct of licensed activities. A license is issued on the basis of representations contained in an application that have been reviewed and approved by the FAA. Accordingly, a licensee is responsible for ensuring that it operates in a manner that is consistent with its application. Any deviation from the application would be a basis for revocation of the license or other enforcement action by the FAA against a licensee.

Section 431.73 Continuing Accuracy of License Application; Application for Modification of License

Section 431.73 applies to a licensed RLV mission, the FAA's regulatory program for requiring approval of any changes in licensed activity from that reviewed by the FAA and authorized by a license. A licensee is therefore responsible for ensuring that representations contained in its application remain accurate for the life of the license. Any proposed change in operation that may affect public health and safety or the safety of property is subject to prior approval by the FAA. Section 431.73(b)(2) lists elements of an application that, if altered or affected by the change, would constitute a change in the accuracy of the license application. An application to amend or modify a license must comply with 14 CFR part 413 requirements applicable to preparation and submission of an application. The FAA does not re-open findings that are not affected by a proposed change and limits its review to those determinations affected.

Kelly commented that a time limit should be imposed upon FAA license modification reviews and that a fast track approach should be used for issue resolution. The FAA has not specified in regulations the amount of time within which it would approve an application to amend a license. A proposed modification may affect approvals already granted in a significant way, essentially requiring that they be performed anew, such as where an RLV safety-critical system or mission proposal would change significantly. In such cases, the FAA may treat the application for modification as a new license application and commence the 180-day review clock. Minor changes would require far less time. This variability prevents the FAA from imposing upon itself strict time limits, other than those dictated by statute, for reviewing a proposal for modification of a license. The FAA does agree with Kelly, however, that issues posed by a proposed modification should be identified as quickly as practicable to facilitate their resolution and to this end seeks support from the proponent of the modification. With this in

mind, Sec. 431.73(c) requires that the licensee seeking modification of its license identify those parts of its license or its application that would be changed or affected by a proposed modification.

USA and ERPS requested clarification of FAA policy on what constitutes a material change requiring reporting to the FAA and request for license modification. ERPS is concerned that too strict a requirement would have a chilling effect on willingness of license applicants to disclose fully technical information in an application. ERPS would like the FAA to designate those designs, operations and the like that must be ``frozen'' in order to remain in compliance with a license. Otherwise, according to ERPS, a development program would be hindered by the need to continuously submit license modification applications to the FAA.

In response to USA and ERPS, FAA believes that a change is material if it could affect fulfillment of the FAA's safety mandate, that is, if it could affect public health and safety or the safety of property. The final rule designates procedures, hardware, systems and plans that, if changed, could affect public safety. The final rule does so in the interest of providing notice to RLV mission licensees of particular aspects of an RLV mission application that must be maintained under current FAA approval for the license to remain valid. Minor modification to the list that appears in Sec. 431.73(b)(2) is made in the final rule to track more closely the required components of a license application.

Section 431.75 Agreements

For reasons explained in the NPRM, an RLV mission licensee must enter into a variety of agreements, including an agreement for use of property and services of a Federal launch range, if applicable, or an agreement with a licensed site operator. If launch and reentry will occur at separate sites then agreements with each site operator would be required. The FAA expects that licensed operators of launch and reentry sites will impose safety requirements on their customers, including RLV mission licensees, that would cover activities other than launch and reentry at the site. Adherence to such safety requirements is also a requirement under the RLV mission licensing rules.

Where a licensed site is used to support launch or reentry for an RLV mission, Sec. 431.75(b) of the final rule requires an agreement between an RLV mission licensee and the U.S. Coast Guard for issuance of Notice to Mariners before a launch or reentry unless the licensed site operator already has arrangements in place under the terms of an agreement with the U.S. Coast Guard. A similar agreement is also required between an RLV mission licensee and the regional FAA office for issuance of Notice to Airmen and for closing of air routes during launch and reentry windows, unless the licensed site operator maintains a comparable agreement. An RLV mission licensee also bears responsibility for such agreements when it uses a private site or has exclusive use of a site that is not a Federal launch range. Where launch or reentry takes place at a Federal launch range, the Federal range authority coordinates the Notices with the U.S. Coast Guard and FAA regional offices, respectively, so the requirement would not be imposed on the RLV mission licensee.

ACTA commented that closing of air routes anywhere under the flight path of an RLV may be too restrictive. ACTA states that Federal launch

ranges close airways only if the hazard area includes any part of an airway or the vehicle or any of its jettisoned stages and debris would penetrate an airway at an altitude below 100,000 feet. Instead of a change in the final rule, the FAA prefers to resolve air route closing issues, including those presented by potential use of contingency abort locations, as part of the concept of operations it is developing for use of the National Airspace System and on an individual basis as part of the FAA's safety review of a proposed mission. The FAA also reserves discretion within the FAA regional office to impose measures deemed necessary by that office to protect public safety. The need to clear airspace over a contingency abort location may depend upon a number of factors, such as the likelihood of using that location, air traffic density around it, and the time required to coordinate and clear airspace should a contingency abort be implemented. The FAA makes no change to the final rule requirement regarding agreements for notices to mariners and airmen.

Section 431.77 Records

Section 431.77 extends record retention requirements imposed on ELV launch licensees to RLV mission licensees. The FAA does not accept the recommendation offered by TGV to change the record retention requirement from three years to one year. In the event of an accident or incident in the course of an RLV mission, a licensee is required to preserve relevant records until completion of any Federal

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investigation and the licensee is advised by the FAA that the records need not be maintained any longer. ERPS questions why records must be maintained in perpetuity if they can be made available to the FAA. The FAA does not require perpetual record retention and does not intend to be the custodial record retention office for private industry. The FAA would share a licensee's interest in prompt, efficient resolution of an investigation and would require that records be maintained in the interest of developing accurate and comprehensive investigation findings. The FAA does not envision that this requirement would be unduly burdensome to industry.

Section 431.79 Reusable Launch Vehicle Mission Reporting Requirements

The FAA requested public comment on proposed reporting requirements contained in the NPRM in light of rapid turnaround missions contemplated for RLV operations. The NPRM proposed 60-day and 15-day reporting requirements in advance of an RLV mission, in addition to mishap reporting consistent with the MIP and ERP submitted as part of a license application under 14 CFR 431.45. Lockheed Martin, ERPS and TGV recommended a 24-hour advance reporting requirement for an RLV mission for notifying the FAA of the time and date of intended launch and reentry of an RLV. TGV also suggested 7 days advance reporting for a new type of payload and 24 hours for a payload type previously launched. Vela argued that 60 minutes advance reporting is no more realistic for an RLV than it would be for an aircraft and was echoed by ASTi in suggesting use of an aircraft model and filing of a flight plan in lieu of reporting. The X PRIZE Foundation and B-G suggested using

notice periods comparable to those used for issuance of notices to airmen and notices to mariners. Kelly suggested a provision be added for quick turnaround missions, perhaps 3-7 days in lieu of 15.

Mission reporting requirements as proposed in the NPRM provide a minimum of 60 days notice to the FAA of a planned mission to facilitate FAA scheduling and final checks on license status. Collision avoidance analysis must be completed and inspector schedules arranged to accommodate mission scheduling. As time draws closer to an actual mission, the FAA seeks 15 days notice of mission plans assuming a licensee is then actively pursuing a launch campaign to meet its intended mission date. The 15-day notice is provided to U.S. Space Command to facilitate its collision avoidance analysis and tracking efforts. For ELV launches, in particular, comparable requirements have been extremely useful for the FAA and have not proven burdensome or problematic for licensees. For purposes of facilitating FAA planning and scheduling and to ensure the FAA can support a licensed RLV mission as part of its launch manifest, the FAA retains the 60-day minimum reporting requirement in the final rule. The FAA also retains the 15-day requirement. As RLV operation matures and if practical experience so indicates, the FAA will consider modification of these requirements in the future, particularly when necessary to facilitate rapid turnaround missions.

Comments also requested clarification of procedures and paperwork required to fulfill reporting requirements. Information that must be reported at least 60 days in advance of a mission is not restricted to a particular format. For 15-day notification of ELV launches, the FAA utilizes the FAA/U.S. Space Command Launch Notification Form located at 14 CFR part 415, Appendix A. A licensee may use this form to provide the required information.

Section 431.81 Financial Responsibility Requirements

A companion rulemaking details requirements for demonstration of compliance by an RLV mission licensee with financial responsibility requirements for reentry. For purposes of an RLV launch, requirements of 14 CFR part 440 apply. Financial responsibility requirements applicable to a particular mission are set forth in a license order that is part of an RLV mission license.

Section 431.83 Compliance Monitoring

Section 431.83 of the final rule states the statutory requirement that a licensee must allow Federal officials or their designee access to observe activities associated with the conduct of a licensed mission, including contractor and subcontractor activities.

Kelly commented that access should be qualified by noting that to the maximum extent possible it should be done on a non-interference basis. ERPS requested clarification of FAA compliance monitoring policy.

In fulfilling its safety mandate, the FAA may observe activities associated with the conduct of licensed activity, including activities conducted at a production facility or assembly site, as necessary to ensure compliance by a licensee with the terms and conditions of a license. Representations made by a licensee in its application are part of the license and the FAA may observe any activities associated with

the conduct of licensed activity to ensure adherence to representations made in a license application. The FAA does not use, and has not used, its authority to interfere with applicant activities or to in any way obstruct them. However, the FAA is entitled by law to full access to facilities and need not give a licensee notice of its intent to monitor activities.

Section 431.85 Registration of Space Objects

Section 431.85 of the final rule retains proposed requirements for registration of space objects to facilitate fulfillment of responsibilities accepted by the United States as a signatory to the Convention on Registration of Objects Launched into Outer Space.

Subpart F--Environmental Review

Subpart F contains environmental review requirements applicable to licensing of RLV missions. The FAA must comply with the National Environmental Policy Act (NEPA), 42 U.S.C. 4321 et seq., Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, 40 CFR parts 1500-1508 and its own procedures.

Section 431.91 General

Section 431.91 of the final rule sets forth the basic requirement that an applicant for an RLV mission license must provide to the FAA sufficient information to enable the FAA to analyze the environmental impacts of proposed RLV mission activities, including those to be performed at a reentry site. Comparable requirements for launch site impacts are already required under 14 CFR 415.101, and are not repeated here.

Section 431.93 Environmental Information

Section 431.93 lists the categories of information the FAA requires from an applicant in order to analyze and assess environmental impacts resulting from use of a launch site, reentry site or contingency abort location or RLV in the conduct of an RLV mission, if use of that site or vehicle as proposed is not already covered by existing environmental documentation. The same would apply to reentry of a payload that may have significant environmental impacts in the event of a reentry accident. Other information needed by the FAA for the agency to comply with its environmental review requirements under NEPA is also required from the applicant. Specific reference to the launch site proposed for

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the conduct of an RLV mission is added to the final rule to address proposed use by an RLV operator of a private site not already assessed by existing Federal environmental documentation.

Kelly registered its concern that attempts to comply with environmental laws have been known to quash commercial projects and expressed unease at the number of potentially applicable laws and the research needed to identify and comply with them. Kelly suggested that

the FAA be aggressive, with support from Congress, in assuring that environmental laws do not prevent the RLV industry from developing. In a similar vein, ERPS was concerned that every new type of RLV could be subject to environmental review requirements and associated burdens. ASTi suggested that a licensed site operator should bear responsibility for covering vehicles in its environmental documentation.

The FAA understands the commitment required by government and industry to facilitate environmental reviews required by law. Pre-application consultation is a useful device for scoping environmental review issues presented by an RLV mission proposal, in addition to technical safety and policy matters. Issues presented by a specific proposal would depend upon the proposed action, the proposed sites and contingency abort locations if any will be used as part of an application, and the vehicle proposed for flight. To the extent those issues are covered by existing documentation, such as that prepared in support of a site operator license, the FAA ``tiers off'' of such documentation to ensure reviews are conducted only to the extent necessary to deal with the unique attributes of a proposed mission. For example, the FAA facilitates environmental reviews for launch vehicles by covering in programmatic documentation a range of vehicle characteristics. Accordingly, for many vehicles, only site specific environmental effects may require analysis.

The FAA works closely with an applicant to identify particular environmental data and documentation needs and ensure compliance with applicable environmental laws. The agency encourages early involvement by an applicant in preparation of environmental documentation to facilitate the environmental review process and satisfy an applicant's scheduling needs.

Part 433--License To Operate a Reentry Site

Section 433.1 General

A new part 433 is added to 14 CFR Chapter III governing licensing of the operation of a reentry site. The FAA will evaluate safety issues on a case by case basis to allow prospective operators maximum flexibility in determining the array of services that may be offered at a site and this principle is reflected in Sec. 433.1 of the final rule.

A license would be required for an entity to operate a reentry site and offer it for use by reentry vehicle operators. A separate license to operate a reentry site is not required for an RLV or reentry vehicle operator to develop and use a private facility for its exclusive use. Safety and environmental issues associated with private use of a site by a launch or reentry licensee, as well as an RLV mission licensee, would be addressed as part of the license to operate the vehicle.

Section 433.3 Issuance of a License To Operate a Reentry Site

Section 433.3 of the final rule establishes that, consistent with its statutory mandate, the FAA will license an operator to operate a reentry site in accordance with representations presented in an application for review and approval by the FAA, and subject to terms and conditions stated in the license.

Kelly and ASTi inquired as to whether safety operations conducted at a reentry site would be the sole consideration for licensing

operation of a site. The FAA's mandate in licensing the operation of a reentry site also includes consideration of national security and foreign policy interests of the United States. Government policy considerations would also be a factor in determining whether a license to operate a reentry site may be issued. However, issuance of a license to operate a reentry site would not authorize an RLV or reentry vehicle operator to use that site. An operator wishing to use the site for reentry would have to demonstrate through the licensing procedure applicable to it that the site is suitable for the use proposed by that operator in accordance with FAA regulations.

NorthStar noted in its comments that a site may qualify as a reentry site under certain conditions that may not exist on a year-round basis due to atmospheric or other conditions. The FAA agrees and, consistent with its approach to licensing commercial space transportation activities, the authorization granted by a license to operate would be limited to representations and information contained in the application and evaluated by the FAA.

Section 433.5 Operational Restrictions on a Reentry Site

In addition to other limitations on operation imposed by the FAA in accordance with Sec. 433.3, a reentry site may only be offered for use by those reentry vehicles, including RLVs, for which the three-sigma footprint of the vehicle is wholly contained within the site. Whereas Sec. 431.43(b) imposes a restriction on an RLV operator in identifying suitable landing sites, a licensed reentry site operator would be similarly restricted in terms of the vehicles that may land at its reentry site. The criteria applicable to identifying and defining the three-sigma dispersion of a reentry vehicle presented above in the discussion of Sec. 431.43(b) and the agency's three-pronged public safety strategy for RLV missions also applies to Sec. 433.5.

Orbital Sciences observed that an RLV stage that is not itself a reentry vehicle is not covered by the definition of a reentry site and therefore its landing would not be regulated by the FAA. Landing of stages is covered by Sec. 431.43(b), which applies to vehicle staging impact areas as well as nominal landing and contingency abort locations for an RLV.

Section 433.7 Environmental

Because licensing the operation of a reentry site is a major Federal action requiring compliance by the FAA with NEPA and associated regulations, Sec. 433.7 of the final rule requires that a license applicant supply sufficient information to the FAA to enable the agency to do so.

Section 433.9 Environmental Information

The FAA understands that a proposed reentry site may be covered by existing documentation that addresses environmental impacts when that site is used for certain purposes. Reentry impacts may require additional environmental consideration and Sec. 433.9 establishes the requirement that information necessary for doing so must be provided by an applicant for a license to operate the site as a reentry site. A licensee authorized to operate a launch site may, for example, be

required to submit additional data for agency review under environmental laws before the site may also be authorized for use as a reentry site.

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Part 435--Reentry of a Reentry Vehicle Other Than a Reusable Launch Vehicle (RLV)

A new part 435 is added to 14 CFR Chapter III under the final rule to address licensing requirements for reentry of a reentry vehicle that is not an RLV. Since the COMET/METEOR program was discontinued, all of the reentry concepts presented to the FAA for informational purposes or in pre-application consultation have involved RLVs. The final rule therefore provides detailed requirements for obtaining an RLV mission license under part 431. Rather than repeat in part 435 all of the requirements of part 431 that are applicable to the reentry phase of an RLV mission, part 435 expressly states requirements and licensing considerations that are unique to reentry of a reentry vehicle that is not an RLV. An applicant for a license under part 435 is referred to part 431 for additional requirements applicable to a proposed reentry.

The FAA uses the same three-pronged strategy to address public safety considerations employed in evaluating an RLV mission. Comments were solicited on the proposed approach of assessing reentry risk in combination with the launch of the launch vehicle that placed the reentry vehicle in Earth orbit or outer space. ERPS commented on this combined approach to risk noting that an RLV mission to launch a reentry vehicle as a payload for subsequent reentry involves three events that, in combination, must satisfy the expected casualty risk criteria for an RLV mission, that is, launch and reentry of an RLV and subsequent reentry of the reentry vehicle. ERPS also stated that if the RLV and reentry vehicle have different operators, they would be required to negotiate their respective risks and the RLV mission licensee would have to certify to the FAA that mission risk is within acceptable limits even though it is not the reentry vehicle operator. ERPS therefore recommends retention of the combined risk approach unless the reentry vehicle is intended to reenter after an RLV mission license has expired.

The FAA does not agree with the recommended approach offered by ERPS. Currently, in licensing ELV launches, the FAA considers, in some measure, reentry of upper stages after an ELV launch is completed for purposes of assessing launch risk because that is part of the launch mission. In response to a question from Kelly regarding upper stage reentry risk, the FAA would assess the risk of reentry of an expendable upper stage of an RLV as part of mission risk for an RLV mission. Reentry of a reentry vehicle placed in orbit as part of an RLV launch mission ought to be assessed as part of RLV mission risk, in the FAA's view, just as an RLV utilizing multiple stages would be subject to combined risk assessment for the mission, because its reentry may be considered part of the launch mission. The FAA notes, however, that its combined risk approach would apply only to launch vehicle stages and to payloads that are themselves reentry vehicles. It would not apply to natural de-orbiting of a satellite placed in space by an ELV or RLV for which purposeful return to Earth, substantially intact, is not intended, because the return to Earth is not part of the launch

mission.

Subpart A establishes the kinds of reentry licenses that may be granted by the FAA and the approvals necessary to obtain a reentry license and describes in general terms the authorization granted by a reentry license.

Subpart B identifies the policy review and approval required for a reentry license and incorporates policy review and approval requirements applicable to reentry of an RLV under part 431, subpart B of 14 CFR Chapter III, subchapter C.

Subpart C identifies the safety review and approval required for a reentry license and incorporates safety review and approval requirements applicable to reentry of an RLV under part 431, subpart C of 14 CFR Chapter III, subchapter C. The combined risk criteria for a proposed reentry mission is identified in Sec. 435.35 of the final rule to be consistent with that applicable to an RLV mission.

Subpart D identifies the payload reentry review and determination required for a reentry license and incorporates requirements applicable to a payload reentry determination under part 431, subpart D of 14 CFR Chapter III, subchapter C.

Subpart E identifies post-licensing requirements and license terms and conditions applicable to a reentry license and incorporates requirements applicable to reentry of an RLV under part 431, subpart E of 14 CFR Chapter III, subchapter C.

Subpart F identifies environmental review requirements applicable to reentry of an RLV under part 431, subpart F of 14 CFR Chapter III, subchapter C.

Except for the comments cited in the above paragraphs of this part, comments directed at provisions of proposed part 435 repeated and reiterated industry concerns registered with respect to corresponding requirements of part 431. Likewise, the FAA echoes its response to those comments and does not separately discuss them here. Other than nonsubstantive corrections, the FAA makes no change to part 435 in the final rule from that proposed in the NPRM.

Paperwork Reduction Act

As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the FAA has submitted a copy of these sections to the Office of Management and Budget for its review. The collection of information was approved and assigned OMB Control Number 2120-0643. This final rule will amend the commercial space transportation licensing regulations by establishing operational requirements for launches of reusable launch vehicles (RLVs) and the authorized conduct of commercial space reentry activities. The final rule will respond to advancements in the development of commercial reentry capability and enactment of legislation extending the FAA's licensing authority to reentry activities. The agency is proposing requirements that limit risk to the public from RLV and reentry operations.

The required information will be used to determine whether applicants satisfy requirements for obtaining a launch license to protect the public from risks associated with RLV missions and other reentries. The information collected includes data required for performing a safety review, which includes a technical assessment to determine if the applicant can safely reenter a reentry vehicle, including an RLV and payload, if any, to a designated reentry site

without jeopardizing public health and safety and safety of property. The frequency of required submissions may depend upon the frequency of licensed launch activities; however, a license may authorize more than one launch. The agency received two comments on potential paperwork burden. One commenter agreed with FAA's estimated cost of $20,000 per license application and the other commenter stated that as currently done a large amount of paperwork exists to complete the licensing process. Once the regulatory process is complete the company does not believe their there will be enhanced operational efficiency and decreased paperwork costs. Neither entity presented any compelling information that disputes FAA's position regarding paperwork reduction. The estimated number of respondents on an annual basis is five. The estimated average annual burden is 4,384 hours.

An agency may not conduct or sponsor and a person is not required to respond to a collection of information

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unless it displays a currently valid Office of Management and Budget (OMB) control number.

International Compatibility

The FAA has determined that a review of the Convention on International Civil Aviation Standards and Recommended Practices is not warranted because there is not a comparable rule under ICAO standards.

Regulatory Evaluation Summary

Proposed and final rule changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (19 U.S.C. 2531-2533) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, the Trade Agreements Act also requires agencies to consider international standards and, where appropriate, use them as the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 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).

In conducting these analyses, the FAA has determined that the final rule: (1) Has benefits that do justify its costs, is not ``a significant regulatory action'' as defined in the Executive Order, and is ``significant'' as defined in the Department of Transportation's Regulatory Policies and Procedures; (2) will not have a significant impact on a substantial number of small entities; (3) will not reduce barriers to international trade; and (4) does not impose an unfunded mandate on State, local, or tribal governments, or on the private sector. These analyses are available in the docket, and are summarized

below.

Baseline for Economic Analysis

The final rule implements certain policies developed by AST in 1992 with respect to public safety for the first commercial space reentry operation. However, the safety criteria in this final rule use different measures that better reflect current agency and range safety practices. The 1992 policy established safety criteria pertaining to a unique and specific request to conduct a first-of-a-kind payload reentry mission; that is, the COMET, later renamed METEOR, reentry vehicle. Accordingly, a comprehensive regulatory (benefit-cost) analysis was not required. Therefore, the baseline case used for this analysis views the final rule as a new requirement imposed on an emerging segment of the commercial space transportation industry that plans to operate reusable launch vehicles (RLVs) or conduct reentry operations with reentry vehicles (RVs). Doing so implies that, but for imposition of safety requirements by the agency, some compliance costs will not have been incurred by entities planning to conduct RLV missions (launch and reentry) and RV operations that are associated with launches from Federal ranges and non-Federal launch sites. (Regulatory costs and benefits associated with launches from Federal ranges are assessed as part of a separate rulemaking on launch licensing requirements for launches from Federal ranges.)

Costs

The final rule is expected to impose a total estimated cost of $151 million ($86 million, discounted), in 1999 dollars, on the commercial space transportation industry and the FAA over the 15-year period from 2001 to 2015. Commercial space transportation industry entities potentially impacted by the final rule will incur approximately 20 percent (or $31 million) of this total cost estimate in the form of compliance costs. The FAA will incur about 70 percent (or $120 million) of the total cost estimate in the form of administrative costs. All monetary values shown in this regulatory evaluation summary are expressed in 1999 dollars over the 15-year period. Due to some of the operational requirements of the final rule, costs may materialize that have not been specifically considered in this evaluation. For example, the requirement for each commercial space operator to have an independent safety inspector could, under certain circumstances, result in costs not examined in this evaluation. The independent safety inspector could require the operator to abort a launch or reentry for safety reasons, which could result in higher operating costs.

Reentry of RLVs and RVs are subject to comparable safety requirements and therefore regulatory costs for reentry are assessed collectively. Costs are assessed on the basis that, over the next 15-year period, five commercial operators of RLVs or RVs will be impacted by the regulations. It is assumed that five operators will obtain all necessary approvals to conduct RLV missions or RV reentries and that market demand is sufficient to support that level of vehicle operation.

Industry Compliance Costs

Section 431.25: Application Requirements for Policy Review and

Sec. 435.23 Policy Review Requirements and Procedures

These sections of the final rule will impose an administrative paperwork burden on each of the five anticipated commercial space industry operators potentially impacted by requiring them to provide specific policy review information to the FAA with regard to their anticipated RLV missions (launch and reentry) or RV reentry operations. The cost estimate of $400 per operator assumes an employee with an annual loaded salary of approximately $2000 (with fringe benefits) and a level of effort of eight hours.

Section 431.33: Safety Organization and Sec. 435.33: Safety Review Requirements and Procedures

Under the baseline, a safety organization with clearly defined roles, responsibilities, authorities, and lines of communication is consistent with the findings and recommendations of the Rodgers Commission and National Transportation Safety Board. However, the requirement to `` * * * designate a qualified safety official * * * to monitor independently compliance * * * with * * * [all] safety policies and procedures'' is not necessarily customary and usual practice. Inclusion of this requirement suggests that it is a refinement of industry baseline practices designed to mitigate safety risks to the public. For example, to be ``responsible for the conduct of all * * * mission activities * * * '' implies a degree of comprehensiveness that may not be common practice in industry. Because the safety official must be independent, the function cannot be assigned as a collateral duty to an individual with line responsibility for launch and reentry operations, though it could conceivably be assigned to an existing employee. Furthermore, the magnitude of responsibilities of the safety official suggests that the level of effort required to perform this function will exceed part-time employment. Assuming that the independent safety official function will not be performed as a collateral duty, this requirement will result in a commercial space transportation entity hiring a person to

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fulfill the safety official role. Industry as a whole will incur $6.4 million for all five operators over the 15-year period.

Section 431.35: Acceptable Reusable Launch Vehicle Mission Risk and Sec. 435.35 Acceptable Reentry Risk for Reentry of a Reentry Vehicle

Commercial space transportation entities are expected to incur additional costs for performance of risk analyses of vehicle operations, including reentry, and will incur costs in assessing the probabilities and consequences of all reentry hazards, events, and system failures that potentially expose the public to risk. Additionally, commercial entities will expend effort preparing documentation and establishing an associated document control system for drawings and schematics. This compliance activity is expected to fulfill the level of rigor implied by the requirements contained in the final rule. The total cost of compliance for all potentially impacted operators will be approximately $4 million over the 15-year period.

Section 431.37: Mission Readiness and Sec. 435.33: Safety Review Requirements and Procedures

The requirement to provide specific procedures to the FAA that verifies mission readiness presents an administrative paperwork burden to a commercial entity. This requirement will cause an operator to incur costs for preparing and submitting the requisite information to the FAA. For all entities, this requirement will impose an estimated cost of compliance of approximately $20,300 over the 15-year period.

Section 431.39: Mission Rules, Procedures, Contingency Plans, and Checklists and Sec. 435.33: Safety Review Requirements and Procedures

Commercial space transportation entities are generally expected to fulfill the requirements as part of their standard operating procedures. However, the FAA anticipates that these entities will incur some additional costs conforming to FAA requirements. Additionally, commercial entities are expected to incur costs from submitting updated documents with the FAA periodically, and preparing for, accommodating and reacting to FAA inspection and compliance monitoring activities. Industry will incur $418,000 over the 15-year period.

Section 431.41: Communications Plan and Sec. 435.33: Safety Review Requirements and Procedures

Commercial space transportation entities are expected to have in place communications plans that, for the most part, are consistent with the final regulatory requirements as a matter of standard business practice. However, they are expected to incur incremental costs complying with the requirement, annual recurring costs from interfacing and exchanging documents with the FAA periodically and preparing for, accommodating and reacting to FAA inspection and compliance monitoring activities. Industry will incur $418,000 over the 15-year period.

Section 431.43: Reusable Launch Vehicle Mission Operational Requirements and Restrictions and Sec. 435.33: Safety Review Requirements and Procedures

Commercial space transportation entities are expected to expend additional levels of effort to comply with risk mitigation requirements that, to some extent, limit vehicle flight path options during nominal and non-nominal operations. This requirement also imposes limitations on dwell time over populated areas and requirements for performing a collision avoidance analysis during launch windows to maintain adequate separation from orbiting objects.

This final rule will impose work restrictions and personnel rest requirements on commercial space transportation entities potentially impacted by this action. For example, an individual having direct control over reentry or involved in decisions affecting reentry operations is restricted to working 60 hours over the seven-day period preceding reentry. Further, the final rule will reduce the maximum permissible hours worked per shift to 12, limits the maximum number of consecutive workdays to 14, and specifies the minimum rest required (48 hours) between five consecutive days of 12-hour work shifts.

Currently, based on information received from industry, it is common practice among commercial space transportation entities to follow Air Force work and rest standards for launches. Those standards are similar to the requirements of this rule. Ordinarily, based on industry information, launch mission operations personnel work less than the maximum currently permissible, such as a 40-hour work week comprised of five eight-hour shifts. Hence, the 72-hour workweek is generally an extreme condition that occurs infrequently.

The duration of a reentry operation is likely to determine the extent of the impact that the work and rest requirements will have on commercial space transportation entities. However, this impact will occur under extreme or limiting conditions only (e.g., one reentry operations person).

Given the relatively small size of the entities comprising the emerging RLV segment of the commercial space transportation industry, staff augmentation of at least one person is not unlikely as a result of the requirements. Additionally, the FAA anticipates that additional costs will be incurred for recordkeeping to ensure compliance with required work and rest standards, and preparing for, accommodating and reacting to FAA inspection and monitoring activities.

The total cost to industry for the 15-year period will be about $15 million.

Section 431.45: Accident Investigation and Emergency Response Plan and Sec. 435.33: Safety Review Requirements and Procedures

As a matter of standard business practice, commercial entities are expected to have in place emergency response plans consistent with much of the regulatory requirement. However, the FAA anticipates that these plans will require additional annual maintenance to comply with certain elements of the final rule. For example, entities are likely to incur additional costs to establish their ability to successfully respond to accidents occurring in remote areas having sparse populations. Furthermore, additional annual maintenance costs are expected to arise from preparing for, accommodating and reacting to FAA inspection and monitoring activities. Industry will incur total compliance costs of approximately $2 million for the 15-year period.

Section 431.57: Information Requirements for Payload Reentry Review and Sec. 435.43: Payload Reentry Review Requirements and Procedures

The final requirement to provide specific payload information to the FAA presents an administrative paperwork burden to a commercial entity. The submission of data to the FAA is estimated to impose costs of approximately $400 per application or $2,000 for five entities over the 15-year period.

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Section 431.73: Continuing Accuracy of License Applications Application for Modification of License and Sec. 435.51: General--Post Licensing Requirements--Reentry License Terms and Conditions

The final requirement will impose minor costs on a licensee to advise the FAA of material changes to its application, and RLV and

reentry missions that may impact public safety and property. Depending upon the types of changes reported, it is assumed based on input received from FAA and industry technical personnel that, on average, a commercial space transportation entity will incur incremental compliance costs of approximately $34,000 per modification application. Industry as a whole will incur total compliance costs of approximately $170,000 for the 15-year period.

Section 431.75: Agreements and Sec. 435.51: Post Licensing Requirements--Reentry License Terms and Conditions--General

Entities that conduct commercial launches of ELVs from Federal ranges must enter into formal agreements with the Federal range authority prior to using such facilities. Entities planning to use these same facilities for reentry missions will also be required to enter into such agreements. The final requirement has no impact on commercial entities other than the negligible level of effort expended (e.g., less than one hour) to advise the FAA of compliance, and the incremental cost to industry to comply with this requirement will be negligible.

Section 431.77: Records and Sec. 435.51: Post Licensing Requirements--Reentry License Terms and Conditions--General

It is generally accepted practice among all commercial concerns to maintain business operations records for some period of time, often more than three years. Furthermore, the availability and capability of electronic storage systems renders records retention a manageable task. Accordingly, the three-year requirement to maintain records for FAA review, upon request, will not impact commercial space transportation entities. From a worst case perspective, this evaluation assumes the FAA will exercise its record request authority. Total costs to industry will be approximately $24,000 for the 15-year period.

Section 431.79: RLV Mission Reporting Requirements and Sec. 435.51: Post Licensing Requirements--Reentry License Terms and Conditions (General)

The information to be supplied by a licensee under this requirement is similar to that supplied previously to the FAA during the application process in accordance with Sec. 431.57. The burden placed on the licensee is to provide more specific mission data than that supplied previously but closer in time to the actual conduct of the mission. Because an operator must have this data to perform a scheduled mission, the incremental cost to industry to comply with this final requirement will be zero.

Section 431.93: Environmental Information and Sec. 435.61: Environmental Review--General

Because licensing is a major Federal action, a commercial space transportation entity will be required to provide information addressing the environmental effects of its operations so that the agency can fulfill its responsibility under NEPA and CEQ environmental regulations, even in the absence of the final rule. Commercial entities

planning to conduct launch and reentry missions must submit environmental assessment data to the FAA regarding environmental impacts of its activities to enable the FAA to evaluate environmental effects not previously assessed by the agency. This will cause a commercial entity to incur incremental compliance costs of $278,000. Industry will incur compliance costs of $1.4 million over the 15-year period.

Section 433.7: Environmental Information

An analysis of the environmental impacts of operating a reentry site is required under NEPA. The requirement, as distinct from similar requirements for operation of a launch site, will cause a commercial entity to incur incremental compliance costs of $167,000. Industry will incur total compliance costs of approximately $834,000 over the 15-year period.

FAA RLV/RV Administrative, License Processing and Monitoring Costs

The final rule will result in the FAA expending great effort in evaluating RLV mission and reentry license applications and monitoring licensees for compliance. This evaluation estimates that the FAA will incur costs of approximately $120 million over the 15-year period, as the result of administering its review of license applications and monitoring licensee compliance in accordance with the requirements of certain sections of parts 431, 433, and 435.

The FAA's actual experience in evaluating an application to conduct a reentry mission is limited to the COMET/METEOR program. Much of the final rule reflects safety policies for reentry developed by the agency in 1992 to ensure that the COMET/METEOR payload reentry mission will not jeopardize public health and safety and or the safety of property. Consequently, this experience provides a partial basis for establishing the costs to the FAA for administering the final rule. Using this past experience, AST expects that the costs to be incurred in performing its RLV mission and reentry licensing pre-application consultation, application evaluation, and compliance monitoring duties in the near term to be higher than that incurred for COMET/METEOR for a single application, with or without a formal reentry licensing regulation. The extent to which such costs will be higher than that incurred for COMET/METEOR is unknown since there is no history of U.S. commercial reentry activity. The assessment of higher application costs, however, is largely due to the expectation that inherently more complex RLV programs will dominate reentry missions in the future and initially these will require greater evaluative effort on the part of FAA personnel until they have developed experience in this area. While AST budget estimates for fiscal year 2000 reflect additional funding needed to exercise its reentry mission approval function, this need cannot be attributed to the final rule, but rather to the complexity associated with the advancing technology that will be evaluated.

AST budget estimates of the cost to perform its pre-application consultation and application evaluation licensing responsibilities may be correlated collectively to Secs. 431.23, 431.27, 431.31, 431.47, 431.55, 431.59, and 431.91; 433.3, 433.9; and 435.23, 435.31, 435.43, and 435.61 of the final regulation. The costs to be incurred by the FAA to implement its compliance monitoring responsibilities corresponding

to Secs. 431.73, 431.83, and 435.51 can vary widely, as the spectrum of changes to reentry program operations can range from minor to major. Therefore, the FAA expects to spend $3.6 million--an amount equivalent to that expended for COMET/METEOR--to implement and administer these final requirements for a single application.

Based on projections of the level of application activity over the 15-year period from 2001 to 2015, the FAA is

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expected to spend approximately $120 million in administering the safety requirements of parts 431, 433, and 435. Approximately 94 percent (or $112 million) of the cost by the FAA to administer these parts will be incurred to approve the projected reentry license applications and modifications to be evaluated over the 15-year period. Approximately 6 percent (or $7.7 million) of the cost to administer parts 431, 433, and 435 will be expended on the review of application denials and reconsideration process.

Unlike the estimates for potential benefits, the costs section of this evaluation uses a point (or single) estimate rather than a range. The point estimate approach was chosen in estimating FAA administrative costs because, due in large measure to the agency's experience with the COMET/METEOR Program, there is far less uncertainty associated with the estimation of costs for this final rule relative to benefits.

Benefits

The final rule is expected to generate both quantitative and qualitative benefits. This rule is expected to generate quantitative benefits of $119 million (or $66 million, discounted), which represents enhanced safety over the 15-year period. Benefits include enhanced safety by limiting reentry risk to a level that does not exceed an expected average number of 30 casualties per one million RLV missions or reentries for the general public. The rule is also expected to generate qualitative benefits in the form of enhanced operational efficiency on the part of both the U.S. commercial space industry and the FAA. A formalized licensing process for reentry operations will enhance communications between the FAA and the commercial space transportation industry in terms of frequency and efficiency of information exchange. In so doing, it will instill a regulatory climate that will promote and foster growth and technological advancement in this maturing industry.

Quantitative Benefits

The potential safety benefits that are expected to accrue as the result of this final rule stem principally from a safety criterion implemented and administered by the FAA on commercial space transportation industry operators who wish to engage in RLV missions or reentries. The criterion is as follows:

E_c 30 x 10^{-6}: This criterion applies on a per mission basis and includes both launch and reentry phases of an RLV mission. It requires that the risk to the public associated with each mission incorporate a level of

safety that is equivalent to a probabilistic outcome of no more than an expected average number of 30 public casualties per one million missions.

Compliance by operators with this safety criterion, along with other restrictions addressed in the final rule, are intended to limit risk to public safety. In estimating these potential safety benefits, the FAA employed the following steps.

First, the agency examined six accident types, grouped into two categories, related to airborne explosions and ground point-of-impact crashes. (For the purpose of this evaluation, the term accident is defined as any unplanned event with potential public casualty losses.) For each accident category--airborne or ground--the population density of the area surrounding the accident scene or accident zone can be either (1) none, (2) sparse (e.g. rural), or (3) dense (e.g., urban). An examination of the consequences of these types of accidents was conducted. To arrive at accident consequences, the accident scenes or zones for airborne and ground accidents are characterized in terms of fatalities, injuries, and property damage under the baseline and the final rule. The difference between the baseline scenario and final rule scenario represents the incremental safety benefits that will be generated by the final rule. This process was performed for each of the steps below.

Second, monetary values are assigned to each of the various types of accidents expected to occur during launch or reentry (including accidents at or near launch sites).

Third, probabilities are assigned to each of the six accident types based on the percentage of impacted landmass (e.g., no population, sparse population, and dense population) for the baseline and the final rule. That is, the probability of occurrence for each accident type over the next 15 years was determined by using the two types of risk criteria mentioned earlier.

Fourth, expected values were estimated for each of the accident types under the baseline and the final rule. For this final rule, the expected benefit values represent the difference between these two scenarios. One of the more difficult areas to ascertain is the probability of a reusable launch vehicle (RLV) accident in the absence of government regulation in order to calculate the expected value of an accident under the baseline and estimate the incremental safety benefits of the final rule. This difficulty stems from the fact there is no empirical evidence or historical RLV accident history. Because of this difficulty, there is uncertainty associated with estimating the probability of a RLV or RV accident. As a result of this uncertainty, the FAA estimated a range of accident probabilities, which are based on historical experience with ELV accidents and incidents, and sorted them into six categories or types of accidents. In estimating the expected casualty and property loss values, the probability of each of six accident types is multiplied by the accident consequence values (e.g., the cost of an accident). This process was repeated for all six accident types and summed. This procedure was done for both scenarios (baseline and final rule). Thus, the difference in casualty and property losses for these two scenarios was used as the estimated benefits for this final rule. The results of these calculations generate the potential safety benefits as discussed below.

Safety benefits--accident costs avoided--are realized as RLV launch

and reentry operations are performed, without incident. Therefore, the number of completed RLV missions and reentries projected over the 15-year period is multiplied by incremental safety benefits per mission to estimate total incremental safety benefits over the period 2001 to 2015. The total safety benefit resulting from the final rule is estimated to be $119 million for the period 2001 to 2015. This estimate of $119 million represents the midpoint of benefits ranging from $21 million to $217 million over the 15-year period. This midpoint estimate of benefits was chosen because of the high degree of uncertainty associated with the wide range of accident probabilities. Uncertainty stems from the extent to which industry has already adopted and implemented safety measures similar to those requirements as part of this rulemaking action. (Based on information obtained from commercial space industry technical personnel, nearly all of the potentially impacted operators will be in compliance with the final rule to some degree.) The low end of the range of benefits assumes that practically all of the potentially impacted operators will be in almost complete compliance in the absence of the final rule. The high end of the range of benefits assumes the opposite. There is insufficient information that will support adopting the benefits estimates at either end of the range. Thus, the median(or midpoint) was chosen as an appropriate benefits estimate. It suggests that the actual benefits to be generated by the final rule lie somewhere between the lower and upper end of this range.

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Since uncertainty is associated with using a midpoint benefits estimate and range of benefits, the FAA solicits public comment as to whether its assumptions are appropriate and the validity of this approach. The agency asks that comments be specific and supported by quantitative data wherever possible.

Qualitative Benefits

The final rule is also expected to generate qualitative benefits in the form of enhanced operational efficiency to both the FAA and the commercial space industry. These types of benefits are not readily quantifiable. Examples of these qualitative benefits are shown below.

Formalizing licensing responsibilities for RLV and reentry operations (by establishing a specific regulation) will emphasize FAA duties and expectations.

It will also better define the licensing process relative to the ad hoc approach implemented for COMET and METEOR. This will afford applicants with clearly defined direction, possibly helping to facilitate the iterative pre-application consultation process. As the number of requests for RLV and reentry licensing increases, formality will also help ensure consistency in implementing the licensing process. This could lead to cost-savings to the FAA as a result of economies of scale from repetitive operations. These cost savings will spill over to commercial space transportation entities by reducing the turnaround time between application submittal and licensing approval.

Consistent application of the licensing process will help commercial space transportation entities gain familiarity with its requirements, leading to proficiency in their ability to interact with

the process and the FAA. This in turn will lead to industry cost-savings, possibly due to less rework or paperwork avoided.

A formalized licensing process for reentry operations will enhance communications between the FAA and the commercial space transportation industry in terms of frequency and efficiency of information exchange. In so doing, it will instill a regulatory climate that will promote and foster growth and technological advancement in this maturing industry, while protecting public health and safety, and the safety of property.

Summary of Total Costs and Benefits

The total quantitative potential benefits and costs of this final rule are shown below in Table 1. This Table shows that the potential cost imposed by the final rule will be approximately $151 million over the 15-year period. Also shown in Table 1, about $31 million of this total cost will be incurred by industry. Table 1 also shows that the final rule will generate potential quantitative safety benefits of $119 million over the 15-year period. As noted previously in the benefits section of this evaluation, this rule is also expected to generate qualitative benefits in the form of enhanced operational efficiency to both the FAA and the U.S. commercial space industry.

Table 1.--Summary of Quantitative Total Costs and Benefits

Category (in 1999 dollars, 15 yrs.)	Undiscounted (in millions)	Discounted (in millions)
Commercial Space Transportation Industry Compliance Costs.....	$30.8	$20.4
Federal Aviation Administration Implementation Costs.....	120.1	65.9
Total Costs.....	151.0	86.3
Accident Costs Avoided: Lower Bound (Safety Benefits).....	21.1	11.8
Accident Costs Avoided: Upper Bound (Safety Benefits).....	216.6	120.9
Total Accident Costs Avoided: Midpoint (Safety Benefits).....	118.9	66.3

Final Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) establishes ``as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and 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 Act (which was amended March 1996) requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act 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 determination is that it will, the agency must prepare a regulatory flexibility analysis as described in the Act.

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 1980 act provides that the head of the agency may so certify and an 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 Small Business Administration has defined small business entities relating to space vehicles (Standard Industrial Codes 3761, 3764, and 3769) as entities comprising fewer than 1,000 employees.

The FAA projects that the commercial space industry will be composed of five small businesses over the 2001 to 2015 period. Furthermore, the FAA expects that the final rule will impact all five of these entities by imposing an average compliance costs of approximately $6 million over the 15-year period (in 1999 dollars).

The annualized compliance cost to each small business is approximately $700,000 (in 1999 dollars). Ordinarily, this section of the evaluation will be based on typical financial data (for example, annual net income or losses) as a means to determine whether any of the commercial space transportation small entities would be significantly impacted by the final rule. However, the traditional use of such financial data for these small entities cannot be employed since RLV operators (including a number of RV operators) represent relatively new companies and they have no revenue history. In fact, these small operators are in the process of raising funds to finance their new ventures. Due to the lack of data on the financial characteristics of these small RLV operators, this evaluation uses the 1998 average revenue received per launch for ELV operators. The revenue that RLV operators will obtain from their customers is expected to be similar to the revenue that established ELV

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operators currently receive from their customers. Revenue data based on ELV operators' experience will be used for the purpose of assessing the extent to which compliance with the final rule will impose significant economic impacts on each of the five potentially impacted small RLV operators. This assessment will be done by comparing the annualized cost of compliance to the annual average revenue, which is expected to be received by each of the five small RLV operators over the next 15 years. While the long-term revenues of RLV operators are expected to exceed those of ELV operators, which will be due to inherent lower operating costs, for the purpose of this evaluation they are assumed to be nearly the same over the 15-year period, thereby representing a worst-case scenario. Hence, the average revenue of about $50 million generated by each ELV launch in 1999 will be used as a indicator of what RLV operators will be expected to generate per RLV mission in future years. This assessment is based primarily on information received for orbital launch events for ELV operators from the FAA's Office of Commercial Space Transportation Report entitled, ``Commercial Space Transportation: 1999 Year In Review'', Table 1 and the Appendix (January 2000).

Each of the five potentially impacted small RLV entities is expected to average about seven missions per year over the next 15 years. Using $50 million as an average expected revenue per mission, each entity will be expected to receive about $350 million in revenue ($50m x 7 missions annually) for all missions annually. The FAA has determined that none of the five small entities will incur a significant economic impact, since the average annualized cost of compliance ($681,000) will be only 0.2 percent of the anticipated average annual revenues of $350 for missions conducted annually.

The FAA certifies that the final rule will not impose a significant economic impact on a substantial number of small businesses. Therefore, a regulatory flexibility analysis is not required. Furthermore, the final rule is not likely to cause small business failures or adversely impact their competitive position relative to larger businesses.

International Trade Impact Assessment

The Trade Agreement Act of 1979 prohibits Federal agencies from engaging in any standards or 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. The statute also requires consideration of international standards and where appropriate, that they be the basis for U.S. standards. In addition, consistent with the Administration's belief in the general superiority and desirability of free trade, it is the policy of the Administration to remove or diminish to the extent feasible, barriers to international trade, including both barriers affecting the export of U.S. goods and services to foreign countries and barriers affecting the import of foreign goods and services into the United States.

In accordance with the above statute and policy, the FAA has assessed the potential effect of this final rule and has determined that it will have only a domestic impact and therefore no affect effect on any trade-sensitive activity.

Unfunded Mandates Act of 1995 Assessment

The Unfunded Mandates Reform Act of 1995 (the Act), enacted as Pub. L. 104-4 on March 22, 1995, is intended, among other things, to curb the practice of imposing unfunded Federal mandates on State, local, and tribal governments.

Title II of the Act requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in a $100 million or more expenditure (adjusted annually for inflation) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ``significant regulatory action.''

Based on those impacts shown in the costs and benefits sections of the regulatory evaluation, the final rule does not contain such a mandate. Therefore, the requirements of Title II of the Unfunded Mandates Reform Act of 1995 do not apply to the final rule for RLV Reentry and Licensing Requirements.

Executive Order 13132, Federalism

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

Environmental Assessment

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental assessment (EA) or environmental impact statement (EIS). In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(i), regulatory documents which cover administrative or procedural requirements qualify for a categorical exclusion. Proposed Secs. 431.91, 431.93, 433.7, 433.9, and 435.61 would require an applicant to submit sufficient environmental information for the FAA to comply with NEPA and other applicable environmental laws and regulations during the processing of each license application. Accordingly, the FAA has determined that this rule qualifies for a categorical exclusion because no significant impacts to the environment are expected to result from implementation of its administrative provisions for licensing.

Energy Impact

The energy impact of the notice has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) Pub. L. 94-163, as amended (42 U.S.C. 6362) and FAA Order 1053.1. It has been determined that the final rule is not a major regulatory action under the provisions of the EPCA.

List of Subjects

14 CFR Part 400

Space transportation and exploration.

14 CFR Part 401

Organization and functions (Government agencies), Space transportation and exploration.

14 CFR Part 404

Administrative practice and procedure, Space transportation and exploration.

14 CFR Part 405

Investigations, Penalties, Space transportation and exploration.

14 CFR Part 406

Administrative practice and procedure, Space transportation and exploration.

14 CFR Part 413

Confidential business information, Space transportation and exploration.

14 CFR Part 415

Aviation safety, Environmental protection, Space transportation and exploration.

14 CFR Part 431

Aviation safety, Environmental protection, Investigations, Reporting and recordkeeping requirements,

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Rockets, Space transportation and exploration.

14 CFR Part 433

Aviation safety, Environmental protection, Investigations, Reporting and recordkeeping requirements, Rockets, Space transportation and exploration.

14 CFR Part 435

Aviation safety, Environmental protection, Investigations, Reporting and recordkeeping requirements, Rockets, Space transportation and exploration.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends parts 400, 401, 404, 405, 406, 413, and 415, of Chapter III Title 14, Code of Federal Regulations and adds parts 431, 433 and 435 as follows:

PART 400--BASIS AND SCOPE

1. The authority citation for part 400 is revised to read as follows:

Authority: 49 U.S.C. 70101-70121.

2. Section 400.2 is revised to read as follows:

Sec. 400.2 Scope.

These regulations set forth the procedures and requirements

applicable to the authorization and supervision under 49 U.S.C. Subtitle IX, chapter 701, of commercial space transportation activities conducted in the United States or by a U.S. citizen. The regulations in this chapter do not apply to amateur rocket activities or to space activities carried out by the United States Government on behalf of the United States Government.

PART 401--ORGANIZATION AND DEFINITIONS

3. The authority citation for part 401 is revised to read as follows:

Authority: 49 U.S.C. 70101-70121.

4. Section 401.5 is revised to read as follows:

Sec. 401.5 Definitions.

As used in this chapter--

Act means 49 U.S.C. Subtitle IX, Commercial Space Transportation, ch. 701--Commercial Space Launch Activities, 49 U.S.C. 70101-70121.

Amateur rocket activities means launch activities conducted at private sites involving rockets powered by a motor or motors having a total impulse of 200,000 pound-seconds or less and a total burning or operating time of less than 15 seconds, and a rocket having a ballistic coefficient-i.e., gross weight in pounds divided by frontal area of rocket vehicle-less than 12 pounds per square inch.

Associate Administrator means the Associate Administrator for Commercial Space Transportation, Federal Aviation Administration, or any person designated by the Associate Administrator to exercise the authority or discharge the responsibilities of the Associate Administrator.

Contingency abort means cessation of vehicle flight during ascent or descent in a manner that does not jeopardize public health and safety and the safety of property, in accordance with mission rules and procedures. Contingency abort includes landing at an alternative location that has been designated as a contingency abort location in advance of vehicle flight.

Emergency abort means cessation of vehicle flight during ascent or descent in a manner that minimizes risk to public health and safety and the safety of property. Emergency abort involves failure of a vehicle, safety-critical system, or flight safety system such that contingency abort is not possible.

Federal launch range means a launch site, from which launches routinely take place, that is owned and operated by the government of the United States.

Flight safety system means a system designed to limit or restrict the hazards to public health and safety and the safety of property presented by a launch vehicle or reentry vehicle while in flight by initiating and accomplishing a controlled ending to vehicle flight. A flight safety system may be destructive resulting in intentional break up of a vehicle or nondestructive, such as engine thrust termination enabling vehicle landing or safe abort capability.

Hazardous materials means hazardous materials as defined in 49 CFR

172.101.

Launch means to place or try to place a launch vehicle or reentry vehicle and any payload from Earth in a suborbital trajectory, in Earth orbit in outer space, or otherwise in outer space, and includes activities involved in the preparation of a launch vehicle for flight, when those activities take place at a launch site in the United States. The term launch includes the flight of a launch vehicle and pre-flight ground operations beginning with the arrival of a launch vehicle or payload at a U.S. launch site. For purposes of an ELV launch, flight ends after the licensee's last exercise of control over its launch vehicle. For purposes of an orbital RLV launch, flight ends after deployment of a payload for an RLV having payload deployment as a mission objective. For other orbital RLVs, flight ends upon completion of the first sustained, steady-state orbit of an RLV at its intended location.

Launch accident means

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

(2) 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.

(3) 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.

Launch incident means an unplanned event occurring during the flight of a launch vehicle, other than a launch accident, involving a malfunction of a flight safety system or safety-critical system or failure of the licensee's safety organization, design or operations.

Launch operator means a person who conducts or who will conduct the launch of a launch vehicle and any payload.

Launch site means the location on Earth from which a launch takes place (as defined in a license the Secretary issues or transfers under this chapter) and necessary facilities at that location.

Launch vehicle means a vehicle built to operate in, or place a payload in, outer space or a suborbital rocket.

Mishap means a launch or reentry accident, launch or reentry incident, failure to complete a launch or reentry as planned, or an unplanned event or series of events resulting in a fatality or serious injury (as defined in 49 CFR 830.2), or resulting in greater than $25,000 worth of damage to a payload, a launch or reentry vehicle, a launch or reentry support facility or government property located on the launch or reentry site.

Operation of a launch site means the conduct of approved safety operations at a permanent site to support the launching of vehicles and payloads.

Operation of a reentry site means the conduct of safety operations at a permanent site on Earth at which a reentry vehicle and its payload, if any, is intended to land.

Payload means an object that a person undertakes to place in outer space by means of a launch vehicle, including components of the vehicle specifically designed or adapted for that object.

Person means an individual or an entity organized or existing under

the laws of a state or country.

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Reenter; reentry means to return or attempt to return, purposefully, a reentry vehicle and its payload, if any, from Earth orbit or from outer space to Earth. The term ``reenter; reentry'' includes activities conducted in Earth orbit or outer space to determine reentry readiness and that are critical to ensuring public health and safety and the safety of property during reentry flight. The term ``reenter; reentry'' also includes activities conducted on the ground after vehicle landing on Earth to ensure the reentry vehicle does not pose a threat to public health and safety or the safety of property.

Reentry accident means any unplanned event occurring during the reentry of a reentry vehicle resulting in the known impact of the reentry vehicle, 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; or any damage estimated to exceed $25,000 to property not associated with the reentry and not located within a designated reentry site.

Reentry incident means any unplanned event occurring during the reentry of a reentry vehicle, other than a reentry accident, involving a malfunction of a reentry safety-critical system or failure of the licensee's safety organization, procedures, or operations.

Reentry operator means a person responsible for conducting the reentry of a reentry vehicle as specified in a license issued by the FAA.

Reentry site means the location on Earth where a reentry vehicle is intended to return. It includes the area within three standard deviations of the intended landing point (the predicted three-sigma footprint).

Reentry vehicle means a vehicle designed to return from Earth orbit or outer space to Earth substantially intact. A reusable launch vehicle that is designed to return from Earth orbit or outer space to Earth substantially intact is a reentry vehicle.

Reusable launch vehicle (RLV) means a launch vehicle that is designed to return to Earth substantially intact and therefore may be launched more than one time or that contains vehicle stages that may be recovered by a launch operator for future use in the operation of a substantially similar launch vehicle.

Safety-critical means essential to safe performance or operation. A safety-critical system, subsystem, condition, event, operation, process or item is one whose proper recognition, control, performance or tolerance is essential to system operation such that it does not jeopardize public safety.

Vehicle safety operations personnel means those persons whose job performance is critical to public health and safety or the safety of property during RLV or reentry operations.

State and United States means, when used in a geographical sense, the several States, the District of Columbia, the Commonwealth of Puerto Rico, American Samoa, the United States Virgin Islands, Guam, and any other commonwealth, territory, or possession of the United States; and

United States citizen means:

(1) Any individual who is a citizen of the United States;

(2) Any corporation, partnership, joint venture, association, or other entity organized or existing under the laws of the United States or any State; and

(3) Any corporation, partnership, joint venture, association, or other entity which is organized or exists under the laws of a foreign nation, if the controlling interest in such entity is held by an individual or entity described in paragraph (1) or (2) of this definition. Controlling interest means ownership of an amount of equity in such entity sufficient to direct management of the entity or to void transactions entered into by management. Ownership of at least fifty-one percent of the equity in an entity by persons described in paragraph (1) or (2) of this definition creates a rebuttable presumption that such interest is controlling.

PART 404--REGULATIONS AND LICENSING REQUIREMENTS

5. The authority citation for part 404 is revised to read as follows:

Authority: 49 U.S.C. 70101-70121.

6. Section 404.1 is revised to read as follows:

Sec. 404.1 Scope.

Under 49 U.S.C. 70105, this part establishes procedures for issuing regulations to implement the provisions of 49 U.S.C. Subtitle IX, chapter 701, and for eliminating or waiving requirements of Federal law otherwise applicable to the licensing of commercial space transportation activities under 49 U.S.C. Subtitle IX, chapter 701.

7. Section 404.3 is amended by revising the heading and paragraph (a) to read as follows:

Sec. 404.3 Filing of petitions to the Associate Administrator.

(a) Any person may petition the Associate Administrator to issue, amend, or repeal a regulation to eliminate as a requirement for a license any requirement of Federal law applicable to commercial space launch and reentry activities and the operation of launch and reentry sites or to waive any such requirement in the context of a specific application for a license.

* * * * *

PART 405--INVESTIGATIONS AND ENFORCEMENT

8. The authority citation for part 405 is revised to read as follows:

Authority: 49 U.S.C. 70101-70121.

9. Section 405.1 is revised to read as follows:

Sec. 405.1 Monitoring of licensed and other activities.

Each licensee must allow access by and cooperate with Federal officers or employees or other individuals authorized by the Associate Administrator to observe licensed facilities and activities, including launch sites and reentry sites, as well as manufacturing, production, and testing facilities, or assembly sites used by any contractor or a licensee in the production, assembly, or testing of a launch or reentry vehicle and in the integration of a payload with its launch or reentry vehicle. Observations are conducted to monitor the activities of the licensee or contractor at such time and to such extent as the Associate Administrator considers reasonable and necessary to determine compliance with the license or to perform the Associate Administrator's responsibilities pertaining to payloads for which no Federal license, authorization, or permit is required.

10. Section 405.5 is amended by revising the introductory text and paragraph (a) to read as follows:

Sec. 405.5 Emergency orders.

The Associate Administrator may immediately terminate, prohibit, or suspend a licensed launch, reentry, or operation of a launch or reentry site if the Associate Administrator determines that--

(a) The licensed launch, reentry, or operation of a launch or reentry site is detrimental to public health and safety, the safety of property, or any national security or foreign policy interest of the United States; and

* * * * *

PART 406--ADMINISTRATIVE REVIEW

11. The authority citation for part 406 is revised to read as follows:

Authority: 49 U.S.C. 70101-70121

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12. Section 406.1 is amended by revising paragraphs (a), introductory text, (a)(2), and (a)(3) to read as follows:

Sec. 406.1 Hearings.

(a) Pursuant to 49 U.S.C. 70110, the following are entitled to a determination on the record after an opportunity for a hearing in

accordance with 5 U.S.C. 554.
(1) * * *
(2) An owner or operator of a payload regarding any decision to prevent the launch or reentry of the payload;
(3) A licensee regarding any decision to suspend, modify, or revoke a license or to terminate, prohibit, or suspend any licensed activity; and
* * * * *

PART 413--LICENSE APPLICATION PROCEDURES

13. The authority citation for part 413 continues to read as follows:

Authority: 49 U.S.C. 70101-70121

14. Section 413.1 is revised to read as follows:

Sec. 413.1 Scope.

This part prescribes the procedures applicable to applications submitted under this chapter to conduct licensed activities. These procedures apply to all applications for issuance of a license, transfer of an existing license, and renewal of an existing license. More specific requirements applicable to obtaining a launch license or a license to operate a launch site are contained in parts 415 and 417 of this chapter, respectively. More specific requirements applicable to obtaining a license to launch and reenter a reentry vehicle or to operate a reentry site are contained in parts 431, 433 and 435 of this chapter.

15. Section 413.3 is revised to read as follows:

Sec. 413.3 Who must obtain a license.

(a) A person must obtain a license--
(1) To launch a launch vehicle from the United States;
(2) To operate a launch site within the United States;
(3) To reenter a reentry vehicle in the United States; or
(4) To operate a reentry site within the United States.
(b) An individual who is a U.S. citizen or an entity organized under the laws of the United States or any State must obtain a license--
(1) To launch a launch vehicle outside the United States;
(2) To operate a launch site outside of the United States;
(3) To reenter a reentry vehicle outside of the United States; or
(4) To operate a reentry site outside of the United States.
(c) A foreign entity in which a United States citizen has a controlling interest, as defined in Sec. 401.5 of this chapter, must obtain a launch license to launch a launch vehicle from or a license to operate a launch site within--
(1) Any place that is both outside the United States and outside the territory of any foreign nation, unless there is an agreement in

force between the United States and a foreign nation providing that such foreign nation shall exercise jurisdiction over the launch or the operation of the launch site; or

(2) The territory of any foreign nation if there is an agreement in force between the United States and that foreign nation providing that the United States shall exercise jurisdiction over the launch or the operation of the launch site.

(d) A foreign entity in which a U.S. citizen has a controlling interest, as defined in Sec. 401.5 of this chapter, must obtain a license to reenter a reentry vehicle or to operate a reentry site in--

(1) Any place that is outside the United States and outside the territory of any foreign nation, unless there is an agreement in force between the United States and a foreign nation providing that such foreign nation shall exercise jurisdiction over the reentry or the operation of the reentry site; or

(2) The territory of any foreign nation if there is an agreement in force between the United States and that foreign nation providing that the United States shall exercise jurisdiction over the reentry or the operation of the reentry site.

PART 415--LAUNCH LICENSE

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

Authority: 49 U.S.C. 70101-70121

17. Section 415.1 is revised to read as follows:

Sec. 415.1 Scope.

This part prescribes requirements for obtaining a license to launch a launch vehicle, other than a reusable launch vehicle (RLV), and post-licensing requirements with which a licensee shall comply to remain licensed. Requirements for preparing a license application are contained in part 413 of this subchapter. Requirements for obtaining a license to launch an RLV and conduct an RLV mission are contained in part 431 of this subchapter.

18. Part 431 is added to read as follows:

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

Subpart A--General

Sec.

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Authority: 49 U.S.C. 70101-70121

Subpart A--General

Sec. 431.1 Scope.

This part prescribes requirements for obtaining a reusable launch vehicle (RLV) mission license and post-licensing requirements with which a licensee must comply to remain licensed. Requirements for preparing a license application are contained in part 413 of this subchapter.

Sec. 431.3 Types of reusable launch vehicle mission licenses.

(a) Mission-specific license. A mission-specific license authorizing an RLV mission authorizes a licensee to launch and reenter, or otherwise land, one model or type of RLV from a launch site approved for the mission to a reentry site or other location approved for the mission. A mission-specific license authorizing an RLV mission may authorize more than one RLV mission and identifies each flight of an RLV authorized under the license. A licensee's authorization to conduct RLV missions terminates upon completion of all activities authorized by the license or the expiration date stated in the reentry license, whichever occurs first.

(b) Operator license. An operator license for RLV missions authorizes a licensee to launch and reenter, or otherwise land, any of a designated family of RLVs within authorized parameters, including launch sites and trajectories, transporting specified classes of payloads to any reentry site or other location designated in the license. An operator license for RLV missions is valid for a two-year renewable term.

Sec. 431.5 Policy and safety approvals.

To obtain either type of RLV mission license, an applicant must obtain policy and safety approvals from the FAA. Requirements for obtaining these approvals are contained in subparts B and C of this part. Only the license applicant may apply for the approvals, and may apply for either approval separately and in advance of submitting a complete license application, using the application procedures contained in part 413 of this subchapter.

Sec. 431.7 Payload and payload reentry determinations.

(a) A payload determination is required to launch a payload unless the proposed payload is exempt from payload review under Sec. 415.53 of this chapter. Requirements for obtaining a payload determination are set forth in part 415, subpart D of this chapter.

(b) A payload reentry determination is required to reenter a payload to Earth on an RLV unless the proposed payload is exempt from payload reentry review.

(c) A payload reentry determination made under a previous license application under this subchapter may satisfy the requirements of paragraph (b) of this section.

(d) The FAA conducts a review, as described in subpart D of this part, to make a payload reentry determination. Either an RLV mission

license applicant or a payload owner or operator may request a review of the proposed payload using the application procedures contained in part 413 of thissubchapter. Upon receipt of an application, the FAA may conduct a payload reentry review independently of an RLV mission license application.

Sec. 431.9 Issuance of a reusable launch vehicle mission license.

(a) The FAA issues either a mission-specific or operator license authorizing RLV missions to an applicant who has obtained all approvals and determinations required under this chapter for the license.
(b) An RLV mission license authorizes a licensee to launch and reenter, or otherwise land, an RLV and payload, if any, in accordance with the representations contained in the licensee's application, subject to the licensee's compliance with terms and conditions contained in license orders accompanying the license, including financial responsibilityrequirements.

Sec. 431.11 Additional license terms and conditions.

The FAA may amend an RLV mission license at any time by modifying or adding license terms and conditions to ensure compliance with 49 U.S.C. Subtitle IX, chapter 701, and applicable regulations.

Sec. 431.13 Transfer of a reusable launch vehicle mission license.

(a) Only the FAA may transfer an RLV mission license.
(b) An applicant for transfer of an RLV mission license shall submit a license application in accordance with part 413 of this subchapter and satisfy the applicable requirements of this part. The FAA will transfer an RLV mission license to an applicant who has obtained all of the approvals and determinations required under this chapter for an RLV mission license. In conducting its reviews and issuing approvals and determinations, the FAA may incorporate any findings made part of the record to support the initial licensing determination. The FAA may modify an RLV mission license to reflect any changes necessary as a result of a license transfer.

Sec. 431.15 Rights not conferred by a reusable launch vehicle mission license.

Issuance of an RLV mission license does not relieve a licensee of its obligation to comply with requirements of law that may apply to its activities.

Secs. 431.16-431.20 [Reserved]

Subpart B--Policy Review and Approval for Launch and Reentry of a Reusable Launch Vehicle

Sec. 431.21 General.

The FAA issues a policy approval to an RLV mission license applicant upon completion of a favorable policy review. A policy approval is part of the licensing record on which the licensing determination is based.

Sec. 431.23 Policy review.

(a) The FAA reviews an RLV mission license application to determine whether the proposed mission presents any issues, other than those issues addressed in the safety review, that would adversely affect U.S. national security or foreign policy interests, would jeopardize public health and safety or the safety of property, or would not be consistent with international obligations of the United States.

(b) Interagency consultation is conducted as follows:

(1) The FAA consults with the Department of Defense to determine whether an RLV mission license application presents any issues adversely affecting U.S. nationalsecurity.

(2) The FAA consults with the Department of State to determine whether an RLV mission license application presents any issues adversely affecting U.S. foreign policy interests or international obligations.

(3) The FAA consults with other Federal agencies, including the National Aeronautics and Space Administration, authorized to address issues identified under paragraph (a) of this section, associated with an applicant's RLV mission proposal.

(c) The FAA advises an applicant, in writing, of any issueraised during a policy review that would impede issuance of a policy approval. The

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applicant may respond, in writing, or revise its license application.

Sec. 431.25 Application requirements for policy review.

In its RLV mission license application, an applicant must--

(a) Identify the model, type, and configuration of any RLV proposed for launch and reentry, or otherwise landing on Earth, by the applicant.

(b) Identify all vehicle systems, including structural, thermal, pneumatic, propulsion, electrical, and avionics and guidance systems used in the vehicle(s), and all propellants.

(c) Identify foreign ownership of the applicant as follows:

(1) For a sole proprietorship or partnership, identify all foreign ownership;

(2) For a corporation, identify any foreign ownership interests of 10% or more; and

(3) For a joint venture, association, or other entity, identify any participating foreign entities.

(d) Identify proposed launch and reentry flight profile(s),

including--
(1) Launch and reentry site(s), including planned contingency abort locations, if any;
(2) Flight trajectories, reentry trajectories, associated ground tracks, and instantaneous impact points for nominal operations, and contingency abort profiles, if any;
(3) Sequence of planned events or maneuvers during the mission; and for an orbital mission, the range of intermediate and final orbits of the vehicle and upper stages, if any, and their estimated orbital life times.

Sec. 431.27 Denial of policy approval.

The FAA notifies an applicant, in writing, if the FAA hasdenied policy approval for an RLV mission license application. The notice states the reasons for the FAA's determination. The applicant may respond to the reasons for the determination and request reconsideration.

Secs. 431.28-431.30 [Reserved]

Subpart C--Safety Review and Approval for Launch and Reentry of a Reusable Launch Vehicle

Sec. 431.31 General.

(a) The FAA conducts a safety review to determine whether an applicant is capable of launching an RLV and payload, if any, from a designated launch site, and reentering the RLV and payload, if any, to a designated reentry site or location, or otherwise landing it on Earth, without jeopardizing public health and safety and the safety of property.
(b) The FAA issues a safety approval to an RLV mission license applicant that satisfies the requirements of this Subpart. The FAA evaluates on an individual basis all public safety aspects of a proposed RLV mission to ensure they are sufficient to support safe conduct of the mission.A safety approval is part of the licensing record on which the FAA's licensing determination is based.
(c) The FAA advises an applicant, in writing, of any issueraised during a safety review that would impede issuance of a safety approval. The applicant may respond, in writing, or revise its license application.

Sec. 431.33 Safety organization.

(a) An applicant shall maintain a safety organization and document it by identifying lines of communication and approval authority for all mission decisions that may affect public safety. Lines of communication within the applicant's organization, between the applicant and the launch site, and between the applicant and the reentry site,shall be employed to ensure that personnel perform RLV mission operations in

accordance with plans and proceduresrequired by this subpart. Approval authority shall beemployed to ensure compliance with terms and conditionsstated in an RLV mission license and with the plans and procedures required by this subpart.

(b) An applicant must designate a person responsible for the conduct of all licensed RLV mission activities.

(c) An applicant shall designate by name, title, and qualifications, a qualified safety official authorized by the applicant to examine all aspects of the applicant's operations with respect to safety of RLV mission activities and to monitor independently compliance by vehicle safety operations personnel with the applicant's safety policies and procedures. The safety official shallreport directly to the person responsible for an applicant's licensed RLV mission activities, who shall ensure that all of the safety official's concerns are addressed both before a mission is initiated and before reentry or descent flight of an RLV is initiated. The safety official is responsible for--

(1) Monitoring and evaluating operational dress rehearsals to ensure they are conducted in accordance with proceduresrequired by Sec. 431.37(a)(4) and under Sec. 431.37(a)(1)(iv) to ensure the readiness of vehiclesafety operations personnel to conduct a safe mission under nominal and non-nominal conditions; and

(2) Completing a mission readiness determination as required by Sec. 431.37 before an RLV mission is initiated. The safety official must monitor and report to the person responsible for the conduct of licensed RLV mission activities any non-compliance with procedures listed in Secs. 431.37 and 431.43, or any representation contained in the application, and the readiness of the licensee to conduct mission operations in accordance with the license and this part. The safety official is responsible for compliance with Secs. 431.37 and 431.43, and with representations contained in the application.

Sec. 431.35 Acceptable reusable launch vehicle mission risk.

(a) To obtain safety approval for an RLV mission, an applicant must demonstrate that the proposed mission does not exceed acceptable risk as defined in this subpart. For purposes of this section, the mission commences upon initiation of the launch phase of flight and consists of launch flight through orbital insertion of an RLV or vehiclestage or flight to outer space, whichever is applicable, and reentry or descent flight, and concludes upon landing on Earth of the RLV.

(b) Acceptable risk for a proposed mission is measured in terms of the expected average number of casualties (Ec).

(1) To obtain safety approval, an applicant shalldemonstrate:

(i) For public risk, the risk level to the collective members of the public exposed to vehicle or vehicle debris impact hazards associated with a proposed mission does notexceed an expected average number of 0.00003 casualties per mission (or Ec criterion of 30×10^{-6}) to members of the public from the applicant's proposed activity; and

(ii) For public risk, the risk level to an individual does not exceed .000001 per mission (or individual risk criterion of 1×10^{-6}).

(c) To demonstrate compliance with acceptable risk criteria in

thissection, an applicant shall employ a system safety process to identify the hazards and assess the risks to publichealth and safety and the safety of property associated with the mission, including nominal and non-nominal operation and flight of the vehicle and payload, if any. An acceptablesystem safety analysis identifies and assesses the probability and consequences of any reasonably foreseeablehazardous event, and safety-critical system failures during launch flight or reentry that could result in a casualty to the public.

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(d) As part of the demonstration required under paragraph (c) of this section, an applicant must--

(1) Identify and describe the structure of the RLV, including physical dimensions and weight;

(2) Identify and describe any hazardous materials, including radioactive materials, and their container on the RLV;

(3) Identify and describe safety-critical systems;

(4) Identify and describe all safety-critical failure modes and their consequences;

(5) Provide drawings and schematics for each safety-critical system identified under paragraph (d) (3) of this section;

(6) Provide a timeline identifying all safety-critical events;

(7) Provide data that validates the applicant's system safety analyses required in paragraph (c) of this section; and

(8) Provide flight trajectory analyses covering launch or ascent of the vehicle through orbital insertion and reentry or descent of the vehicle through landing, including its three-sigma dispersion.

Sec. 431.37 Mission readiness.

(a) Mission readiness requirements. An applicant shall submit the following procedures for verifying mission readiness:

(1) Mission readiness review procedures that involve the applicant's vehicle safety operations personnel, and launch site and reentry site personnel involved in the mission. The procedures shall ensure a mission readiness review is conducted during which the designated individual responsible for the conduct of licensed activities under Sec. 431.33(b) is provided with the following information to make a judgment as to mission readiness--

(i) Readiness of the RLV including safety-critical systems and payload for launch and reentry flight;

(ii) Readiness of the launch site, personnel, and safety-related launch property and launch services to be provided by the launch site;

(iii) Readiness of the reentry site, personnel, and safety-related property and services for reentry flight and vehicle recovery;

(iv) Readiness of vehicle safety operations personnel to support mission flight, including results of dress rehearsals and simulations conducted in accordance with paragraph (a)(4) of this section;

(v) Mission rules and constraints, including contingency abort plans and procedures, if any, as required under Sec. 431.39;

(vi) Unresolved safety issues identified during the mission

readiness review and plans for addressing them; and

(vii) Any additional safety information required by the individual designated under Sec. 431.33(b) to determine launch and reentry readiness.

(2) Procedures that ensure mission constraints, rules, contingency abort and emergency abort procedures are listed and consolidated in a safety directive or notebook approved by the person designated by the applicant under Sec. 431.33(b), the launch site operator, and the reentry site operator, if any;

(3) Procedures that ensure currency and consistency of licensee, launch site operator, and reentry site operator checklists;

(4) Dress rehearsal procedures that--

(i) Ensure crew readiness under nominal and non-nominal flight conditions;

(ii) Contain criteria for determining whether to dispense with or add one or more dress rehearsals; and

(iii) Verify currency and consistency of licensee, launch site operator, and reentry site operator checklists; and

(5) Procedures for ensuring the licensee's vehicle safety operations personnel adhere to crew rest rules of this part.

(b) [Reserved]

Sec. 431.39 Mission rules, procedures, contingency plans, and checklists.

(a) An applicant shall submit mission rules, procedures, checklists, emergency plans, and contingency abort plans, if any, that ensure safe conduct of mission operations during nominal and non-nominal vehicle flight.

(b) Mission rules, procedures, checklists, emergency plans, and contingency abort plans must be contained in a safety directive, notebook, or other compilation that is approved by the safety official designated under Sec. 431.33(c) and concurred in by the launch site operator and reentry site operator, if any.

(c) Vehicle safety operations personnel must have current and consistent mission checklists.

Sec. 431.41 Communications plan.

(a) An applicant shall submit a plan providing vehicle safety operations personnel communications procedures during the mission. Procedures for effective issuance and communication of safety-critical information during the mission shall include hold/resume, go/no go, contingency abort, if any, and emergency abort commands by vehicle safety operations personnel. The communications plan shall describe the authority of vehicle safety operations personnel, by individual or position title, to issue these commands. The communications plan shall ensure that--

(1) Communication networks are assigned so that personnel identified under this section have direct access to real-time, safety-critical information required for making decisions and issuing commands;

(2) Personnel identified under this section monitor a common

intercom channel for safety-critical communications during launch and reentry;

(3) A protocol is established for utilizing defined radio communications terminology; and

(4) Communications affecting the safety of the mission are recorded in a manner that accurately reflects communications made on individual channels, synchronized time coding, and sequence of communications.

(b) An applicant shall submit procedures to ensure that licensee and reentry site personnel, if any, receive a copy of the communications plan required by this section and that the reentry site operator, if any, concurs with the communications plan.

Sec. 431.43 Reusable launch vehicle mission operational requirements and restrictions.

(a) An applicant for RLV mission safety approval shall submit procedures--

(1) That ensure RLV mission risks do not exceed the criteria set forth in Sec. 431.35 for nominal and non-nominal operations;

(2) That ensure conformance with the system safety process and associated hazard identification and risk assessment required under Sec. 431.35(c);

(3) That ensure conformance with operational restrictions listed in paragraphs (c) through (e) of this section;

(4) To monitor and verify the status of RLV safety-critical systems sufficiently before enabling both launch and reentry flight to ensure public safety and during mission flight unless technically infeasible; and

(5) For human activation or initiation of a flight safety system that safely aborts the launch of an RLV if the vehicle is not operating within approved mission parameters and the vehicle poses risk to public health and safety and the safety of property in excess of acceptable flight risk as defined in Sec. 431.35.

(b) To satisfy risk criteria set forth in Sec. 431.35(b)(1), an applicant for RLV mission safety approval shall identify suitable and attainable locations for

nominal landing and vehicle staging impact or landing, if any. An application shall identify such locations for a contingency abort if necessary to satisfy risk criteria contained in Sec. 431.35(b)(1) during launch of an RLV. A nominal landing, vehicle staging impact and contingency abort location are suitable for launch or reentry if--

(1) For any vehicle or vehicle stage, the area of the predicted three-sigma dispersion of the vehicle or vehicle stage can be wholly contained within the designated location; and

(2) The location is of sufficient size to contain landing impacts, including debris dispersion upon impact and any toxic release.

(c) For an RLV mission--

(1) A collision avoidance analysis shall be performed in order to maintain at least a 200-kilometer separation from any inhabitable orbiting object during launch and reentry. The analysis shall address:

(i) For launch, closures in a planned launch window for ascent to

outer space or, for an orbital RLV, to initial orbit through at least one complete orbit;

(ii) For reentry, the reentry trajectory;

(iii) Expansions of the closure period by subtracting 15 seconds from the closure start-time and adding 15 seconds to the closure end-time for each sequential 90 minutes elapsed time period, or portion there of, beginning at the time the state vectors of the orbiting objects were determined;

(2) The projected instantaneous impact point (IIP) of the vehicle shall not have substantial dwell time over densely populated areas during any segment of mission flight;

(3) There will be no unplanned physical contact between the vehicle or its components and payload after payload separation and debris generation will not result from conversion of energy sources into energy that fragments the vehicle or its payload. Energy sources include, but are not limited to, chemical, pneumatic, and kinetic energy; and

(4) Vehicle safety operations personnel shall adhere to the following work and rest standards:

(i) A maximum 12-hour work shift with at least 8 hours of rest after 12 hours of work, preceding initiation of an RLV reentry mission or during the conduct of a mission;

(ii) A maximum of 60 hours worked in the 7 days, preceding initiation of an RLV mission;

(iii) A maximum of 14 consecutive work days; and

(iv) A minimum 48-hour rest period after 5 consecutive days of 12-hour shifts.

(d) In addition to requirements of paragraph (c) of this section, any unproven RLV may only be operated so that during any portion of flight--

(1) The projected instantaneous impact point (IIP) of the vehicle does not have substantial dwell time over populated areas; or

(2) The expected average number of casualties to members of the public does not exceed 30×10^{-6} (Ec 30×10^{-6}) given a probability of vehicle failure equal to 1 (pf=1) at any time the IIP is over a populated area;

(e) Any RLV that enters Earth orbit may only be operated such that the vehicle operator is able to--

(1) Monitor and verify the status of safety-critical systems before enabling reentry flight to assure the vehicle can reenter safely to Earth; and

(2) Issue a command enabling reentry flight of the vehicle. Reentry flight cannot be initiated autonomously under nominal circumstances without prior enable.

Sec. 431.45 Mishap investigation plan and emergency response plan.

(a) Mishap investigation plan and emergency response plan. An applicant shall submit a mishap investigation plan (MIP) containing the applicant's procedures for reporting and responding to launch and reentry accidents, launch and reentry incidents, or other mishaps, as defined in Sec. 401.5 of this chapter, that occur during the conduct of an RLV mission. An acceptable MIP satisfies the requirements of paragraphs (b)-(d) of this section. An applicant shall also submit an

emergency response plan (ERP) that contains procedures for informing the affected public of a planned RLV mission. An acceptable ERP satisfies the requirements of paragraph (e) of this section. The MIP and ERP shall be signed by an individual authorized to sign and certify the application in accordance with Sec. 413.7(c) of this chapter, the person responsible for the conduct of all licensed RLV mission activities designated under Sec. 431.33(b) of this subpart, and the safety official designated under Sec. 431.33(c) of this subpart.

(b) Report requirements. A MIP shall provide for--

(1) Immediate notification to the FAA Washington Operations Center in case of a launch or reentry accident, launch or reentry incident, or a mishap that involves a fatality or serious injury (as defined in 49 CFR 830.2);

(2) Notification within 24 hours to the Associate Administrator for Commercial Space Transportation in the event of a mishap that does not involve a fatality or serious injury, as defined in 49 CFR 830.2; and

(3) Submission of a written preliminary report to the FAA Associate Administrator for Commercial Space Transportation in the event of a launch accident or launch incident occurring in the conduct of an RLV mission, or reentry accident or reentry incident, occurring in the conduct of an RLV mission, within 5 days of the event. The report shall identify the event as either a launch or reentry accident or incident and must include the following information:

(i) Date and time of occurrence;

(ii) Description of the event and sequence of events leading to the accident or incident, to the extent known;

(iii) Intended and actual location of launch and reentry or other landing on Earth;

(iv) Identification of the vehicle;

(v) Identification of the payload, if applicable;

(vi) Number and general description of any fatalities and injuries;

(vii) Property damage, if any, and an estimate of its value;

(viii) Identification of hazardous materials, as defined in Sec. 401.5 of this chapter, involved in the event, whether on the vehicle, payload, or on the ground;

(ix) Action taken by any person to contain the consequences of the event;

(x) Weather conditions at the time of the event; and

(xi) Potential consequences for other vehicles or systems of similar type and proposed operations.

(c) Response plan. A MIP must contain procedures to--

(1) Ensure the consequences of a launch accident, launch incident, reentry accident, reentry incident, or other mishap occurring in the conduct of an RLV mission are contained and minimized;

(2) Ensure data and physical evidence are preserved;

(3) Require the licensee to report and to cooperate with FAA and the National Transportation Safety Board investigations and designate one or more points of contact for the FAA or NTSB; and;

(4) Require the licensee to identify and adopt preventive measures for avoiding recurrence of the event.

(d) Investigation plan. A MIP shall contain--

(1) Procedures for investigating the cause of an event described in paragraph (c)(1) of this section;

(2) Procedures for reporting investigation results to the FAA;

(3) Delineated responsibilities, including reporting

responsibilities, for

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personnel assigned to conduct investigations and for any unrelated entities retained by the licensee to conduct or participate in investigations.

(e) Emergency response plan. An ERP shall provide for--

(1) Notification to local officials in the event of an off-site or unplanned landing so that vehicle recovery can be conducted safely and effectively and with minimal risk to public safety. The plan must provide for the quick dissemination of up to date information to the public, and for doing so in advance of reentry or other landing on Earth to the extent practicable; and

(2) A public information dissemination plan for informing the potentially affected public, in laymen's terms and in advance of a planned reentry, of the estimated date, time and landing location for the reentry activity.

Sec. 431.47 Denial of safety approval.

The FAA notifies an applicant, in writing, if the FAA has denied safety approval for an RLV mission license application. The notice states the reasons for the FAA's determination. The applicant may respond to the reasons for the determination and request reconsideration.

Secs. 431.48-431.50 [Reserved]

Subpart D--Payload Reentry Review and Determination

Sec. 431.51 General.

(a) A payload reentry review is conducted to examine the policy and safety issues related to the proposed reentry of a payload, other than a U.S. Government payload or a payload whose reentry is subject to regulation by another Federal agency, to determine whether the FAA will approve reentry of the payload.

(b) A payload reentry review may be conducted as part of an RLV mission license application review or may be requested by a payload owner or operator in advance of or separate from an RLV mission license application.

(c) A payload reentry determination will be made part of the licensing record on which the FAA's licensing determination is based.

Sec. 431.53 Classes of payloads.

(a) The FAA may approve the return of a type or class of payload (for example, communications or microgravity/scientific satellites).

(b) The RLV mission licensee that will return a payload approved for reentry under this section, is responsible for providing current

information in accordance with Sec. 431.57 regarding the payload proposed for reentry no later than 60 days before a scheduled RLV mission involving that payload.

Sec. 431.55 Payload reentry review.

(a) In conducting a payload reentry review to decide if the FAA should approve reentry of a payload, the FAA determines whether its reentry presents any issues that would adversely affect U.S. national security or foreign policy interests, would jeopardize public health and safety or the safety of property, or would not be consistent with international obligations of the United States.

(b) The FAA consults with the Department of Defense to determine whether reentry of a proposed payload presents any issues adversely affecting U.S. national security.

(c) The FAA consults with the Department of State to determine whether reentry of a proposed payload presents any issues adversely affecting U.S. foreign policy interests or international obligations.

(d) The FAA consults with other Federal agencies, including the National Aeronautics and Space Administration, authorized to address issues identified under paragraph (a) of this section.

(e) The FAA advises a person requesting a payload reentry determination, in writing, of any issue raised during a payload reentry review that would impede the issuance of a favorable determination to reenter that payload. The person requesting a payload reentry review may respond, in writing, or revise its application.

Sec. 431.57 Information requirements for payload reentry review.

A person requesting reentry review of a particular payload or payload class must identify the following:

(a) Payload name or class and function;

(b) Physical characteristics, dimensions, and weight of the payload;

(c) Payload owner and operator, if different from the person requesting the payload reentry review;

(d) Type, amount, and container of hazardous materials, as defined in Sec. 401.5 of this chapter, and radioactive materials in the payload;

(e) Explosive potential of payload materials, alone and in combination with other materials found on the payload or RLV during reentry;

(f) Designated reentry site(s); and

(g) Method for securing the payload on the RLV.

Sec. 431.59 Issuance of payload reentry determination.

(a) The FAA issues a favorable payload reentry determination unless it determines that reentry of the proposed payload would adversely affect U.S. national security or foreign policy interests, would jeopardize public health and safety or the safety of property, or would not be consistent with international obligations of the United States.

The FAA responds to any person who has requested a payload reentry review of its determination in writing. The notice states the reasons for the determination in the event of an unfavorable determination.

(b) Any person issued an unfavorable payload reentry determination may respond to the reasons for the determination and request reconsideration.

Sec. 431.61 Incorporation of payload reentry determination in license application.

A favorable payload reentry determination issued for a payload or class of payload may be included by an RLV mission license applicant as part of its application. Before the conduct of an RLV mission involving a payload approved for reentry, any change in information provided under Sec. 431.57 must be reported by the licensee in accordance with Sec. 413.17 of this chapter. The FAA determines whether a favorable payload reentry determination remains valid and may conduct an additional payload reentry review.

Secs. 431.62-431.70 [Reserved]

Subpart E--Post-Licensing Requirements--Reusable Launch Vehicle Mission License Terms and Conditions

Sec. 431.71 Public safety responsibility.

(a) A licensee is responsible for ensuring the safe conduct of an RLV mission and for protecting public health and safety and the safety of property during the conduct of the mission.

(b) A licensee must conduct a licensed RLV mission and perform RLV safety procedures in accordance with representations made in its license application. A licensee's failure to perform safety procedures in accordance with the representations made in the license application or comply with any license condition is sufficient basis for the revocation of a license or other appropriate nforcement action.

Sec. 431.73 Continuing accuracy of license application; application for modification of license.

(a) A licensee is responsible for the continuing accuracy of representations contained in its application for the entire term of the license.

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(b) After a license has been issued, a licensee must apply to the FAA for modification of the license if--

(1) The licensee proposes to conduct an RLV mission or perform a safety-critical operation in a manner not authorized by the license; or

(2) Any representation contained in the license application that is material to public health and safety or the safety of property is no

longer accurate and complete or does not reflect the licensee's procedures governing the actual conduct of an RLV mission. A change is material to public health and safety or the safety of property if it alters or affects the--

(i) Mission rules, procedures, checklists, emergency plans, and contingency abort plans, if any, submitted in accordance with Sec. 431.39

(ii) Class of payload;

(iii) Type of RLV;

(iv) Any safety-critical system;

(v) Type and container of the hazardous material carried by the vehicle;

(vi) Flight trajectory;

(vii) Launch site or reentry site or other landing location; or

(viii) Any safety system, policy, procedure, requirement, criteria, or standard.

(c) An application to modify an RLV mission license must be prepared and submitted in accordance with part 413 of this chapter. The licensee must indicate any part of its license or license application that would be changed or affected by a proposed modification.

(d) The FAA reviews determinations and approvals required by this chapter to determine whether they remain valid after submission of a proposed modification.

(e) Upon approval of a modification, the FAA issues either a written approval to the licensee or a license order amending the license if a stated term or condition of the license is changed, added, or deleted. An approval has the full force and effect of a license order and is part of the licensing record.

Sec. 431.75 Agreements.

(a) Launch and reentry site use agreements. Before conducting a licensed RLV mission using property and services of a Federal launch range or licensed launch or reentry site operator, a licensee or applicant shall enter into an agreement with the Federal launch range and/or licensed site operator that provides for access to and use of property and services required to support a licensed RLV mission or reentry and for public safety related operations and support. The agreement shall be in effect before any licensed RLV mission or reentry. A licensee shall comply with any requirements of the agreement that may affect public health and safety and the safety of property during the conduct of its licensed activity.

(b) Agreements for notices to mariners and airmen. Unless otherwise addressed in agreements between a licensed launch site operator and the U.S. Coast Guard and the FAA, respectively, a licensee authorized to conduct an RLV mission using a launch site or reentry site other than a Federal launch range shall complete the following:

(1) An agreement between the licensee and the local U.S. Coast Guard district to establish procedures for the issuance of a Notice to Mariners prior to a launch or reentry and other measures as the Coast Guard deems necessary to protect public health and safety; and

(2) An agreement between the licensee and the FAA regional office having jurisdiction over the airspace through which a launch and reentry will take place, to establish procedures for the issuance of a

Notice to Airmen prior to the conduct of a licensed launch or reentry and for closing of air routes during the respective launch and reentry windows and other measures deemed necessary by the FAA regional office in order to protect public health and safety.

Sec. 431.77 Records.

(a) Except as specified in paragraph (b) of this section, a licensee shall maintain for 3 years all records, data, and other material necessary to verify that a licensed RLV mission is conducted in accordance with representations contained in the licensee's application.

(b) In the event of a launch accident, reentry accident, launch incident or reentry incident, as defined in Sec. 401.5 of this chapter, a licensee shall preserve all records related to the event. Records must be retained until completion of any Federal investigation and the FAA advises the licensee that the records need not be retained. The licensee shall make all records required to be maintained under the regulations available to Federal officials for inspection and copying.

Sec. 431.79 Reusable launch vehicle mission reporting requirements.

(a) Not less than 60 days before each RLV mission conducted under a license, a licensee shall provide the FAA with the following information:

(1) Payload information in accordance with 14 CFR Sec. 415.59 of this chapter and Sec. 431.57; and

(2) Flight information, including the vehicle, launch site, planned launch and reentry flight path, and intended landing sites including contingency abort sites.

(3) Launch or reentry waivers, approved or pending, from a federal Federal range for at which the launch or reentry will take place, that are unique and may affect public safety.

(b) Not later than 15 days before each licensed RLV mission, a licensee must notify the FAA, in writing, of the time and date of the intended launch and reentry or other landing on Earth of the RLV and may utilize the FAA/U.S. Space Command Launch Notification Form, contained in part 415, Appendix A, of this subchapter for doing so.

(c) A licensee must report a launch accident, launch incident, reentry accident, reentry incident, or other mishap immediately to the FAA Washington Operations Center and provide a written preliminary report in the event of a launch accident, launch incident, reentry accident, or reentry incident, in accordance with the mishap investigation and emergency response plan submitted as part of its license application under Sec. 431.45.

Sec. 431.81 Financial responsibility requirements.

A licensee under this part must comply with financial responsibility requirements specified in its license.

Sec. 431.83 Compliance monitoring.

A licensee shall allow access by, and cooperate with, federal officers or employees or other individuals authorized by the FAA to observe any activities of the licensee, or of the licensee's contractors or subcontractors, associated with the conduct of a licensed RLV mission.

Sec. 431.85 Registration of space objects.

(a) To assist the U.S. Government in implementing Article IV of the 1975 Convention on Registration of Objects Launched into Outer Space, each licensee shall provide to the FAA the information required by paragraph (b) of this section for all objects placed in space by a licensed RLV mission, including an RLV and any components, except:

(1) Any object owned and registered by the U.S. Government; and

(2) Any object owned by a foreign entity.

(b) For each object that must be registered in accordance with this section, a licensee shall submit the following information not later than thirty (30) days following the conduct of a licensed RLV mission :

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(1) The international designator of the space object(s);

(2) Date and location of the RLV mission initiation;

(3) General function of the space object; and

(4) Final orbital parameters, including:

(i) Nodal period;

(ii) Inclination;

(iii) Apogee; and

(iv) Perigee.

(c) A licensee shall notify the FAA when it removes an object that it has previously placed in space.

Secs. 431.86-431.90 [Reserved]

Subpart F--Environmental Review

Sec. 431.91 General.

An applicant shall provide the FAA with sufficient information to analyze the environmental impacts associated with proposed operation of an RLV, including the impacts of anticipated activities to be performed at its reentry site. The information provided by an applicant must be sufficient to enable the FAA to comply with the requirements of the National Environmental Policy Act, 42 U.S.C. 4321 et seq., the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, 40 CFR parts 1500-1508, and the FAA's Procedures for Considering Environmental Impacts, FAA Order 1050.1D. Copies of FAA Order 1050.1D may be obtained from the Office of Environment and Energy, AEE-300, Federal Aviation Administration, 800 Independence Avenue SW., Washington, DC 20591,

(202) 267-3553. Copies of FAA Order 1050.1D may be inspected in the Rules Docket at the Federal Aviation Administration, Office of the Chief Counsel, AGC-200, Room 915G, 800 Independence Avenue SW., Washington, DC 20591 weekdays between 8:30 a.m. and 5:**00** p.m.

Sec. 431.93 Environmental information.

An applicant shall submit environmental information concerning--

(a) A designated launch and reentry site, including contingency abort locations, if any, not covered by existing FAA or other Federal environmental documentation;

(b) A proposed new RLV with characteristics falling measurably outside the parameters of existing environmental documentation;

(c) A proposed reentry to an established reentry site involving an RLV with characteristics falling measurably outside the parameters of existing environmental impact statements covering that site;

(d) A proposed payload that may have significant environmental impacts in the event of a reentry accident; and

(e) Other factors as necessary to comply with the National Environmental Policy Act.

19. Part 433 is added to read as follows:

PART 433--LICENSE TO OPERATE A REENTRY SITE

Subpart A--General

Sec.

Authority: 49 U.S.C. 70101-70121

Sec. 433.1 General.

The FAA evaluates on an individual basis an applicant's proposal to operate a reentry site.

Sec. 433.3 Issuance of a license to operate a reentry site.

(a) The FAA issues a license to operate a reentry site when it determines that an applicant's operation of the reentry site does not jeopardize public health and safety, the safety of property, U.S. national security or foreign policy interests, or international obligations of the United States.

(b) A license to operate a reentry site authorizes a licensee to operate a reentry site in accordance with the representations contained in the licensee's application, subject to the licensee's compliance with terms and conditions contained in any license order accompanying

the license.

Sec. 433.5 Operational restrictions on a reentry site.

A license to operate a reentry site authorizes the licensee to offer use of the site to support reentry of a reentry vehicle for which the three-sigma footprint of the vehicle upon reentry is wholly contained within the site.

Sec. 433.7 Environmental.

An applicant shall provide the FAA with information for the FAA to analyze the environmental impacts associated with proposed operation of a reentry site. The information provided by an applicant must be sufficient to enable the FAA to comply with the requirements of the National Environmental Policy Act, 42 U.S.C. 4321 et seq. (NEPA), the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA, 40 CFR Parts 1500-1508, and the FAA's Procedures for Consideration Environmental Impacts, FAA Order 1050.1D.

Sec. 433.9 Environmental information.

An applicant shall submit environmental information concerning a proposed reentry site not covered by existing environmental documentation for purposes of assessing reentry impacts.

20. Part 435 is added to read as follows:

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

Authority: 49 U.S.C. 70101-70121

Subpart A--General

Sec. 435.1 Scope.

This part prescribes requirements for obtaining a license to reenter a reentry vehicle other than a reusable launch vehicle (RLV), and post-licensing

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requirements with which a licensee must comply to remain licensed. Requirements for preparing a license application are contained in part 413 of this subchapter.

Sec. 435.3 Types of reentry licenses.

(a) Reentry-specific license. A reentry-specific license authorizes a licensee to reenter one model or type of reentry vehicle, other than an RLV, to a reentry site or other location approved for the reentry. A reentry-specific license may authorize more than one reentry and identifieseach reentry authorized under the license. A licensee's authorization to reenter terminates upon completion of all activities authorized by the license or the expiration date stated in the reentry license, whichever occurs first.

(b) Reentry-operator license. A reentry operator license authorizes a licensee to reenter any of a designated family of reentry vehicles, other than an RLV, within authorized parameters, including trajectories, transporting specified classes of payloads to any reentry site designated in the license. A reentry operator license is valid for a 2-yearrenewable term.

Sec. 435.5 Policy and safety approvals.

To obtain a reentry license, an applicant must obtain policy and safety approvals from the FAA. Requirements for obtaining these approvals are contained in subparts B and C of this part. Only a reentry license applicant may apply for the approvals, and may apply for either approval separately and in advance of submitting a complete license application, using the application procedures contained in part

413 of this subchapter.

Sec. 435.7 Payload reentry determination.

(a) A payload reentry determination is required to transport a payload to Earth on a reentry vehicle unless the proposed payload is exempt from payload review.

(b) A payload reentry determination made under a previous license application under this subchapter may satisfy the requirements of paragraph (a) of this section.

(c) The FAA conducts a review, as described in subpart D of this part, to make a payload reentry determination. Either a reentry license applicant or a payload owner or operator may request a review of the proposed payload using the application procedures contained in part 413 of thissubchapter. Upon receipt of an application, the FAA may conduct a payload reentry review independently of a reentry license application.

Sec. 435.9 Issuance of a reentry license.

(a) The FAA issues a reentry license to an applicant who has obtained all approvals and determinations required under this chapter for a reentry license.

(b) A reentry license authorizes a licensee to reenter a reentry vehicle and payload, if any, in accordance with the representations contained in the reentry licensee's application, subject to the licensee's compliance with terms and conditions contained in license orders accompanying the reentry license, including financial responsibilityrequirements.

Sec. 435.11 Additional license terms and conditions.

The FAA may amend a reentry license at any time by modifying or adding license terms and conditions to ensure compliance with 49 U.S.C. Subtitle IX, chapter 701, and applicableregulations.

Sec. 435.13 Transfer of a reentry license.

(a) Only the FAA may transfer a reentry license.

(b) An applicant for transfer of a reentry license shall submit a reentry license application in accordance with part 413 of this subchapter and satisfy the applicable requirements of this part. The FAA will transfer a reentry license to an applicant who has obtained all of the approvals and determinations required under this chapter for a reentry license. In conducting its reviews and issuing approvals and determinations, the FAA may incorporate any findings made part of the record to support the initial licensing determination. The FAA may modify a reentry license to reflect any changes necessary as a result of a reentry license transfer.

Sec. 435.15 Rights not conferred by reentry license.

Issuance of a reentry license does not relieve a licensee of its obligation to comply with requirements of law that may apply to its activities.

Secs. 435.16-431.20 [Reserved]

Subpart B--Policy Review and Approval for Reentry of a Reentry Vehicle

Sec. 435.21 General.

The FAA issues a policy approval to a reentry license applicant upon completion of a favorable policy review. A policy approval is part of the licensing record on which the licensing determination is based.

Sec. 435.23 Policy review requirements and procedures.

Unless otherwise indicated in this subpart, regulations applicable to policy review and approval of the reentry of an RLV contained in part 431, subpart B of this subchapter shall apply to the policy review conducted for a license to reenter a reentry vehicle under this part.

Secs. 435.24-435.30 [Reserved]

Subpart C--Safety Review and Approval for Reentry of a Reentry Vehicle

Sec. 435.31 General.

The FAA conducts a safety review to determine whether an applicant is capable of reentering a reentry vehicle and payload, if any, to a designated reentry site without jeopardizing public health and safety and the safety of property. A safety approval is part of the licensing record on which the licensing determination is based.

Sec. 435.33 Safety review requirements and procedures.

Unless otherwise stated in this subpart, regulations applicable to safety review and approval of the reentry of an RLV contained in part 431, subpart C of this subchapter shall apply to the safety review conducted for a license to reenter a reentry vehicle under this part.

Sec. 435.35 Acceptable reentry risk for reentry of a reentry vehicle.

To obtain safety approval for reentry, an applicant must demonstrate that risk for the proposed reentry, when assessed in

combination with launch of the reentry vehicle, does not exceed acceptable risk for the conduct of an RLV mission as defined in paragraphs (a) and (b) of Sec. 431.35 of this subchapter.

Secs. 435.36-435.40 [Reserved]

Subpart D--Payload Reentry Review and Determination

Sec. 435.41 General.

The FAA conducts a payload reentry review to examine the policy and safety issues related to the proposed reentry of a payload, except a U.S. Government payload, to determine whether the FAA will approve the reentry of the payload.

Sec. 435.43 Payload reentry review requirements and procedures.

Unless otherwise indicated in this subpart, regulations contained in part 431, subpart D of this subchapter applicable to a payload reentry review and determination for reentering a payload using an RLV shall apply to the payload reentry review conducted for a license to reenter a reentry vehicle under this part.

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Secs. 435.44-435.50 [Reserved]

Subpart E--Post-Licensing Requirements--Reentry License Terms and Conditions

Sec. 435.51 General.

Unless otherwise indicated in this subpart, post-licensing requirements contained in part 431 subpart E, of this subchapter applicable to a license to reenter an RLV shall apply to a license issued under this part.

Secs. 435.52-435.60 [Reserved]

Subpart F--Environmental Review

Sec. 435.61 General.

Unless otherwise indicated in this subpart, environmental review requirements contained in part 431 subpart F, applicable to a license to reenter an RLV shall apply to an application for a reentry license under this part.

Secs. 435.62-435.70 [Reserved]

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