STREAMLINING FAA COMMERICIAL SPACE TRANSPORTATION REGULATIONS

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Abstract

In May 2018, the President of the United States issued Space Policy Directive-2 that asked the U.S. Secretary of Transportation to review regulations that provide for and govern licensing of commercial space flight launch and re-entry. The directive asked the Secretary to consider; 1) "requiring a single license for all types of commercial space flight launch and re-entry operations"; and 2) "replacing prescriptive requirements in the commercial space flight launch and re-entry licensing process with performance-based criteria." DOT assigned the task of rapidly developing a Notice of Proposed Rulemaking (NPRM) to the Federal Aviation Administration's Office of Commercial Space Transportation (FAA/AST). An NPRM was released in spring 2019. DOT has licensed over 370 launches since 1989.

The FAA plans to consolidate and revise many launch and reentry licensing requirements into a single regulation to streamline the licensing process, while protecting public safety and national security. Specifically, the FAA will consolidate and revise 14 Code of Federal Regulations Chapter III parts 415, 417, 431, and 435 into a single new regulatory part. The new part will enable safety objectives to be achieved for the launch of suborbital and orbital expendable and reusable launch vehicles, and the reentry of reentry vehicles, and will leave design or operational solutions up to the applicant.

The new regulation will also enable flexible timeframes, redefine when launch begins, and allow the space industry to seek a single license to launch from multiple sites. The overall goal is to simplify the licensing process for launch and reentry activity, enable novel operations, and reduce costs.

This paper will summarize the extensive changes to FAA regulations, address the shift to a more performance-based regulatory framework, and discuss the philosophies used to strike a balance between reducing time spent by industry and government on applications and evaluations while maintaining the U.S. government's robust safety protections for public. The paper may be useful to countries that are considering new national frameworks for commercial space transportation, including hosting U.S. vehicles in their country that would be licensed by the FAA.

1. Introduction

As commercial space transportation grows and evolves, regulations for industry must also keep pace.

In the United States, public safety and regulatory oversight of commercial space transportation is carried out by the Department of Transportation's Federal Aviation Administration (DOT/FAA).

Since the first licensed launch in 1989, there have been over 370 orbital and suborbital U.S. commercial launches and 20 reentries. Licensing is done by the FAA's Office of Commercial Space Transportation.

One of the continual challenges for the FAA is to be able to write regulations that cover different types of vehicle capabilities and missions to keep pace with industry while ensuring public safety.[1]

In May 2018, Space Policy Directive-2 assigned the Secretary of Transportation to review regulations for launch and reentry as part of a new policy to streamline regulations for commercial space activity.

This paper will summarize the extensive changes to FAA commercial space transportation regulations that were released as a Notice of Proposed Rulemaking in April 2019.

The paper will address a single-license approach, performance-based regulations, neighboring operations personnel, adaptable hazard control strategies, changes to public safety criteria, application flexibility, and next steps.

Because the rulemaking process is ongoing at the time this paper was written, some aspects of the regulatory proposal are still evolving.

2. Background on FAA Office of Commercial Space Transportation

The FAA Office of Commercial Space Transportation (FAA/AST) licenses U.S. commercial launch and reentry activities and the operation of launch and reentry sites in the United Stater or by U.S. citizens. The law establishing DOT authority, the Commercial Space Launch Act of 1984, as amended, is in 51 U.S.C. Chapter 509. The primary mission of FAA/AST is to "protect public health and safety, safety of property, and national security and foreign policy interests of the United States."[2] The office also has a promotion role to "encourage private sector launches, reentries, and associated services and, only to the extent necessary, regulate those launches, reentries, and services to ensure compliance with international obligations of the United States…"[3]

It is important to note that the FAA does not certify the design of commercial launch or reentry vehicles. Instead, the FAA licenses the operation of the launch or reentry vehicles for public safety.[4]

The U.S. Congress has incrementally given DOT/FAA additional oversight authority. Launch and launch site authority was originally granted in 1984. Reentry authority was added in 1998. Limited authority over human space flight and statutory authority to issue experimental permits for suborbital vehicle testing were added in 2004.

3. History and ELVs, RLVs

DOT regulations for commercial launch activities became effective in 1988. During this time, commercial launches only included Expendable Launch Vehicles (ELVs) from federal ranges that had established safety practices.

In 1991, DOT simplified the licensing process for launch operators with established safety records by instituting a launch operator license, which allowed one license to cover multiple launches where the same safety resources support identical or similar missions.

In the mid-1990s, companies developing new, Reusable Launch Vehicles (RLVs) identified the need for regulations that fit their new industry, particularly reentry operations. In 2000, the FAA established regulations for the launch of an RLV, the reentry of a reentry vehicle, and the operation of reentry sites.[5]

At the time, the FAA believed that the differences between ELVs and RLVs justified a different regulatory approach. There was a long history of successful ELV launches from Federal launch ranges using detailed prescriptive regulations that the FAA adopted to ensure public safety. In addition, ELV launches typically relied on flight safety systems that terminated flight by preventing a vehicle from traveling beyond approved safety limits. For an RLV, the FAA contemplated other means of ending vehicle flight, such as returning to the launch site or using an alternative landing site.

Moreover, there was little experience with RLVs, other than NASA's Space Shuttle. As a result, the FAA decided to enact flexible process-based regulations for RLVs and other reentry vehicles.

Today's regulations remain largely unchanged from those initial licensing regimes. Regulations for ELVs are contained in 14 Code of Federation Regulations (CFR) parts 415 and 417. RLV and reentry vehicle regulations reside in 14 CFR parts 431 and 435, respectively.

Over time, operators have developed unique launch concepts that do not align well with the prior assumptions underlying the prescriptive ELV regulations and the processes set forth in the RLV regulations. The requirements for ELVs have proven difficult to adapt from their rigid one-size-fits all approach. New and larger RLVs, that now sometimes look similar to reusable ELV stages that return to launch sites, have exposed the lack of regulatory clarity about required hazard controls in the RLV regulations that relied on broad system safety principles. As ELVs and RLVs have become less meaningful distinctions in the face of innovative new launch concepts, the current regulations have grown outdated and unwieldy.

4. Directive from the President

The President of the United States issued Space Policy Directive-2 (SPD-2), "Streamlining Regulations on Commercial Use of Space," on May 24, 2018.[6]

The new policy stated that it is "important that regulations adopted and enforced by the executive branch promote economic growth; minimize uncertainty for taxpayers, investors, and private industry; protect national security, public-safety, and foreign policy interests; and encourage American leadership in space commerce."[7]

As part of the SPD-2, the Secretary of Transportation was given one year to review regulations for launch and reentry licensing and either "rescind or revise those regulations, or publish for notice and comment proposed rules rescinding or revising those regulations…"[8]

Specifically, DOT was asked to consider:

- "requiring a single license for all types of commercial space flight launch and re-entry operations; and
- replacing prescriptive requirements in the commercial space flight launch and re-entry licensing process with performance-based criteria."[9]

The Secretary was also instructed to coordinate with members of the National Space Council.

5. New Part 450

After significant effort, on April 15, 2019, the FAA published its Streamlined Launch and Reentry Licensing Requirements (SLR2) Notice of Proposed Rulemaking (NPRM) in the Federal Register.

The NPRM proposed a number of amendments to the definitions in part 401 of Title 14 of the Code of Federal Regulations (CFR), the administrative processes in part 404, the application procedures in part 413, and the title of part 414, with minor clarifying amendments to parts 420, 433, 437, and 440. Primarily, the proposal focused on the removal and consolidation of launch and reentry licensing regulations in parts 415, 417, 431, and 435. The result is a new proposed part 450 that defines licensing requirements that apply to all launch and reentry vehicles.

With the emergence of RLVs that look and operate like traditional ELVs, vehicle stages that return to launch sites, balloon-based rockets, and other innovative vehicle concepts, the SLR2 rulemaking has sought to create a single comprehensive licensing regime. The proposed rule is broad enough to enable these new designs but still effectively regulates unique operations to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States.

The proposed regulations offer several important improvements and updates, and focus on building flexibility into the licensing process to enable new operational concepts, higher launch cadence, and a flexible level of rigor where appropriate that can be scaled to the potential consequences of a vehicle's failure.

6. Single License for Launches from Multiple Sites

Under the FAA's proposal, a vehicle operator licenses would allow a licensee to launch or reenter their vehicles within given parameters specified in the license, eliminating the FAA's current launch-specific license and launch operator license for ELVs, mission-specific license and operator license for RLVs, and reentry-specific license and reentry-operator license for reentry vehicles. The vehicle operator license would allow the FAA to scope the duration of the license to the operation. The new license proposal also eliminates the restriction specifying an ELV launch license covers only one

launch site, allowing operators to apply for one license to cover multiple launch or reentry sites.

Under the current FAA regulations, an ELV operator must apply for multiple licenses to launch the same vehicle from multiple sites, which results in redundant paperwork. Under the proposal, information that is not site-specific (such as system design and testing details), can be submitted once. Site-specific information, like trajectories, flight abort rules, and risk calculations, can be submitted for each site an applicant wants to conduct operations from. Together, the site-specific and non-site-specific information would make up a complete application for a single license to conduct operations at all included sites.

The FAA acknowledges that many of the important aspects of protecting public health and safety are site specific, as well as financial responsibility requirements and the environmental impacts associated with proposed launches or reentries, but in its proposal the FAA foresees that a license that authorizes launches or reentries at more than one site would make it administratively easier for an operator to change sites for a particular operation. Launch operators today may apply to launch from multiple sites, but are often required to obtain multiple licenses to do so. The proposal eliminates an unnecessary paperwork exercise and the implication that non-site-specific information is reviewed for each location.

Under the NPRM proposal, an applicant should identify sites during pre-application consultation so that the applicant and the agency can scope the application and identify any potential issues early on. This coordination should prevent delays during the application process and expansion of the license authorization should reduce the need for license modifications.

The proposal also extends the license duration to a maximum of five years, but still allows an operator to request a shorter license for limited specific activity rather than for a more general range of activities, if desired. More limited licenses may better scope the licensee's financial responsibility and the operational time subject to FAA safety inspections. Bounding the license time more appropriately tailors those obligations to the planned activity. Of course, the FAA plans to continue its current practice of extending licenses through renewals or modifications to accommodate delays in authorized launches or reentries.

7. Performance-Based vs Prescriptive Regulation

Performance-based regulations are a way to structure rules so as to require a desired outcome rather than require a process or design expected to produce the desired outcome. These required results can be quantitative thresholds, such as parts per million for emissions standards, or qualitative targets, such as requirements that labelling be readily legible. Performance-based regulations are generally contrasted with prescriptive regulations, which prescribe design standards or detailed processes known to achieve the desired outcome.

The move towards performance standards, where appropriate, has been a key promise of regulatory reform since the 1980s.[10] Performance-based regulations allow innovation by enabling creative designs and operations to meet the designated performance outcome. For that reason, they are thought to be ideal for emerging industries. Prescriptive process or design requirements often require the issuance of multiple waivers or equivalent level of safety determinations to allow innovation or even growing business practices, because the regulations rely on experienced design to ensure safe operation.

Performance-based regulations are more difficult to implement for industries where risks and performance must be predicted, than in industries where hazards are measurable and cumulative. Under a performance-based regulatory regime, the question of how to acceptably demonstrate compliance often relies on an agency's promulgation of significant amounts of guidance material. Potential difficulties aside, the ultimate goal of performance-based regulations is to redirect the focus of the relationship between regulator and the regulated entities to one centered on compliance with requirements rather than on necessary enforcement.

Currently, the FAA uses both prescriptive and performance-based requirements for launches and reentries. The commercial space transportation licensing regulations for both ELVs and RLVs set performance-based risk criteria that must be met and demonstrated in an applicant's submitted materials. The regulations in part 417 also include detailed design requirements for flight safety systems and part 431 contains very prescriptive work shift and rest requirements. Most regulations are on a spectrum between performance-based and prescriptive language, and this holds true for many of the launch and reentry licensing regulations as well. In the

current launch and reentry licensing regime, mandated readiness reviews contain both performance-based requirements to demonstrate readiness for flight and prescriptive requirements about specific verifications that must be made to be ready.

Performance-based regulations can be broadly or narrowly scoped, depending on what performance is being measured. There is an often-repeated joke that the most performance-based regulation is "be safe." This of course raises issues of implementation, oversight, and enforcement, but is also used as an example to discuss how broad a performance standard should be. A similarly hyperbolic example of a narrowly scoped performance-based regulation would be a required outcome indistinguishable from a design requirement (e.g. a fence that reaches at least six feet tall). The flexibility of performance-based regulations are dependent on the scope of the regulated performance. In its proposal, the FAA has sought to achieve requirement flexibility wherever safety allows.

The FAA has some experience with performance-based regulations, notably the overhaul of Part 23 and the Airworthiness Standards in 2016.[11] In that rulemaking the FAA sought to replace prescriptive requirements with performance-based regulations, and to enable the adoption of voluntary consensus standards developed by industry and safety associations.

In streamlining the commercial space transportation regulations, the FAA has proposed to move more towards performance-based language on the regulatory spectrum but has also emphasized building in options for flexibility, scalability, and adaptability. Carrying forward the successes of part 23, the FAA now seeks to enable voluntary consensus standards in the streamlining of its launch and reentry licensing.

8. Neighboring Operations Personnel

The proposal makes few significant changes to the current performance-based public safety criteria, which includes both collective and individual public risk thresholds. One change of note however is the proposed provision for separate risk criteria for neighboring operations personnel. This is an example of an added performance-criteria that expands operational flexibility. While the provision adds more text to the regulation, the text is intended to allow operations to better adapt to changing business practices in the launch and reentry industry.

In establishing collective risk requirements in 1999, the FAA's rationale for setting the expected casualty (E_C) limit, taken from the U.S. Air Force's range requirements, was that commercial launches should not expose the public to greater than normal background risk. The public is defined as those not involved in supporting the licensed launch or reentry and includes other co-located operators and their personnel, even if they are also licensed by the FAA. Because of the stringent risk requirements to protect uninvolved public, neighboring operations personnel (NOPs) are often evacuated during commercial launches or reentries. These evacuations of other launch operator personnel can range from a handful of workers to over a thousand employees prevented from working for a significant portion of a day, and often results in schedule impacts and lost productivity costs to other range or site users.

For years, the federal ranges have had less stringent protections for NOPs to allow essential personnel to continue working during nearby operations. The FAA agrees that NOPs have accepted an inherently greater background risk than the general public, but as NOPs are not participating in the specific hazardous licensed or permitted operation currently being conducted they are still uninvolved public and must be protected under the statutory mandate of the FAA. The NPRM proposes to harmonize FAA regulations with federal range practices and in doing so allow the continuation of critical tasks for neighboring operators. This enabling feature is becoming increasingly necessary with the growth in operations and launch rate.

The SLR2 proposal achieves the statutory requirement to protect NOPs as public by setting a risk threshold for them consistent with their normal background risk from working at a launch or reentry site, but acknowledges that that risk is higher than the risk accepted by the general public. The FAA proposed to define NOPs as "personnel required to perform safety, security, or critical tasks and who are notified of neighboring hazardous operations."[12] As the proposal states, "critical tasks may include maintaining the security of a site or facility or performing critical launch processing tasks such as monitoring pressure vessels or testing safety critical systems of a launch vehicle for an upcoming mission."[13] NOPs would not include administrative, janitorial, food service, and other non-safety or non-security staff.

While the proposal would add a separate collective risk limit and individual risk limit for neighboring operations personnel, and could potentially impose some increased burden on operators who must account for personnel permitted to stay in safety clear zones, the benefit to industry as a whole and the enabling of continued operations at launch and reentry sites is expected to far outweigh any inconvenience.

9. Hazard Control Strategies and a Safety Framework

In order to create a more flexible and adaptable safety review process, the FAA has proposed a new safety framework for commercial space launch and reentry licensing that allows more flexibility in the use of hazard control strategies to meet the outcome-based thresholds set forth in the public safety criteria. The FAA's proposal requires all operators to have a general system safety program that would establish system safety management principles for their operations, to include a safety organization, lifecycle evaluation procedures, configuration control, and post-flight data review. The system safety program unites operational safety principles across both ground and flight safety during any licensed launch or reentry.

For flight, the proposal requires a preliminary flight safety assessment as a top-level consideration of the potential public safety impacts per phase of flight and an opportunity to demonstrate selection of an appropriately scoped hazard control strategy. The preliminary safety assessment would generally clarify whether an operator should use traditional hazard controls such as physical containment, wind weighting, or flight abort to mitigate hazards, or whether an operator can derive unique hazard controls through the conduct of a flight hazard analysis.

Hazard analysis is a proven engineering discipline best applied during system development and maintained throughout the system's lifecycle. As a result, the FAA recommends that an operator perform their initial preliminary safety assessment early in the design phase of a proposed operation. In some cases, the proposal would require that flight abort be used as a reliable hazard mitigation given possible consequences of a failure, but the FAA expects that the new safety framework will allow more operators alternatives to traditional flight safety systems for some phases of flight.

The hazard control strategy options are meant to further scale an operator's required flight safety analysis (FSA). The FSA is the quantitative demonstration that the public safety criteria is met for hazards such as debris, far-field overpressure, and toxic release and further designates any flight hazard areas. Additional analyses may be required to support the flight abort or wind weighting hazard control strategies.

Any additional hazard controls identified from the flight hazard analyses or from the expanded FSA for traditional hazard controls would need to be described and implemented as a derived hazard control.

Under the proposed safety framework, there are also prescribed hazard controls that are required of all operators regardless of their hazard control strategy. These include requirements for safety critical systems, agreements, safety-critical personnel qualifications, crew rest, radio frequency management, readiness, communications, preflight procedures, surveillance and publication of hazard areas, lightning hazard mitigation, flight commit criteria, tracking, collision avoidance, safety at the end of launch, and mishap planning. The FAA is requiring these controls because they have historically proven necessary to safeguard the public during spaceflight operations. Despite these requirements, the FAA has proposed ways to make all of these prescribed flight hazard controls more flexible and scalable without impacting their public safety benefits.

In addition, the FAA believes that a ground hazard analysis can derive suitable ground hazard controls for any required ground safety, paired with a handful of prescribed hazard controls. Along with any hazard controls derived from the ground hazard analysis, the FAA has proposed requirements related to explosive siting, coordination with the site operator, toxic release mitigation, procedures for protecting any public in controlled areas, countdown abort procedures, and emergency and fire procedures. The FAA's proposal sought to significantly reduce the burden of demonstrating acceptable public safety during ground operations.

Like the general transition to more performance-based requirements, the FAA developed and proposed this safety framework as a way to adapt to the changing commercial space transportation industry and enable future changes that are equally safe. By requiring some basic launch and reentry

safety elements but allowing more flexibility in operator's hazard control strategies, the FAA hopes to promulgate regulations that work for the full spectrum of proposed vehicles, from traditional rockets with traditional hazard controls to novel concepts with hazard controls that can be derived from engineering principles and operational reviews.

Most importantly, the FAA is confident that despite the changes in the licensing regulations approach to a safety framework, the proposed hazard control options will continue to protect public health and safety for all licensed operations.

10. Other Significant Changes in the Public Safety Criteria

To enable the scalability afforded by different hazard control strategies, a move toward performance-based regulatory language, and the consolidation of the launch and reentry licensing regulations, the FAA has proposed other significant changes to its rules. Most notably, apart from specifically added flexibilities, the NPRM contains additions to the public safety criteria. The proposal to enable neighboring operations personnel was discussed in some detail earlier, but the FAA has also proposed the addition of consequence protection criteria used for determining the need for and reliability of a flight safety system, and critical asset protections. These changes are attempts to better align the proposed regulatory regime and the performance thresholds with the statutory mandate of the FAA to protect public health and safety, and the safety of property, and national security and foreign policy interests of the United States.

The proposal to implement consequence protection criteria as a determinant for whether a vehicle stage must use flight abort as a hazard control strategy during launch or reentry may be the most significant change to the public safety criteria in the proposed rule. If the consequence of any reasonably foreseeable vehicle response mode in any one-second period of flight is greater than the conditional expected casualties threshold for uncontrolled areas, then the operator must be able to abort the flight using a flight safety system.

Conditional expected casualties (CE_C) is the potential consequence, measured in terms of collective risk, without regard to the probability but instead assuming that a failure event will occur. Effectively, CE_C represents the consequence of the worst foreseeable events during a launch or reentry and is meant to protect the uninvolved public from an unlikely but catastrophic event. Flight safety systems (FSS) and flight abort are a traditional means of reliable hazard control that are known to protect against such low-probability, but high consequence events.

The consequence protection limit would apply to all phases of flight, unless otherwise agreed to by the FAA based on the demonstrated reliability of the launch or reentry vehicle during that phase of flight. Captive carry of a rocket by a certificated aircraft is an example of when the use of an FSS would likely not be necessary even if the CE_C would be above the threshold. The demonstrated high reliability of any given certified aircraft would likely obviate the need for a high reliability FSS.

Aside from determining the need for flight abort with a reliable FSS as a hazard control strategy, the FAA also proposes to use CE_C to scope the needed reliability standards for any required FSS, and to determine when to initiate a flight abort. In this way, the FAA seeks to make the FSS requirement more adaptable and scalable so that if the potential consequences from an unplanned event mandate an FSS for safety, the less severe those consequences are, then the less stringent the requirements will be. The FAA believes this is an improvement on the current ELV regulations in part 417, which mandates a one-size-fits-all FSS regardless of the individual and collective risks, or the consequences in the case of a catastrophic event. Besides requiring a potentially overly reliable and expensive FSS, the part 417 hazard control approach also has the potential to limit vehicle flight paths unnecessarily, even when those flight paths would produce low public risks and potential consequences. The introduction of CE_C to scale both the reliability of the FSS and the level of rigor for the flight abort requirements is meant to remove the unnecessary burden of those current requirements while maintaining best safety practices for all types of launch and reentry vehicles.

In addition to the consequence protection criteria as a means to scope FSS requirements, the FAA has also proposed the addition of the property protection criteria to the overall public safety criteria. The FAA has a statutory mandate to protect property, but it also has a mandate to protect the national security interests of the United States. One of the key aims of the streamlining effort is to remove duplicative requirements between the FAA and other government entities, like the federal ranges. To enable our government partners to reduce their requirements on

launch and reentry operators and entrust the FAA with the oversight, the proposed rule would protect the continuing functionality of critical assets at those sites.

A critical asset would be defined as an asset that is essential to the national interests of the United States, as determined in consultation with relevant federal agencies. Critical assets would include property, facilities, or infrastructure necessary to maintain national defense, or assured access to space for national priority missions. Certain military, intelligence, and civil payloads would also be considered critical assets, including essential infrastructure when directly supporting the payload at the launch site. In setting a property risk criteria that mandates a low probability of loss of functionality for each critical asset, the FAA seeks to advance the goal of common standards for launches from any U.S. site.

The FAA has proposed these new criteria as a means of introducing hazard control scalability and reducing regulatory redundancy. The public safety criteria are the outcome-based thresholds that articulate "how safe is safe enough," and would be comprehensive and common to all U.S. commercial space operations.

11. Applications and Additional Flexibility

The FAA's stated and specific goal in this effort is to streamline the application process and to enable safe innovation in the U.S. commercial spaceflight industry. To those ends, the FAA has proposed a number of application process improvements to reduce uncertainty, expand flexibility, and reduce the burdens of applying for a launch or reentry license.

The FAA proposed to relax the requirements about when a commercial space vehicle operator license is needed by amending the definition of the beginning of launch to commence at the start of hazardous activities that pose a threat to the public. The current definition of launch is inflexible and requires a license to be obtained for any operational activity after the arrival of a launch vehicle or payload at a U.S. launch site. The FAA has granted frequent waivers allowing operators to delay the need for a license until the commencement of hazardous activities. These waivers were granted in recognition that in many cases the current requirement is more restrictive than public safety requires.

To limit FAA oversight to those launch operations that pose a hazard to public safety and the safety of property, the FAA has proposed to amend the beginning of launch such that launch begins with the first hazardous activities related to the assembly and ultimate flight of the launch vehicle at a U.S. launch site. For ease of administration and clarity, the FAA has also proposed that absent a later point that has been agreed to by the FAA, hazardous preflight ground operations would be presumed to begin when the launch vehicle or its major components arrive at the launch site, however it is expected that nearly all operators would be easily able to identify a later point at which hazardous operations begin for their launch system and obtain the necessary FAA agreement.

The FAA is seeking to enable flexible timeframes that can be tailored to specific operations and business practices in other ways as well. The FAA has proposed to add the clause "as agreed to by the Administrator" for most of the timeframes throughout the proposed regulations. For these timeframes, an operator may submit an alternative to the proposed requirement to the FAA (ideally during pre-application consultation) for review and agreement.

The proposal includes additional process flexibility in the proposed incremental application reviews and approvals. Industry made clear that operators were seeking a way to make the application process modular, to obtain FAA approvals more in line with the design and testing process, and in so doing obtain more schedule assurance. The FAA is directed by statute to issue or deny a launch or reentry license no later than 180 days after accepting an application or to report to Congress why it was unable to do so.

The FAA sought to enable a modular application and review process that meets the statutory requirement but is neither too prescriptive to be useful to all operators nor sets impossible timeframes for FAA safety reviewers who often review application elements in parallel. The proposed incremental review process would empower operators to better define when certain portions of an application are reviewed prior to their formal submission and would allow an operator that has satisfied certain requirements early to receive credit for those portions of its application in advance.

In this way, the FAA proposes to enable applicants to work with the FAA towards an incremental review process that is aligned to both the development process for an applicant and the necessities of the FAA's evaluation framework,

rather than codifying a more limited process fully defined by regulations.

The FAA is also seeking to give credit to applicants for prior evaluation and approvals by enabling operators to apply for a safety element approval concurrent with license application. Safety element approvals under part 414, formerly just "safety approvals," are an FAA-issued determination that a safety element, when used or employed within parameters defined by the determination, will not jeopardize public health and safety or safety of property. Safety elements can include any vehicle, safety system, process, service, or personnel and a safety element approval allows applicants to employ that element during a license application without the FAA's reevaluation (to the extent its use is within its approved envelope).

By authorizing applicants to designate portions of their license application as a request for a safety element approval, the FAA hopes to encourage use of such approvals. The FAA proposal to streamline the process for obtaining safety element approvals would further formalize the elimination of duplicative or repetitive reviews for safety elements that rarely change from license to license.

12. Alternative Means of Compliance

One of the biggest steps towards performance-based flexibility in the FAA's proposal is the expansion of opportunities to utilize new acceptable means of compliance to the proposed regulations. An acceptable means of compliance is one means, but not the only means, by which a requirement could be met. Most of the proposed regulations would be satisfied by any means that sufficiently demonstrates compliance. However, the FAA has identified five areas where any means of compliance must be pre-approved. These five sections represent areas of safety concern where the FAA has proposed that it needs to continue to prescribe specific hazard controls, but the FAA is seeking to expand the ability to use alternative means of compliance even to these sections if they are approved by the FAA prior to the submission of a license application. For all other sections, applicants may submit alternative means of compliance as part of their application.

Specifically, for five of the proposed requirements, an operator would have to demonstrate compliance using a means of compliance that has been approved by the FAA before an operator could use it in a license application. These five requirements are flight safety systems, flight safety analysis methods, lightning flight commit criteria, and the sections on airborne toxic concentration and duration thresholds. Any operator may propose to demonstrate compliance with one of the five requirements through use of a means of compliance not previously accepted by the FAA. For these five sections, the FAA would have to review and accept the proposed alternative methods prior to an operator using that means of compliance to satisfy those licensing requirements.

Approving new means of compliance is easier to accomplish than updating regulatory standards through the rulemaking process. Therefore, the proposed regulatory scheme would be more adaptable to the fast-evolving commercial space industry. A potential applicant, an existing license holder, a consensus standards body, any individual, or any organization would be able to submit means of compliance documentation to the FAA for consideration and potential acceptance for the five areas discussed above. This process will also enable the development of unique means of compliance, like the "tailoring" of safety standards practices at federal launch ranges, which the FAA cannot accept through other regulatory mechanisms. Although applying for the acceptance of a new means of compliance may take time, once an operator's unique means of compliance is accepted by the FAA, the operator can use it in future license applications. The FAA believes this is the best approach to enabling new ways of achieving acceptable levels of safety through industry innovation.

In the long run, the FAA expects the ability to secure early approvals, timeframe flexibility, and propose alternative means of compliance will enable expedited licenses application review. The FAA also hopes to encourage industry to develop voluntary consensus standards, unleash novel but safe launch and reentry systems, and achieve efficiencies.

13. Next Steps

The FAA's proposal was released for public review and comments from April 15 to August 19, 2019. One hundred and fifty-four submissions were received.[14] The comments are being diligently reviewed so the FAA can amend its proposal, if appropriate. Beyond the regulatory revisions, the FAA has charted a number of next steps to supplement and augment the impact of the proposed regulatory reform. This important work is already underway and will be completed in tandem with any forthcoming regulatory publications.

First and foremost, the FAA is committed to publishing guidance documents to detail possible means of compliance to the more-flexible performance-based regulations. With previous performance-based regulations, the FAA has received comments that some regulated entities (especially small companies) do not know how to comply with regulations that do not contain more specific direction on what is acceptable. It is necessary for the FAA to offer that guidance, but the FAA is seeking to move that information out of prescriptive regulations and into FAA advisory circulars. Some of the identified means of compliance are also likely to be existing governmental or industry standards. These advisory circulars or identified standards will ameliorate some of the ambiguity of performance-based rules and will give potential applicants at least one means of compliance that will be accepted by the FAA. As guidance, advisory circulars and accepted standards will pave the way for innovative approaches and means of compliance tailored to new operational practices enabled by outcome-based regulations. This approach recognizes that it is significantly easier to update guidance documents as safety practices change than it is to update regulatory language.

One of the primary complaints operators expressed at the outset of this process was that FAA regulations and federal range requirements are duplicative and inconsistent. The FAA cannot regulate the requirements of another government agency, and the FAA cannot designate or ignore its own statutory mandates, but the FAA is taking steps to reduce the burden on operators and better harmonize or eliminate overlapping requirements with those agencies.

The FAA currently accepts flight safety analyses performed by the Air Force on behalf of an operator without additional analysis and expects to continue to do so. To streamline interagency processes, the FAA is discussing with other departments how to identify areas of concern and develop approved coordination processes that satisfy each department's obligations while reducing the impact on operators. Currently the FAA is finalizing a memorandum with the Air Force to streamline commercial launch and reentry requirements at their federal ranges. The FAA is also leveraging the multi-agency Common Standards Working Group (CSWG) to better work towards common requirements overall.

In response to the regulatory streamlining, the FAA is also looking to be more effective in its processes. One of the most visible ways the FAA is working towards better processes is by reorganizing its office that manages commercial space transportation. The FAA's commercial space licensing workload has grown tenfold, and while its launch and reentry licensing staff has grown, the FAA has not been able to keep staffing pace with the increased workload. To increase efficiency and address the growing number of license applications from industry, the new structure will be aligned to more appropriately implement the new rule and reduce review periods where possible. The proposed new regulatory flexibilities are expected to create some additional work for the licensing staff, but the FAA is confident that the new structure and some new tools, like improved license and issue tracking, can offset increased evaluation work.

Through regulatory flexibility, enabled by performance-based regulations and requirements that are more adaptable to evolving business practices, the FAA seeks to open the door for a 21st century licensing process that can approve exciting new technologies for the growing launch and reentry industry. Improved processes for approving commercial space transportation operations clears the path for our economy and our future, while never losing sight of our responsibility to safeguard the public. The FAA hopes to build a regulatory regime that can unleash American innovation and secure the promises made about the potential of these exciting times.

References

[1] FAA regulations can be found at: https://www.faa.gov/about/office_org/headquarters_offices/ast/regulations/

[2] 51 USC Chapter 509 is available at https://www.faa.gov/about/office_org/headquarters_offices/ast/legislation_policies/

[3] Ibid. Executive Order 12465 was signed by President Reagan in February 1984, before Congress passed the CSLA. The Executive Order designated the Department of Transportation as the lead agency within the Federal government for encouraging and facilitating commercial ELV activities by the United States private sector. In 1995, the Office of Commercial Space Transportation was transferred from the DOT Office of the Secretary to within the Federal Aviation Administration.

[4] See "Certification Versus Licensing for Human Space Flight in Commercial Space Transportation," Federal Aviation Administration, IAC-12-D6.1.3, (2012 International Astronautical Congress) Available at: https://www.faa.gov/about/office_org/headquarters_offices/ast/programs/international_affairs/

[5] Commercial Space Transportation Reusable Launch Vehicle and Reentry Licensing Regulations, Final Rule. 65 FR 56617, Federal Register, Vol. 65, No. 182, September 19, 2000.

[6] "Space Policy Directive-2 Streamlining Regulations on Commercial Use of Space," The White House, May 24, 2018. https://www.whitehouse.gov/presidential-actions/space-policy-directive-2-streamlining-regulations-commercial-use-space

[7] Ibid.

[8] Ibid.

[9] Ibid.

[10] The Regulatory Flexibility Act of 1980 instructed agencies to consider regulatory alternatives such as "the use of performance rather than design standards…"

[11] **"**Revision of Airworthiness Standards for Normal, Utility, Acrobatic, and Commuter Category Airplanes; Proposed Rule", Federal Register, Vol. 81, No. 49, page 13452, March 14, 2016.

[12] "Streamlined Launch and Reentry Licensing Requirements," FAA-2019-0229, https://www.regulations.gov/docket?D=FAA-2019-0229

[13] Ibid.

[14] Ibid.