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January 21, 2000

United States Department Of Transportation Dockets
Docket No. [FAA-1999-6265] — 9
400 Seventh Street SW, Room Plaza 401
Washington, D.C. 20590

Subject: Financial Responsibility Requirements for Licensed Reentry Activities, Docket No. FAA-I 999-6265; Notice No. 99-17

Reference: 64 F.R. 54448 dated Wednesday, October 6, 1999

Dear Ms. Rosenberg:

The Boeing Company has completed Its review of the proposed rule entitled "Financial Responsibility Requirements for Licensed Reentry Activities", which was published in the Federal Register on Wednesday, October 6, 1999, page 54448. As presently drafted, we do not support adoption of this proposed which is to be incorporated permanently into the Federal Aviation Administration Supplement to the Federal Acquisition Regulations,

We ask that you carefully consider our comments and incorporate them into any final rule promulgated by the Department of Transportation through the Federal Aviation Administration, or utilize them as justification for future legislative and/or regulatory changes

The Boeing Company has some serious concerns and questions related to the licensing approach of the Federal Aviation Administration (FAA) Notice of Proposed Rulemaking (NPRM). The approach appears to raise both short-term regulatory issues and long-term policy questions. The NPRM introduces uncertainty over liability determinations and creates potential insurance coverage conflicts. Additionally, it creates an indemnification "void" for on-orbit activities. Finally, it creates an artificially narrow mission envelope for Reusable Launch Vehicles (RLV's) and appears to raise questions as to obligations of the United States under applicable treaties and conventions of the United Nations,

Although some of Boeing's comments relate to the FAA's earlier RLV licensing NPRM, issued April 21, 1999, Docket # 1999-5535, Notice 99-04, the definitional issue of launch and the applicability of the "licensee control test" remain unresolved issues and are fundamentally linked to almost every issue raised in our response to the current NPRM. Given that the FAA has acknowledged that the current NPRM on Financial Responsibility Was "intended as a companion document to the RLV licensing regulations" and that "there has not been a final determination by the FAA on the scope and characteristics of an RLV licensing program," Boeing comments reexamining launch and reentry definitions are necessary elements to support a meaningful response to the current NPRM.

1. The proposed rule contains a narrow definition of Launch linked to payload deployment.

The definition in the proposed rule at page 54452 should be modified to reflect the "accomplishment of the launch phase of any RLV mission-" Not all RLV missions will involve the deployment of payloads. For example, RLV's are inherently flexible

enough to perform space station and satellite servicing, as well as on-orbit research activities requiring multiple orbit revolutions around the Earth. Hence, It makes no sense to restrict mission completion to deployment of payloads only.

We suggest that the definition of payload be modified to read as follows:

> "Payload" *means an object that a person undertakes to place in outer space for injection into orbit, on-orbit transfer to another orbiting spacecraft, or "captive-carry" operations by means of a launch vehicle or reentry vehicle, including components of the vehicle' specifically designed or adapted for that object. "*

2. Non-application of the ELV "Control Test" to RLV's.

The Code of Federal Regulations at 14 CFR 401.5 provides for an expansive definition to launch of ELV's broader than the statutory definition of Commercial Space Launch Act (CSLA) contained in section ¶70102(3) of the statute. (See page 5452 of the proposed rule.)

However, in the legislative history of *the* Commercial Space Act (PL 105-303) as amended, the FAA determined that an expansive definition of launch, linked to the licensee's control over the vehicle, would inappropriately necessitate licensing on-orbit activities, Boeing acknowledges there are CSA legislative limits on the FAA rulemaking; however, Boeing questions the wisdom of a licensing regime which results in the following regulatory environment:

- Fails to address the full mission range of RLV's;
- Ignores the potential for causal connections between on-orbit activities and non-nominal reentry;
- Overlooks the relevance and applicability of FAA commercial aircraft "flight worthiness" standards to RLV's. Aircraft are designed to meet air worthiness and vehicle certification requirements in accordance with well established national and international standards that have evolved over the past 70 years (beginning with the Warsaw Convention). These standards are designed to promote safety and reliability in aircraft systems; they apply to all aircraft designs, whether they are operational or developmental; and they are not restricted to take-off and landing, but cover the entire flight regime (as opposed to the present NPRM);
- Understates the international requirements of the United States as a launching state under Article VI of the Outer Space Treaties to supervise on-going activities of non-government entities in outer space,

The emerging commercial reusable launch vehicles do not have the benefit of specific, codified standards (and will not have to qualify for a "flight worthiness" certificate). RLV risks will present a series of serious problems, such as critically low predictability, an almost complete lack of risk spreading through homogeneous units',

[1] Initially, RLV variants will be produced in small quantities of one to three, as opposed to commercial aircraft variant production runs of hundreds to thousands (e.g., Boeing 737, 747, etc.).

technological volatility, an inability to exercise meaningful risk control and containment, and the nearly absolute asymmetry of Information'.

Hence, it is extremely important that until an RLV, certification regime can be established, licensing and indemnification **coverage** is provided throughout the entire RLV mission regime (**I.e., launch,** on-orbit, and **re-entry** flight phases).

Therefore, the final rule adopted **by** the FAA should apply control tests to RLV's, thereby, making on-orbit activity a licensed activity.

3. The Definition of reentry and use of "purposeful test" is ambiguous and needs to be revised to be more technically precise in the final published rule.

The FAA's effort to expand reentry definition is presumably to **extend** indemnification coverage. Unfortunately, it introduces potential interpretive conflicts as to what constitutes "qualifying" reentry activity.

For **consistency,** the definition of "reentry" contained in the final rule should be modified to begin with reentry planning activities, followed by the ignition of RLV retrograde propulsion systems and subsequent first movement toward the atmospheric entry interface (EI). Nominal reentry occurs when the RLV descends from a state where aerodynamic forces are not a factor, through the atmosphere, to a precise landing on the designated runway or recovery site. A "non-nominal" reentry would occur when an RLV fails to intercept for any reason, the correct EI during **a** planned or unplanned reentry maneuver. (See page **54454** of **the** proposed rule.)

4. The FAA's position on non-nominal reentry needs clarification in any future final rule which is published,

Any future final rule should specify that a non-nominal reentry occurs when the RLV fails to intercept for any reason, the correct atmospheric entry interface (EI) during a planned *or* unplanned reentry maneuver. The correct EI is the only interface that will enable the vehicle to successfully descend from a state **where** aerodynamic forces are not a **factor,** through the atmosphere, to a precise landing on the designated runway or recovery **site.** Unplanned reentry **maneuvers** can result **from** collisions **with other** space objects or be caused by human error or RLV system malfunction(s), including but not limited to on-orbit activity. (See pages **5453** to **5454** of the proposed regulation.)

5. Uniform licensing coverage for non-RLV reentry vehicles.

For internal consistency and clarity, reentry-licensing coverage for non-RLV reentry vehicles should fall under the same rules as RLV's for "nominal" and "non-nominal" reentries. , (See pages **5453** to **5454** of the proposed **regulation)**

6. The proposed regulation could result in multiple determinations of maximum probable loss (MPL) as a result of separate license for launch vs. reentry.

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[2] RLV's based on different concepts will have failure modes, etc., that are not consistent across the "generic RLV-class" of space transportation vehicles—unlike commercial aviation.

While this conceptually makes sense in the context of the FAA NPRM and potentially provides the benefit of multiple indemnification safety nets, the potential for uncertainty and inconsistency in the claims adjudication process seems probable given the existence of a gray zone of unlicensed on-orbit activities separating launch and reentry. (See Section 450.7, Determination of Maximum Probable Loss, page 55448 of the **proposed** rule.)

7. The application of Appendix B, Cross-Waivers and Assumption of Responsibility for Licensed Activities.

It is unclear, under the proposed rule, whether independent agreements between launch participants providing for Appendix B-type allocation of risks for unlicensed activities provide an adequate contractual, legal and insurance scheme for participants.

Given the uncertainties of when licensed reentry activity commences, Boeing believes that the applicability of Appendix B cross-waivers and contract clause flow-downs will become unnecessarily unpredictable as to when licensed activities begins and ends, thus, resulting in increased disputes and adjudication of insurance coverage and related liability determinations.

Further aggravating this situation Is the nature of unlicensed RLV activity. Unlike the ELV financial responsibility regime where unlicensed activity generally constitutes non-hazardous activity, Boeing questions that on-orbit **activity** of RLV's can be treated as non-hazardous[3]. As a result, it will be crucial that the licensee execute Appendix B type agreements for unlicensed RLV activities. However, we believe there will certainly be increased reluctance from the participants to execute RLV waivers for unlicensed activity in comparison to execution of waiver agreements for ELV non-hazardous activities. Boeing believes the uncertainty over the scope of licensed RLV activity, combined with the potentially hazardous nature of unlicensed on-orbit activity, will adversely impact the ability of the licensee to execute Appendix B-type agreements. Boeing is especially concerned with foreign customers who will probably find the allocation of risk scheme convoluted and uncertain, thereby, negatively impacting the U.S. commercial launch industry's international competitiveness. (See the Section 450.17, Reciprocal' Waiver of Claims Requirements, and Appendix B of the proposed rule at page 54462.)

8. The proposed rule contains an indemnification gap for on-orbit activities.

As discussed in paragraph 7 above, the United States' commercial RLV launch industry will be confronted with a financial responsibility and allocation of risk scheme which appears conceptually artificial in the context of RLV technology and creates unpredictable indemnification gaps for on-orbit activities. Industry's ability to procure and maintain adequate insurance at a reasonable cost for future RLV activities, especially on-orbit activities, is going to be unnecessarily subjected to increased

[3] RLV on-orbit activities will be inherently hazardous, as evidenced by past experiences involving inadvertent collisions between docking spacecraft (Russian Progress resupply vehicle with the Ml R space station); near misses between orbiting spacecraft and orbital debris (Space Shuttle and the MSTI-2 satellite); and the dangers associated with spacecraft subsystem and component near-catastrophic failures (Apollo 13). As RLV's become operationally pervasive, there is a high probability that these incidents may occur in connection with commercial on-orbit activities.

policy costs, claims activity, litigation and customer anxiety. (See the Section 450.17, Reciprocal Waiver of Claims Requirements and Appendix B of the proposed rule at page 54462.)

9. Potential international Jurisdictional conflicts do not appear to be completely addressed In the NPRM.

Although the FAA has indicated in its earlier rulemaking on RLV licensing that a United States' citizen or entity organized under the laws of the United States must obtain a license to reenter outside the United States, it seems some type of international convention will be needed in the future. For example, how does the FAA intend to establish and implement MPL's for a foreign reentry site? What if the FAA proposes an MPL of $X but the foreign jurisdiction demands $3X? What rights and obligations, if any, shall the licensee have in this process? How will the United Nations' treaties and conventions enter this regulatory process? We request that the FAA provide clarification in this area before publication of any final rule. (See the Section 450.13, Standard Conditions of Insurance Coverage, of the proposed rule at pages 54461 to 54462.)

10. The liability for and obligations of the United States Government to supervise space activities of its non-governmental entities, under the United Nations' treaties and conventions, requires further clarification in any final rule which is published.

The FAA NPRM as presently drafted raises issues as to the United States' international commitments regarding on-orbit activity. It appears that the definitions of "launch," "reentry" and "non-nominal reentry" need to be expanded to include on-orbit operations so they are fully consistent with the liability provisions stipulated in the international space treaties. Boeing seeks clarification from the FAA prior to the publication of any final rule on how the proposed licensing scheme (particularly the exclusion of on-orbit activities) fully satisfies United States' international obligations under United Nations' treaties which appear to require supervision by the launching state of all activities conducted by non-governmental entities in outer space. (See the Section "Non-Nominal Reentry" of the proposed rule at pages 54453 to 54455.)

11. Collision avoidance must be addressed in detail in any final published rule.

The potential impacts of the FAA's Commercial Space Transportation Concept of Operations in the National Airspace System In the 2005 (CONOPS) document on the NPRM should be considered. Specific areas in the CONOPS affecting the NPRM include traffic and workload, environment, vehicle profile, mission profile and airspace requirements. Today, the NAS has no defined upper limit; however, once the NAS upper limit is defined, there could be implications regarding the financial responsibility, insurance and licensing aspects associated with RLV operations.

SUMMARY

The current level of research, development and technological advancements within the RLV community (e-g-, Kistler's K-1, Rotary Rocket's Roton, Orbital's X-34, Boeing's Future X, Bristol's Ascender, NASA's X-38, and Scaled Composites' Proteus and on-going NASA ISS program) is creating a dynamic opportunity of potential for RLV commercial

and civil activity in outer space. Boeing seeks clarification or comment on how the FAA's NPRM will accommodate and/or address future space activities such as:

- Commercial docking with ISS
- Satellite refueling and servicing
- On-orbit assembly of structures for space-based utilities, manufacturing and entertainment
- Space tourism and rescue
- Space servicing and transfer
- Space debris management

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In addition to public safety, promotion of international competitiveness of the United States commercial space launch industry should be a crucial factor in assessing current NPRM. The promotion of the United States' commercial launch industry and its international competitiveness is a fundamental legislative goal of the CSLA. Boeing hopes the FAA's final rule shall reflect adequate consideration of this national policy priority.

Thank you for the opportunity to provide comments to this Important proposed rule. Please contact Mark Olague et (206) 662-1179 or Robert F. Catania, Esq. at (562) 797-1164 if you have any questions.

Sincerely,

for W. B. Linscott
Director, Contract Policy
The Boeing Company

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