

Permission to Launch? The Mission Authorization Gap for Novel Space Activities

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Honor Pledge

On my honor as a student, I have neither given nor received unauthorized aid on this assignment.

Glossary

DOC: Department of Commerce

DOT: Department of Transportation

FAA: Federal Aviation Administration

ICUAS: International Conference on Unmanned Aircraft Systems

Mission Authorization: The licensing process for private space activities (Swope, 2023). These licenses are required to ensure compliance with the requirements of Article VI of the Outer Space Treaty. It is a precautionary measure to protect global space safety and keep track of actors in the case of damages to the U.S. or other member states.

Novel Space Activities: Private space activities that are not currently regulated under the U.S. regulatory framework (NSC, 2023).

NSC: National Space Council

OSC: Office of Space Commerce

OST: Outer Space Treaty of 1967. The multilateral treaty that is the basis of international space law. According to Article VI, states party to the treaty must ensure private space actors comply with treaty provisions (United Nations, 2002). The OST requires nations to develop frameworks that discourage or prohibit risky private space endeavors, including authorizing all missions into space.

RPS: Radio-isotope power systems. Zeno Power's product. They are compact devices that convert the heat from decaying radioisotopes into a supply of clean energy. RPSs using Plutonium-238 have long been used on many government space missions, such as NASA's Voyager and New Horizons Missions (Zeno Power, 2024).

Executive Summary

In recent years, the space industry has boomed, and its growth is expected to continue. The space economy will be worth \$1.8 trillion by 2035 and play a pivotal role in aiding American progress (Khlystov, 2024). It is projected that the commercial space market will increase access to education, healthcare, and economic activity and will enable the precise monitoring of agriculture and economic changes through bridging digital divides (Khlystov, 2024). Space technology influences countless aspects of daily life. Commercial organizations are the backbone of this modernization.

Maintaining a powerful space industry leads to economic, innovative, and national security benefits. All commercial space actors should be given equal opportunity to pursue this goal. Regulations ensure that the United States can reap the benefits of a thriving, diverse commercial space industry safely. The lack of mission authorization regulation for novel space activities creates unequal opportunities and limits the potential of the commercial space industry. As innovation goes beyond Earth, the need for clear and forward-thinking regulations has become as critical as the technology that propels us there.

This report offers a recommendation Zeno Power should promote to address the problem of the lack of mission authorization regulation for novel space activities. This analysis examines three alternative solutions to this problem that will benefit novel space activities as well as the United States. The three alternatives are:

1. Status Quo
2. Sole Authority Regulation
3. Dual Authority Regulation

Each alternative was assessed on its effectiveness, equity, political feasibility, and administrative burden. Based on the outcome of this analysis, it is recommended that Zeno Power advocate for the adoption of the sole authority alternative. This recommendation will create a clear regulatory pathway for novel space activities to receive mission authorization. The sole authority model functions under a presumption of approval and a strict timeline for review before granting or denying mission authorization. Sole authority concentrates regulatory power under one department, cultivating expertise and maintaining a fast, safe regulatory process. Implementation of this recommendation will require passing an amended version of a proposed piece of House of Representatives legislation. Zeno Power together with other novel space activities must place pressure on members of Congress to promote the sole authority approach as well as inform the public of the urgency of this issue.

Creating a clear regulatory avenue for mission authorization of novel space activities limits barriers to the growth of a diverse and powerful commercial space industry. Space is an increasingly important domain for innovation, security, and economic opportunity. Adoption of the sole authority alternative will assist novel space activities in contributing to this domain's potential.

Introduction

Mission authorization is the process of granting commercial space actors government approval for launch. The Outer Space Treaty (OST) is the basis of international space law. Article VI outlines that states party to the treaty must ensure private space actors comply with treaty provisions and requires nations to develop frameworks that discourage or prohibit risky private space endeavors (Swope, 2023). The United States created a mission authorization process for commercial space activities in compliance with the OST. However, novel space activities do not have a regulatory pathway to obtain mission authorization.

Novel space activities are those that are not currently regulated under the U.S. regulatory framework (NSC, 2023). Despite the lack of regulatory coverage, these activities are very important to U.S. capabilities. Some current examples are “commercial activities on the Moon or Mars, commercial services such as satellite repair or on-orbit refueling, or commercial extraction of inspace resources such as water or minerals” (Lindbergh, 2018).

This document presents a set of alternatives to address this problem as well as an analysis of continuing under the current status quo. These alternatives are measured against four criteria: effectiveness, equity, administrative burden, and political feasibility. After analysis, I provide a final recommendation of the best approach to solving the problem below.

Problem Statement:

In 2023, the total U.S. space economy reached \$518.8 billion, and of that, Commercial space activities generated \$445.2 billion in revenue for the United States (Space Foundation, 2024). These values demonstrate that commercial space activities account for over 85% of the U.S. space industry. Demand for commercial space technologies is growing faster than our ability to regulate mission authorization for novel commercial space activities. This problem further concentrates activities within a small number of actors in the industry, grounds projects, and restricts the U.S.’s ability to reap the innovative, national security, and economic advantages that novel space activities can provide.

Client Overview

My APP client is Zeno Power. The organization specializes in clean energy for use in outer space and maritime environments, specifically through Radioisotope Power Systems (RPS). These are small devices that convert heat from decaying radioisotopes into a constant supply of clean energy (Zeno Power, 2024).

Zeno Power’s goals are influenced by the lack of mission authorization for novel space activities because Zeno Power is classified as a novel space activity. The organization’s main goal as a private organization selling RPSs is to maximize sales of their product. Demand for their product is negatively impacted by inconsistent and insufficient regulation of mission authorization for novel private actors in space. The current regulatory process is slow and unclear, limiting project success, and innovative progress.

Zeno Power is also passionate about this problem because nuclear power in space is a national security issue. Without concrete mission authorization regulations, nuclear materials could be improperly used, causing extraterritorial damage as well as potential damage on Earth. This touches on why the problem is societally important. Space leadership is vital for security in our current climate of great power competition. Innovation is a key factor in the United States maintaining its place as the leading space power. Additionally, innovation generates significant

economic benefits that improve the lives of Americans and empower the United States on the world stage.

Zeno Power aims to contribute to these benefits. Addressing the problem now is an integral part of Zeno Power's ability to maximize the advantages of clearer regulation. The sooner a mission authorization process is created for novel space activities, the sooner they can contribute to U.S. innovative efforts, the economy, national security, and maximize their profits. The organization's role in addressing the problem should be sharing the drawbacks that a lack of mission authorization has on novel space activities and lobbying for changes that would benefit the organization and its peers.

Background:

International regulation of space is governed by the OST of 1967. According to Article VI, states party to the treaty must ensure private space actors comply with treaty provisions; it requires nations to develop frameworks that discourage or prohibit risky private space endeavors (Swope, 2023). The United States has developed its own authorization process so that it can ensure private actors are acting in compliance with the OST and U.S. goals. The Federal Aviation Administration (FAA) is currently the entity responsible for granting licenses (mission authorization) for commercial launch and reentry vehicles (Lindbergh, 2018). However, novel space activities are not federally allocated to any regulatory body for licensing. The lack of regulation negatively impacts novel space activities but also restricts the United States' ability to reap the benefits of a thriving and diverse commercial space industry.

Causes and Consequences

Outdated Regulation

International regulation of space governed by the OST of 1967 is outdated. The treaty requires government checks on private actors to ensure global security. This includes authorizing all missions into space. Without mission authorization licenses, missions cannot be launched. The United States has thus developed authorization processes, however, the specific category of commercial actors called "novel space activities" lack a mission authorization process in the United States. This prevents novel space activities from fulfilling missions, as launches without mission authorization would violate international law. Policymakers writing the OST could never have foreseen the level of innovation capable of private entities today, but we still govern according to this law.

The commercial space industry is relatively immature. There was no commercial space launch industry until 1980. Private companies and most foreign governments (other than the former Soviet Union) contracted with NASA to launch their satellites" (Lindbergh, 2018). Regulators were unaware there would be a need for specific private mission authorization because the level of innovation and wealth necessary to achieve this in the past was impossible and thus was not included. This outdated regulation directly conflicts with the advantages innovation can bring the United States. The nature of regulations and space are conflictual. To use the domain for exploration, national security purposes, and scientific discovery, innovation is required to push the limits of what we know and go beyond. However, regulations exist to comply with outdated rules and ensure safety that often exists within strict confines. Space regulation has been a wicked problem and mission authorization for novel space activities is no different.

Legislative Gridlock

Political polarization is a foundational issue contributing to the lack of mission authorization regulation for novel space activities. As the problem is a regulatory issue, there is heavy reliance on the functioning of our government to create new mission authorization laws for novel commercial space entities. Political polarization has acted as an obstacle in this process as efforts to pass new legislation have reached many standstills in Congress becoming the primary root cause of legislative gridlock.

In November 2023, The White House's National Space Council (NSC) released a legislative proposal that would create a licensing process [mission authorization] for private sector novel space activities (Swope, 2024). It is important to note that then Vice President Kamala Harris, who was a presidential nominee, chaired the NSC. The House and the Senate agreed on the importance of this issue and began creating respective bills on the topic. In November, Representatives Frank Lucas (R-OK), House Science Committee chairman, and Brian Babin (R-TX), Science Subcommittee on Space and Aeronautics chairman, introduced the Commercial Space Act of 2023 (Swope, 2024). The Senate has not yet released its bill.

The role of political polarization comes into play because both the executive and legislative branches agree on the necessity of new mission authorization legislation. However, in practice, when the Commercial Space Act of 2023 was presented, Democratic members of the Science Committee voted against the bill because they wanted the White House proposal to succeed (Foust, 2024), likely in efforts to favor presidential candidate Harris. Political competition and tension become more apparent in the fact that the White House revealed its plan for regulation of novel space activities less than one hour before the House committee began their markup meeting of the Commercial Space Act of 2023 (Smith, 2023). This was done intentionally so committee members would have to review the NSC proposal and avoid updating the Commercial Space Act of 2023.

Legislative gridlock contributes to the problem because no new laws can be created. Representative Babin stated that the problem created a "perception of regulatory uncertainty" (Foust, 2024) that diminished the U.S.' international perception as a leading space power. Regulatory uncertainty also disincentivizes economic investments in novel commercial space activities (Clayson et al., 2023). This is because the uncertainty and gridlock can lead projects to take years to get approved if they even reach that point. Losing perception as a leading space power also limits the national security benefits that a diverse and innovative commercial space industry can provide. A weaker international perception decreases our competitiveness with our great power rivals.

Risk Aversion

The federal government increasingly relies on commercial space companies to share the burden of providing public goods (Dodge, 2016). A clear regulatory process for novel space companies will ensure that all commercial space organizations can equally assist in bolstering the national security and economic benefits space provides to the public.

Space is an inherently monopolistic industry. Starting a business in the domain is costly. Established organizations that are not categorized as novel space activities have designated mission authorization processes. Larger space companies do not face the regulatory burden that novel space companies do. They have an official authorization process that is timely and clear, granting them the ability to launch at higher rates than novel space activities.

Lack of mission authorization for novel commercial space activities means that they will either be grounded or take years to go through licensing processes. These setbacks lead to risk

activities that are related to an application for a [launch or reentry] license or permit and are not subject to authorization under other Federal law” (Lindbergh, 2018). Creating a regulatory avenue for novel space activities to get their missions authorized which streamlines this complex net of stakeholders will help the commercial space industry and the United States.

Evidence on Potential Solutions to the Problem:

Crafting a solution to the lack of mission authorization for novel space activities is a government priority today. Legislative action to update or create new mission authorization regulations for novel space activities is what solutions look like for this problem. The U.S. House of Representatives and the NSC have proposed two potential solutions. While all parties acknowledge the need for mission authorization, they disagree on how it should be done (Swope, 2023).

The Commercial Space Act of 2023 is the House of Representatives’ plan. Its purpose is to modernize government oversight of commercial space activities and ensure that the U.S. remains the world leader in commercial space activities (Babin, 2023). There are four main features that would alleviate the policy problem at hand. First, it designates the Department of Commerce Office of Space Commerce (DOC/OSC) as the single authority responsible for the authorization process, specifically including novel space activities (Babin, 2023).

Second, the proposal states that the DOC/OSC will use a presumption of approval approach when reviewing novel space activities’ mission authorization requests. Novel space activities can presume their authorization request will be approved unless the DOC denies the application within a strict 60-day timeline (Foust, 2023).

Third, it proposes the establishment of a Private Space Activity Advisory Committee to monitor the effectiveness and efficiency of the new authorization process, make recommendations on how the U.S. can further promote and facilitate a robust and innovative private space sector, and identify challenges the U.S. private space sector faces (Babin, 2023). This committee would ensure a smooth and supported transition for novel space activities from the current patchwork authorization process to the concrete new process.

Fourth and most relevant to my client, the bill explicitly supports the development and deployment of space nuclear power and propulsion technology as well as proposes a regime for licensing the launch of spacecraft containing space nuclear systems (Babin, 2023). No other regulatory document details how nuclear novel space activities will receive mission authorization. The Commercial Space Act will create a regime to facilitate these organization’s licensing processes.

The NSC’s proposed plan is the United States Novel Space Activities Authorization and Supervision Framework. It is intended to balance economic competitiveness with safety, security, sustainability, and responsibility in the space domain (NSC, 2023). The NSC emphasizes that U.S. national interests are furthered if the U.S. space sector thrives. Developing a clear, comprehensive, and flexible regulatory environment inclusive of novel space activities will maximize the benefits of a thriving private space sector. The NSC model splits mission authorization power for novel space activities between the Departments of Commerce (DOC) and Transportation (DOT). They will authorize and supervise missions, including novel space activities, throughout the lifecycle of space operations, ensuring consistency with U.S. obligations under international law (NSC, 2023).

Like the House’s plan, the NSC proposes the creation of a Private Sector Space Activities Interagency Steering Group. The Secretaries of Commerce and Transportation will co-lead this group comprised of representation from all relevant federal agencies with expertise or equities

pertaining to private sector novel space activities (NSC, 2023). In consultation with the private sector, the group will collate, develop, and promote standards, best practices, and information-sharing protocols to address core U.S. Government interests relevant to novel space activities (NSC, 2023).

Agreed-upon best practices will decide the guidance the Secretaries of Commerce and Transportation will provide to the industry as the main regulators in this model. This plan has a broader scope of regulators than the House's plan. It also allows for the input of private and public sector stakeholders to constantly improve the regulatory environment for novel space activities.

X axis: Split of authority between DOT and DOC

Y axis: Amount of authority given to Executive Branch

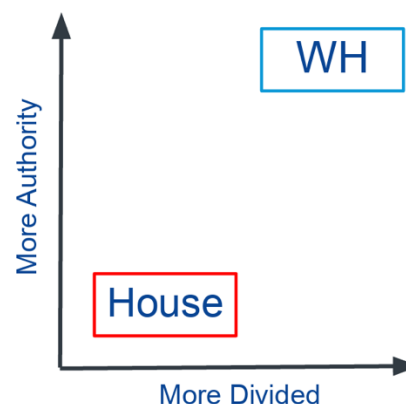


FIGURE 2 (ACES, 2024)

Analogous Examples

Regulation of drones owned by private actors serves as a useful analogous example for observing the outcomes of updating regulations placed on emerging commercial technologies. In the recent past, the drone industry also struggled with an unclear and outdated regulatory environment. Scholars describe the legal frameworks as “fuzzy.” Fuzziness meant that facts or terms were not clearly defined, which created uncertainty in their interpretation and implementation and highlighted a need for further specification for efficient technical implementation (Grebner, 2022). A study by the International Conference on Unmanned Aircraft Systems (ICUAS) found that with a reduction of procedural fuzziness, the strategic planning phase of drone flights (which includes mission authorization) was significantly improved (Grebner, 2022). This was done by clarifying the regulatory language in the strategic planning phase of the drone flight timeline. This study focused on European regulation of drones.

In the U.S. context, in 2016, the FAA created a clear process for the registration of small, unmanned aircraft systems (FAA, 2022). This was known as the small drone rule, which broadened the accessibility of officially registering commercial drones. One year after the change in regulation, more than 80,000 individual drones were registered for commercial and government purposes (FAA, 2017). This analogy demonstrates that in novel space, creating clear regulations can stimulate a commercial boom. Clear regulations allow commercial entities to take advantage of opportunities to enter the market and serve the national interest.

Outcomes & Effectiveness

The solutions in the analogous cases were both effective. The ICUAS study found that clarifying regulatory language enhanced the European drone mission authorization process. Clarifying regulatory language caused a large increase in mission authorization proposals. The authors noted that the increase required the incorporation of automation into the authorization process since tasks could no longer be handled manually as the number of unmanned aerial systems authorization requests increased so much (Grebner, 2022). This is an important insight for the implementation of new regulations in the U.S. The incorporation of AI and automation

into the authorization process could speed up the regulatory process and lower the administrative burden on U.S. agencies.

The second analog example demonstrated that implementing new, clear regulations did increase the commercial registration of drones. Applying these lessons to this policy problem in a parallel domain could mean that updating regulation would increase the number of novel space activity missions authorized and diversify the space industry.

Reliability of Evidence

Focusing on the drone analogs, the policy changes demonstrate reliable evidence that updating or creating regulations for commercial technology increases authorization or registration. While we cannot be certain that creating the small drone rule was the causal reaction for an increase of 80,000 drone registrations, the correlation between the new regulation and an increase in the registration of novel drones is strong. The ICUAS study demonstrates the utility of clear commercial drone regulation as the number of authorization requests rose so much that there was a need for automation to manage the number of requests.

A limitation of these analogs is that they are not in the space industry. Regulation of drones and novel space activities may have significant differences that would not translate into these successes carrying over to mission authorization for novel space activities. A drawback of the ICUAS study is that the report states that a reduction in procedural fuzziness leads to significant improvement but does not quantify that amount. It would be beneficial to have a quantitative figure associated with this policy implementation.

Another limitation is that the ICUAS example is not a U.S. policy implementation. Since all nations party to the OST create their own mission authorization process, the U.S. space regulatory environment may be too different from the European drone regulatory environment for these successes to be replicable. However, drones have similar benefits and risks to novel space activities which could provide strong evidence that these policy implementations could be successful in U.S. regulation. Additionally, in the case of the small drone rule, the FAA is the current regulator of both novel space activities and small drones, further justifying the similarities between these examples and their regulatory environments.

The House and NSC proposals were developed by policy and technical experts. Public/private subject matter experts crafting these proposals add credibility to their content. The main limitation of proposed solutions in the U.S. is that the commercial space industry is nascent. There have been few policy solutions implemented that provide evidence of positive causal outcomes. Furthermore, this limits policymakers' ability to mirror previous successes in the case of this policy problem because there are few, if any at all.

Alternatives

This analysis presents three alternatives to the problem at hand: status quo, sole authority, and dual authority. The sole authority and dual authority alternatives were developed based on existing proposed legislation. Sole authority is based on the Commercial Space Act of 2023 and Dual Authority is based on the United States Novel Space Activities Authorization and Supervision Framework. The analysis will judge the alternatives based on the proposals as they exist in the regulatory realm today.

1.) Status Quo

The first alternative is to maintain the status quo. No legislative changes are necessary to maintain the status quo. The FAA is currently the entity responsible for granting licenses (mission authorization) for commercial launch and reentry vehicles (Lindbergh, 2018). However, novel space activities are not federally allocated to any regulatory body for licensing. The Space Frontier Act of 2018 acts as a temporary solution to this problem because it allows the FAA “to authorize nongovernmental space activities that are related to an application for a [launch or reentry] license or permit and are not subject to authorization under other Federal law” (Lindbergh, 2018). The current process that does not explicitly include novel space activities is also complex and lengthy. It involves three steps: a pre-application consultation, application evaluation, and finally, license issuance or denial (Clayson, 2023). The first step has no time limit for response, meaning an application can collect dust. Once the FAA begins the evaluation process, there is a 180-day limit on that evaluation, but this stops if the application has an issue, or the FAA needs more information (Clayson, 2023). The current process can take years to approve new projects. This is a further disadvantage to novel space activities as they are not covered by current regulations, increasing the likelihood of the FAA requiring more information from them. Despite the lack of clarity in regulation and the negative consequences, novel space activities can still pursue mission authorization. Continuing the use of this system will be the maintenance of the status quo.

2.) Sole Authority Regulation

The second alternative is mission authorization for novel space activities governed by one regulatory body that works under a presumption of approval with the input of a public-private sector committee. All mission authorization license requests will be sent to one authority that will grant or deny requests for all private space companies, including novel space activities. The sole authority will presume a mission authorization request will be approved unless the novel space activity fails a security investigation that must be completed within 60 days. The sole regulatory authority will be the DOC/OSC. To achieve this change, a legislative agreement must be met to designate authority to a singular department and specifically include a novel space activity mission authorization protocol.

This idea is currently being proposed in the House of Representatives plan for mission authorization, the Commercial Space Act of 2023. Its purpose is to modernize government oversight of commercial space activities and ensure that the U.S. remains the world leader in commercial space activities (Babin, 2023). According to the bill, the DOC/OSC will be the single authority responsible for the authorization process, specifically including novel space activities (Babin, 2023). This is because mission authorization is required specifically for private space companies, classifying their activities as commerce. The DOC/OSC’s primary goal is to foster economic growth in the commercial space industry and currently licenses commercial remote sensing satellites (Smith, 2023). The Commercial Space Act would expand its authority to grant mission authorization licenses to all novel space activities.

The bill also proposes the establishment of a Private Space Activity Advisory Committee to monitor the effectiveness and efficiency of the new authorization process, make recommendations on how the U.S. can further promote and facilitate a robust and

innovative private space sector, and identify challenges the U.S. private space sector faces (Babin, 2023). This committee would ensure a smooth and supported transition for novel space activities from the current patchwork authorization process to the concrete new process. Also, the committee will ensure the OSC avoids other potential problems due to lack of clarity in regulation.

Third and most relevant to my client, the bill explicitly supports the development and deployment of space nuclear power and propulsion technology and proposes a regime for licensing the launch of spacecraft containing space nuclear systems (Babin, 2023). No other regulatory document details how nuclear novel space activities will receive mission authorization. The Commercial Space Act will create a regime to facilitate these organizations' licensing processes.

3.) Dual Authority Regulation

The final alternative is mission authorization for novel space activities governed by two regulatory bodies with the input of a public-private sector committee. All mission authorization license requests will be divided between two authorities, the DOC and the DOT, which will grant or deny requests for all private space companies, including novel space activities. To achieve this change, a legislative agreement must be met to designate authority between two departments and specifically include a novel space activity mission authorization protocol.

This is the NSC's proposed plan, the United States Novel Space Activities Authorization and Supervision Framework. It is intended to balance economic competitiveness with safety, security, sustainability, and responsibility in the space domain (NSC, 2023). The NSC model splits mission authorization power for novel space activities between the DOC and DOT. Their responsibilities will be divided based on prior expertise. The DOT currently licenses space launch and Earth reentry for non-novel space activities. They also currently regulate the safety of humans in space, in Earth orbit, and during launch (Smith, 2023). The NSC's proposal would also expand its regulatory authority to in-space transportation for delivering goods from one point to another in space, including delivering fuel from space fuel depots to space stations and to/from the lunar surface (Smith, 2023). The DOC currently licenses commercial remote sensing satellites. This element of the NSC plan is most relevant to the central problem. The NSC proposes that the DOC also license all novel space activities that are not human-related. Otherwise, they will be assigned to DOT, including in-space assembly, manufacturing, and active debris removal (Smith, 2023). DOC will authorize and supervise missions, including novel space activities, throughout the lifecycle of space operations, ensuring consistency with U.S. obligations under international law (NSC, 2023). Developing a clear and comprehensive regulatory environment inclusive of novel space activities will maximize the benefits of a thriving private space sector.

Like the first alternative, the NSC proposes the creation of a Private Sector Space Activities Interagency Steering Group. The Secretaries of Commerce and Transportation will co-lead this group comprised of representation from all relevant federal agencies with expertise or equities pertaining to private sector novel space activities (NSC, 2023). In consultation with the private sector, the group will collate, develop, and promote standards, best practices, and information-sharing protocols to address core U.S. Government interests relevant to novel space activities (NSC, 2023). Agreed-upon best

practices will decide the guidance the Secretaries of Commerce and Transportation will provide to the industry as the main regulators in this model. This alternative, with authority in the hands of DOT and DOC, has a broader scope of regulators than the first alternative. This ensures that the best decisions are made and maintains a slow mission authorization process that is cautious of national security. It also allows for the input of private and public sector stakeholders to constantly improve the regulatory environment for novel space activities.

Criteria

- **Effectiveness:** This will be operationalized in how effective an alternative is at creating a clear mission authorization process for novel space activities. This can be determined by whether it increases the number of novel space activity mission authorization approvals. How an alternative approves missions that will contribute to U.S. national security, innovation, and economic growth will also influence effectiveness. To quantify this for comparison, I will assign each alternative an effectiveness score on a scale of -3 to +3, with +3 being the most effective and -3 being the least effective.
- **Equity:** This will be operationalized in how much an alternative increases access to the commercial space industry. An alternative will score highly on equity if it is successful in diversifying the space industry. This criterion is important because it represents how much an alternative was successful in diversifying the space industry and thus boosting U.S. innovation. To quantify this for comparison, I will assign each alternative an equity score on a scale of -3 to +3, with +3 being the most equitable and -3 being the least equitable.
- **Administrative Burden:** This can be operationalized by how much an alternative will disrupt the current regulatory process and how much effort implementation will require. This can be measured by the amount of regulatory responsibility gained or lost by different organizations. Points will be assigned on a scale of -3 to +3, with positive three being the least additional administrative burden and negative three being the converse.
- **Political Feasibility:** This can be operationalized by how likely an alternative will be to get political support. To measure this criterion, I will also use a point scale of -3 to +3. I will assign positive points to the degree of how much a political group is likely to support the alternative and negative points if they are likely to oppose the alternative. The likelihood will be derived from historical voting trends on related issues.

Analysis

1. Status Quo

Effectiveness

This alternative is not effective as it does not create a clear mission authorization process for novel space activities. The status quo process is a complex and lengthy process that does not explicitly outline steps for novel space activities. This alternative would not increase the number of novel space activity mission authorization approvals. The status quo limits novel space activities that could contribute to broader innovation, security, and economic growth through participation in the commercial space industry. The status quo maintains barriers to entry and thus does not improve the effectiveness of the industry. One benefit is that even though the novel space activities that could create technology to bolster national security are

limited by this alternative, the unclear process does not allow for risky projects to receive mission authorization either. The lack of a clear regulatory process impedes beneficial novel space activities from getting their missions authorized but also potentially dangerous novel space activities, keeping the U.S. safe but stifled from innovation. Since no change has been made, there is no increase in novel space activity mission approvals or benefit to U.S. interests, earning this alternative an effectiveness score of -3.

Equity

This alternative is not equitable. The status quo alternative does not increase access to the commercial space industry. The current mission authorization process for novel space activities leads to an element of the unknown that leads to hesitancy from potential investors in new and exciting technologies, reducing the industry's ability to translate innovative ideas into fielded capabilities (Clayson, 2023). The status quo does not diversify the commercial space sector as novel space activities are not included in regulations that would support their missions and goals. Equity score: -3.

Administrative Burden

There would be no administrative burden associated with the outcome of this alternative as there would be no change in regulatory authority and no effort to implement it. This makes this alternative appealing as there would be no effort to achieve this outcome. Score: 3.

Political Feasibility

This alternative is somewhat politically feasible. No political action would need to be taken to achieve this alternative. However, politicians and industry leaders understand the value of the commercial space industry to the U.S. economy and national security. There is pressure from the public to make political changes to foster this innovative environment by creating a novel space activity mission authorization framework. This alternative is also an attractive option if stakeholders cannot come up with a better approach to mission authorization for novel space activities. Despite the process being long and unclear, novel space activities can still pursue mission authorization even if they are at a disadvantage. Since no political changes need to be made to achieve this alternative, matched with the fact that inaction could lead to a negative political reputation, this alternative receives a political feasibility score of 2

2. Sole Authority

Effectiveness

The sole authority alternative would effectively create a clear mission authorization process for novel space activities as its designation of authority assigns one body to manage this issue. At the most basic level, sole authority will provide an avenue for novel space activities to pursue licensing where there wasn't one before.

Presumption of approval enhances this alternative's effectiveness. Novel space activities can presume their authorization request will be approved unless the DOC denies the application within a strict 60-day timeline (Foust, 2023). An application will be declined if the novel space activity does not meet the outlined expectations for U.S. security. This strict security review process ensures that only novel space activities that will not harm U.S. national security receive authorization after the 60-day review. Additionally, Novel space activity mission authorization requests will increase because most companies applying for

authorization have created products that promote U.S. security and economic interests. Sole authority creates an avenue for novel space activities to apply for mission authorization, increasing the ease of application and presuming approval will likely lead to more novel space activities getting their missions authorized. As mission authorization approval for novel space activities increases so will the diversity of the industry, strengthening the U.S. innovative power and its competitiveness with its great power peers.

Providing clear timeline expectations for novel space activities' mission authorization approval increases this alternative's effectiveness. Private companies applying for mission authorization want the quickest turnaround possible to get their missions off the ground. Delays incentivize firms to pursue alternate regulators, such as conducting business abroad (Clayson, 2023). A strict 60-day timeline assists novel space activities' planning while also reducing risk for investors. They can expect their investments to lead to returns if they support a novel space activity project that is expected to pass the investigation conducted by the sole authority. Lowering risk aversion with presumed approval and a clear timeline increases the effectiveness of this alternative because there will be more investment in novel space companies, more applications being requested, and thus more mission authorization licenses granted. This streamlined process is faster but does not sacrifice security. All mission authorization requests must pass the security review process, this alternative simply outlines a time limit for the experts in the DOC/OSC to complete this review. More novel space activities being successful in the industry will lead to U.S. economic progress because more individuals will have the chance to work in the industry, sell their products, and thus contribute to the U.S. economy by putting money back in the system.

The nature of sole authority relying on only one regulatory body for mission authorization management makes this alternative effective. Mission authorization licenses must pass through only one body for approval, concentrating expertise and shortening the regulatory timeline. Specialization in mission authorization regulation enhances U.S. national security because regulators in the sole authority model will be experts who solely dedicate their time to ensuring novel space activities that receive approval are safe, innovative, and thus beneficial to the economy. A faster mission authorization process will increase the number of novel space activity missions authorized.

The addition of a Private Space Activity Advisory Committee will ensure that DOC can be proactive in solving any future mission authorization kinks. Collaboration between the public and private sectors can ensure that the process works best for all parties and the United States as a whole. A clear and smooth mission authorization process will increase mission authorization, U.S. interests, and effectiveness.

Lastly, sole authority regulation specifically includes novel nuclear space activities. Broadening the scope of novel space activities that can apply for mission authorization will inherently increase the number of them approved. As previously stated, as mission authorization approval for novel space activities increases, so will the diversity of the industry, strengthening U.S. innovative power and its competitiveness with its great power peers.

Sole authority's creation of a clear mission authorization process for novel space activities in conjunction with all these factors will increase the number of novel space activity mission authorization approvals and promote U.S. national interests through the commercial space industry. Effectiveness score: 3

Equity

The sole authority alternative increases equity in the commercial space sector. The creation of a clear, streamlined regulatory avenue for novel space activities allows for organizations that were not previously covered by regulation to pursue mission authorization. Creating a regulatory structure for all commercial space activities increases access to the market and combats the monopolistic nature of the industry. The expansion of opportunity is exacerbated by the sole authority alternative's inclusion of novel nuclear space activities into the regulatory process. A mission authorization process for these companies creates an environment where diverse U.S. innovation can be explored. More novel nuclear space activity mission authorization approvals provide the U.S. leverage with its peers on several levels of commercial space innovation. A mission authorization process for these novel nuclear space activities expands access to the industry, increasing its equity.

The presumption of approval used by the sole authority breaks down barriers to investment for novel space activities. This element will increase investment in novel space activity missions because now there is a higher likelihood that their missions will be approved. Increasing investment in novel space activities provides a more equal field for these companies against commercial space giants that allows for innovation to grow. Decreasing the risk of investment through the presumption of approval increases equity as diverse novel space activities can now enter the market with higher chances of financial support.

The Private Space Activity Advisory Committee increases equity because it ensures that once sole authority is implemented, there will be constant oversight to ensure the industry is open to all. This group creates a space where public and private sector actors can communicate the successes and drawbacks of this alternative. Any issues impacting U.S. innovation can be addressed in real-time, ensuring equitable collaboration in the commercial space industry.

Sole authority's creation of a clear mission authorization process for novel space activities, inclusion of nuclear actors, and public/private sector collaboration will increase diversity in the commercial space industry. Equity score: 3

Administrative Burden

Sole authority carries some administrative burden. This stems from the fact that the DOC/OSC will be taking on new responsibilities, including mission authorization of novel space activities. Implementation of the sole authority alternative would move the OSC, currently within the National Oceanic and Atmospheric Administration, into the main DOC (Foust, 2023). This transition would create some administrative burden; however, the DOC already has expertise in certain aspects of commercial space. The DOC currently licenses commercial remote sensing satellites. Employees will have to undertake responsibility for expanding their knowledge on novel space activity mission authorization. This is a substantial additional burden. However, the authorization security investigation process follows clear requirements that already exist. Employees can rely on this when becoming familiar with their new responsibilities. This alternative will not require the hiring of new employees or building new facilities, which will not add any administrative burden. Due to the additional burden of employees having to undertake new responsibilities and shifting the placement of the OSC, this alternative receives an administrative burden score of -2 as it increases the administrative burden.

Political Feasibility

The sole authority alternative is somewhat politically feasible. The Commercial Space Act of 2023 that this alternative is based on was introduced in the House of Representatives in November 2023. After being presented, it was ordered to be amended by the Committee on Science, Space, and Technology by a vote of 21 yeas and 17 nays (Congress.gov, 2023). While this bill did get sent back to the committee for updates, the vote margin was close. After the committee's amendments, the bill will be sent to the Senate for reconciliation (Usynin, 2023). Commercial space is a bipartisan issue, as both sides understand the economic and security benefits of a thriving U.S. space industry. Many in the industry view the sole authority approach as the better option and may place pressure on legislators when it comes time to vote. For example, Mat Dunn, the Senior Director of Global Business & Government Affairs at SpaceX wrote in support of the Commercial Space Act and stated that "this timely legislation would put into action important policy updates and regulatory modernization that is essential to maintaining the competitiveness of the U.S. commercial space industry while protecting public safety" (Committee of Science, Space, and Technology, 2023). The new presidential administration has led SpaceX CEO, Elon Musk, to become very influential in U.S. politics. The support of this space giant could demonstrate potential political success for the sole authority alternative. Sole authority was not initially politically accepted, but after amendments, it is projected to be well accepted and promoted by external political actors. This alternative receives a political feasibility score of 3.

3. Dual Authority

Effectiveness

The dual authority alternative would effectively create a clear mission authorization process for novel space activities as its designation of authority assigns two bodies to manage this issue. At the most basic level, dual authority will provide an avenue for novel space activities to pursue licensing where there wasn't one before.

The nature of this alternative, which relies on two government agencies to conduct the mission authorization process, makes it slower. Before granting a license, each department is required to coordinate with several other federal agencies, such as the National Aeronautics and Space Administration, the Department of Defense, and the Federal Communications Commission (Swope, 2023). The DOT and DOC have slightly different responsibilities, but the additional guardrails of another organization's double-checking mission authorization requests add substantial time to an already lengthy process. There is concern in the industry that the dual authority approach would create duplicative and conflicting requirements between the two agencies (Foust, 2023). Lack of clarity is a factor that currently limits the approval of novel space activity mission authorization; a more complex regulatory web would not solve this.

It must be noted that the length and complexity of the dual authority model could be beneficial in its security review process. The scrutiny of coordination with multiple agencies ensures that only novel space activities that get approval from all parties receive mission authorization. This could contribute to effectiveness by ensuring that U.S. national security is protected, the novel space activities are truly innovative, and the U.S. economy would benefit from their participation in the industry.

Another limitation is that this approach does not include a specific timeline. Creating a regulatory avenue for novel space activities addresses some sources of investors' risk aversion by ensuring that an entity is managing mission authorization. However, the process is not guaranteed to be any faster; involving another agency may even slow down the regulatory process, increasing risk aversion and disadvantaging novel space activities. Even if the lack of clarity and lengthiness contribute to risk aversion, these drawbacks could contribute to the scrutiny of the review process that would ensure U.S. national security is protected, the novel space activities are truly innovative, and that the U.S. economy would benefit from their participation in the industry.

Complexity in the dual authority review process would not increase the number of approved novel space activity mission authorization requests. Effectiveness score: 1

Equity

The dual authority alternative somewhat increases equity in the commercial space sector. The creation of an official regulatory process for novel space activities to pursue mission authorization allows organizations that were not previously covered to have more clarity in their mission processes. Creating a regulatory structure for more commercial space activities increases access to the market and combats the monopolistic nature of the industry.

The dual authority model does not include an explicit mission authorization process for novel nuclear space activities. Failing to include all actors in the commercial space industry under regulation circles back to the initial problem. To increase access to the industry and achieve the most competitive innovation possible, all sectors must have a clear regulatory process. Not having a clear mission authorization process for novel nuclear space activities limits the equity of this alternative.

The dual authority process limits the extent of innovation capable of novel space activities because of its complexity and how long authorization will take. Without clear guidelines on a timeline of approval, novel space activities still face uncertainty in their mission authorization regulation. This limits investment opportunities that will facilitate the number of novel space activities succeeding in the industry.

The Private Sector Space Activities Interagency Steering Group increases equity because it ensures that once dual authority is implemented, there will be constant reform to ensure the industry is open to all. This group creates a space where public and private sector actors can communicate the successes and drawbacks of this alternative. Any issues impacting U.S. innovation can be addressed in real-time, ensuring equitable collaboration in the commercial space industry.

This alternative increases equity by creating a mission authorization process for novel space activities but is limited in its scope and complexity. Equity Score: 1

Administrative Burden

The dual authority alternative results in significant administrative burden. This results from the fact that both employees in the DOT and DOC will have to take on new responsibilities, including mission authorization of novel space activities. The reorganization of responsibilities of two government agencies is a large change. The DOT and DOC already have some expertise on space-related issues. Employees will have to undertake the responsibility of expanding their knowledge on novel space activity mission authorization. The authorization security investigation process follows clear requirements that already exist,

which relieves some pressure. However, the White House proposal specifies many criteria that are unrelated to OST obligations by which license applications would be assessed, including space sustainability and whether the application is consistent with national security, foreign policy, and other U.S. interests (Swope, 2023). Implementing dual authority will add a lot of administrative burden. Two agencies must take on more work, restructure organizations, and add extra bureaucratic steps to the mission authorization process. A positive aspect is that this alternative will not require the hiring of new employees or building new facilities, which will not add any administrative burden.

Due to the substantial administrative burden that employees of two government agencies must take on with the dual authority alternative, it receives an administrative burden score of -3.

Political Feasibility

The dual authority alternative is not politically feasible. The White House's legislative proposal has yet to be introduced to Congress or incorporated into another bill (Foust, 2024). This is troubling when implementation would require legislative action.

Another aspect of this alternative that decreases its political feasibility is that it was introduced by former Vice President Kamala Harris (Swope, 2023). Commercial space is a bipartisan issue, as both sides understand the economic and security benefits of a thriving U.S. space industry. However, the approach to achieve this is not bipartisan. The new presidential administration and Republican-controlled legislative branch are unlikely to accept any plans crafted by the former administration. The fact that dual authority was crafted under Harris decreases the alternative's political feasibility.

The dual authority approach is also not favored by experts and players in the industry. Many commercial space leaders say they are opposed to the dual authority approach as it could be "burdensome and confusing for companies and agencies" (Foust, 2023). Many of the same industry leaders favor the sole authority approach and are placing pressure on members of Congress to accept this alternative to creating mission authorization regulation for novel space activities.

For all these reasons, this alternative receives a political feasibility score of -3.

Outcomes Matrix

Outcomes Matrix				
	Effectiveness	Equity	Administrative Burden	Political Feasibility
Status Quo	-3	-3	3	2
Sole Authority	3	3	-2	3
Dual Authority	1	1	-3	-3

Recommendation

Zeno Power should support alternative #1, Sole authority. This alternative scores the best after weighing it against the set of criteria. As a radio-isotope power company, sole authority is the only alternative that includes novel nuclear space activities in its regulatory framework. The sole authority alternative will result in the fastest and simplest way for novel space activities to achieve mission authorization. Pursuing sole authority will provide a clear regulatory framework for mission authorization that can assist Zeno Power in achieving its goals of selling and launching the most radio-isotope power systems as well as bolstering the U.S. economy, innovation, and national security.

The outcomes matrix demonstrates that this alternative scored the lowest on administrative burden. This alternative will require a substantial administrative burden upon implementation that may result in difficulties for the regulatory side. This is a tradeoff that must be accepted for the U.S. national interest. The speed of this alternative's ability to grant mission authorization to novel space activities and its presumption of approval could also be seen as a tradeoff to some. A slow regulatory process is a cautious one. It must be emphasized that the benefits of a fast authorization process cannot sacrifice the attention to detail in the security investigation process, as this could be detrimental to U.S. national security.

Sole authority will result in the most favorable outcomes for novel space activities like Zeno Power. This alternative grants them the ability to contribute to the commercial space industry fully, resulting in a competitive U.S. economy, a more innovative market, and a strengthened national security approach.

Implementation

The recommended policy proposal for Zeno Power's support is for sole authority regulation of novel space activities by the DOC/OSC. This alternative will result in a fast, transparent mission authorization process for novel space activities that will diversify the commercial space industry and promote U.S. economic activity in the sector.

Implementing the sole authority recommendation presents several challenges, primarily involving legislative hurdles, stakeholder coordination, and regulatory adaptability. Novel space companies must actively engage in the legislative process to shape regulations that foster industry growth. Addressing these risks through adaptive policymaking and stakeholder collaboration will be essential for success.

Stakeholders

The main stakeholders that will play a role in moving the sole authority recommendation forward are Congress, the OSC, the White House, Vice President, and novel space companies. As implementation requires passing a bill in Congress, the members of Congress involved in drafting the new bill will be especially important. The House Science, Space, and Technology Committee is responsible for updating this bill. Representative Brian Babin is the Chairman of the committee, with Representative Zoe Lofgren as the ranking member. These leaders will play an important role in maintaining focus on commercial space and driving action within the committee to move the new bill to the floor. The 118th Congress only cleared five pieces of space-related legislation: the two National Defense Authorization Acts, the Launch Communications Act, the FY2024 Consolidated Appropriations Act, and the FY2025 appropriations bill (Smith, 2025). The history of limited action in space-related legislation will be an implementation challenge, especially when Congress is partisanly gridlocked.

The OSC is a major stakeholder as it will be receiving the regulatory authority if the sole authority bill passes. They should work with the DOT's FAA to learn more about mission authorization for novel space activities, as it is the current band-aid regulator for novel space companies. The OSC should gain mission authorization expertise from the FAA to ensure American security if the transition should occur.

The White House is a major stakeholder in the implementation of this alternative. The NSC, within the Executive Office of the President, is responsible for "ensuring the United States capitalizes on the rich opportunities presented by our nation's space activities" (White House, 2025). Mission authorization for novel space activities is an example of the nation capitalizing on the innovative minds commercial space has to offer. The Vice President, JD Vance, chairs the NSC and uses this position to assist the President in the development and implementation of space policies. The White House and Vice President must coordinate with Congress, the OSC, and representatives on the Private Space Activity Advisory Committee to ensure that changes brought by the sole authority alternative are effectively woven into other aspects of space policy so the United States can fully capitalize on all the benefits that novel space activities provide.

Novel space companies play a vital role in implementing this recommendation. Novel space companies should communicate how the bill should be amended to best serve the commercial space sector and the U.S. as a whole. They should approach the key stakeholders above and outline their needs in the industry and how implementing the sole authority model will help them and the United States. Novel space actors can also place pressure on Congress to move the bill forward. Identifying key members that are in favor of creating a mission authorization process for novel space activities, such as those that voted in favor of the Commercial Space Act

of 2023 or have a history of supporting space innovation. Reaching out to representatives with the perspective of novel space companies can highlight elements of the perspective they had not considered previously. Communication through the public can also be an effective way for novel space companies to influence implementation. Using social media to spread public awareness that there is a lack of clear mission authorization regulation for novel space activities and how this is stifling innovation, limiting U.S. competitiveness, and further monopolizing the space industry could be beneficial. The average U.S. citizen is unaware of this problem; spreading awareness that there is a problem could influence public opinion towards favoring the implementation of the sole authority alternative. More voices would increase the pressure on members of Congress to implement the sole authority model, including the novel space activity perspective.

Perspectives

Despite the initial Commercial Space Act's failure, the House Science, Space, and Technology Committee agrees that progress must be made around mission authorization for novel space activities. The initial bill was never brought to the floor for a vote after a party-line committee vote; this was largely because the White House plan for a dual authority model was introduced less than an hour before the Commercial Space Act was scheduled to be marked up (Smith, 2025). Two years later, with little progress made on the issue and the pressures of a new presidential administration, I predict that the committee will be more supportive of progressing the amended bill. Former Chairman Representative Frank Lukas stated, "We must advance the Commercial Space Act and not wait for another Congress to act" (Lukas, 2024). There is a sense of urgency within Congress to take action on this issue now, which makes the stakeholders' perspectives more favorable toward the implementation of this recommendation.

The OSC is in favor of this recommendation. Despite the additional responsibilities, the DOC recognizes the broad advantages that a mission authorization process for novel space activities will provide. Previous Deputy Secretary of Commerce Don Graves stated that "U.S. industry leads the world in bringing the benefits of space to Earth. This legislation (Commercial Space Act of 2023) ensures that our government will build a regulatory environment that supports commercial expansion to benefit all Americans" (Smith, 2023). The sentiment has continued into the new administration, Secretary of Commerce Howard Lutnick stated that "space and the data we can collect from space is fundamental to America" (Feldscher, 2025). Updating the legislation will likely strengthen support as the updates will center around promoting American competitiveness in space, access to the industry, security, and economic prosperity.

Novel space companies will be very supportive of this recommendation. The sole authority regulation of mission authorization for novel space activities by the OSC creates a clear regulatory pathway for them. This recommendation will provide fast action on mission authorization requests, increase access to the market, and allow novel space activities to fully contribute to U.S. prosperity. Novel space activities can exercise leadership by sharing their perspectives with members of Congress to ensure mission authorization legislation that serves them best passes.

Worst Case Scenario

The worst-case scenario regarding the implementation of this alternative centers on three main factors. First, congressional gridlock could impede the bill from passing despite the public's favor of it. This is somewhat likely as Congress has struggled to pass a lot of space-related

legislation recently. Even if the bill makes it out of committee, success on the floor becomes even more difficult when members can be strictly tied to their party lines. To address this challenge, the benefits of the passage of the bill must be made very clear. Testimonies from novel space actors who struggle in the current system and how the updated bill will help them, and the United States could be a powerful influencer in motivating the implementation of this recommendation.

Second, the inherent challenge with regulating an innovative domain such as space is that innovation leads to constant growth and change. Creating a clear mission authorization process for novel space activities creates space for them to thrive and innovate. However, the evolving capabilities that come from increasing access to the industry may lead to the same problem that the bill initially aimed to solve. Commercial innovation outpaced some of the existing regulatory processes, there is a real possibility that in a few years, innovation will lead to the sole authority approach to regulation being outdated. The regulation that is needed now may become obsolete as innovation changes the needs of the market. This is likely to happen as regulations become outdated, as has been the case with other space regulations, such as the OST. The Private Space Activity Advisory Committee included in this recommendation can work to address some of these inherent challenges through periodic review and updating the regulatory process as it evolves.

Third, after the implementation of this recommendation, the OSC could grant mission authorization to a novel space activity that conducts a mission that ends up being dangerous to the United States. For example, if a product, despite passing the security review process malfunctioned in space having negative consequences on Earth. This would reduce support for commercial space actors and likely result in more barriers to entry and a slower review process that would not be beneficial to novel space actors. This is unlikely as this recommendation includes a strict security review process. The focus on national security should be a primary focus of implementation, and when transitioning regulatory authority to the OSC, this goal should be emphasized to preserve U.S. safety.

Conclusion

Implementing sole authority regulation of novel space activities by the Office of Space Commerce offers a clear, efficient, and transparent pathway for mission authorization, fostering growth in the commercial space sector while enhancing U.S. economic and security interests. Challenges such as legislative gridlock, evolving regulatory needs, and security concerns will be present, but overcoming them will be critical to successful implementation. By collaborating with Congress, leveraging expertise from regulatory bodies, and ensuring industry support, this policy can provide a sustainable framework for innovation and leadership in space. Through the implementation of the sole authority regulatory model, novel space activities can fully participate in the commercial space industry, can effectively innovate, provide security and economic growth to the United States.

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