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Department of Transportation Dockets
Docket No. FAA-1 999-5535-15
Room Plaza 401
400 Seventh Street SW
Washington DC 20590

DEPT OF TRANSPORTATION
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Greetings,

The attached comments are submitted to Docket No. FAA-I 999-5535, Notice No. 99-04, against the Part III, DoT, FAA 14 CFR Part 400 et al., "Commercial Space Transportation Reusable Launch Vehicle and Reentry Licensing Regulations; Proposed Rule Proposed Advisory Circular (AC) 431-01, Reusable Launch Vehicle System Safety Process and AC 431-02, ExpecCasualty Calculations for Commercial Space Launch and Reentry Missions; Notice".

All comments will be referenced to page number, column number, major heading within the column, if available, paragraph number and then line from the top.

Sincerely,



Robert H. Ballard
Program Manager

Comments

14 CFR Parts 400, 401, 404, **405**, 406, 413, 415, 431, 433 and 435
[Docket FAA-1 **999-5535**, Notice No. **99-04**]

Nbr. Reference Comment

- A. General comment: This NPRM, since it is intended as a modification to the rules for Expendable Launch Vehicles (ELV), necessarily reflects a considerable heritage/baggage from the ELV world. As such, many of the concepts contained herein do NOT benefit from having been thought through considering the basic differences between ELV construction/ operations/ missions from those of **RLVs**. The fundamental issue with this NPRM is not, therefore, making adjustments to individual paragraphs. That can and will evolve over time as flying hardware is developed. It is, rather, to address the fundamental fact that **RLVs** are NOT **ELVs**. This results in a need to rethink the very lexicon being used. The very terms (and concepts they embody) of “launch”, re-entry site”, etc., have little or no meaning in the RLV world. Until that thinking is done and applied, these rules, while perhaps a necessary starting point, will remain largely inappropriate to the licensing and operation of **RLVs**.
- B. pg. 19630; column 2, line 18 (“Absent these two elements...”) and column 2, **para 2**, line 25 (“...**there** was never any deliberate intent...”) and column 3, line 15 (“...**difference...without** a distinction...“): The idea that some controlled reentering material (RLV’s) poses a licensable risk while other **predict** a **b l e** (non-zero probability) uncontrolled+ reentry’s (ELV’s) are somehow free from this risk and therefore exempt from the same licensing is indeed a “difference without a distinction”.
- c. pg. 19631; column 2, **para 2**: the whole discussion of separating reentry risk from launch risk presupposes a meaning to the concepts of launch and reentry for RLV activities: neither concept having been adequately addressed in either this NPRM nor in predecessor rules. Also left out entirely is the notion of the risk of reentry of structures constructed on orbit from materials “launched” on one or more flights.
- D. pg. 1963 1; column 3, **para 2** (“A discussion of launch duration...“): Such a discussion, as it applies to RLV’s exists nowhere at this time. The unfortunate politically constructed notion that “launch” (itself inadequately defined for RLV’s) starts with “arrival of first hardware to the launch site” is without substance or merit when applied to RLV’s. Until an adequate definition is forthcoming for RLV’s, the substance and applicability of this NPRM is lacking.

- E. pg. 19632; column 1; **para 4** (“...**the** FAA envisions...”) and column 3; **para 3**; line 7; (The FAA understands...“): We believed that the FAA vision/understanding is faulty at best and misleading at worst. We have many mission scenarios under development which entail the RLV spending time beyond that “envisioned by the FAA” on orbit prior to initiating “re-entry” (whatever that means—we suggest applying the concept of return-to-controlled-airspace rather than “reentry”: see later comment). Some examples include **trans-orbital** activities required to reach “final orbit”; extended micro gravity activities; and docking with (perhaps loading/unloading at) another structure. Conclusions derived from this faulty vision/understanding are therefore suspect. (See also next comment)
- F. pg. 19632; column 2, **para 3**; line 11; (“...**as** the point after payload separation.. .”) and pg. 19633; column 1, **para 1**; line 4 (“...**at** deployment of the payload.“): This is clearly a construct/definition that presupposes (even requires!) a payload that separates (or is “deployed”). Most of our currently planned mission scenarios have no such separating payload. Thus, the definition of “launch” per this NPRM does not have an adequate end point definition. (This is an example of the outdated ELV thinking that **permeates** this NPRM and is without much if any substance in the RLV world.) (This also raises **again** another interesting question: If a separating payload fails to separate, does the “launch” go on forever?)
- G. pg. 19633; column 1; line 13 (“...**point** for commencing reentry...“): First let’s ask why re-entry even needs definition. When, for instance do you define “landing” as being a separate “regulated” event for an aircraft? And, in fact why would you care? Similarly, why do you need to define “re-entry”? The only time “re-entry” poses a real risk to the public is when it is unpredictable/uncontrolled as it most assuredly is with **ELV’s**; yet, you have excluded ELV re-entry from a need for your licensing. We suggest, entry into and or operations within “controlled” airspace be the only time any operations should need licensing and it shouldn’t matter whether it’s an RLV or an ELV that is involved. Risk is risk is risk.
- H. pg 19636; column 3; **para 4**; (...“operational restrictions apply to a // RLV launches...”): This is an onerous and unjustified restriction. Restricting “unproven” RLV is expected (after all experimental aircraft always carry certain restrictions), but to place blanket restrictions on **RLVs** is without support and places an unjustified burden on system developers and operators alike.

- I. pg. 19637; column 2; **para 3**; line 16 (...”**applicant** would need to **prove...structural** and aerodynamic integrity **throughout...flight** lifetime...”): Is it meant by this that a full destructive structural testing program, ala aircraft certification, would have to be used before you’d license a vehicle to fly in this manner? And, if it was “certified” why would we need your license?
- J. pg. 19638; column 1; **para C**. Positive enabling of *fail-safe reentry*
The issue is not that autonomous re-entry systems CANNOT be used; but, rather, WHEN and with WHAT AUTHORITY can such systems be employed. Virtually all RLV systems will be autonomous, just as are most aircraft systems today. The question is simply how much external control is required and at what point the autonomous system can be enabled to do its job. The point in question is the “point of inevitability”; that is, when the vehicle is or will place itself into a physical state that makes a part of the predictable flight path inevitable; and whether, when in that state, some risk is posed to the public. And, in fact, just the fact of being in a state of inevitability does NOT in and of itself a risk to the public necessarily pose! In any case, who’s to say that such a controlled system is likely to pose more risk to the public than the uncontrolled, unlicensed risk experienced everyday from inevitable but unpredictable ELV re-entry.
- K. pg. 19638; column 1; **para D**. *Reentry* sites; line 8;
 (“...**size**... reentry.. site.. . three-sigma.. .”): This notion seems to derive from the anticipation of the point of impact of a warhead on the ground. (old ELV bias showing through) Shouldn’t this deal with entry into “controlled airspace” and involve a dimensioned corridor or “entry box” as well as the possibility (not present with all, or even very many, RLV designs) of intended ground “impact”.
- L. pg. 19638; column 2; last two lines (“...**not** greater than .997...”): This probability seems backwards. Shouldn’t it read “1 minus 0.997”? Seems to us that the intent is to ensure the warhead lands inside the target area.
- M. pg. 19638; column 3; *I. Reusable Launch vehicle Mission Licensing Overview*, **para 2**; line 5 (“...**countdown** to launch.”): Has no meaning given the definition of the start of launch presented elsewhere in this NPRM.
- N. pg. 19639; column 1; **para 3** (“Members of the RLV industry have agreed...”)
We believe this statement to be FALSE and misleading. We believe the RLV industry has generally agreed that any type of FTS (the real meaning of FSS; after all, what is an FSS if it’s not an FTS?) will NEVER be used on RLV’s. And, I suggest, most RLV launches of the

future will originate from other than Federal Ranges further obviating the statement made in this paragraph.

- O. pg. 19639; column 2; **para 1**; line 14 (“...**random** reentry will not exceed...“): This requirement is not levied on ELV’s nor is it levied on aircraft. Almost any ELV re-entry is a “random re-entry”. An RLV “random reentry” is, by definition, a mission failure similar to the failure of the flight control system on an aircraft. Why do aircraft not have to demonstrate such a feature? To force RLVs to do so on further speaks to an unwarranted inconsistency of rule making.
- P. pg. 19646; column 3; *Section 43 7.79*: Reporting of most types of information 60 days, or maybe even 60 minutes, before a mission is no more realistic for an RLV than it is for an aircraft. The same rules of filing a flight plan should hold and no more.
- Q. pg. 19647; column 1; **para Part 433**: “**Re-entry** corridors” may bear little or no relationship to “landing sites” and the holding of a “re-entry site license” is just as likely to have no meaning or may even be impossible in many if not most cases. (This too is largely a leftover from warhead re-entry vehicle thinking.)
- R. pg. 19649; column 1; International **Compatibility**: This matter will yet need to be addressed. International issues of Tort venues; Rights of passage; Salvage; Customs, Immigration, “Missile Early Warning”, Technology Transfer, to name a few, are forefront in the minds of most RLV developers. (Just imagine what a sub-orbital flight from Bismarck, ND to Helsinki Finland would look like to Russian radar! or the return flight look to NORAD for that matter!!!)
- s. pg 19655; column 3; **para 7**; *Launch*: This definition is totally inappropriate, inadequate and misleading “Launch”: the irretrievable hurling of some missile on a trajectory (often mostly ballistic) is NOT a term that has much meaning the world of RLVs. The U.S. Congress notwithstanding, under NO circumstances does RLV “launch” begin “**pre-flight** ground...arrival...flight hardware...at a U.S. launch site.” For RLVs, this would imply that “launch” is a never ending condition. (old ELV thinking plus some politically manufactured liability evasion pervades this NPRM and needs desperately to be excised) This misbegotten definition even concludes with a definition of the end of “Flight”, without regard to when “launch” ends; which is itself misleading and inadequate. And, this “flight” end definition raises its own problems. (Are we to assume that when all my launch systems are autonomous (or at least the point at which my autonomous systems take over) and we (the licensee) have therefore exercised our last control over the vehicle, that **flight** has ended! Or, conversely, if our

system, having recovered to earth and sitting on the ground, in its hangar, is still under our direct command and being checked out for a future mission, are we still in “flight”! — fix the lexicon; RLV’s are NOT ELVs.)

- T. Just a thought: What happens when an RLV is neither going into a sub orbital trajectory nor an orbital trajectory nor “**re-enter**”s from same. Is it not on a flight? Is it not launching? Does it not need a license? Or, worse, is no license available to it?
- U. **pg.** 19656; column 2; *reentry site*: The inadequacy of this definition has already been pointed out in an earlier comment.
- V. **pg.** 19661; column 1; 431.43(a)(4) “mission operations”: is an undefined term
- W. **pg.** 19661; column 1; **431.43(c)(1)**: this should be a procedure vice an analysis; since this in an on-going, dynamic situation that will require near real-time awareness and not just one-time, future looking, pre-flight analysis.