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INITIAL REGULATORY EVALUATION, INITIAL REGULATORY FLEXIBILITY DETERMINATION, TRADE IMPACT ASSESSMENT, AND UNFUNDED MANDATES ASSESSMENT

SUPPLEMENT TO NOTICE OF PROPOSED RULEMAKING

LICENSING AND SAFETY REQUIREMENTS FOR LAUNCH (14 CFR PART 413, 415, 417)

**OFFICE OF AVIATION POLICY AND PLANS,
OPERATIONS REGULATORY ANALYSIS BRANCH, APO-310**

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LIST OF ABBREVIATIONS

AST	Associate Administrator for Commercial Space Transportation
CCAFS	Cape Canaveral Air Force Station in Florida
DDESB	Department of Defense Explosive Safety Board
DOD	Department of Defense
ELV	Expendable launch vehicle
E_C	Expected average number of casualties
EWR 127-1	*Eastern and Western Range Requirements 127-1*
FAA	Federal Aviation Administration
ft-lbs	Foot-pounds
NASA	National Aeronautics and Space Administration
NPRM	Notice of Proposed Rulemaking
psi	Pounds per square inch
RLV	Reusable launch vehicle
SNPRM	Supplement to Notice of Proposed Rulemaking
VAFB	Vandenberg Air Force Base

EXECUTIVE SUMMARY

This draft regulatory evaluation examines the costs and benefits of the Supplement to Notice of Proposed Rulemaking (SNPRM), Licensing and Safety Requirements for Launch (Title 14, Code of Federal Regulations, Parts 413, 415, 417). The SNPRM, along with the October 25, 2000 Notice of Proposed Rulemaking (NPRM), propose to codify the Federal Aviation Administration's license application process for launch from non-federal launch sites, and would codify the safety requirements for licensed launch operators in order to protect the public from the hazards of launch from either a federal range or non-federal launch site.

The changes contained in the SNPRM would impose a total estimated cost of approximately $700,000 on the commercial space transportation industry to comply with the FAA's requirements over the 5-year period from 2003 through 2007. The FAA believes that there would be some administrative costs imposed on the FAA by the SNPRM, but there is insufficient information to quantify these costs at this time.

Codification of federal range and non-federal launch site data, reporting, and other requirements may improve launch operators' understanding of such, thereby resulting in operating efficiencies that could yield some cost savings. The general public may realize some additional safety benefits from applying more stringent toxic risk criteria for launches.

The changes from the NPRM, as contained in the SNPRM, would not impose a significant economic impact on a substantial number of small entities. Additionally, the SNPRM would not impose a competitive trade disadvantage on U.S. entities or to foreign entities. The SNPRM does not contain any federal intergovernmental or private sector mandate. Therefore, the requirements of Title II of the Unfunded Mandates Reform Act of 1995 do not apply.

1.0 INTRODUCTION

1.1 Overview

This document contains an evaluation of the costs and benefits of the Federal Aviation Administration (FAA) Supplement to the Notice of Proposed Rulemaking (SNPRM) on Licensing and Safety Requirements for Launch (Title 14, Code of Federal Regulations, Parts 413, 415, and 417). The SNPRM offers clarifications and proposed changes to the October 25, 2000 Notice of Proposed Rulemaking (NPRM) based on certain public comments to the NPRM. Some issues raised by public comments to the NPRM that are beyond the scope of the SNPRM will be addressed in the final rule. Hence, the SNPRM focuses on certain principal public comments to the NPRM.

The NPRM, and subsequent changes that are contained in the SNPRM, propose to codify safety requirements for licensed expendable launch vehicle (ELV)[1] launches from federal and non-federal launch sites, and establish launch license requirements for launch operators launching from a non-federal launch site where federal range personnel do not perform the safety functions.

1.2 Regulatory Background

The Commercial Space Launch Act of 1984, as codified and amended at 49 U.S.C. Subtitle IX — Commercial Space Transportation, chapter 701 — Commercial Space Launch Activities, 49 U.S.C. 70101-70121 (the Act), authorizes the Department of Transportation, and thus the Office of the Associate Administrator for Commercial Space Transportation of the FAA, to oversee, license, and regulate launch and reentry,[2] and the operation of launch and reentry sites as carried out by U.S. citizens or within the United States. 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.[3] The FAA is also responsible for

[1] The proposed SNPRM is not applicable to reusable launch vehicles.
[2] The NPRM and SNPRM are not applicable to reusable launch vehicles.
[3] See 49 U.S.C. 70105.

encouraging, facilitating and promoting space launches by the private sector.[4]

Under its statutory authority, the FAA licenses commercial launches that occur at federal launch sites. The FAA has relied on the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA) for performing the safety function at the federal ranges for commercial launches. Notwithstanding its oversight responsibilities as defined in the subject SNPRM, the FAA would continue to rely on these organizations for safety oversight at federal ranges.

Recent space industry changes have resulted in investments in, and development of, non-federal launch sites (i.e., launch sites not located on a federal launch range) and their use by commercial space launch providers. The FAA anticipates an increasing number of launches from an increasing number of non-federal launch sites. Safety oversight activities currently performed by the DOD and NASA at federal ranges are not always available at non-federal sites. Consequently, under the existing regulations, the FAA has licensed launches from non-federal sites on a case-by-case basis.

The FAA's Associate Administrator for Commercial Space Transportation, on October 25, 2000, issued an NPRM that proposed to amend the commercial space transportation regulations. The NPRM was designed to amend the FAA's regulations by codifying the license application process for launches from non-federal launch sites. The NPRM was also intended to codify the current safety requirements for launch operators regarding license requirements, criteria, and responsibilities in order to protect the public from hazards of launches from federal and non-federal launch sites.

Comments received on the NPRM resulted in the development of the SNPRM. Many of the comments were not cost-related and responses to certain of these comments are found in the preamble to the SNPRM. Where the FAA did not address technical comments in the SNPRM, it plans to address those comments in the final rule. Cost-related comments suggested that the

[4] See 49 U.S.C. 70103.

FAA had underestimated in its regulatory evaluation the cost impact of the NPRM. The FAA has carefully reviewed these comments and concluded that it may not have properly depicted current practice in every case. Consequently, after thorough review of both the NPRM and comments thereto, the FAA now concludes that while some of the cost comments received were not supportable or unclear, there are some incremental costs associated with the NPRM that were not identified and estimated in the associated initial regulatory evaluation. This regulatory evaluation should closely depict the expected impact of the proposed regulatory amendments to the NPRM, as presented in the SNPRM, relative to current practice.

1.3 Problem Statement

Consistent with its authority and mission, the FAA is proposing a supplement to the NPRM that would codify certain current safety requirements that a launch operator must satisfy for licensed launches of expendable launch vehicles, from either a federal or non-federal launch site, in order to protect the public from the hazards of such activities.[5] The SNPRM would establish industry-wide safety standards that complement existing regulations by ensuring comparable safety requirements for launches from federal and non-federal launch sites.

1.4 Scope and Limits

This regulatory evaluation identifies the expected economic impacts of proposed amendments to the commercial space transportation licensing and safety regulations, as contained in the SNPRM, that a launch operator must satisfy for licensed launches of expendable launch vehicles,[6] from either a federal or non-federal launch site, in order to protect the public from the hazards of such activities. Where possible, the magnitude of the economic impacts is estimated.[7] The evaluation concentrates on the principal regulatory requirements that constitute a change from the NPRM, as presented in the SNPRM, identifies which of these is a departure from

[5] The NPRM addressed requirements to obtain a license for launch from a non-federal range and the requirements of licensees launching from federal and non-federal ranges.
[6] The SNPRM is not applicable to reusable launch vehicles.
[7] The principal requirements evaluated are the amendments and additions to the Commercial Space Transportation Licensing Regulations, Title 14, Code of Federal Regulations, Part 417, Launch Safety.

current practice, and addresses the direct costs and benefits attributable to the SNPRM that would be incurred by the commercial space transportation industry, the FAA, and the general public. Also included in this report are determinations of the impacts that the SNPRM would have on (1) small entities, (2) international trade, and (3) state, local, and tribal governments.

2.0 INDUSTRY PROFILE

2.1 Commercial Launch Operators

Historically, launch operators conducted their launches from federal launch ranges operated by DOD and NASA. These Federal launch ranges include the Eastern Range, located at Cape Canaveral Air Force Station in Florida (CCAFS), and the Western Range, located at Vandenberg Air Force Base (VAFB), in California, both operated by the U.S. Air Force; Wallops Flight Facility in Virginia, operated by NASA; White Sands Missile Range (WSMR), located in New Mexico, operated by the U.S. Army; and the Kauai Test Facility in Hawaii, a tenant on the Navy's Pacific Missile Range facility, owned by the Department of Energy and operated by Sandia National Laboratories. More recently, the FAA issued a license to conduct launches from Kwajalein Missile Range, Republic of the Marshall Islands, which is operated by the U.S. Army. Federal launch ranges provide existing launch infrastructure and associated range safety services. Launch companies are able to obtain a number of services from a federal launch range, including radar, tracking and telemetry, flight safety analyses, and flight termination.

In recent years, the commercial space transportation industry has launched from locations other than the federal ranges as a result of the development of a number of non-federal launch sites. On September 19, 1996, the FAA granted the first license to operate a launch site to Spaceport Systems International, whose launch site, California Spaceport, is located within VAFB. Since this action, three other launch site operators have received licenses. The Spaceport Florida Authority (SFA) received an FAA license to operate Launch Complex 46 at CCAFS as a launch site. Virginia Commercial Space Flight Authority received a license to operate Virginia Spaceflight Center within NASA's Wallops Flight Facility. Alaska Aerospace Development Corporation received a license to operate Kodiak Launch Complex on Kodiak Island, Alaska as a launch site, and Sea Launch Company, L.L.C., was licensed to launch from a platform located in the Pacific Ocean. Recently, Astrotech was issued a license to conduct launch operations from Australia.

The commercial space transportation launch industry is growing and diversifying. From the first licensed commercial launch in March 1989 through October 2001, 139 licensed launches have taken place. These included licensed launches from six different federal launch ranges. Nine launches have taken place outside of a federal launch site, and there have been nine launches from a launch site operated by a licensed launch site operator. The vehicles have included traditional orbital expendable launch vehicles, such as the Atlas, Titan, and Delta, and sub-orbital rockets, such as the Black Brant, Talos Castors, and Terrier Orions. They have also included new expendable launch vehicles using traditional launch techniques, such as Athena, Conestoga, and Taurus, and unique vehicles such as the airborne Pegasus and the Zenit 3SL (launched from a platform located at the equator). The commercial transportation launch industry has evolved from one relying on traditional orbital and sub-orbital launch vehicles to one with a diverse mix of vehicles using new technology and new concepts. In addition, a number of international ventures involving U.S. companies have also formed, further adding to this diversity. For example, Sea Launch Company, L.L.C., utilizes a Russian and Ukrainian launch vehicle, a Zenit 3SL, and has already received several launch licenses from the FAA. Launch vehicles such as Sea Launch's Zenit, Lockheed Martin's Athena, and Orbital Sciences' Pegasus have been used primarily for orbital launches such as communications satellites. Launch vehicles such as Starfire I and Terrier Orion have been used for suborbital launches.

2.2 Commercial Launch Projections

FAA estimates for launch operator licenses and launches for the next five years are summarized in Table 2-1 below. During the period 2003 through 2007, the FAA estimates that there will be from 65 to 70 orbital licenses issued for launch operators.[8] Associated with these launch operator's licenses, the FAA estimates that there will be 62 to 67 orbital launches covered by the proposed rule. Similarly, the FAA estimates that during the 2003 through 2007 period there will

[8] These estimates are optimistic.

be 5 to 13 suborbital and an undetermined number of orbital launch-specific licenses issued. Associated with these launch-specific licenses, the FAA estimates that there will be 5 to 12 suborbital launches and an undetermined number of orbital launches.[9] The FAA's license and launch estimates include a broad mix of launch operators, ranging from large organizations, such as Lockheed Martin Corporation and The Boeing Company, to small organizations like amateur rocket enthusiasts primarily launching small-scale unguided sub-orbital rockets.

TABLE 2-1. Commercial License and Launch Forecast[a]

Activity	Year					Number of Licenses 2003-2007	Number of Launches 2003-2007
	2003	2004	2005	2006	2007		
Launch Operator Licenses and Launches							
Suborbital Licenses	0	0	0	0	0	0	-
Suborbital Launches	0	0	0	0	0	-	0
Orbital Licenses	12-13	12-13	13-14	14-15	14-15	65-70	-
Orbital Launches	11-12	12-13	12-13	13-14	14-15	-	62-67
Launch-Specific Licenses and Launches							
Suborbital Licenses	1-3	1-2	1-3	1-2	1-3	5-13	-
Suborbital Launches	1-2	1-3	1-2	1-3	1-2	-	5-12
Orbital Licenses[b]	-	-	-	-	-	-	-
Orbital Launches[c]	-	-	-	-	-	-	-

Source: Office of the Associate Administer, Commercial Space Transportation, Federal Aviation Administration, December 2001.

[a] The difference in the time frames associated with licenses and launches is due to the assumption that there is a one-year lag between applying for a license and undertaking a launch.

[b, c] Cannot forecast year in which activity will occur.

2.3 Public Comments Having Economic Implications

There were many comments on a variety of subjects in response to the NPRM. Certain comments raised technical issues that resulted in the FAA's decision to prepare the SNPRM (which contains amendments to certain NPRM requirements). The preamble to the SNPRM discusses the proposed changes, while the cost implications of these revisions are addressed in

[9] A launch-specific license is a license that specifies the number of specific launches that can be made under that license. Each launch occurs under the same set of conditions and is valid only for the launching of one type vehicle. A launch operator license is for multiple launches. For example, under this kind of license, an operator could launch any number of commercial satellites out of Cape Canaveral using a family of launch vehicles on a variety of flight azimuths.

this regulatory evaluation. Any cost comments not directly related to changes contained in the SNPRM will be addressed when the final rule is published.

The FAA received cost comments from several sources. Some of these comments included aggregate cost estimates by provision. This information would have been more useful if the assumptions and analyses supporting these estimates (e.g., wage rates, hours to complete certain tasks, overall methodology, discount rate, methodology for discounting, whether inflation was built into the cost estimates, capital cost of equipment, operating and maintenance costs) were made available to the FAA. Some organizations requested that the FAA not disclose the information contained in their "public comments." While this restriction precluded the FAA from providing an explicit and direct response to such comments, all information received was used to the maximum extent possible in preparing this regulatory evaluation.

The FAA, after reviewing all of the comments, believes that current practice for all launch operators was not accurately depicted and proposed in the NPRM in every case.[10] With the clarifications and proposed changes being offered in the SNPRM, the FAA believes that many of the commenter's concerns regarding compliance costs will be allayed.[11]

2.3.1 Compliance Costs

Public comments and the associated FAA response pertaining to compliance costs attributable to the NPRM are presented below.

Comment: The total cost of the NPRM will be between $500 million and $1 billion over a period of five years. The NPRM, in addition, will cause the U.S. launch industry to become less competitive.

Joint industry comments[12] stated that the NPRM would cost the U.S. commercial space industry

[10] There maybe some entity-specific idiosyncrasies not captured by the proposed requirements in the NPRM, because the FAA attempted to depict the operations of a generic or representative commercial space transportation launch operator.

[11] For more specifics on many of these issues, the reader is encouraged to examine the preamble of the SNPRM.

[12] Lockheed Martin Corporation, The Boeing Company, Orbital Sciences Corporation, Sea Launch Company, L.L.C. and International Launch Services. Consolidated Industry Response to FAA NPRM Licensing and Safety

between $500 million and $1 billion over a period of five years (p. ii). They claim that the NPRM would place undue burdens and competitive disadvantages on the U. S. commercial launch services industry (p. ii). The Boeing Company[13] estimated that it would incur costs in excess of $100 million, and Lockheed Martin Corporation (p. 4)[14], reiterated the comments provided jointly by industry members. Orbital Sciences Corporation (p. 2)[15] also estimated that it would incur costs in excess of $100 million over a five-year period. Each of these commenters provided specific comments, many of them on a provision-by-provision basis. However, due to the confidentiality of the submissions, the FAA will not publish the estimates in this regulatory evaluation.[16]

Joint industry comments[17] (pp. 3-12), (in their non-confidential submission) state that these substantial cost increases are due to many factors. They claim that: (1) launch operators at Federal Ranges will be required to demonstrate compliance with two sets of requirements imposed on them by two separate and independent agencies (p. 3); (2) they will incur a loss of operational flexibility (p. 4), experience adverse cost and schedule impacts (p. 5), and highly detailed, legally mandated design requirements (p. 6.); (3) they could not duplicate the cost savings estimates suggested by the FAA and disagreed with the premise that the cost impact would be minimal; and (4) the proposal would discourage alternative means of meeting the safety requirements (p. 12).

Requirements for Launch, October 25, 2000 Docket Number FAA 2000-7953 Volume 1: Executive Summary. Undated. Location not indicated.

[13] The Boeing Company, Boeing Comments and Cost Analysis to FAA NPRM Licensing and Safety Requirements for Launch. 25 October 2000. Docket No. FAA 2000-7953. Undated. Location not indicated. Boeing stated in its submission to the FAA that they did not want the information that they submitted to be displayed in public. The estimate presented above is a very rough approximation of the costs that Boeing had calculated.

[14] Lockheed Martin Corporation, Futron Corporation, The Tauri Group LLC, Cost Impact Analysis FAA Notice of Proposed Rulemaking on Licensing and Safety Requirements for Launch October 25, 2000 Docket Number FAA 2000-7953, April 23, 2001. Undated. Location not indicated.

[15] Orbital Sciences Corporation. NPRM Cost Impact FAA NPRM Licensing and Safety Requirements for Launch October 25, 2000 Docket Number FAA 2000-7953. April 23, 2001. Location not indicated. Orbital stated in their submission to the FAA that they did not want the information that they submitted to be displayed in public. The estimate presented above is a very rough approximation of the costs that Orbital had calculated.

[16] Each of the commenters (Boeing Company, Lockheed Martin Corporation, and Orbital Sciences Corporation) provided cost estimates to the FAA. There was a great deal of variation among these estimates but each commenter concluded that its' costs would be over $100 million over five years.

[17] Lockheed Martin Corporation, The Boeing Company, Orbital Sciences Corporation, Sea Launch Company, L.L.C., and International Launch Services. Consolidated Industry Response to FAA NPRM Licensing and Safety

The joint industry members commented that (p. 8) many of the requirements were more conservative than what is set out in the current version of *Eastern and Western Range Requirements 127-1* (EWR 127-1). In the NPRM the FAA proposed to aggregate the risks attributable to all mission hazards and set a ceiling on the total mission risk to the public due to all hazards at an $E_c = 30 \times 10^{-6}$. The FAA, with the agreement of the U.S. Air Force, now proposes in the SNPRM to adopt the current practice of the Eastern Range, by establishing a ceiling on the risk presented by each of three major hazards associated with launch — debris, toxic release, and distant focus overpressure.

In the NPRM, the FAA proposed to require that an aggregate of the hazards created by a particular launch not exceed an $E_c = 30 \times 10^{-6}$. This meant that the launch operator would have to account for all hazards, including, but not limited to, the risks associated with debris, toxic releases, and distant focus overpressure. The preamble of the SNPRM contains further discussion on this issue, particularly in the flight analysis area. Commenters also stated their concerns pertaining to the restrictions on grandfathering; tailoring and waivers and the impact of the proposed procedural changes; and the new requirements for launch licenses. Joint industry comments concluded by stating that this proposed rulemaking would cause the U.S. commercial launch industry to incur: (1) increased financial and operational costs, (2) eroded operational flexibility, and (3) adverse impacts on the launch industry's scheduling processes and capabilities (including the introduction of significant delays). According to the commenters, the NPRM would also discourage alternative methods of meeting safety requirements.

The common thread throughout the joint industry comments is that cost is of critical importance. Over the past several years, the price for a commercial launch has dropped significantly. According to the commenters, this corresponds to an increase in the supply of launch services available to satellite owners. Further, the aggressive competition presented by non-U.S. launch operators, particularly those that enjoy significant levels of continued government support, is evident and well documented. As a result, the U.S. launch industry has had to endure decreasing

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Requirements for Launch, October 25, 2000 Docket Number FAA 2000-7953 Volume 1: Executive Summary.

margins.

XCOR (p. 2) states that the current regulatory philosophy of AST will cause the U.S. to lose market share in the worldwide market.[18] Sea Launch Company, L.L.C. (p. 2) states that the detailed requirements would significantly limit the company's flexibility in the implementation of safety requirements. Sea Launch also states that this would "impact Sea Launch's ability to compete in an industry trending toward reduced integration cycles."[19]

Lockheed Martin Corporation (p. 4) finds that the safety requirements set forth in the NPRM will significantly increase the regulatory burden, and the associated costs imposed on the U.S. space launch industry. The substantial cost increases claimed in both their assessment and the joint industry assessment result from, among other factors, increased design requirements, additional analyses, more conservative approaches to flight constraints, the potential requirement to re-verify that existing components or processes meet standards established by the NPRM (although they already qualify under EWR 127-1), and the requirement to demonstrate compliance to two different governmental agencies.

Substantial increases in the costs of regulatory compliance could have a critical impact on Lockheed Martin Corporation and the U.S. launch services industry more broadly. Margins in the industry have dropped significantly over the past several years as an increase in the supply of launch services available. Increased costs may further reduce margins and affect the commercial viability of some launch service providers. Additionally, cost increases specific to launches in the United States will undercut the ability of U.S. launch services providers to compete internationally. U.S. launch services providers face strong competition from foreign rivals, some of which benefit from significant levels of government support. Cost increases affecting only launches in the United States will only weaken the competitive position of U.S. launch service providers and send customers of U.S. launch services off-shore for a better deal.

Undated. Location not indicated.

[18] XCOR Aerospace. XCOR Aerospace Comments in Response to FAA Notice of Proposed Rulemaking on Licensing and Safety Requirements for Launch. Undated. Location not identified.

[19] Sea Launch Company, L.L.C., Notice of Proposed Rulemaking Licensing and Safety Requirements for Launch, 14 CFR Parts 413, 415, and 417. Undated. Location not identified.

FAA Response

The launch operators incorrectly interpreted the NPRM to mean that they would have to duplicate the work of the federal ranges, which would result in additional costs. This is not the case under the FAA's current regulations, nor would it be under the proposed rule. The NPRM did not propose changing certain provisions of Title 14, Code of Federal Regulations, Part 415, Subpart C, which specifically limit the requirements of applicants proposing to launch from federal ranges. Many of the ranges' own internal requirements were perceived by commercial launch operators as being new when proposed in the NPRM. They are not new, as discussed in greater detail in the preamble to the SNPRM. The comments, however, identified some valid concerns in the proposed regulatory text that might have incorrectly been interpreted as more conservative (i.e., resulted in higher costs) than current practices at the federal ranges.

In proposing the requirements of the NPRM, the FAA attempted to capture and codify current practice because current practice provides a high level of safety. The FAA did not, therefore expect the NPRM to place undue burdens and competitive impacts on the United States commercial launch services industry. The FAA believes that the costs to the commercial space transportation industry would be significantly less than suggested in the comments.

The FAA did not and does not intend through this rulemaking to duplicate the work, evaluation, inspection, and monitoring conducted by the federal launch ranges (see NPRM, 65 Fed. Reg. at 63924). The NPRM and SNPRM do not propose to alter the provisions of Subpart C, Part 415 of the existing regulation dealing with launch operations from federal ranges. However, from reading the public comments, it appears that launch operators who stated that the FAA was requiring duplicate work did not understand that reliance on federal range oversight would remain, and were not fully familiar with the precise nature of the safety services the federal ranges provide. For example, as stated in the preamble to the SNPRM, a federal range conducts its own flight safety analyses based upon raw data provided by the launch operator. As another example, the launch operators thought that many of the federal ranges' own internal requirements, when proposed in the NPRM were new, when in fact they are not; the NPRM simply proposed to codify them. The launch operators mistakenly believed that this rulemaking

would change their legal responsibility for safety. They are already responsible for safety under the statute and their existing licenses.

Some comments stated that the NPRM would reduce operational flexibility given the highly detailed, legally mandated design requirements. The FAA has carefully considered these comments and believes that some of the proposed requirements should be modified for the reasons stated in the comment. The vast majority of the design and test requirements contained in the NPRM are existing flight safety system requirements. The current Air Force range safety requirements were used as the basis for the requirements in the NPRM, and the FAA has not sought to add requirements. Changes to the design and test requirements are not contained in the SNPRM; however, the Air Force and FAA Common Standards Working Group is currently making every effort to streamline the range design and test requirements and, to the greatest extent possible, replace currently required design solutions with performance requirements. The results will be reflected in the FAA's final rule and the Air Force's revised range safety document. Moreover, as proposed in the NPRM, the FAA is willing to consider alternatives to the detailed design requirements if a launch operator succeeds in demonstrating that the alternative provides an equivalent level of safety to that of the codified requirements. This should help enhance the operational flexibility that is currently being enjoyed by launch operators while maintaining an equivalent level of safety.

The comments also indicated that the requirements were too conservative. The FAA interprets this to mean that the NPRM is too costly. The FAA believes, as explained in the preamble to the SNPRM, that launch operators will not have to duplicate the work of the ranges. A launch operator who clearly and convincingly demonstrates that an alternative provides an equivalent level of safety will not have to follow any given design requirement. In addition, the SNPRM will allow for grandfathering and will allow launch operators to continue to enjoy almost all of the operational flexibility that they have had. Comments also indicated that the launch risk criteria were too conservative and might result in launch holds and associated costs. The SNPRM contains changes to the proposed public risk criteria to better reflect current practice at the Eastern Range, which is where the majority of the licensed launches have taken place. The revised proposed risk criteria in the SNPRM are in some ways less conservative than those used at other federal ranges. The preamble to the SNPRM covers this issue in greater detail. For all

of these reasons, the FAA believes that the incremental costs associated with the SNPRM would be small.

The requirements in the NPRM represent the first attempt to draft common Air Force and FAA requirements. As in any such first attempt, there is no doubt that some areas still can be improved. Although only some of the provisions are being modified by the SNPRM, the changes that are being made are so significant that they should mitigate many of the concerns. The FAA, working with the Air Force, will resolve the remaining issues and ensure that the necessary corrections are implemented in the final rule.

Comment: Certain general requirements would impose significant cost increases.
Some comments included confidential cost information suggesting that the NPRM would result in significant cost increases to them. They claimed some of these cost increases are due to some general requirements associated with the flight termination system and the expanded requirements to track hazards. They also claimed that some of these cost increases would be due to the more explicit requirements on expanded work hour restrictions [section 417.113(d) of the NPRM].

FAA Response
The FAA will address these particular comments upon publication of the final rule and the associated regulatory evaluation.

2.3.2 Risk Aggregation

Public comments and the associated FAA response pertaining to risk aggregation as addressed in the NPRM are presented below.

Comment: The concept of aggregating all potential launch risks into a single E_c will undoubtedly restrict launch availability and cause launch delays, both of which are extremely costly

The joint industry comments (p. 8)[20] and others indicated that the concept of aggregating all potential launch risks into a single E_c would restrict launch availability and cause launch delays. The joint industry comments state that the downrange debris risk assessment alone would be close to or surpass 30×10^{-6} E_c criteria for most missions with the desired flight azimuths that involve African or European overflights.

FAA Response

The logic behind risk aggregation as proposed in the NPRM is contained in the preamble to the SNPRM and will not be repeated here. After reading the comments submitted to the docket, the FAA again visited the issue of current practice at the ranges through consultations with the FAA and Air Force Common Standards Working Group. The FAA also examined the results of a study conducted in 2001 indicating that there were only a few commercial launches in the past five years that would not have satisfied the aggregation criteria.[21] The FAA now proposes to adopt the current practice at the Eastern Range, with respect to risk aggregation, which is to set a ceiling on the risk presented by each of the three major hazards associated with launch. The FAA, because of the differences in underlying assumptions and methodologies for assessing the risk of each hazard, proposes not to require or consider a limit on the total mission risk created by all the hazards of launch.

2.3.3 Grandfathering

Public comments and the associated FAA response pertaining to grandfathering as addressed in the SNPRM are presented below.

[20] Orbital Sciences Corporation. NPRM Cost Impact FAA NPRM Licensing and Safety Requirements for Launch October 25, 2000 Docket Number FAA 2000-7953. April 23, 2001. Location not indicated. Orbital stated in their submission to the FAA that they did not want the information that they submitted to be displayed in public. The estimate presented above is a very rough approximation of the costs that Orbital had calculated.

[21] The Eastern Range Aggregate Risk Study was reported in a record of communication from Mr. Ken Kaisler, RTI International Florida Office to Mr. Ron Gress, FAA/AST-200.October 2, 2001.

Comment: Denying grandfathering as it applies to range policy, will adversely impact commercial space operations.

The joint industry comments (p. 9)[22] state that the commercial space transportation industry has operated under the concepts of grandfathering and tailoring as utilized by the federal ranges for over forty years. The joint industry comments claim that if the FAA chooses to alter the current range policy, launch operators will experience a significant adverse cost impact. The cost impact arises from the fact that they will need to reassess, reevaluate, and redesign existing systems that have been certified as being in compliance with the range requirements.

The joint industry comments (p. 9) also stated in their public response to the docket that when public safety is not adversely affected, the federal ranges presently allow grandfathering for sub-systems or launch vehicles that become non-compliant when safety requirements are modified by later versions of the range safety documents. They state that the practices of grandfathering, as well as tailoring and waivers help support the industry's operational efficiency and competitiveness. The joint industry comments further state that there has never been any evidence or assertion that these practices present any adverse implications for ensuring that public safety standards are met or exceeded. The joint industry comments (p. 9) believe that these practices should be as currently applied and implemented.

FAA Response

In light of the concerns raised by the comments, the FAA again revisited what was current practice as it relates to grandfathering. The FAA now believes, after reviewing the comments, that it has a greater understanding of the Air Forces' approach to grandfathering and how the Air Force has successfully implemented its grandfathering policies to ensure public safety without putting undue burden on the launch industry. Therefore, upon the urging expressed in the comments, the FAA now proposes in the SNPRM to adopt a similar approach. The new and revised requirements for grandfathering contained in the SNPRM attempt to mirror current practice and should not result in incremental costs to the commercial space transportation launch

[22] Lockheed Martin Corporation, The Boeing Company, Orbital Sciences Corporation, Sea Launch Company, L.L.C. and International Launch Services. Consolidated Industry Response to FAA NPRM Licensing and Safety

industry.

2.3.4 Regulatory Flexibility

Public comments and the associated FAA response pertaining to regulatory flexibility as addressed in the NPRM are presented below. These issues will be addressed in greater detail in the final rule.

Comment: The impact on systems designed for very low mission cost for very small payloads

One commenter (XCOR Aerospace, p. 1), states that two different customers interested in developing partially expendable, partially reusable systems, have approached XCOR. These systems, designed for very low mission cost for very small payloads, would be economically infeasible to operate under the proposed regulations, and it is by no means clear whether ELV or reusable launch vehicle (RLV) regulatory regimes would apply to these hybrid concepts.

FAA Response

The FAA believes that the XCOR comment is directed more toward the community of amateur, high power rocket groups and RLVs that are not likely to be affected by this rulemaking.[23] Nevertheless, the FAA states in the SNPRM preamble, that the applicability of part 417 to all licensed launches, regardless of their launch location, is necessary. It states that universality ensures a single standard of safety. Publication of the requirements currently in place permits a launch operator to know and plan for the requirements with which it must comply. The NPRM was published with the intent of codifying the principles underlying the existing requirements in the performance standard format. The response based on the comments submitted after the NPRM was published was that certain areas of the proposed regulatory text were more conservative than current practice at the federal ranges. The appropriate corrections, some of which are presented in the SNPRM, are being made to accurately depict current practice. Even if

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Requirements for Launch, October 25, 2000 Docket Number FAA 2000-7953 Volume 1: Executive Summary. Undated. Location not indicated.

[23] It should be noted that current regulations exclude from licensing requirements those launch vehicles meeting the definition of amateur rockets. Also the NPRM and SNPRM are not applicable to reusable launch vehicles, as these operations are covered in Title 14 Code of Federal Regulations, Parts 431-435. Finally, the FAA has held public

smaller companies like XCOR (compared to Lockheed Martin Corporation or The Boeing Company) were to face a regulatory regime such as that being modified by the SNPRM, it is not expected to be any different than current practice.

2.3.5 Safety Benefits

Public comments and the associated FAA response pertaining to safety benefits as addressed in the NPRM are presented below.

Comment: The NPRM does not promote safety.

XCOR (p. 2) states that current practice, in the absence of the NPRM, already protects public safety. XCOR states that codifying current practices of the federal ranges and requiring private launch sites to conform, removes one of the few incentives for badly needed private investment in launch infrastructure.

XCOR sites a contrasting paradigm regarding the certification regime covering experimental aircraft today and the emerging regulatory regime for unmanned aerial vehicles. Another alternative paradigm is in the field of high power rocketry, with launches outside the "amateur" exemption and an excellent safety record with almost no paperwork.

FAA Response

The NPRM, and the changes made in the SNPRM,[24] are designed to protect public safety by making current practice a legal requirement to be applied consistently. There is expected to be no diminution of safety compared to current practice. When a commercial launch takes place from a federal range, costs are incurred by the launch range, by the FAA, and by the commercial launch operator. A portion of these costs is incurred in the process of demonstrating that adequate safety, as required by the federal range and the FAA, will be achieved. The FAA licensing process relies, to a large extent, upon the federal range safety approvals and analyses

meetings on possible changes to the treatment of amateur rockets and other small rockets under the current regulations.

[24] For example, changing the criteria for blast overpressure radius from 3.0 psi in the NPRM to 1.0 psi in the SNPRM.

and public safety-related data provided to the FAA by the launch operator. The NPRM and SNPRM represent the FAA's attempt at achieving the same level of safety associated with launching from non-federal ranges as when launching from federal sites, and whether licensing on a case-by-case basis or in accordance with the proposed rulemaking. Whatever the scenario may be, the FAA is attempting to draft a rule to reflect current practice at the federal ranges and achieve the same level of safety at federal and non-federal sites. Therefore, codifying these requirements is not expected to create any disincentive or additional cost to the commercial space transportation launch industry. As noted earlier, the FAA has held a public meeting on the issues associated with amateur and small rocket launches and will be addressing this issue separately.

Comment: Impact of proposed procedural changes and new requirements for launch licenses. The joint industry comments (p. 10) state that tests, analyses, various reports, schedules, etc., which currently are not part of the launch license, would now be included and incorporated as a part of it. Once included as part of the license, these items must be kept current. They further state that keeping items current will require parallel amendments of the actual license itself to take into account any changed, modified, or updated circumstances. Many of these new requirements constitute constantly evolving documents or situations that reflect the complex dynamics of the launch process. The commenters conclude by stating that this proposed change would entail an extensive administrative burden that is currently not part of the process of obtaining and maintaining a license.

The joint industry comments (p. 10) also state that under the NPRM, the license process now begins twenty-four months prior to the commencement of licensable activities. In addition to the new and significant amounts of additional data and information that the NPRM would require to be submitted, this is a substantially longer lead-time for preparing, submitting, and maintaining a license than what is currently required. Typically, only very basic data and analysis products are available prior to 18 months from the expected launch date. Some programs do not have detailed data and analysis products available until less than six months prior to launch. Even if it is possible to perform detailed analyses and tests early in the launch program integration cycle, those analyses and tests performed too early in the program integration cycle may be invalid later

in the cycle, resulting in extra and unplanned work. According to the joint industry comments, most launch operators are accustomed to making submittals incrementally, when the needed input data are available and it is less likely that the input data will change. The federal ranges have been flexible in accommodating launch operator submittals on a best effort basis regardless of the submittal process dates specified in the Air Force's EWR 127-1.

FAA Response

As stated in the preamble to SNPRM, the FAA believes that most issues raised by the joint industry comments reflect concerns surrounding federal launch ranges. The FAA interprets this particular concern as applying to the federal range context as well. That being the case, the FAA can state that proposed subpart F would not apply to those launch operators who launch from a federal launch range. As proposed in the NPRM, the existing Part 415, Subpart C, Safety Review and Approval for launch from a Federal Launch Range, governs safety reviews for launch license applications from a federal range and will continue to apply. Proposed subpart F, which is titled, Safety Review and Approval for Launch of an Expendable Launch Vehicle from a Non-Federal Launch Site, applies to license applications for launch from outside of a federal launch range [See NPRM, 65 at 63944, 63965 (proposed section 415.101 and accompanying discussion)].

3.0 REQUIREMENTS OF THE SUPPLEMENT TO THE NOTICE OF PROPOSED RULEMAKING

3.1 Notice of Proposed Rulemaking and the Supplement

The SNPRM amendments to the NPRM clarify certain responsibilities of a launch operator when launching from a non-federal launch site and propose to codify the safety requirements for launch operators launching from either a federal range or a non-federal launch site, regarding license requirements, criteria, responsibilities and operational requirements. The proposed supplementary regulatory action is intended to maintain the same level of safety at all launch sites, as delineated in prior FAA rulemakings related to commercial space transportation. The SNPRM builds on the safety successes and standards of federal launch ranges.

The SNPRM contains amendments to the NPRM regulatory requirements as it relates to risk aggregation, "grandfathering," design requirements, and debris risk analysis that may impose costs on the commercial space transportation industry and the FAA. The SNPRM also contains clarification and supporting rationale with regards to industry comments on costs. Each of these areas is addressed below.

3.1.1 Risk Aggregation

In the NPRM the FAA proposed to aggregate the risks attributable to all mission hazards and set a ceiling on the total mission risk to the public due to all hazards at an $E_c = 30 \times 10^{-6}$. This meant that the launch operator would have to account for all hazards within this ceiling, including, but not limited to, the risks associated with debris, toxic releases and distant focus overpressure. The FAA, with the agreement of the U.S. Air Force, now proposes in the SNPRM to adopt the current practice at the Eastern Range of establishing a ceiling on the risk presented by each of three major hazards associated with launch — debris, toxic release, and distant focus overpressure. The preamble of the SNPRM contains further discussion on this issue.

3.1.2 Grandfathering

Some launch operators are currently operating under older versions of EWR 127-1, and might not meet the current safety requirements that were proposed in the NPRM. They would, however, meet federal range safety requirements under the range's "grandfathering" policy. In the NPRM, the FAA proposed not to grandfather existing non-compliances, but requested public comments on the issue. Upon consideration of input from industry and the federal range safety organizations, the FAA now believes that it would be appropriate to provide a form of grandfathering for federal range waivers and other non-compliances that have been grandfathered by a federal range. Since the NPRM was published, the FAA has gained greater understanding of how grandfathering is implemented in current practice at the federal ranges, and that there is a degree of safety assurance that can be derived from the demonstrated flight history of an existing vehicle. The proposed "grandfathering" provisions in the SNPRM would also apply to "meets intent" decisions made when a federal range determines whether a launch operator's proposed alternative, although not compliant with the specific range requirements, meets the safety intent of the requirement.

3.1.3 Design Requirements

A memorandum of agreement established a partnership between the FAA and the Air Force to develop common launch safety requirements. The development of common flight safety requirements is a major component of this partnership effort, which is continuing towards the development of the FAA's final rule and revised Air Force range safety requirements. The current Air Force range safety requirements have been used as the basis for the common requirements with no desire to add requirements. Every effort is being made to streamline the design and test requirements and, to the greatest extent possible, replace currently required design solutions with performance requirements.

3.1.4 Debris Risk Analysis

The NPRM proposed using a ballistic coefficient as a metric for vulnerability to estimate risk from most debris impacts. There was some discussion in the comments from government sources highlighting the pitfalls of using this metric. Specifying a ballistic coefficient as a

criterion ignores some important factors. A heavy fragment may be lethal, even if its ballistic coefficient is less than 3.0; a light fragment may be harmless even if its ballistic coefficient is greater than 3.0. The preamble to the SNPRM shows that a 30-pound tumbling plate object, with an aerodynamic reference of 11 square feet and a subsonic drag coefficient of 0.9, has a ballistic coefficient of 3.0 pounds per square inch (psi). The terminal velocity for this object is about 50 feet per second and the kinetic energy is about 1,164 foot-pounds (ft-lbs.) at impact. This is well in excess of the 35 to 58 ft-lbs. typically considered to be hazardous. These issues are discussed in greater detail in the preamble of the SNPRM.

The NPRM required that for a debris risk analysis, the effective casualty area of any explosive debris would account for a 3.0 psi blast overpressure radius. The FAA, in coordination with the Air Force, has reviewed the recent human vulnerability modeling results and now believes that the peak incident overpressure of 1.0 psi or greater due to any explosive debris impact should be used as the casualty threshold instead of 3.0 psi. The Eastern Range, for example, uses 1.0 psi in its casualty expectation analysis. A more detailed discussion of the issues can be found in the preamble to the SNPRM.

4.0 EVALUATION OF THE SUPPLEMENT TO THE NOTICE OF PROPOSED RULEMAKING

4.1 Overview of Analytical Approach

Presented in this section is an evaluation of the effects of the SNPRM on the commercial space transportation industry, the federal government,[25] and the general public. Also presented are estimates of the total incremental costs and a discussion of the benefits attributable to the SNPRM. This is accomplished by comparing operations under the SNPRM with current practice.

4.1.1 Identification of Current Practice

Whether launching from a federal range, a launch site located on a federal range, or a non-federal launch site, a launch operator is responsible for ground and flight safety under its FAA license. At a federal launch range a launch operator is currently required to comply with the rules and procedures of the federal range. Current federal range procedures and practices satisfy the majority of the FAA's safety concerns. In the absence of federal launch range oversight, each launch operator would be required to demonstrate the adequacy of its ground and flight safety programs to the FAA in order to satisfy the FAA's statutory responsibility.

The first licensed launch from a non-federal launch site occurred on a modified mobile drilling platform located in the Pacific Ocean, and was conducted by Sea Launch Company, L.L.C. No federal launch range safety review was available for this launch. The FAA's approach to the evaluation of the Sea Launch Company license application was to ensure that a level of safety was being achieved that was at least equivalent to a federal launch range. Although the foreign safety system, technology, procedures, and operations created a number of differences, the FAA was able to successfully apply the federal launch range approach as a benchmark and make a

safety determination.[26]

Existing regulations governing launch primarily address launches as they take place from DOD or NASA federal launch sites. The regulations for launch from a federal launch range are designed to avoid duplication of effort between the FAA and the federal launch ranges in overseeing launch safety. The ranges require compliance with their safety rules as a condition of using their facilities and services. The federal ranges act, in effect, both as landlords and as providers of launch facilities and services.

The federal launch range requires a launch operator to provide data regarding its proposed launch. The range evaluates the data to ascertain whether the launch operator is in compliance with range safety requirements. The range also uses the data to prepare range support for the mission. NASA and DOD ranges require that a launch operator apply for and obtain specific mandatory approvals from the range in order to conduct certain specified operations. For example, the current version of EWR 127-1 requires a launch operator to obtain approvals for hazardous and safety critical procedures before the range will allow those operations to proceed. In the event that a launch operator's proposal does not fully comply with specific federal range requirements, a range may issue a waiver and permit the launch, thereby accepting greater safety risk. Provided a launch operator is able to demonstrate that the safety intent of the federal range requirement can be achieved using alternative means, a "meets intent certification" would be awarded permitting the launch to proceed.

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[25] This regulatory evaluation focuses principally on the costs to the FAA to administer the proposed SNPRM requirements, although there is some further discussion of cost impacts on federal government range organizations in Section 4.3.5.

[26] The Sea Launch Company, L.L.C. flight safety system represents a dramatic difference in concept and approach from U.S. standards and does not meet several of the current federal range safety requirements. However, the case-by-case process and proposed flexibility identified in the NRPM and SNPRM would continue to allow significantly different concepts to be considered and, if appropriate, approved as was done for Sea Launch.

Current practice for launches from federal ranges and non-federal launch sites may be characterized as follows:

- The FAA relies on the federal range safety requirements for licensed launches from federal ranges.
- The FAA requires that the safety intent of federal range requirements be achieved for launches from non-federal launch sites.

4.1.2 Incremental Impact Analysis

This regulatory evaluation focuses on determining the difference between all relevant FAA and commercial space transportation industry actions under current practice and under the SNPRM. The incremental effects of the SNPRM are identified and measured relative to common commercial space transportation practice only. Accordingly, if the SNPRM creates a situation that departs from current practice, then the cost to the commercial space transportation launch industry to comply with it, the cost to the FAA to administer it, and the effects on safety are identified and estimated in dollars to the extent practicable.

The section entitled, Part Analysis, in the preamble to the SNPRM, identifies nine principal revisions to the NPRM that affects 12 sections of Part 417. This is summarized in Table 4-1. Seven of the affected 12 sections are not substantive, as the revisions are editorial and organizational changes and the resulting modifications to certain sections of Part 417 do not depart from current practice and would not have any effect on commercial launch operators, the FAA, or public safety (and therefore would have no impact of any economic consequence). Three of the 12 affected sections — 417.1(b), 417.107(c), and 417.107(d) — are consistent with current practice and therefore do not present any potential cost impacts on commercial space launch operators, the FAA, or public safety. However, they are addressed in this regulatory evaluation principally because these requirements represent a significant change from the NPRM. Two of the 12 revised sections — 417.107(b) and 417.203 — as contained in the SNPRM, modify and augment certain sections of the NPRM. These proposed regulatory requirements are a departure from current practice and therefore would affect commercial launch

operators and the FAA, respectively. The FAA believes that these effects would have potential economic impacts.

As summarized in Table 4-1, only two revisions to the NPRM — section 417.107(b), public risk criteria, and section 417.203, compliance — would result in economic impacts. These two sections are the principal focus of this regulatory evaluation of the SNPRM. They contain the following regulatory proposals relative to the NPRM:

- Applying the risk criteria of $Ec = 30 \times 10^{-6}$ to each hazard individually rather than aggregating the risk over all hazards as was proposed in the NPRM, and
- Requiring the FAA to perform more intensive and timely baseline assessments of federal range flight safety analyses (to verify launch operator compliance with range safety).

4.2 Incremental Effects and Associated Impacts of the SNPRM on the Commercial Space Transportation Industry

The changed regulatory requirements contained in the SNPRM would have a range of effects and impacts on commercial space transportation launch operators. Effects and associated potential impacts range from none, as is the case for section 417.1(b), to commercial space transportation launch operators taking additional safety-related precautions and incurring associated costs to comply with the requirements contained in section 417.107(b).[27] This comparative incremental analysis is summarized in Table 4-2. The FAA estimate of this additional cost to commercial launch operators is summarized in Table 4-3, followed by a discussion of all principal revisions to the NPRM contained in the SNPRM as they pertain to industry responsibilities and current practices.

[27] Not all commercial space transportation industry launch operators are expected to incur costs, as this proposed requirement pertains to Eastern Range launches only where the toxic risk criteria is exceeded.

TABLE 4-1. Principal Revisions to the Notice of Proposed Rulemaking Contained in the Supplement

Section of Proposed Supplement To Notice of Proposed Rulemaking		Summary of Revision	Impact of Proposed Revision On	
			Commercial Launch Operators	Federal Aviation Administration
§ 417.1(b)	Scope and Applicability	Addresses waiver and "grandfathering" policy	No impact	No impact
§ 417.3	Definitions	Insert and delete definitions	No impact	No impact
§ 417.107(b)	Public risk criteria	Public risk criteria	Potential impact	No impact
§ 417.107(c)	Casualty thresholds for debris	Debris analysis	No impact	No impact
§ 417.107(d)	Casualty modeling	Required FAA approval of casualty model or use of federal range models accepted by FAA baseline assessment	No impact	No impact
§ 417.107(e)	Collision avoidance	Re-letter section	No impact	No impact
§ 417.107(f)	Flight safety analysis	Re-letter section	No impact	No impact
§ 417.107(g)	Radionuclides	Re-letter section	No impact	No impact
§ 417.107(h)	Flight safety plan	Re-letter section	No impact	No impact
§ 417.203	Compliance	Required FAA approval of flight safety analysis methods or allows use of federal range methods accepted by FAA baseline assessment	No impact	Potential impact

TABLE 4-1. Principal Revisions to the Notice of Proposed Rulemaking Contained in the Supplement

Section of Proposed Supplement To Notice of Proposed Rulemaking		Summary of Revision	Impact of Proposed Revision On	
			Commercial Launch Operators	Federal Aviation Administration
Subpart C (Except § 417.203)	Flight Safety Analysis	Contains analysis performance requirements jointly developed by the Air Force and FAA. Moves methodology requirements to appendix A.	No impact	No impact
Appendix A	Methodologies for Determining Hazard Areas for Orbital Launch	Contains analysis methodology moved from subpart C and clarifies their application to non-federal launch sites. Changes to technical requirements - makes more performance oriented. Streamlines administrative requirements.	No impact	No impact

TABLE 4-2. Effects of Principal Revisions to Commercial Space Transportation Licensing Regulations on the Compliance Actions Performed by Commercial Space Transportation Industry Launch Operators

Section of Supplement to Notice of Proposed Rulemaking	Summary of Proposed Required Actions	Current Practice Performed by Commercial Space Transportation Launch Operators	Principal Difference Between Current Practice and Proposed Required Actions That Affect Commercial Space Transportation Launch Operators
§ 417.1(b)	FAA acceptance of preexisting waivers, meets intent and non-compliances due to grandfathering for launches from federal ranges.	Preexisting waivers, meets intent and non-compliances due to grandfathering that have been applied for by operators are currently accepted at federal ranges.	No difference
§ 417.107(b)	Apply risk criteria of $E_c \leq 30 \times 10^{-6}$ individually to toxic, debris and blast overpressure hazards.	The Western Range determines the risk for each hazard for licensed launches and considers the aggregate risk over all hazards in the decision process. Eastern Range applies $E_c \leq 30 \times 10^{-6}$ to debris and blast and has accepted $E_c \leq 233 \times 10^{-6}$ for toxic hazards. FAA rules specify at federal launch ranges and non-federal launch sites an $E_c \leq 30 \times 10^{-6}$ for debris hazards.	SNPRM proposes equivalent risk criteria to individual hazards and does not aggregate risk over all hazards as is considered by the Western Range. SNPRM proposes more stringent toxic risk criteria than that actually currently used by the Eastern Range.
§ 417.107(c)	Establish casualty thresholds for debris: 11 ft-lb for inert debris, 1.0 psi for explosive debris; allow deterministic or probabilistic analysis	At federal ranges, launch operators currently use the federal ranges' casualty models for debris, which are consistent with the proposed thresholds. Launches must be as safe from non-federal ranges as from federal ranges.	No difference
§ 417.107(d)	The FAA must approve probabilistic casualty model used by launch operator.	At federal ranges launch operators use ranges' models that have been accepted by FAA baseline assessment. Those launching from non-federal ranges need FAA approval of models.	No difference

TABLE 4-2. Effects of Principal Revisions to Commercial Space Transportation Licensing Regulations on the Compliance Actions Performed by Commercial Space Transportation Industry Launch Operators

Section of Supplement to Notice of Proposed Rulemaking	Summary of Proposed Required Actions	Current Practice Performed by Commercial Space Transportation Launch Operators	Principal Difference Between Current Practice and Proposed Required Actions That Affect Commercial Space Transportation Launch Operators
§ 417.203	Federal range operators and operating contractors will be assessed by the FAA to determine whether federal range flight safety analyses associated with licensed launches satisfy the proposed requirements.	Federal range operators and operating contractors are periodically assessed by the FAA to update baseline assessment of federal ranges.	Federal range operators and operating contractors would be subjected to more extensive and timely baseline assessments of federal range flight safety analyses.

TABLE 4-3. Incremental Cost to Commercial Space Transportation Launch Operators to Comply with the Supplement to the Notice of Proposed Rulemaking[a]

(In 2001 Dollars)

Section of Proposed Supplement To Notice of Proposed Rulemaking		Incremental Compliance Costs Incurred by Commercial Space Transportation Industry Launch Operators[a]	
		Undiscounted	Discounted[b]
§ 417.1(b)	Scope and Applicability	$0	$0
§ 417.107(b)	Flight Safety	$701,500	$532,600
§ 417.107(d)	Casualty Modeling	$0	$0
Total		$701,500	$532,600

[a] Compliance costs are expected to be incurred over the five-year period from 2003 through 2007, and can be borne by a single commercial launch operator or industry collectively, as there is insufficient information currently available to attribute this cost to a specific number of entities.
[b] Discounted at seven percent over a five-year period.

4.2.1 Section 417.1(b): Federal Launch Range Pre-Existing Meets Intent Certifications, Waivers, and Non-Compliances Due to Grandfathering

This proposed amendment to the NPRM changes the FAA's regulatory proposal based on an improved understanding of current practice resulting from public comments and discussions with federal launch site personnel. Under this proposed requirement the FAA would accept qualifying pre-existing "meets intent certifications," waivers, and non-compliances due to "grandfathering" performed by the federal ranges if the launch operator satisfied the proposed criteria. The proposed criteria reflect current practice. The federal range would continue to be the primary interface with licensed launch operators with regard to these pre-existing arrangements. These requirements are consistent with current practice. Hence, this proposed requirement would not affect the commercial space transportation industry. Therefore, the FAA estimates that the incremental cost to commercial space transportation launch operators to comply with this requirement would be zero.

4.2.2 Section 417.107(b): Public Risk Criteria

This requirement proposes that the risk criteria be applied to each hazard individually, rather than aggregating the risk, as was proposed in the NPRM. The proposed limits and method of applying risk on a per hazard basis are less stringent than that of aggregating the risk for all

hazards. Current practice is to rely on the federal range requirements for launches from federal ranges, in accordance with an assessment performed by the FAA. The majority of licensed launches to date have taken place from Air Force ranges, and primarily the Air Force's Eastern Range. The Eastern Range calculates risk and applies risk criteria on a per hazard basis without considering the aggregate risk.[28] The Air Force's Western Range also calculates the risk due to each hazard; however the Western Range does consider the aggregate risk in its decision-making process. Therefore, current practice could be either approach, depending on from which federal range the launch takes place.

Although EWR 127-1 requires a limit of 30×10^{-6} for toxic risk, the Eastern Range has allowed a toxic risk criteria of up to 233×10^{-6} for expected casualty, which is less stringent than the 30×10^{-6} per hazard proposed in the SNPRM.[29] While it is mainly government launches that rely on this risk ceiling for toxic hazards in excess of 30×10^{-6}, there have been a few licensed launches that have exceeded this level.[30] For example, a licensed launch took place with a toxic risk level as high as 114×10^{-6}. Although the Eastern Range criteria of 233×10^{-6} is not consistent with EWR 127-1 requirements (and the criterion was primarily established for government launches), it is current practice. The Air Force and FAA Common Standards Working Group has agreed that 233×10^{-6} should only be applied to future government launches, and that the proposed criterion of 30×10^{-6} would be appropriate for general application to non-government launches (and would not have a major impact on launch availability).

During the last three and a half years there have been three instances where a commercial vehicle ready for launch has exceeded a toxic risk level of 30×10^{-6} at the Eastern Range. In one of these instances, the launch was scrubbed because the toxic risk level exceeded the acceptable level of the Eastern Range. In two instances, the launch proceeded because it did not exceed the

[28] This practice was introduced as an option in EWR 127-1 dated March 1995.
[29] The Eastern Range and local Brevard County authorities reached agreement on what predicted concentration of parts per million for various substances would be acceptable.
[30] The regulatory evaluation associated with the NPRM did not address the probability that licensed launches from the Eastern Range would exceed 30×10^{-6} for toxic risk. Further evaluation and a better understanding of current range practice indicates that Eastern Range launches have proceeded with a significantly higher toxic risk criteria (i.e., up to 114×10^{-6}) than that being proposed. Therefore, the FAA is now prepared to assume that there may be some future launches that would be delayed due to the proposed requirement.

acceptable toxic risk level at the Eastern Range.

There were 39 launches of commercial launch vehicles from the Eastern Range from the years 1997 to August 2001. Two of these 39 launches exceeded the toxic risk ceiling proposed by the SNPRM due to meteorological conditions, but were launched anyway because they fell within the acceptable range of the Eastern Range. These launches were as follows:

- Launch #1[31] occurred with a toxic risk level of 57×10^{-6}
- Launch #2 occurred with a toxic risk level of 114×10^{-6}

If these precise meteorological launch conditions existed under the SNPRM, then the two launches, which took place under the current practice at the Eastern Range, would not have launched. Therefore, the proposed requirement, under the same meteorological launch conditions, would cause a commercial launch operator to delay a planned launch from the Eastern Range until more favorable weather prevailed. At the Western Range the 30×10^{-6} criteria is applied as current practice, and accordingly, commercial space launch operators would not experience launch delays due to this proposed requirement (i.e., $E_c = 30 \times 10^{-6}$ for each hazard).

Although the proposed requirement would standardize the risk criteria for licensed launches from both the Eastern Range and the Western Range, it would affect launch operators differently, depending on the federal launch site used.[32] Launch delays from the Eastern Range would cause a launch operator to incur additional costs.

The current toxic risk accepted at the Eastern Range (i.e., $E_c \leq 233 \times 10^{-6}$) is less stringent than the proposed criteria of 30×10^{-6}. As previously mentioned, application of this requirement could result in launch delays under certain conditions, as compared to current practice. The Air

[31] An earlier launch attempt previously mentioned had to be delayed because the toxic risk level exceeded 900×10^{-6}.

Force Eastern Range experience mentioned above — that two out of 39 launches (or five percent, calculated as 2÷39 = .051282)[33] might have to be delayed under the SNPRM — is used to develop an estimate of the probability of a launch delay in any given year during the 2003 through 2007 period. Accordingly, due to the proposed toxic risk ceiling requirement, as many as two of the 36[34] expected Eastern Range launches from 2003 through 2007 could be delayed (calculated as .051282 × 36 = 1.85). Using the Eastern Range experience, the FAA assumes that these two launches would be delayed by one day. (The FAA also assumes that these launches would not fail the proposed risk ceiling on the second day after the launch had been delayed.) The FAA estimates that the average cost of these one-day delays to commercial space launch operators would be $380,000.[35]

It is important to note that the estimate of two delays attributable to this proposed requirement over the five-year period may be an overstatement. The likelihood of launch delays resulting from toxicity limits is expected to decrease, as future launch vehicle toxicity is expected to be reduced significantly, and future launches are likely to be conducted from launch complexes that are farther away from populated areas.[36] Collectively, these launch characteristics will result in E_c values significantly lower than that experienced historically, as well as the proposed ceiling.

It is not possible to ascertain with certainty when, if ever, during the 2003 through 2007 period there might be a launch delay at the Eastern Range as a result of the toxic standard in the SNPRM. Therefore, the probability of a delay based on past experience is multiplied by all projected launches per annum, yielding the expected number of launch delays. The average cost to a commercial space launch operator of a one-day delay (i.e., $380,000) is multiplied by the

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[32] The FAA believes that the proposal to apply risk to hazards individually would not result in a substantial increase in demand for launches from the Western Range yielding economies of scale and associated decreasing operating costs.

[33] This statistic is calculated using the number of launches rather than the number of attempted launches. There were 63 attempted launches during the 1997 through August 2001 period, 24 of which were scrubbed or cancelled, resulting in 39 launches. Two of the 39 launches exceeded the 30×10^{-6} threshold. Another scheduled launch did exceed this threshold but was among the 24 scrubbed attempts.

[34] FAA/AST STAR Database, December 15, 2001

[35] Air Force Space Command Financial Management, January 2002.

[36] Based on *Final Environmental Impacts Statement for the Evolved Expendable Launch Program*, U.S. Air Force, April 1998; and *Final Supplemental Environmental Impacts Statement for the Evolved Expendable Launch Vehicle Program*, U.S. Air Force, March 2000.

expected number of launch delays, resulting in the expected incremental cost to commercial space transportation industry launch operators to comply with the proposed requirement. This is summarized in Table 4-4.

TABLE 4-4. Incremental Cost to Commercial Space Transportation Industry Launch Operators to Comply with Section 417.107(b) of the Supplement to the Notice of Proposed Rulemaking

(In 2001 Dollars rounded)

Year	Number of Eastern Range Launches[a]	Probability of Delay[b]	Average Cost of Launch Delay[c]	Cost of Delay[d]	Present Value Factor[e]	Discounted Cost[f]
2003	6	0.051282	$380,000	$116,900	0.8734	$102,100
2004	7	0.051282	$380,000	$136,400	0.8163	$111,300
2005	7	0.051282	$380,000	$136,400	0.7629	$104,100
2006	8	0.051282	$380,000	$155,900	0.713	$111,200
2007	8	0.051282	$380,000	$155,900	0.6663	$103,900
Total	36			**$701,500**		**$532,600**

[a] Projected number of launches from the Eastern Range derived from FAA/AST STAR database, December 15, 2001.
[b] Calculated as 2 ÷ 39 = .051282.
[c] Estimate provided by Air Force Space Command Financial Management, January 2002.
[d] Calculated as the number of projected Eastern Range launches multiplied by the probability of delay multiplied by the average cost of delay.
[e] Discounted at seven percent over a five-year period.
[f] Calculated as the cost of delay multiplied by the present value factor.

This proposed amendment would codify and standardize this requirement for all launches regardless of launch site, and would not differ from current practice for launch operators seeking licenses to perform launches from non-federal launch sites. Accordingly, commercial launch operators would not incur additional costs to comply with this requirement as it pertains to non-federal launch sites.

This proposed requirement would yield some additional safety benefits for licensed commercial launches from the Eastern Range only. This is because commercial launches that exceed 30×10^{-6} for toxic risk would no longer be allowed to launch from this site. The FAA has not quantified these safety benefits, which are addressed in more detail in Section 4.5. Additionally, this proposed amendment would enhance launch operators' understanding of regulatory requirements and their associated responsibilities, and accordingly may yield some operating

efficiencies and associated cost savings which the FAA has neither quantified nor estimated, respectively. This is addressed in more detail in Section 4.6.

4.2.3 Section 417.107(c): Casualty Thresholds for Debris

This amendment proposes two distinct metric requirements for safety risk from debris —inert debris and explosive debris. Each of these two metrics is discussed below.

Inert debris

This requirement proposes using kinetic energy[37] as a metric for debris, with a threshold of 11 ft-lbs for estimating risk from inert debris impacts, rather than using a ballistic coefficient of 3.0 as was proposed in the NPRM.[38, 39] This proposed amendment would be a more stringent safety requirement than proposed in the NPRM. However, the proposed 11 ft-lb threshold is consistent with current practice at the federal ranges and in some cases may be less restrictive.[40] The proposed threshold would not result in degradation of public safety[41] and would not have any negative effect on launch availability. Accordingly, compliance with this proposed requirement would not affect launch operators launching from federal ranges. Further, since it is current practice at non-federal sites for launch safety to be equivalent to that at federal ranges, the proposed threshold of 11 ft-lbs would not affect non-federal launches.

[37] Based on input from the FAA and Air Force Common Standards Working Group

[38] While the NPRM did propose an 11 ft-lb threshold for aircraft impact by debris, the SNPRM in addition, proposes using the 11 ft-lb threshold for assessing individual and collective public risk and collective risk to water-borne vehicles.

[39] As discussed in the SNPRM preamble, the use of a ballistic coefficient of 3.0 might degrade safety to an unacceptable degree.

[40] The models used at Air Force ranges satisfy the proposed 11 ft-lb threshold; there are examples of debris models used for some launches that have accounted for inert debris at the 7 ft-lb level. [Memorandum for AFSPC/SECE, Department of the Air Force, 45th Space Wing, October 26, 2001]

[41] The Air Force and FAA Common Standards Working Group has conducted research indicating that for the general public, a kinetic energy of 11 ft-lb at impact is a reasonably conservative threshold level for serious injury for blunt trauma.

Explosive Debris

This requirement proposes that the debris risk analysis account for a 1.0 psi blast over-pressure radius in the effective causality area of any explosive debris, rather than a 3.0 psi blast over-pressure radius as was proposed in the NPRM. As discussed in the preamble to the SNPRM, Air Force concern that there is significant potential for casualties at a blast overpressure threshold of 3.0 psi prompted the FAA to propose the 1.0 psi threshold. While it is current practice at federal ranges to use a .5 to 3.0 psi value, depending on the flight safety analysis, these federal range values have been applied in a manner that is consistent with the proposed threshold of 1.0 psi. The Common Standards Working Group has reviewed the casualty models and analysis processes used at the Air Force ranges and concluded that the use of 1.0 psi as a casualty threshold for explosive debris would be consistent overall with current practice at those ranges and in the explosive safety community.[42, 43] Since it is current practice at non-federal sites for launch safety to be equivalent to that at federal ranges, the proposed threshold of 1.0 psi would not affect non-federal site launches.

This requirement proposes threshold values that are a change from those proposed in the NPRM, but are consistent with current practice at federal and non-federal launch sites. Therefore, the FAA estimates that the incremental cost to comply with this requirement would be zero.

4.2.4 Section 417.107(d): Casualty Modeling

This proposed amendment requires FAA approval of a probabilistic casualty model used by launch operators during the licensing process. In the event that a launch operator is using a federal launch range casualty model that has been accepted as part of the FAA baseline assessment of the federal launch range safety process, the launch operator need not expend additional effort in order to seek FAA approval. These requirements (for launches from federal launch sites) are consistent with current practice regarding commercial launches from federal ranges. Commercial launch operators launching from non-federal sites must obtain FAA

[42] The Department of Defense Explosive Safety Board (DDESB) approves the siting of public buildings that may be subject to approximately 1.0 psi over pressure level in the event of an accident.
[43] Technical details on this issue may be found in the Preamble to the SNPRM.

approval, as is consistent with current practice. Hence, the proposed amendment would not cause commercial launch operators to expend additional effort. Therefore, the incremental costs to the commercial space transportation industry to comply with this requirement would be zero.

4.2.5 Section 417.203: Compliance

This proposed amendment addresses launch operator compliance with flight safety analysis requirements. Under the proposed amendment, launch operator responsibilities would not differ from current practice if launching from a federal range where a FAA baseline assessment of range safety services has been performed. If the federal range safety services are acceptable to the FAA based on the baseline assessment, then the launch operator is not required to provide the FAA with additional information. However, if the federal range safety services are unacceptable as a result of the baseline assessment, such as the proposed launch being outside federal range experience, then the launch operator is required to confer with the FAA. Under either scenario, launch operator requirements for demonstrating compliance with flight safety analysis requirements are consistent with current practice. Further, a launch operator proposing to launch from a non-federal launch site without federal range safety support must demonstrate compliance with safety analysis requirements, as is also current practice. Therefore, the FAA estimates that the incremental cost to commercial space transportation launch operators to comply with this requirement, as it pertains to a federal range or a non-federal launch site, would be zero. To the extent that this proposed amendment would enhance launch operators' understanding of regulatory requirements and their associated responsibilities, it may yield some operating efficiencies and associated cost savings which the FAA is unable to quantify.

4.3 Incremental Effects and Associated Impacts of the SNPRM on the Federal Aviation Administration

While the FAA confers with other Federal Government organizations in performing its responsibilities under the existing regulations, such as NASA and the Departments of Defense and State, the FAA anticipates no cost to these agencies as a result of this SNPRM. Therefore, the incremental analysis associated with administering the requirements of the SNPRM pertains to the effects on the FAA only.

Only one section in the SNPRM, as revised from the NPRM, has regulatory requirements that would have an effect and impact on the FAA. This is section 417.203, which would cause the FAA to undertake more extensive baseline assessments of federal range flight safety analyses and incur the associated costs. Although the FAA believes that this additional cost would not be substantial, there is insufficient information currently available to prepare a supportable estimate at this time. This comparative incremental analysis is summarized in Table 4-5. Presented below is a discussion of all principal revisions to the NPRM contained in the SNPRM, as they pertain to FAA responsibilities and current practices.

4.3.1 Section 417.1(b) Federal launch range pre-existing meets intent certifications, waivers, and non-compliances due to grandfathering.

This proposed requirement is a significant change from that proposed in the NPRM. As stated in Section 4.2.1, this proposed revision to the NPRM changes the FAA's regulatory proposal based on an improved understanding of current practice resulting from public comments and discussions with federal launch site personnel. This proposed requirement, as presented in the SNPRM, would not cause the FAA to incur additional effort addressing pre-existing "meets intent certifications", waivers, and non-compliances due to federal range grandfathering policy, as what pre-exists would be accepted by the FAA; this reflects current practice. Therefore, the total incremental cost to the FAA to administer this proposed requirement would be zero.

4.3.2 Section 417.107(b) Public Risk Criteria

The FAA is not expected to be affected by this proposed requirement. Consistent with the effects and associated impacts addressed in Section 4.2.2, a delay at a federal launch site will result in costs to the commercial launch operator. Further, it is expected that any costs initially incurred by the range operator due to the delay (i.e., the Air Force Eastern Range) would be passed on to a commercial launch operator. Accordingly, these costs are reflected in the incremental cost to a commercial space transportation launch operator to comply with this proposed requirement presented in Section 4.2.2. Hence, the incremental cost to the FAA to administer this proposed requirement would be zero.

4.3.3 Section 417.107(c): Casualty Thresholds for Debris

As explained above in Section 4.2.3, this proposed amendment establishes casualty thresholds for inert and explosive debris, and requirements for how the thresholds would be applied in the flight safety analysis for a licensed launch. The FAA is proposing that a launch operator's flight safety analysis demonstrate compliance with the public risk criteria, which involves the estimation of casualties. The analysis would be required to incorporate one of two approaches when applying the proposed casualty thresholds. The more sophisticated of the two approaches, and the one which would perhaps result in the more accurate casualty estimate, would require the use of probabilistic models to account for the probability of casualty to any person exposed to the threshold levels or greater. The simpler of the two approaches, would count all members of the public exposed to the threshold levels or greater as casualties. The more simple would result in a relatively higher casualty estimation, which may be sufficient for a launch operator, depending on the specifics of a proposed launch.

Federal ranges currently apply a number of analysis options, depending on the specifics of a launch; the probabilistic approach is most prevalent. As is current practice, any probabilistic casualty model used for a launch would have to be approved by the FAA during the licensing process or, if the launch is from a federal launch range, accepted as part of the FAA's baseline assessment of the federal range. Since it is current practice at non-federal sites for launch safety to be equivalent to that at federal ranges, the proposed requirement would not affect current FAA practices with respect to non-federal launches. Therefore, the additional costs to the FAA to administer the proposed requirements would be zero.

TABLE 4-5. Effects of Revision of Commercial Space Transportation Licensing Regulations on the Administrative Functions Performed by the Federal Aviation Administration

Section of Supplement to Notice of Proposed Rulemaking	Summary of Proposed Required Actions	Current Practice Performed by Federal Aviation Administration	Principal Difference Between Current Practice and Proposed Required Actions that Affect the Federal Aviation Administration
§ 417.1(b)	Acceptance of preexisting waivers, meets intent and non-compliances due to grandfathering for launches from federal ranges.	FAA accepts preexisting waivers, meets intent and non-compliances due to grandfathering	No difference
§ 417.107(b)	Applies risk criteria of $E_c \leq 30 \times 10^{-6}$ individually to toxic, debris and blast overpressure hazards	Accept federal range criteria: • Western Range: $E_c \leq 30 \times 10^{-6}$ to each hazard and considers the aggregate risk over all hazards in its decision process. • Eastern Range: applies $E_c \leq 30 \times 10^{-6}$ each to debris and blast hazards. Has accepted up to $E_c \leq 233 \times 10^{-6}$ for toxic hazards. Non-federal range criteria is $E_c \leq 30 \times 10^{-6}$ for debris hazard and must be as safe as launches from federal ranges	No difference
§ 417.107(c)	Establish casualty thresholds for debris: 11 ft-lb for inert debris 1.0 psi for explosive debris; allow deterministic or probabilistic analysis	FAA accepts federal range practice that uses comparable or more restrictive thresholds. FAA requires launches from non-federal launch sites to be as safe as federal range launches. FAA accepts modeling similar to that proposed at federal and non-federal launch sites.	No difference
§ 417.107(d)	The FAA must approve probabilistic casualty model used by launch operator.	FAA approves ranges' models as part of baseline assessment. Those launching from non-federal ranges need FAA approval of models.	No difference

TABLE 4-5. Effects of Revision of Commercial Space Transportation Licensing Regulations on the Administrative Functions Performed by the Federal Aviation Administration

Section of Supplement to Notice of Proposed Rulemaking	Summary of Proposed Required Actions	Current Practice Performed by Federal Aviation Administration	Principal Difference Between Current Practice and Proposed Required Actions that Affect the Federal Aviation Administration
§ 417.203	Extensive and timely baseline assessments of federal range flight safety analyses	Periodic baseline assessments of federal range flight safety analyses	More rigorous, extensive, and possibly more frequent baseline assessments of federal range flight safety analyses.

4.3.4 Section 417.107(d): Casualty Modeling

It is current practice for the FAA to review and approve, either directly or indirectly, the use of any probabilistic casualty model used by a commercial launch operator during the licensing process, regardless of launch site. Direct review approval occurs when the FAA examines the specific probabilistic casualty model used during licensing. Indirect review and approval occurs in the event that a launch operator is using a federal launch site which has a casualty model that has been accepted as part of the FAA baseline assessment of the federal launch range safety process. In this instance, further FAA approval is not required. Hence, this proposed requirement would not cause the FAA to incur additional effort. Therefore, the FAA estimates that the total incremental cost to administer this proposed requirement would be zero.

4.3.5 Section 417.203: Compliance

It is a current practice of the FAA to perform baseline assessments of federal range flight safety analyses.[44] However, this proposed requirement creates some urgency in the frequency with which these assessments are performed (i.e., it is imperative that the baseline assessments be updated so as to be consistent with current federal range flight safety analyses, thereby permitting application of this proposed requirement). Further, the FAA believes that more extensive reviews of federal range flight safety programs would be required in order to keep abreast of the increasing number, diversity, and complexity of commercial launches from federal ranges and associated flight safety analyses. As a result of this proposed amendment, the FAA would expend additional effort and incur associated incremental costs to perform more rigorous and timely baseline assessments. Although the FAA believes that these incremental costs would not be substantial, there is insufficient information currently available to provide a supportable estimate of these costs at this time. The FAA invites comments on the validity of this assertion and any potential impacts related thereto.

[44] Another FAA current practice is to issue advisory circulars to industry announcing new regulatory requirements. While the frequency of these notices varies, the FAA anticipates it would have to issue several advisory circulars to provide more information on the overall final rule. However, to the extent that these costs are considered standard operating practice and are not a direct result of a final rule, they generally are not considered in regulatory

Additionally, federal organizations other than the FAA, such as DOD and NASA (i.e., federal personnel that are range operators), may be required to expend additional effort and incur incremental costs cooperating with the FAA as it prepares for more rigorous, extensive, and frequent baseline assessments and cooperating with the FAA during their conduct. Additionally, federal range operating contractors may also be similarly affected by these activities. The FAA solicits comments and detailed information to help better address this subject in this regulatory evaluation.

4.4 Summary of Cost Impacts of Supplement to Notice of Proposed Rulemaking

The FAA estimates that the total costs of the SNPRM would be approximately $700,000; these costs would be incurred entirely by commercial space transportation launch operators to comply with the proposed requirements contained in the SNPRM. The incremental costs to the FAA to administer the SNPRM would not be substantial and there is insufficient information currently available to develop a supportable estimate. This is summarized in Table 4-6.

TABLE 4-6. Summary of Cost Impacts of Supplement to Notice of Proposed Rulemaking (In 2001 Dollars)

Category	Undiscounted	Discounted[a]
Commercial Space Transportation Industry Launch Operator Compliance Costs	$701,500	$532,600
Federal Aviation Administration Administrative Costs	Not estimated[b]	Not estimated[b]
Total Costs	$701,500	$532,600

[a] Discounted at seven percent over a 5-year period from 2003 through 2007.
[b] FAA believes that the incremental costs that would be incurred to administer the SNPRM requirements pertaining to Section 417.203, Compliance, would not be substantial and is not prepared to quantify and estimate these costs at this time.

4.5 Safety Benefits from the Supplement to the Notice of Proposed Rulemaking

The SNPRM would result in some additional safety benefits associated with licensed commercial launches from the Eastern Range only. This is due to the proposed requirement associated with

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evaluations.

section 417.107(b), public risk criteria. Specifically, licensed launches exceeding an average expected casualty of 30×10^{-6} for toxic risk would no longer be permitted to launch from the Eastern Range. Therefore, the positive safety benefits would be the accident costs avoided (i.e., the dollar value of fatalities, injuries, and property damage) due to applying the toxic risk criteria of 30×10^{-6} (which is less than the 233×10^{-6} threshold currently used at the Eastern Range).

In Section 4.2.2 the FAA presented estimates of Eastern Range launches that would exceed the average expected casualty of 30×10^{-6} for toxic risk during the 2003 through 2007 period. Although the FAA has not quantified the accident prevention or damage limiting effects[45] the proposed requirement would have on Eastern Range launches, it does believe that the proposed requirement would yield some incremental safety benefits. The FAA invites comments on the validity of this assertion and any potential impacts related thereto.

4.6 Qualitative Benefits from the Supplement to the Notice of Proposed Rulemaking

The proposed SNPRM offers a variety of impacts that would benefit both the FAA and the commercial space transportation industry that are not readily quantified. Formalizing and identifying licensing responsibilities by establishing a specific regulation would emphasize commercial launch operator responsibilities and FAA expectations, and would enhance launch operators' understanding of such. Consequently, the proposed requirement may yield some operating efficiencies and associated cost savings that the FAA has not quantified or estimated.

Further, as the number of applications for launch licensing increases, formality (in the way of a regulation) would 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 would spill over to commercial space transportation entities by reducing the turnaround time between application submittal and licensing approval. Additionally, consistent application of the licensing process would help commercial space

[45] The positive safety effects of the proposed SNPRM include accident prevention and damage limitation effects. The accident prevention effect of the proposed rule is the reduction in the probability of an accident. The damage limitation effect of the proposed rule is the reduction in accident severity if an accident occurs.

transportation entities gain familiarity with its requirements, leading to proficiency in their ability to interact with the process and the FAA. This in turn would lead to industry cost savings, possibly due to less rework or paperwork avoided.

5.0 CONCLUSION

The SNPRM would impose some costs on commercial space transportation industry launch operators to comply with its requirements.[46] The FAA may incur some incremental costs to administer certain requirements in the SNPRM, but these would not be substantial. The general public may realize some additional safety benefits associated with Eastern Range launches. The SNPRM would enhance launch operators' understanding of regulatory requirements and their associated responsibilities, which may yield some benefit to the commercial space transportation launch industry.

[46] This is based on the undiscounted incremental compliance and implementation costs from Table 4-6.

6.0 INITIAL 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 of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation. To achieve that principle, the Act 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 would 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.

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 a regulatory flexibility analysis is not required.

The FAA conducted the required review of the SNPRM and determined that it would not have a significant economic impact on a substantial number of small entities. To make this determination, the FAA has identified the commercial space transportation industry launch operators that would be affected by the SNPRM and found that only a small number of businesses that would be affected by the SNPRM could be considered a small entity. For manufacturers, a small entity is one with 1,500 or fewer employees.

Currently the following companies have active licenses to launch ELV's: McDonnel Douglas Corporation, Lockheed Martin Corporation, Commercial Launch Services, Inc., Orbital Sciences Corporation, Sea Launch Company, L.L.C., Interorbital Systems, and Astrotech Space

Operations, Inc. Only Interorbital Systems and Astrotech Space Operations have fewer than 1,500 employees.

Astrotech Space Operations, Inc. is a wholly owned subsidiary of Spacehab, which has average annual revenues of approximately $100 million. The total cost of the SNPRM to industry would be $700,000, which is less than one percent of Spacehab's annual revenue. Clearly, the cost of the SNPRM would not constitute a significant economic impact on a firm with revenues of this magnitude. The cost of a delayed launch might have a significant impact on Interorbital Systems. Even if delay costs are significant for this entity, one impacted entity is not considered a substantial number of small entities. Accordingly, on this basis and pursuant to the Regulatory Flexibility Act, 5 U.S.C. 605(b), the FAA certifies that the SNPRM would not have a significant economic impact on a substantial number of small entities. The FAA solicits comments with regard to this certification and requests that supporting documentation be supplied.

7.0 INTERNATIONAL TRADE IMPACT ASSESSMENT

The Trade Agreement Act of 1979 prohibits Federal agencies from promulgating any standards or engaging in any 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 accordance with the above statute and policy, the FAA has assessed the potential effect of the SNPRM and has determined that it would impose the same costs on domestic and international entities, and thus has a neutral trade impact.

8.0 UNFUNDED MANDATES ASSESSMENT

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), 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 the expenditure of $100 million or more (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."

The SNPRM does not contain such a mandate. Therefore, the requirements of Title II of the Unfunded Mandates Reform Act of 1995 do not apply.