This document is scheduled to be published in the
Federal Register on 07/22/2014 and available online at
http://federalregister.gov/a/2014-16954, and on **FDsys.gov**

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 400 and 401

[Docket No.: FAA-2012-0045; Notice No. 12-05A]

RIN 2120–AJ90

Exclusion of Tethered Launches From Licensing Requirements

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Supplemental notice of proposed rulemaking (SNPRM).

SUMMARY: On August 23, 2012, the FAA published a notice of proposed rulemaking (NPRM) to exclude certain tethered launches from the FAA's licensing and permitting requirements. The FAA is issuing this SNPRM because a commenter raised an issue regarding toxic propellants that was not discussed in the NPRM, but should be addressed. Therefore, the FAA is issuing this action, which proposes to amend the NPRM so that tethered launches using propellants that cause serious injury to the public would not be eligible for exclusion. This SNPRM also includes clarifications based on recommendations commenters made to the NPRM. These proposed changes are intended to enhance the safety of tethered launches and improve regulatory effectiveness.

DATES: Send comments on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: Send comments identified by docket number FAA-2012-0045 using any of the following methods:

- Federal eRulemaking Portal: Go to http://www.regulations.gov and follow the online instructions for sending your comments electronically.
- Mail: Send comments to Docket Operations, M-30; U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, DC 20590-0001.
- Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to http://www.regulations.gov, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at http://DocketsInfo.dot.gov.

Docket: Background documents or comments received may be read at http://www.regulations.gov at any time. Follow the online instructions for accessing the docket or go to the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: For technical questions concerning this proposed rule, contact Stewart Jackson, AST-300, Office of Commercial Space Transportation, Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591; telephone (202) 267-7903; e-mail Stewart.Jackson@faa.gov. For legal questions concerning this proposed rule, contact Sabrina Jawed, AGC-250, Office of the Chief Counsel, Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591; telephone (202) 267-8839; email Sabrina.Jawed@faa.gov.

SUPPLEMENTARY INFORMATION:

Authority for this Rulemaking

The Commercial Space Launch Act of 1984, as amended and re-codified at 51 U.S.C. 50901-50923 (the Act), authorizes the Department of Transportation and thus the FAA, through delegations, to oversee, license, and regulate commercial launch and reentry activities, and the operation of launch and reentry sites as carried out by U.S. citizens or within the United States. 51 U.S.C. 50904, 50905. The Act directs the FAA to exercise this responsibility consistent with public health and safety, safety of property, and the national security and foreign policy interests of the United States. 51 U.S.C. 50905. Section 50901(a)(7) directs the FAA to regulate only to the extent necessary, in relevant part, to protect the public health and safety and safety of property. The FAA is also responsible for encouraging, facilitating, and promoting commercial space launches by the private sector. 51 U.S.C. 50903.

I. Overview of SNPRM

In its August 23, 2012 NPRM (77 FR 50956), the FAA proposed to exclude certain tethered launches from chapter III requirements if the tethered launches met

specified safety criteria. The proposed criteria did not address the use of toxic propellants onboard a launch vehicle. During the NPRM comment period, the FAA received a comment stating the agency should revise the proposed rule to protect the public from the potential harm exposure to a toxic propellant could cause. The FAA agrees that it should address toxic propellants. Therefore, this SNPRM proposes that if an operator chooses to use any of the toxic propellants identified in Tables I417-2 and I417-3 in Appendix I of part 417, that launch must meet chapter III requirements.

Also, this SNPRM includes two clarifications to the NPRM. First, the agency would remove the term "established strength properties" from proposed § 400.2(c)(2)(i) to better clarify the proposed requirement and preserve the original intent, which is to ensure that the tether system can withstand the maximum dynamic load placed on it. Second, the FAA would revise proposed § 400.2(c)(2)(iii) to clarify that the maximum flight limit of 75 feet for a tethered launch vehicle would be measured from the ground to a fully-extended tether's attachment point to a vertically-oriented vehicle.

II. Background

A. Summary of NPRM

In August 2012, the FAA issued an NPRM proposing to exclude tethered launches that met specified requirements for a safe launch from chapter III licensing, permitting, and waiver requirements. The NPRM proposed defining a tether system as a device that contains launch vehicle hazards by physically constraining a launch vehicle in flight to a specified range from its launch point. It would include all components, from the point where the tether attaches to the vehicle to a solid base, that experience load during a tethered launch. The NPRM proposed that the tether system had to:

- have established strength properties that would not yield or fail under the maximum dynamic load on the system or two times the maximum potential engine thrust;
- have a minimum safety factor of 3.0 for yield stress and 5.0 for ultimate stress;
- constrain the launch vehicle within 75 feet above ground level;
- display no damage prior to the launch; and
- be insulated or located such that it would not experience thermal damage from the launch vehicle exhaust.

The NPRM additionally proposed separation distances for the tethered operation based on the amount of propellant onboard a launch vehicle. Those distances are listed in proposed Table A of the NPRM. Lastly, the NPRM proposed requiring that the launch vehicle be unmanned, have a liquid or hybrid motor, and carry no more than 5,000 pounds of propellant.

B. Summary of Comments

The comment period for the NPRM closed on October 22, 2012. The FAA received comments from three commercial space companies: Masten Space Systems, Inc. (Masten); Unreasonable Rocket; and, SpeedUp, LLC. In addition, the agency received comments from four individuals, making a total of seven commenters. Two of the seven commenters, SpeedUp, LLC and Mr. W. Andrew Shrader, supported the proposal. The other commenters raised issues that are summarized and discussed below.

Toxic Propellants

The FAA did not address toxic propellants in the NPRM. One commenter, Mr. Chad W. Thrasher, suggested that the FAA consider the harmful characteristics of some

liquid propellants. He pointed out that many liquid rocket propulsion systems use liquids that are animal carcinogens, corrosive, and potentially explosive when mixed in specific ratios. He also pointed out that exposure to certain propellants may result in damage to the lungs, liver, kidneys, the central nervous system, and may also result in coma or death by asphyxiation. Mr. Thrasher suggested that the FAA revise proposed § 400.2(c)(3) to ensure that operators and the public are upwind of the test location or at least twice the distance defined in proposed Table A if downwind.

Mr. Thrasher proposed protecting the operators themselves. The Commercial Space Launch Act of 1984, as amended and re-codified at 51 U.S.C. 50901-50923, authorizes the agency through delegation to regulate launch and reentry activities to ensure the public health and safety, safety of property, and the national security and foreign policy interests of the United States. Public safety as defined in § 401.5 refers to the safety of people and property that are not involved in supporting the launch. Therefore, the proposal is not intended to protect the launch operator or the launch operator's personnel who are involved in carrying out the launch.

As this proposal pertains to the public, the FAA agrees with Mr. Thrasher that the NPRM should have addressed the harmful characteristics of certain propellants. However, the agency believes the best solution to keeping the public safe and retaining the burden-relieving components of the proposal would be to exclude from chapter III requirements only those eligible tethered launches that do not use propellants that cause serious injury. Mr. Thrasher suggested changing the proposed rule by stating that Table A would apply only if one is upwind of the test location. He suggested that if one is downwind of the test location, one should be at least one and a half times the separation

distances stated in Table A. Basing the separation distances on wind direction, and increasing the separation distances for anyone standing downwind of the test location would add a level of complexity to the proposal that the FAA does not intend. Thus, the agency would amend proposed § 400.2(c)(1)(iii)[1] to clarify that chapter III continues to apply to a tethered launch using toxic propellants listed in Table I417-2 and Table I417-3 in Appendix I of part 417. If launch operators wish to use a toxic propellant, they would still be required to conduct their launch under chapter III.

Established Strength Properties

The FAA would withdraw the proposed requirement that a tether system eligible for exclusion from chapter III requirements possess "established strength properties." Section 400.2(c)(2)(i) of the NPRM proposed that an eligible tether system have established strength properties that would not yield or fail under the conditions listed in §§ 400.2(c)(2)(i)(A) and 400.2 (c)(2)(i)(B). One commenter, Mr. Alexander Salvato, suggested that the phrase "established strength properties" was too vague, and it was not clear how the strength properties of the tether system would be established, or by whom. He suggested clarifying the phrase with substitute language or integrating the alternate test for tether strength provided in the NPRM.

The FAA agrees that the phrase "established strength properties" is too vague for the reasons Mr. Salvato provided, and no longer proposes it because the remainder of the provision would address the FAA's concerns with sufficient specificity. New proposed § 400.2 (c)(2)(i) would require that an eligible tether system not yield or fail under 1) the

[1] In the NPRM, § 400.2(c)(1)(iii) proposed to limit the amount of fuel the launch vehicle could carry to 5,000 pounds. For the SNPRM, this proposed requirement would be moved to new paragraph (c)(1)(iv) of § 400.2.

maximum dynamic load exerted on the system, or 2) a load equivalent to two times the maximum potential engine thrust.

Factors of Safety

For the tether system, the FAA proposes a minimum factor of safety of 3.0 for yield stress and 5.0 for ultimate stress. Three commenters, Masten, Mr. Thrasher, and Mr. Salvato, expressed concern about the FAA's proposed factors of safety.

Masten commented that while the proposed factors of safety may be appropriate for military development applications, they place unnecessary financial and schedule burdens on commercial reusable launch vehicle (RLV) developers without materially increasing public safety. Masten also stated the performance characteristics of commercial RLVs are driven by market rather than military requirements. As a result, the robust attachment hardware that may be required for a tether system with a yield stress safety factor of 3.0 and an ultimate stress safety factor of 5.0 may prove heavier than can reasonably be flown by a commercial RLV under tether test conditions. Masten suggested the proposed factors of safety may be appropriate for military development purposes, where ordnance or weapons systems requirements may drive a need for reliance on high yield and ultimate stress safety factors; however, commercially competitive RLV developers do not face the same military-based performance, maintainability, and interoperability requirements that U.S. Air Force developers address. Commercial RLV developers do face financing and price competition challenges that are not present in military system development. Masten suggested that based on its extensive experience designing and operating RLVs and tether systems, a safety factor of 2.0 for yield stress and 4.0 for ultimate stress would be consistent with commercial RLV

operator practices and would ensure the tether system design was sufficiently safe but not so robust as to inhibit meaningful tether test activity.

The FAA acknowledges that its proposed factors of safety are also used for military applications. However, the FAA does not agree that the proposed factors of safety should be revised because they are too stringent for commercial operations. In addition to the U.S. Air Force, academia, and NASA have also recommended or used the proposed factors of safety. In 1948, Joseph P. Vidosic established guidelines that recommended when to apply a factor of safety ranging from 1.25 to 4.0 based on yield strength.[2] Since then, various industries have accepted these guidelines as basic guidance that can be used when experience and empirical data are otherwise not available. For brittle material, these guidelines recommend doubling the factor of safety for yield strength. With better known materials that are to be used in uncertain environments or subjected to uncertain stresses, the guidelines recommend using a factor of safety of 3 to 4. NASA used a factor of safety of 3 for yield and 5 for ultimate stress for its lifting slings.[3] Similarly, the U.S. Air Force uses a minimum factor of safety of 3 for yield stress and 5 for ultimate stress for design of ground-based systems, including tether systems.[4] Furthermore, several engineering textbooks contain the same factor of safety guidelines.[5]

As noted previously, the goal of this rulemaking is to maintain public safety while relieving the industry and the FAA from chapter III licensing, permitting, and waiver requirements for tethered launches. Because the FAA would not be overseeing the

[2] Joseph P. Vidosic, "Design Stress Factors," Proceedings of the American Society for Engineering Education, Vol. 55, 1947-48, pp 653-658.
[3] NASA STD 8719.9, "Standard for Lifting Devices and Equipment," May 2, 2002.
[4] Air Force Space Command Manual 91-710, Air Force Space Command, Range Safety User Requirement Manual, Vol. 3 (July 1, 2004).
[5] C.S. Sharma and Kamlesh Purohit, Design of Machine Elements (2005); Rajendra Karwa, A Testbook of Machine Design (2005); Richard M. Phelan, Fundamentals of Mechanical Design (1957).

tethered launches covered under the proposed rule, and because of the inherent uncertainties of the test environment, the agency believes it is reasonable to impose conservative design requirements to ensure the public is protected from a potential accident or incident. The factors of safety the FAA proposed (3.0 for yield stress, which is the elastic limit; and, 5.0 for ultimate stress, which is where breakage occurs) are based on guidance from academia, from successful usage by NASA, and proven results as documented by the U.S. Air Force's application to its operations at the Eastern and Western Ranges involving tethered and ground-based systems. Thus, the proposed factors of safety would render FAA oversight unnecessary.

The FAA does not agree with Masten that it will be too costly for commercial companies to comply with these factors of safety. To the contrary, selecting conservative factors allows an operator to avoid the cost of analysis associated with FAA oversight. The selection of an appropriate factor of safety is based on the level of uncertainties regarding loading conditions, material properties, and environmental factors. The criteria used to select the factor of safety is based on accumulated knowledge associated with the design of the system, historical empirical knowledge, engineering judgment, judgment based on experience, and best practices that ensure safety. The factors of safety applied in industries such as aviation and aerospace reflect years of experience and the accumulation of empirical test data that provide an in-depth understanding of how loading conditions affect the system. Since 1948, engineers in various industries, including the aircraft and spacecraft industries, have achieved a better understanding of how to obtain factors of safety values for various loading conditions by implementing expensive, high fidelity validation and verification testing.

Typically, aircraft and spacecraft industries perform high fidelity verification and validation testing of vehicle structures to ascertain how these structures will perform under actual load conditions and to address how to reduce uncertainties. These test results provide an understanding of the actual loading characteristics associated with the system. With a significant reduction in uncertainties, an operator could reduce the factors of safety values. To achieve these lower factors of safety values, an operator would have to conduct a thorough structure analysis and high cost test programs. For example, if a vehicle attached to a tether started flying erratically and became uncontrollable, an operator would need to conduct costly testing to determine the worst loading condition. However, an operator could use closed-loop analyses and the proposed factors of safety to address uncertainties at lower cost without compromising public safety. With higher factors of safety, it is possible to reduce the need for high fidelity testing and analysis with a resulting reduction in costs. The FAA is not proposing a high fidelity analysis, and is instead focused on factors that protect public safety while making FAA oversight unnecessary.

Mr. Thrasher commented that the NPRM incorrectly interprets the intended minimum safety factor of the tether system by selecting the case requiring the highest, most conservative safety factors. He pointed out that the Martino report[6] the FAA cited in the NPRM references three case studies. The first case addresses the expected or nominal loads based on the expected thrust levels in the desired direction with the proper dispersions. For this case, Mr. Thrasher suggested that the safety factors of 3.0 for yield stress and 5.0 for ultimate stress should be used for the expected nominal loads. He stated

[6] Nicholas E. Martino, Design and Analysis Guidelines for Launch Vehicle Tether Systems, Aerospace Report No. ATR–2008 (5377)–1, The Aerospace Corporation (Sept. 30, 2007). This report is available in the docket for this rulemaking (Docket No. FAA–2012–0045).

that in most cases this would be 100 percent of the thrust level of the system. The second case addresses structures designed to restrain a system during testing. He stated the second case provides safety factors if the structure is actually tested to designated loads, and another set of safety factors if it is just analyzed but not tested. He stated the second set of safety factors is more conservative to allow for minor errors in the structural analysis. He suggested that the third case, using safety factors of 2.0 for yield stress and 3.0 for ultimate stress, should be used in off-nominal cases. The proposed method to calculate the maximum dynamic load by multiplying the maximum potential engine thrust by a factor of two is consistent with an off-nominal event such as an explosion. Mr. Thrasher stated the tether system must satisfy all three load cases—nominal, ground structures, and off-nominal—and, systems must be designed to meet the case with the highest design loads. Mr. Thrasher further commented that to determine the highest design loads of a system, one must calculate each case, and then use the highest loads for both yield and ultimate stress. Based on his calculations, he stated that the proposed rule would require the tether system to withstand a 33 percent greater yield load and a 40 percent greater ultimate stress load to those recommended in the Martino report. He recommended that the FAA revise proposed § 400.2(c)(2) as follows:

(2) Tether system. The tether system must—

(i) Have established strength properties that will not yield or fail under—

(A) The maximum dynamic load of the system; and

(B) The nominal maximum dynamic load on the system with a safety factor of 3.0 for yield stress and 5.0 for ultimate stress; and

(C) The off-nominal dynamic load cases, calculated as the equivalent to two times the maximum potential engine thrust, shall have a minimum safety factor of 2.0 for yield stress and 3.0 for ultimate stress.

In the NPRM, the FAA used the Martino Report to show that a factor of safety of 3 for yield stress and 5 for ultimate stress are accepted industry standards for the design of ground-based systems, including a tether and its attachments to launch facilities or ground equipment. The FAA did not intend to adopt all the load cases discussed in the Martino Report. Instead, the FAA strives to achieve simplicity and clarity in its proposed rule without compromising safety. Because the FAA would not provide oversight for eligible tethered launches, the FAA selected robust and industry-acceptable factors of safety that would not necessitate FAA scrutiny.

Mr. Salvato stated the term "safety factor" is too vague. He said although the FAA discusses in the NPRM what the terms "yield stress" and "ultimate stress" mean, the agency only references factor of safety in its supplementary materials. He recommended including an abbreviated definition in the regulation of safety factor based on the more lengthy definition contained in the supplemental material, or referencing the attached supplemental material in the preamble to the rule.

The FAA does not believe it is necessary to define the term "safety factor" in the rule because it is a widely recognized industry term. However, the agency offers the following brief explanation to clarify the term as it is used in the preamble discussion: The factor of safety (FoS), also called safety factor (SF), is the ratio of the maximum load

that a system is expected to withstand against the allowable design load applied or the ratio of absolute strength (structural capacity) to actual applied design load.

Yield Stress

In the preamble to the NPRM, the FAA stated that yield stress is the point of the elastic limit. Unreasonable Rocket generally supported the rule, but was unclear as to why the FAA described the tether yield point as the point of elastic limit instead of the point of plastic limit for a system that is meant to be stretchy. It stated that all of Unreasonable Rocket's testing used climbing rope designed to yield (i.e., to arrest a climber's fall without snapping him in half). It then recommended the FAA define yield stress in the rule as the point of plastic yield.

The FAA does not agree. Elastic limit is the maximum stress that may be developed such that there is no permanent or residual deformation (the elements subjected to the loading; for example, the tether dynamic rope) when the load is entirely removed. The FAA proposed yield stress for the tether system as the elastic limit rather than the plastic limit because once the plastic limit is reached, the elastic capability of the material ends and permanent deformation occurs. If the applied load continues to increase, the element will weaken and ultimately breakage will occur.[7]

Flight Altitude Limit

In the NPRM, the FAA proposed to confine an eligible launch to one constrained within 75 feet above ground level (AGL). Two commenters asked the FAA to increase the proposed flight limit, but the FAA does not agree. As the agency discussed in the NPRM, to determine a safe flight limit, the FAA calculated the average length of a tether

[7] Stephen W. Attaway, Rope System Analysis (1996); William Storage and John Ganter, Physics for Cavers: Loads, and Energy (1990 & 1998); Tendon, Dynamic and Static Ropes Manual.

(32 feet) and the average height of a crane/forklift (43 feet) and added the two figures together. These averages are based on historical data from past tethered launches. The FAA also used a random sampling of the height of cranes/forklifts from various manufacturers to help determine the average crane/forklift height.

Two commenters, Masten and Mr. Thrasher, stated that the proposed flight limit is too restrictive and should be increased. Masten recommended increasing the flight limit by 275 feet to 350 feet AGL to accommodate existing and contemplated commercial tether launch activities, which would include larger, higher-performance RLVs. Mr. Thrasher suggested increasing the maximum allowable tether length to 40 feet to avoid ground effects from the propulsion system, and increasing the flight limit by 15 feet to 90 feet AGL to account for longer tether lengths and slightly larger than average cranes.

Masten pointed out that to comply with the proposed flight limit, the combined length of the launch vehicle, the vehicle connection, the tether and the fixed connection could not exceed a 37.5-foot radius from the fixed connection to the end of the launch vehicle, and that this threshold would severely limit the availability of the proposed exclusion to larger and higher-performance RLVs.

The FAA does not agree with this reasoning. First, the length of the launch vehicle would not be included in the flight limit calculation, as described in greater detail below. Second, regarding Masten's concern that the proposed flight limit would not account for larger, higher-performance RLVs, the FAA's intent is to provide design and operational criteria for the safe tethered launch of small, liquid or hybrid propulsion launch vehicles similar to those for which the agency has issued past waivers. It is not the

agency's intent to exclude from FAA oversight the larger, higher-performance launch vehicles Masten describes in its comment, specifically Morpheus, Minuteman, and XEUS.

In response to Mr. Thrasher's comment suggesting the FAA increase the maximum allowable tether length, the FAA notes that the NPRM explicitly states that launch operators are not required to use the same measurements for tether length and crane/forklift height in their tether system design that the agency used to calculate the proposed flight limit. Even so, they would still be required to comply with the maximum flight limit threshold in order to be excluded from chapter III requirements. For example, an operator could use a 10-foot crane and a 30-foot tether, or a 50-foot crane and a 25-foot tether. In both scenarios, the maximum flight limit would not exceed 75 feet AGL. If an operator needed to adjust its tether length to avoid ground effects from the propulsion system, as Mr. Thrasher suggested, it would be free to do so as long as the vehicle did not exceed the flight limit for exclusion from chapter III.

Mr. Thrasher also suggested increasing the maximum flight limit 15 feet to account for longer tether lengths and slightly larger than average cranes. The FAA does not agree that increasing the flight limit 15 feet is a necessary or beneficial change from the proposed rule. The proposed 75-foot flight limit is adequate for vehicles that are equivalent in height to the average size of those vehicles for which the FAA granted a launch waiver to conduct tethered launches in the past. Also, Mr. Thrasher did not provide any rationale that addresses the FAA's safety concerns in support of his proposal. The FAA also reiterates that its intention is not to exclude larger than the average size of those vehicles that the FAA granted a launch waiver from chapter III requirements.

Additionally, the agency wishes to clarify the proposed threshold for flight limit. In the NPRM, proposed § 400.2(c)(2)(iii) stated the tether system would "constrain the launch vehicle within 75 feet above ground level." The FAA now proposes to clarify that the restriction would measure from the ground to the point where the tether attaches to the vehicle. To calculate whether a launch vehicle exceeded the proposed threshold, the operator would measure from the ground to the tether's attachment point to a vertically oriented vehicle. In other words, if the attachment point was to the launch vehicle's base, the nose of the launch vehicle could be at an altitude greater than 75 feet. The maximum flight limit would not include the height of the vehicle itself.

Slack Tether

The FAA proposed that a tether system be able to withstand the maximum dynamic load on the system or a load equivalent to two times the maximum potential engine thrust. One commenter, Mr. Andrew Swallow, suggested that "rules are needed to permit slack tethers, such as defining their breaking strength, as well as tethers under static load." He also stated that a tethered vehicle starts and stops on the ground so will need a few inches of slack. The FAA would permit a tethered launch vehicle to be eligible to be excluded from chapter III. A slack tether may, in some circumstances, allow loading in excess of the proposed criteria. A slack tether, particularly a static rope, could increase the magnitude of the applied load placed on the tether system because the velocity of the vehicle would quickly eliminate the slack, and the tether could rapidly decelerate the vehicle. This rapid deceleration would cause the vehicle and the tether system to be subjected to high dynamic loading called shock loading. Shock is produced

when an object (e.g., a launch vehicle) in motion suddenly halts.[8] Shock loading can produce as much as twice the load impact compared to static loading.[9] The force produced by the sudden stoppage of motion could in some cases cause not just damage to the tether or vehicle, but tether separation, because it would exceed the maximum produced loads.

If the tether system could not withstand the dynamic load exerted on it and was damaged, and if tether separation occurred and the launch vehicle exceeded the flight limit, the operator would have failed to comply with two key proposed requirements: 1) ensuring the tether system could withstand the specified dynamic load placed on it; and 2) constraining the launch vehicle to the maximum flight limit. Additionally, the FAA does not agree that a vehicle starts and stops a tethered launch on the ground. An operator could elect to suspend the vehicle in the air. The FAA does not believe it is necessary to add requirements for the use of slack tethers to the proposed rule because the rule requires the tether design to sustain dynamic (or shock) loading conditions.

Inspection of Tether System

Proposed § 400.2(c)(2)(B)(iv)[10] would require that a tether system not display damage prior to the launch. In the NPRM's preamble, the FAA provided guidance on conducting a visual inspection of the tether system to identify damage such as component fatigue, fracture, and wear.

One commenter, Mr. Thrasher, suggested that the FAA require a launch operator to inspect tether hardware because the FAA is relying on visual inspections to ensure

[8] Stephen W. Attaway, Rope System Analysis (1996); William Storage and John Ganter, Physics for Cavers: Loads, and Energy (1990 & 1998); Tendon, Dynamic and Static Ropes Manual.
[9] A. E. H. Love, Mathematical Theory of Elasticity, 2nd ed., Cambridge University Press (1906), pgs. 179-180.
[10] In the NPRM (77 FR 50959), in section heading (C)(4), the FAA inadvertently cited the proposed rule paragraph as § 400.2(c)(3). The correct proposed paragraph is § 400.2(c)(2).

there is no component damage. Mr. Thrasher also recommended that effective inspections of metal components for pre-existing damage, fracture, corrosion, and wear require all surfaces to be bare metal or have clear protective coatings. Further, he noted that any paint or improperly bonded covering used to prevent thermal damage could prevent detection of damage. He proposed that any thermal protective coverings be installed after inspection and any components that require thermal protection be bonded, be visually inspected, and used only one time. He recommended revising proposed § 400.2(c)(2)(B)(iv) to add the following: "Metal components must be inspected unpainted and free of any coverings or coatings that would interfere with visual inspection. Any metal using bonded protective thermal coatings shall be visually inspected and used only one time."

Mr. Thrasher's comment implies the FAA intended the visual inspection to be a primary means of ensuring the structural integrity of the tether system. The FAA's intent for the visual inspection is to provide an added measure of safety to reinforce the safety criteria the agency is proposing. Primary among these safety requirements are the proposed conservative factors of safety. The FAA does not intend for the visual inspection to be a primary means of determining if the tether system is safe. The expectation is the operator will conduct a visual inspection on the eve of the launch, after full compliance with all other required design and operational criteria. However, this does not preclude launch operators from conducting a more substantive inspection if they believe it is necessary to ensure compliance and a safe tethered launch.

IV. Regulatory Notices and Analyses

A. Regulatory Evaluation

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 and Executive Order 13563 direct that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, the Trade Act requires agencies to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this proposed rule.

Department of Transportation Order DOT 2100.5 prescribes policies and procedures for simplification, analysis, and review of regulations. If the expected cost impact is so minimal that a proposed rule does not warrant a full evaluation, this order permits a statement to that effect and the basis for it to be included in the preamble if a full regulatory evaluation of the cost and benefits is not prepared. Such a determination has been made for this proposed rule. The reasoning for this determination is discussed below.

The FAA has licensing authority over tethered launches, which are considered launches under chapter III unless they meet the definition of an amateur rocket launch.[11] To conduct such tethered non-amateur rocket launches, operators must obtain a launch license, experimental permit, or apply for a waiver from chapter III. Applying for waivers, licenses, and permits impose a financial burden on vehicle operators and the FAA because of time and resources required to create and analyze these applications.

The proposed rule would establish clear and simple criteria for an effective tether system. In addition, it proposes vehicle and operational criteria as added measures to protect the public in the event of a tether system failure. Operators would not have to apply for a launch license, permit, or waiver from chapter III to conduct tethered launches of non-amateur rockets[12] that met the proposed criteria for an effective tether system and the vehicle and operational criteria. Operators that met the proposed criteria would not have to incur the costs of applying for a launch license, permit, or waiver and would not have to sustain the costs associated with delay in the processing of these applications. The FAA would not have to conduct case-by-case analyses of tethered launches that met the proposed criteria to verify public safety from a launch vehicle explosion or confirm that the tether system would not fail. Furthermore, launch operators that conducted tethered launches would not be compelled to follow the criteria in this proposal as they would still have the option of applying for a launch license, permit, or waiver under chapter III. Therefore, the proposed rule would impose no additional requirements on operators, but would provide an alternative to conducting a tethered launch under chapter

[11] Launches of amateur rockets are excluded from the requirements of chapter III. *See* 14 CFR 400.2 (2011).

[12] Operators launching amateur rockets on a tether would still be subject to part 101 of chapter I and would continue to be excluded from chapter III.

III. If the operator deemed it more cost effective to apply for a license, permit, or waiver than to follow the criteria proposed here, the operator would have that option.

For the reasons discussed, the rule would be cost relieving to both operators and the FAA. The FAA requested but received no comments on its conclusion in the NPRM that the rule would be cost relieving to operators and the FAA.

This SNPRM revises the FAA's original proposal by not excluding from chapter III tethered launches that use specified toxic propellants from chapter III requirements. Even with the change, the rule is still cost relieving relative to the current regulations, even though tethered launches using toxic fuel must comply with chapter III requirements as they currently do. There would be no additional costs or cost savings due to the change to the NPRM. Operators launching vehicles that are eligible for the chapter III exclusion would still benefit from cost savings relative to the current chapter III requirements. The FAA has determined that this proposed rule is not a ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, and is not ''significant'' as defined in DOT's Regulatory Policies and Procedures.

B. Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) (RFA) establishes as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration. The RFA covers a wide-range

of small entities, including small businesses, not-for profit organizations, and small governmental jurisdictions. Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA.

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

This proposed rule is expected to provide an alternative to conducting tethered launches under chapter III and therefore could alleviate the financial burden of applying for a launch license, permit, or waiver to chapter III if an operator met the proposed criteria. The expected outcome would therefore have either a cost saving impact or no impact on small entities affected by the proposed rule. Under this SNPRM, launches that use toxic propellants would have to comply with chapter III, which they have to do currently. Although the changes introduced with the SNPRM might reduce the number of launch vehicles that would be exempt from chapter III, the rule would still have either a cost saving impact or no impact on small entities. The FAA did not receive comments when it reached the same conclusion in the NPRM.

Therefore, as provided in section 605(b), the head of the FAA certifies this rulemaking will not result in a significant economic impact on a substantial number of small entities.

C. International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39), as amended by the Uruguay Round Agreements Act (Pub. L. 103–465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, establishing standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such as the protection of safety, and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. If a foreign launch operator were to conduct a tethered launch in the United States that meets the requirements of this proposed rule, it would be eligible for the proposed exclusion from chapter III. The FAA has assessed the potential effect of this proposed rule and determined that it would have the same impact on domestic and international entities and thus have a neutral trade impact.

D. Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (in 1995 dollars) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ‘‘significant regulatory action.’’ The FAA currently uses an inflation-adjusted value of $151.0 million in lieu of $100 million. This proposed rule does not contain such a mandate; therefore, the requirements of Title II of the Act do not apply.

E. Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. The FAA has determined that there would be no new requirement for information collection associated with this proposed rule.

Public comments: The FAA did not receive comments to the NPRM on its determination that the proposed rule would not impose new paperwork requirements.

F. International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to conform to International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. No ICAO Standards and Recommended Practices correspond to these proposed regulations.

G. Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. This rulemaking action qualifies for the categorical exclusion identified in paragraph 312f and involves no extraordinary circumstances.

V. Executive Order Determinations

A. Executive Order 12866

See the ‘‘Regulatory Evaluation’’ discussion in the ‘‘Regulatory Notices and Analyses’’ section elsewhere in this preamble.

B. Executive Order 13132, Federalism

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

C. Executive Order 13211, Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA analyzed this proposed rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). The agency has determined that it would not be a ‘‘significant energy action’’ under the executive order and would not be likely to have a significant adverse effect on the supply, distribution, or use of energy.

VI. Additional Information

A. Comments Invited

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. The agency also invites comments relating to the economic, environmental, energy, or federalism impacts that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. To ensure the docket does not contain duplicate comments, commenters should send only one copy of written comments, or if comments are filed electronically, commenters should submit only one time.

The FAA will file in the docket all comments it receives, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking. Before acting on this proposal, the FAA will consider all comments it receives on or before the closing date for comments. The FAA will consider comments filed after the comment period has closed if it is possible to do so without incurring expense or delay. The agency may change this proposal in light of the comments it receives.

Proprietary or Confidential Business Information: Do not file proprietary or confidential business information in the docket. Such information must be sent or delivered directly to the person identified in the FOR FURTHER INFORMATION CONTACT section of this document, and marked as proprietary or confidential. If submitting information on a disk or CD ROM, mark the outside of the disk or CD ROM, and identify electronically within the disk or CD ROM the specific information that is proprietary or confidential.

Under 14 CFR 11.35(b), if the FAA is aware of proprietary information filed with a comment, the agency does not place it in the docket. Proprietary information is held in a separate file to which the public does not have access, and the FAA places a note in the docket that it has received it. If the FAA receives a request to examine or copy this information, it treats it as any other request under the Freedom of Information Act (5 U.S.C. 552). The FAA processes such a request under Department of Transportation procedures found in 49 CFR part 7.

B. Availability of Rulemaking Documents

An electronic copy of rulemaking documents may be obtained from the Internet by—

1. Searching the Federal eRulemaking Portal (http://www.regulations.gov);
2. Visiting the FAA's Regulations and Policies web page at http://www.faa.gov/regulations_policies or
3. Accessing the Government Printing Office's web page at http://www.gpo.gov/fdsys/.

Copies may also be obtained by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 267-9680. Commenters must identify the docket or notice number of this rulemaking.

All documents the FAA considered in developing this proposed rule, including economic analyses and technical reports, may be accessed from the Internet through the Federal eRulemaking Portal referenced in item (1) above.

List of Subjects

14 CFR Part 400

Space transportation and exploration, Licensing, Safety.

14 CFR Part 401

Space transportation and exploration.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend chapter III of title 14, Code of Federal Regulations as follows:

PART 400—BASIS AND SCOPE

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

Authority: 51 U.S.C. 50901–50923.

2. Revise § 400.2 to read as follows:

§ 400.2 Scope.

These regulations set forth the procedures and requirements applicable to the authorization and supervision under 51 U.S.C. subtitle V, chapter 509, 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—

(a) Space activities carried out by the United States Government on behalf of the United States government;

(b) The launch of an amateur rocket as defined in § 1.1 of this title; or

(c) A launch of a tethered launch vehicle that meets the following criteria:

(1) Launch vehicle. The launch vehicle must—

(i) Be unmanned;

(ii) Be powered by a liquid or hybrid rocket motor;

(iii) Not use any of the toxic propellants of Table I417-2 and Table I417-3 in Appendix I of part 417 of this chapter; and

(iv) Carry no more than 5,000 pounds of propellant.

(2) Tether system. The tether system must—

(i) Not yield or fail under—

(A) The maximum dynamic load on the system; or

(B) A load equivalent to two times the maximum potential engine thrust.

(ii) Have a minimum safety factor of 3.0 for yield stress and 5.0 for ultimate stress.

(iii) Constrain the launch vehicle within 75 feet above ground level as measured from the ground to the attachment point of the vehicle to the tether.

(iv) Display no damage prior to the launch.

(v) Be insulated or located such that it will not experience thermal damage due to the launch vehicle's exhaust.

(3) Separation distances. The launch operator must separate its launch from the public and the property of the public by a distance no less than that provided for each quantity of propellant listed in Table A of this section.

TABLE A—SEPARATION DISTANCES FOR TETHERED LAUNCHES

Propellant carried (lbs.)	Distance (ft.) from the launch point
1–500	900
501-1,000	1,200
1001-1,500	1,350
1,501-2,000	1,450
2,001-2,500	1,550
2,501-3,000	1,600
3,001-3,500	1,650
3,501-4,000	1,700
4,001-4,500	1,750
4,501-5,000	1,800

PART 401—ORGANIZATION AND DEFINITIONS

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

Authority: 51 U.S.C. 50101–50923.

4. Amend § 401.5 by adding the definition of Tether system in alphabetical order to read as follows:

§ 401.5 Definitions.

* * * * *

Tether system means a device that contains launch vehicle hazards by physically constraining a launch vehicle in flight to a specified range from its launch point. A tether system includes all components, from the tether's point of attachment to the vehicle to a solid base, that experience load during a tethered launch.

* * * * *

Issued in Washington, DC, on July 9, 2014.

George C. Nield,
Associate Administrator, Commercial Space Transportation.

[FR Doc. 2014-16954 Filed 07/21/2014 at 8:45 am; Publication Date: 07/22/2014]