

# Ensuring a Spacepower Advantage in Prolonged Competition:

Findings and Recommendations  
from the Space Endurance  
Workshop



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and Col Jennifer K. Reeves, USAF (Ret.)

The Mitchell Institute for Aerospace Studies  
Air & Space Forces Association  
Arlington, VA  
February 2025

# About the Mitchell Institute for Aerospace Studies

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## Acknowledgments

The Mitchell Institute's Spacepower Advantage Center of Excellence would like to thank the men and women who volunteered their time to take part in our two-day workshop. Their insight and efforts are the bedrock of this report. We'd especially like to thank our four team leads, Dr. Lamont Colucci, Colonel Jonathan McCall, Mr. Arnie Streland, and Mr. Otis Winkler, who guided the discussions and presented their teams' recommendations. A huge thanks goes to Dr. Joel Mozer, whose prior efforts and continued mentorship were instrumental in developing this workshop. Finally, a special thank you to Mark "Gonzo" Gunzinger, whose work in the Mitchell Institute's ongoing Collaborative Combat Aircraft series of tabletop exercises successfully demonstrated the value of unclassified discussion among groups of subject matter experts to inform Department of the Air Force (DAF) thinking on emerging strategic opportunities. His leadership and continued mentorship have been indispensable.

# About the Authors

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# Foreword

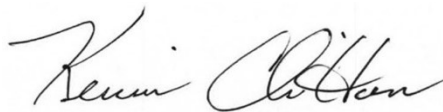
Space operations have become the front line in the competition with China. Space capabilities and effects are the critical underpinning of U.S. military operations in every theater and terrestrial domain. They are interwoven into the fabric of the daily lives of all Americans and billions of civilians around the world. The United States cannot have a day without space—militarily or otherwise. China believes achieving preeminence in space—including offensive military capabilities—is foundational to supplanting the United States’ global leadership. Allowing them to pursue their expansionist and totalitarian goals in space would have dire ramifications for U.S. and allied interests. America’s future security demands gaining and maintaining an enduring spacepower advantage—an undertaking that requires securing space superiority.

Competition between nations can last decades. The United States will face an increasing range of challenges as its national interests in space continue to grow and mature. Leaders must take meaningful steps today to ensure core interests are secured in this domain. To this end, the Mitchell Institute’s Spacepower Advantage Center of Excellence (MI-SPACE) convened its inaugural space workshop in October 2024. The workshop assembled 55 subject matter experts from across the national security space landscape to examine the Space Force’s theory of Competitive Endurance against a set of potential challenges over the next 25 years of competition. The Space Endurance Workshop provided participants with a venue to define the actions, conditions, and effects necessary for the United States, our allies, and partners to preserve U.S. and Coalition leadership in space.

The insights and analysis from this workshop mark the most comprehensive examination of Competitive Endurance to date. In this report, Charles Galbreath and Jennifer Reeves masterfully summarize the workshop’s findings and recommendations, some of which support the continuation and acceleration of ongoing efforts. We highly recommend Space Force leadership, all Guardians, and spacepower advocates from industry, government, and our international partners study this report and take to heart its recommendations. Collectively, we can promote the continued development and fielding of the capabilities and recruitment, training, and retention of the warfighting force necessary to secure our Spacepower Advantage.



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## Key Points

The Space Force must actively and continually articulate why it exists and what it does to Congress, the American people, and even to Guardians. This is fundamentally tied to ensuring it receives the support necessary to maintain a spacepower advantage during a protracted competition with China, as success demands maintaining popular support and national will.

Adopting a space framework based on the Space Force's Theory of Competitive Endurance provides a stable way forward. However, prioritizing endurance over victory may undermine a warfighting mentality and the core of the Guardian identity.

Systemic issues exist within the Space Force and Department of Defense that threaten the success of the Space Force in a long-term competition with China. Chief among these are: inadequate authorities and resources, a lack of clearly defined and understood roles and missions, and the need for increased warfighting ethos.

Existing Space Force lines of effort championed by USSF leadership, such as improved domain awareness, architecture resilience, security classification reform, and the Officer Training Course, are critical to overcoming a range of challenges that the United States might face throughout an extended peer competition and must be expanded.

Defensive and offensive counterspace operations to gain domain superiority must be normalized, like warfighting operations in all other domains performed by the Air Force, Army, Navy, and Marine Corps. The Space Force's success as a military service depends upon this paradigm shift.

The Space Force must proactively lead cooperative efforts with allies and international and commercial partners to fully integrate and synchronize counterspace capability development and operations in a deliberate manner to ensure the service pursues an effective counterspace strategy that minimizes our vulnerabilities and leverages our strengths.

## Abstract

The United States, its allies, and its partners must have the capabilities and authorities to conduct defensive and offensive military operations in, from, and to space. Adversary threats leave no other choice. This matches conditions found in every other warfighting domain—in short, military space operations must be normalized. Given these realities, the defense establishment must take steps today that will empower the U.S. Space Force to secure an enduring spacepower advantage.

Without the means to counter threats in the domain, the United States will lose its critical space advantage in the ongoing competition. An important step for the Space Force to prevent this untenable outcome is to actively engage key decision-makers in plain, simple language and communicate clearly why they exist and why their mission is critical to the nation.

Over the course of a two-day, unclassified workshop, the Mitchell Institute brought together 55 space subject matter experts with diverse backgrounds to examine how the United States, its allies, and partners can maintain an enduring spacepower advantage. This centered on overcoming a series of hypothetical crises without escalating to war. Employing a technique called “backcasting,” workshop participants defined the actions, effects, and conditions necessary to successfully overcome six crises involving space operations. This approach allowed experts to evaluate the Space Force's theory of Competitive Endurance—a proposed theory of success to prevent competition from escalating into conflict—against a wide range of potential future challenges.

The workshop findings reinforced that the U.S. Space Force's current lines of effort are critical and must be expanded. This includes improving space domain awareness, space architecture resilience, and reforming security classification policies. However, the exercise identified establishing a warfighting mindset of Guardians—laser-focused on defeating any potential adversary—as a persistent challenge, despite the Space Force now existing for five years. The theory of Competitive Endurance focuses on maintaining a status quo in competition rather than striving for victory—this detracts from a warrior ethos and further segregates the Space Force and its Guardians from the other military services' warfighters, thus diminishing combat effectiveness and credibility as a military service.

The decision adversaries made to weaponize the space domain has driven a major paradigm shift. Guardians must decisively respond to this new reality. No longer can the domain be viewed in a passive fashion. That means “Space as a warfighting domain” must move beyond the soundbite and be normalized with other warfighting domains. Appropriately authorizing, organizing, training, and equipping America's Guardians to deliver war-winning military effects in, from, and to space is the best way to secure an enduring peace.



# Executive Summary

America’s adversaries have clear ambitions in space and they are willing to pursue those goals through aggression. U.S. leadership understood the growing threat and established a dedicated military service to protect our interests in space and prevent our enemies from achieving control of the domain. This marked a major shift in decades-old thinking of space as a sanctuary and developing capabilities without consideration of growing threats. The United States, its allies, and partners must now make greater efforts to normalize military operations in space, to military operations in all other warfighting domains. The fielding of offensive and defensive weapons to ensure an enduring spacepower advantage throughout the ongoing competition with peer adversaries is essential. To fail in this competition risks losing a future war—in all domains and in a way that could threaten our way of life.

This competition with China could easily last decades, much like the Cold War. Preparing for the long haul means maintaining the ability to continuously deliver effects over the coming years, not just bracing for the “fight tonight” or the immediate challenges of today.<sup>1</sup> For its inaugural Space Endurance Workshop (SEW), the Mitchell Institute gathered 55 subject matter experts to identify the actions, effects, and conditions necessary to preserve a spacepower advantage. They also tested the theory of Competitive Endurance against a series of crises representative of potential future challenges in space.

The U.S. Space Force unveiled its theory of Competitive Endurance in 2023 to control escalation and prevent conflict in space during the ongoing competition with China.<sup>2</sup> The following assessment represents the examination of the theory by a wide variety of experts from across the national security space community in an unclassified setting. Recommendations from these experts include a mix of technologies, policies, and operational concepts. While current Space Force capabilities remain essential to terrestrial (air, land, and naval) warfighters, the most critical next steps for the Space Force are to refine its roles and missions and to normalize space as a warfighting domain with the same superiority objectives held in the terrestrial domains. The Space Force must hone its ability to clearly articulate this message to the American people and Congress. These fundamental measures legitimize the service—not just to assuage space advocates, but to secure the Space Force as the warfighting force the nation needs to deter war and, if deterrence fails, fight and prevail in a future conflict.

## Workshop Methodology

The Space Endurance Workshop presented four teams of experts with a series of crises that sequentially led to a desired future state in space—a peaceful resolution to the ongoing competition. Starting with the desired end state is an analytical technique called backcasting, a sort of conceptual backward engineering of success. The workshop’s crisis scenarios served as incremental data points for discussion by presenting challenges that stressed multiple aspects of national power important to maintaining an enduring spacepower advantage. By presenting a desired end state and a series of crises without defining friendly capabilities or policies, the Mitchell Institute enabled workshop participants to explore multiple options and make recommendations on what actions, effects, and conditions the United States, allies, and partners might need to secure a peaceful future in space.

## Overarching Themes from the Workshop & Follow-On Analysis

Workshop discussions between a variety of space experts in government, academia, industry, and the military uncovered several recommendations important to establishing and maintaining a spacepower advantage throughout a prolonged competition. The following overarching themes represent insights directly from workshop participants as well as from post-event analysis by the Mitchell Institute.

- Roles and missions: DOD needs to clearly define and articulate the current and anticipated roles and missions of the Space Force that align with evolving U.S. interests in space.
- Normalizing the domain: Warfighting operations in space must be treated like those in any other warfighting domain.
- Commercial space: Commercial space offers significant benefits to U.S. and allied military operations, but overreliance and emphasis on commercially available space capabilities by the Space Force undermine the need for a U.S. military space service.
- Warfighting mindset: Space is no longer a benign field of operations. It is a warfighting domain. Guardians must embrace their roles as warfighters.
- Space domain awareness: The Space Force must improve the scope, capacity, and releasability of space domain awareness information. Demand for space domain awareness will increase throughout the competition. As interests in space expand, the need to monitor activities and track threats will grow in frequency and locations. It requires a combination of both releasable and highly exquisite insight to support the desired effect, whether bolstering international support or executing a military operation.
- Allies and partners: The United States must proactively lead efforts for increased cooperation and integration of allied and partner capabilities in space.
- Training infrastructure: A robust space training infrastructure is essential to prepare Guardians and partners for future space warfighting operations and contingencies.
- International norms: The United States must continue to lead the establishment of international norms and definition of common interface and safety standards for operations in space. It is in America's interest to set standards in accordance with its interests and values, especially when those of China are often opposed.

### The Way Ahead:

The Mitchell Institute's analysis of workshop findings identified a set of near-term actions that will have a lasting impact on the ability of the United States, allies, and partners to ensure an enduring spacepower advantage. In addition to continuing existing initiatives, such as those tied to the tenets of Competitive Endurance, the following recommendations are essential steps to normalize the space domain and secure the leadership and public support needed to sustain a spacepower advantage throughout a prolonged competition:

- Space Force needs to develop and communicate a warfighting concept to shape the force. A warfighting concept, with the objective of victory, will better align the Space Force with other military services, educate American citizens, and most importantly inform Congress on the capabilities and force structure needed to deter or win future conflicts.

- The administration and Congress should loosen policy restrictions to authorize the fielding of offensive and defensive weapons to secure our nation's interest in space. This will normalize space to other warfighting domains and enable the Space Force and U.S. Space Command to create a stronger posture, capable of deterring hostile actions and conflict.
- Congress must immediately increase funding for capabilities and personnel for the Space Force to achieve its new warfighting concept that is not only built to endure but to eliminate adversary space capabilities that would support their warfighting effectiveness in the terrestrial domains. This will further enable military options that impose costs on China and not just endure in competition indefinitely.
- The Department of Defense must update the space-related roles and missions among the services. Clearly defined and agreed-upon missions are essential to aligning resources, avoiding unwanted duplication of effort, and synchronizing effects. As capabilities and interests in space mature, the DOD must regularly update these roles and missions to ensure the preservation of an enduring U.S. spacepower advantage.
- Space Force will need to establish internal educational and training programs, to include advanced simulators, that foster an assertive, warfighting culture. Guardians must move past being just an enhancing element to another service's warfighters. Guardians must see themselves as warfighters and project a war-winning ethos.
- Space Force needs to better educate the American people and Congress about the criticality of the Space Force. Congress must understand the threats, risks, and needed force structure to appropriately grow the Space Force. Without this support, the Space Force will be unable to effectively accomplish its core missions throughout the ongoing competition. This ineffectuality will further erode popular support and national will for our competition with China.

# Introduction

When the Chief of Space Operations, Gen Saltzman, unveiled Competitive Endurance, he asked for debate and discussion around the Theory of Success.<sup>3</sup> Competitive Endurance is the Space Force’s theory of success shaping the service’s activities during the ongoing rivalry between the United States and China. Refinement of the theory requires honest debate and study. However, most previous discussions typically focused on things in the very near-term, with little to no discussion addressing what it might take to *endure* and maintain an advantage throughout a protracted struggle for global leadership. As we saw in the Cold War with the Soviet Union, it may take decades of competition before tensions ease. The United States and its allies and partners must be prepared to take actions, establish conditions, and achieve effects over decades to maintain a spacepower advantage and remain the dominant global power in this new competition.

A spacepower advantage, in this context, is the ability to generate space effects and deliver space capabilities at a pace and scale sufficient to achieve national objectives ahead of competitors. This differs slightly from space superiority, “the degree of control in the space domain of one force over another that permits freedom of access and action without prohibitive interference from an adversary and, as required, simultaneously denies an adversary’s freedom of access and action.”<sup>4</sup> The Mitchell Institute chose to use spacepower advantage rather than space superiority during the workshop because it reflects the holistic set of activities executed by multiple organizations during competition rather than those associated exclusively with military organizations in conflict.

## Foundations of the Space Endurance Workshop

The Mitchell Institute’s Space Endurance Workshop integrates two previous efforts to examine long-term competition in space. First, the Space Futures Workshop (SFW) conducted by Air Force Space Command in 2019 explored alternate hypothetical realities to inform near-term investments in science and technology for the soon-to-be stood-up Space Force. Led by Dr. Joel Mozer, the Chief Scientist for Air Force Space Command, this workshop defined eight alternative futures set in 2060 using three factors: degree of human presence in space, state of the commercial space market, and the level of U.S. and allied leadership in space.<sup>5</sup> Within each of these future scenarios, the SFW also created Images of Future Operations (IOFOs), a set of potential challenges and opportunities, to provide further context for participants to think through the ramifications of possible futures and the decisions that led to them.

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*“By taking this long-term look into the future of the space domain, we’ve provided insights for critical decisions that leaders must make today.”*

*—Dr. Joel Mozer, former Chief Scientist, Air Force Space Command*

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Second, the theory of Competitive Endurance serves as the unifying principle for Space Force development and training activities. It aims to provide a continuing advantage in the ongoing competition with China and presents a proposed theory of success to achieve space superiority, while maintaining the long-term viability of the space domain.<sup>6</sup> This theory also aims to preserve the space domain for future generations. This includes maintaining the U.S. strategic advantage by promoting responsible behaviors and deterring hostile and irresponsible actions. It seeks to control escalation to prevent competition from growing into crisis or conflict. The theory rests on three key tenets:

1. Avoid operational surprise
2. Deny first-mover advantage in space
3. Conduct responsible counterspace campaigning

Avoiding operational surprise is critical for both short-term and long-term success. The Space Force seeks to detect and preempt hostile changes in the operational environment that could degrade U.S. and allied use of space primarily by improving space domain awareness.<sup>7</sup> This constant vigilance prevents adversaries from catching U.S. forces off guard and maintains strategic stability by reducing the likelihood of miscalculating an adversary's actions.

Denying first-mover advantage addresses a critical vulnerability in the legacy space architecture. The predictability of satellite locations, the lack of satellite defensive capabilities, and the inability to rapidly reconstitute lost or degraded satellites present adversaries with the opportunity to strike first and reap a lasting advantage.<sup>8</sup> Making an adversary's first strike impractical and self-defeating through a new architecture that avoids these pitfalls could reduce the incentive to escalate to destructive actions in space. Current approaches seek to achieve this by focusing on increasing architectural resilience through proliferating satellites across more diversified orbits.<sup>9</sup>

The third tenet, conducting responsible counterspace campaigning, recognizes that potential adversaries have clear intent and ability to use space to target and attack U.S. and allied forces in a future conflict.<sup>10</sup> The Space Force must have means to prevent adversary use of space for this purpose while preserving Space Force capabilities that enable our terrestrial forces to target and attack adversary forces. Without such capabilities, fielded U.S. and allied forces remain vulnerable to adversary space-enabled kill chains. The Space Force can enhance stability during crises by holding adversary space capabilities at risk to deter escalation to conflict. However, this requires a deterrent posture that demonstrates the United States can take actions to credibly defeat and reciprocate attacks.

Exploring these three tenets further is necessary to transform the legacy space architecture to one more appropriate for a warfighting domain. Most conversations to date have not addressed what is required to provide an enduring spacepower advantage throughout a prolonged competition. Endurance and sustainment of the space national security enterprise were, therefore, the focus of the Space Endurance Workshop.

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*"The ideas in this white paper serve as a point of departure. As our understanding of the operating environment matures, the assumptions and principles that guide our action must evolve as well."*

*—General Saltzman, Chief of Space Operations*

# Methodology

The SEW employed a combination of large and small group discussions with a diverse set of subject matter experts from the military, government, academia, and industry. Since the SEW focused on preserving a spacepower advantage over a decades-long competition, a force-on-force, move-based tabletop exercise was not useful. To provide a context for workshop discussion, the SEW leveraged the same factors and IOFO construct as the SFW. Unlike the SFW's efforts to explore multiple possible futures, the Space Endurance Workshop chose to define one possible future with a series of crises along the path to that future.

## Backcasting

The Space Endurance Workshop employed a modified backcasting technique. The backcasting methodology defines a desired future state and works backward to determine what steps are required to achieve it.<sup>11</sup> A major critique of backcasting is that it overlooks risks or barriers to that future state.<sup>12</sup> To overcome this and to establish a more complete framing context for workshop participants, the Space Endurance Workshop included a series of crises set on the path to the desired future state. These not only fostered more detailed discussion but also presented defined challenges while preserving the intent of the backcasting technique.

Defining a desired future state served as a starting point—it was not an effort to predict the future. The series of crises then provided a guide for discussion that injected likely stresses to multiple aspects of national power that are necessary to maintain an enduring spacepower advantage. Presenting a desired end state and a series of crises, without defining friendly capabilities or policies, allowed workshop participants to explore multiple options and make recommendations on what the United States and its allies might do to overcome each crisis successfully. The workshop aimed to connect effects, actions, and conditions to address each crisis back up to the realities of 2024 in a reverse roadmap.

## Workshop Scenarios & Key Assumptions

The workshop outlined a 2049 end state and a 2024 starting point. The Mitchell Institute chose this 25-year span to enable long-term thinking without falling victim to discussions either bordering on science fiction or too untethered to today's realities.

The SEW provided an initial assessment of 2024 as a point-of-departure for participants following the SFW's three-factors construct (see Figure 1). Human presence in space is at the early stage, with only a handful of astronauts in space at any one time. While commercial space companies do currently offer substantive services, particularly in communication and imaging, space represents only about a half of a percent of U.S. gross domestic product. Finally, the leadership of the United States and allies in space is well established, but China is aggressively pursuing its own space capabilities and fielding systems specifically designed to attack U.S. space capabilities.

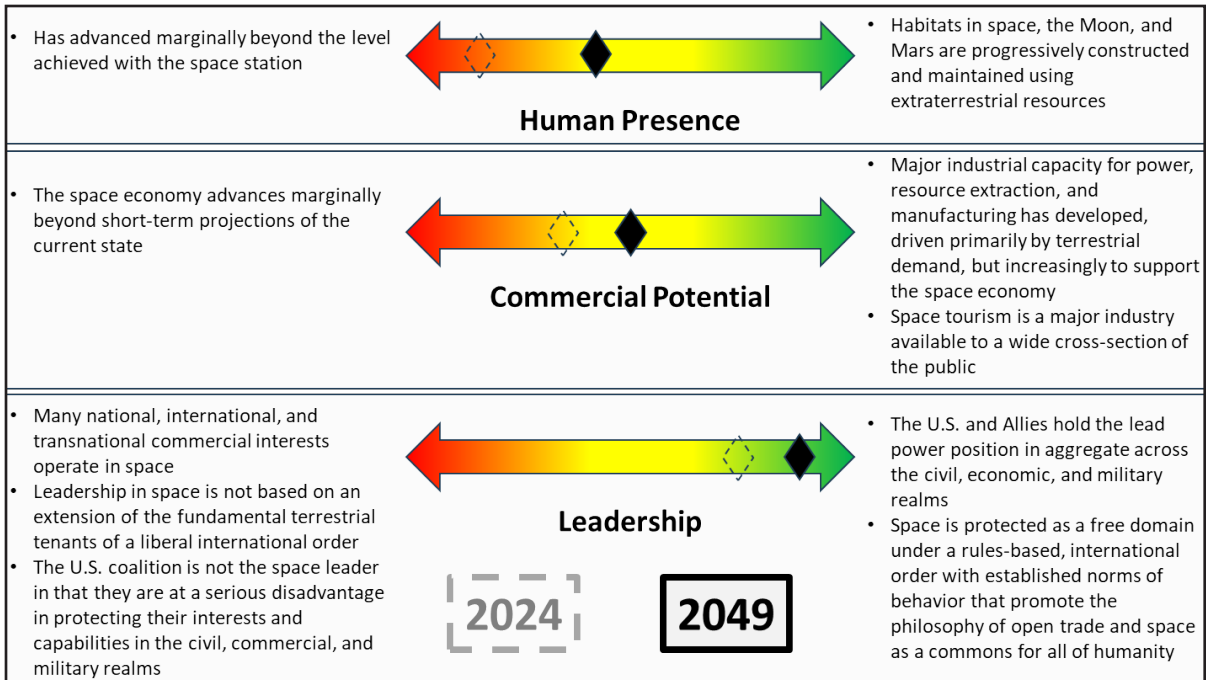


Figure 1: Three Factors defining the context of a future end state applied. The Mitchell Institute made conservative increases along all three factors to define a reasonable and approachable 2049 “ideal end state.” A dashed outline of the 2024 level is provided for reference.

Source: Mitchell Institute.

The SEW assumed conservative advancements in human presence and commercial potential, which helped provide participants with reasonably realistic future states to consider when discussing the crises. These two factors were intended to reflect an increased human presence in space, support scientific and economic activities in space and on the Moon, and demonstrate a continuously increasing economic impact for space-faring nations by 2049. However, the true objective of the workshop, based on the theory of Competitive Endurance, was to preserve and increase the recognized U.S. and allied leadership in space. Accordingly, the leadership axis was used to define the 2049 desired end state by increasing it from even today’s level (see Figure 2).

### Workshop Timeline & Six Space Crises

Throughout the competition, China publicly stated an unwavering intent to surpass the United States in space as part of its goal of becoming the preeminent global power. The SEW’s 25-year timeline included subjective assessments of relative tensions between the United States and China at the point of each crisis. The incremental incidents represent a near-constant game of cat and mouse in space. Operations including orbit matching and proximity operations of satellites, cyber intrusions of networks, and espionage were pervasive. Temporary electromagnetic interference of communications and navigation signals, plus ground-based lasing of remote sensing capabilities were frequent and often accompanied terrestrial exercises and wargames. As the workshop’s series of six crises progressed, the tension levels changed to depict how the ongoing competition was likely affected by the previous crisis (see Figure 3). This backdrop intended to help tie the crises together in an informal narrative and provide a benchmark for comparison as participants considered solutions for each challenge. At the height of tension, during the most overtly provocative actions by China, the SEW asked participants to consider the situation as analogous to the Cuban Missile Crisis.

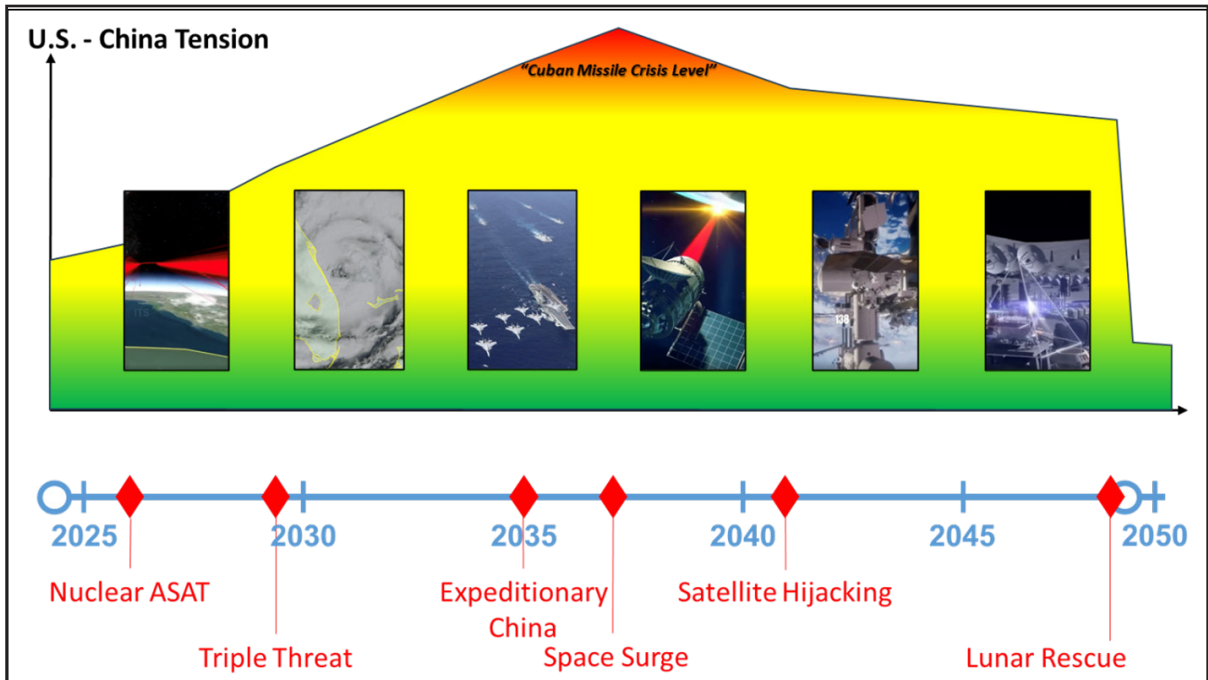


Figure 2: Over the timeframe of the Space Endurance Workshop, the relative tension between the United States and China escalated and deescalated up to and in response to the defined crises.

Source: Mitchell Institute.

While the three factors of human presence, commercial potential, and U.S. leadership, along with the relative tension level, changed for each of the workshop’s six crises, a broad resolution was also provided that connected them to one another and emphasized a culmination without escalating to conflict. In the time leading to the fourth crisis, for example, tensions rose considerably, but the incident still fell short of war. The storyline, while defining the outcomes, did not dictate specific methods to resolve the crises. Those actions, effects, and conditions were left to workshop participants to define.

### Crisis #1: Russia’s Deployment of a Nuclear ASAT

The first crisis represented an extrapolation of current reporting on Russia’s development of a nuclear anti-satellite weapon. This crisis did not deal directly with China, but it provided an opportunity for the United States to demonstrate its leadership in global matters and the importance of establishing and enforcing international norms. In this crisis, the war resulting from the Russian invasion of Ukraine continued. In 2026, frustrated by ongoing Western aid to Ukraine, Russia deployed its nuclear ASAT system and threatened its use if aid was not halted. The goal of this crisis discussion was to find ways to locate and verify the weapon system and identify a method to remove it from orbit and prevent its detonation.

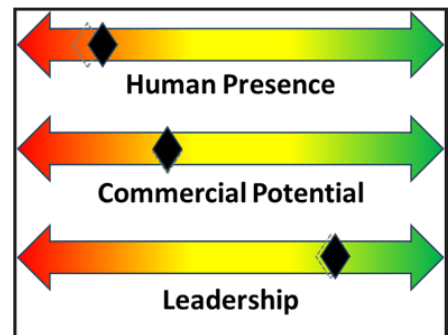


Figure 3: Nuclear ASAT crisis in 2026 with only slight increase in human presence from 2024



### Crisis #2: A Triple Threat to U.S. Space Capabilities

Following the resolution of the first crisis, which demonstrated U.S. space leadership, tensions with China continued to escalate. The second crisis represented the culmination of three conditions that exist today: territorial aggression by China, debris creation from a Chinese launch, and increasingly severe and frequent weather events. This compound “triple threat” challenge involved persistent intelligence, surveillance, and reconnaissance to monitor military activity near Taiwan, debris mitigation, and assured access to space. In this crisis, China conducted a “military exercise,” blockading Taiwan and positioning forces for what appeared to be an imminent invasion. Uncertain of China’s real intentions, the United States, allies, and partners increased their intelligence collection of the region to monitor the situation. China’s activities coincided with hurricane season in the Caribbean, in which a Category 5 hurricane pummeled the central coast of Florida. This caused significant damage to the launch infrastructure responsible for maintaining a high-cadence launch manifest to enable the proliferated warfighting space architecture (PWSA), Starlink constellation, and proliferated National Reconnaissance Office (NRO) satellites.<sup>13</sup> Finally, as part of China’s proliferated low Earth orbit (pLEO) architecture, one of their satellite deployments was responsible for a limited cascade event, destroying approximately 50 percent of all LEO satellites and creating a significant debris field between 350–1,500 km. Whether this debris creation was intentional or not is unknown. The challenge for workshop participants was maintaining coverage of Chinese military activities in the Western Pacific to prevent an intelligence gap that the People’s Liberation Army (PLA) could exploit. Participants also examined methods to maintain the dynamic launch manifest and mitigate the debris in LEO.

### Crisis #3: China’s Use of Space to Enable Aggression in Africa

Recognizing that China is intent on being a global actor, this crisis examined the implications and options associated with China attempting to exert military force in Africa. The persistent demand for scarce resources and China’s increasing engagements globally were the backdrop for the third crisis. The production of cobalt in the Democratic Republic of Congo (DRC) served as the exemplar for what could be any raw material in any part of the world. In 2035, the election of a pro-western leader who severs ties with China drives the PLA to conduct an expeditionary campaign to regain access and control over the cobalt mines of the DRC. The PLA planned to use satellite imagery, communications, and positioning, navigation, and timing (PNT) to enable a coordinated air assault from locations across Africa and the Middle East. The objective for workshop participants was to thwart China’s planned invasion of DRC without escalating to direct military confrontation, thus preserving the legitimate government of the DRC and global stability. Although conflict is avoided, the actions taken in the scenario raise tensions between China and the United States, setting up the next crisis.

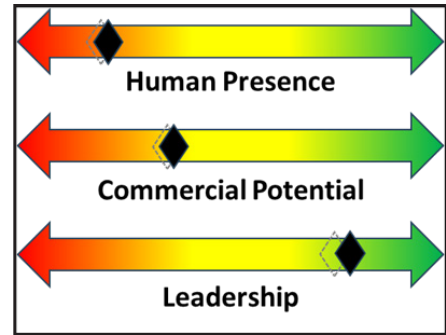


Figure 4: Triple Threat crisis in 2029 continues with modest progression of all three factors. As a result of the successful handling of the Nuclear ASAT crisis, “Leadership” has a larger gain from the previous crisis.

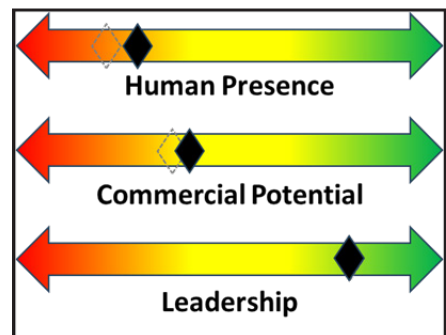


Figure 5: Expeditionary China (2035) maintains strong U.S. leadership and increased use of human presence and commercial space activities as global interests in space continue to mature.

#### Crisis #4: China's Attempted Space Blockade

Angered by what the Chinese leadership decried as “Western interference,” the PLA launched dozens of satellites with significant offensive and maneuver capabilities. This surge of offensive capability amounted to a space blockade and was the height of tension between the United States and China during the workshop. The objective for workshop participants was to identify the effects, actions, and conditions necessary to peacefully resolve this situation.

#### Crisis #5: Terrorism in Space

While tensions between the United States and China started to decrease following the successful resolution of the space surge crisis, another situation arose to challenge the spacepower of the United States, allies, and partners. The increase in human activity in space reached a new plateau with the grand opening of a luxury space hotel, which included guests who were heads of state and captains of industry. A terrorist organization conducted a cyber-attack to commandeer a North Korean satellite and threatened to use it to destroy the space hotel if their demands weren't met. The objective for workshop participants was to preserve the lives of guests and staff and prevent the destruction of the hotel. The unique relationship between China and North Korea added a layer of complexity that could be advantageous or challenging, depending on the response.

#### Crisis #6: Lunar Rescue of Chinese Taikonauts

The final Lunar Rescue crisis played the catalyst to end the prolonged competition with China. Here, a Chinese lunar base experienced an unknown emergency requiring the rescue of its 17 taikonauts. Unable to mount a successful rescue itself, China was willing to accept the aid of other nations. As with the previous crises, participants were asked to identify the effects needed to resolve the crisis, the actions necessary to achieve those effects, and the conditions enabling those actions to succeed. The ability and willingness of the United States, allies, and partners to rescue the Chinese personnel significantly thawed tensions to reach the workshop's ultimate desired end state.

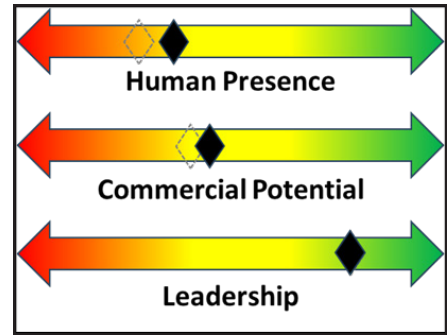


Figure 6: Space Surge (2037) continues growth of human presence and commercial activities while continuing U.S. leadership at a high level.

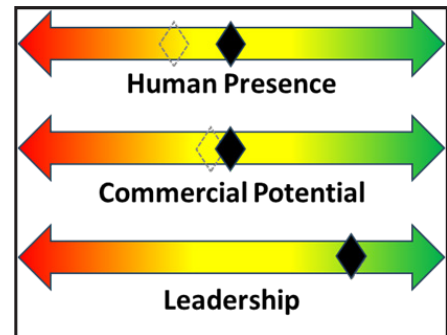


Figure 7: Satellite Hijacking (2041) a space hotel surges human presence in space and creates a target for terrorists.

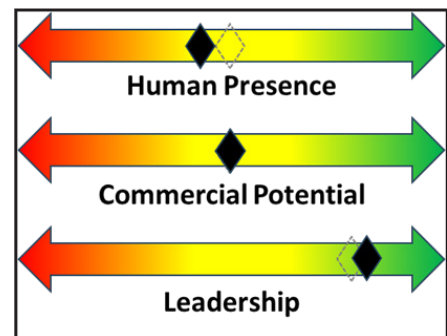


Figure 8: Lunar Rescue (2049) residual fears from the satellite hijacking decrease human presence in space even though its successful resolution bolstered U.S. leadership.

## Teaming Approach

The Mitchell Institute gathered 55 subject matter experts to participate in the workshop. Experts from government included operators, planners, acquirers, lawyers, and intelligence personnel. Industry participants possessed experience and expertise in the major mission areas of the Space Force and provided their insights without advocating for specific products, per the workshop's rules of engagement. Academic participants included professors of national security and economics, as well as a notable science fiction author.

The Mitchell Institute employed a hybrid teaming approach to ensure each workshop participant had opportunities to present their diverse perspectives. First, participants were teamed based on their functional experience and expertise: policy and legal, science and technology, global space operations, or space access and control operations. The Mitchell Institute did not limit the types of responses each functional team could provide but anticipated there would be a natural preference for effects, actions, and conditions related to each functional group. Functional groups were not constrained by budgetary limits, facilitating more open discussion to define what they believed would be required to resolve each crisis. The functional groups worked from the most future crisis backward, then convened to present and discuss their recommendations.

With all views made available to all participants, functional participants regrouped into four integrated teams. These four independent, but similarly experienced groups, reduced the risk of a single voice dominating the conversation. The task of integrated teams was to consolidate and prioritize recommendations. The groups then convened again to present and stress-test their recommendations to elicit further discussion and shared insights.

In the concluding discussion, the Mitchell Institute asked integrated teams for a list of five near-term actions that will support the successful resolution of the six crises and sustainment of a spacepower advantage for the United States, allies, and partners.

# Workshop Results

The true intent of the workshop was to stress a range of elements important to future potential challenges in space, not to develop specific methods to overcome each individual challenge. Discussion and subsequent workshop analysis uncovered a set of overarching themes important to establishing the conditions for maintaining a spacepower advantage throughout prolonged competition. These insights should inform the ongoing maturation of the U.S. Space Force as a warfighting force.

## **The U.S. Space Force Must Clearly Explain Its Roles and Missions**

First and foremost, the Space Force must have a set of clearly understood roles and missions. Unlike other services, the Space Force does not currently have a well-understood role in the minds of most Americans. Why the Space Force exists as a distinct military service and what it does to support national security remain ambiguous to the overwhelming majority of civilians and even many in DOD.<sup>14</sup> This ambiguity presents a distinct risk for the service. As a democracy, what the American public thinks matters and often translates to the priorities and decisions of elected officials. The Space Force executes increasingly critical national security roles and missions. However, leaders in the Department of Defense, the Executive Branch, and Congress risk undervaluing the service from an investment and policy support set of perspectives if they do not understand its importance. For all these reasons, the Space Force must aggressively lean into an education campaign. Topics should include basic roles and missions, a threat conversation, and discussions regarding possible futures. This is not about propaganda—it comes down to empowering smart decision-making. Ongoing discussions between Space Force leadership and key congressional committees are certainly happening to shape the current political environment to secure critical support.

As part of this effort, the Department of Defense needs to clearly define the roles and missions of the Space Force. Once defined, Space Force must pursue an aggressive and persistent campaign to communicate them. This will help clarify responsibilities among the military services and government agencies. It will also reinforce understanding among Guardians of their purpose and identity as a military service. Clearly and proactively articulating these missions and roles is essential to garner public and congressional support, which workshop participants agreed is critical to sustaining capabilities of sufficient scope and scale to generate needed effects and maintain a spacepower advantage.

Some aspects of mission and roles will undoubtedly evolve as interests and capabilities in space grow. However, a set of core missions can endure, just as they have for the Army, Navy, Marine Corps, and Air Force. Failure to establish and convey these roles and missions could lead to confusion among the services, reduced funding from Congress, and a deterioration of national will to maintain leadership in space. The Space Force will require additional Guardians to focus on public affairs and legislative liaison duties, which are essential to advancing understanding of these roles and missions. The costs involved with failing to support a strong Space Force must also be emphasized.

## **Space Must Be Normalized as a Warfighting Domain**

For the United States, allies, and partners to provide credible military options that prevent conflict in space, the domain must be treated like all other warfighting environments: air, land, sea, and cyberspace. “Space as a warfighting domain” has become a standard refrain over the past five years in the U.S. military

community, yet little has changed to move away from the “space as a purely strategic or sanctuary domain” mindset—prevalent during the Cold War and prior to China’s rapid development of anti-satellite weapon systems. It is crucial to recognize this transition, for core decisions tied to strategy, operational concepts, tactics, and technologies are impacted by this reality.

At the center of this issue is the historic U.S. policy of not fielding weapons in space. This is not to be confused with Article IV of the 1967 Outerspace Treaty, which prohibits the placement of nuclear or other weapons of mass destruction in space or on celestial bodies.<sup>15</sup> Rather, this is a self-limiting policy tied to either a lingering sense of the domain as a sanctuary, or an idealistic view of taking the moral high ground. Meanwhile, our adversaries are fielding weapons in space and even developing a nuclear weapon ASAT, in violation of the Outerspace Treaty.

While the United States, allies, and partners may want to preserve space as a peaceful domain, our adversaries have made it a warfighting domain. The best way to ensure no overt conflict erupts in space is to field offensive and defensive space warfighting capabilities that can hold adversary space capabilities at risk with weapons deployed in space and from the terrestrial domains. This creates compounding dilemmas across multiple domains for a would-be adversary to deter hostile enemy actions. Should deterrence fail, the U.S. must be postured to win. Too much is at stake, given the daily impact space capabilities have on military force structure and modern life.

Normalizing space as a warfighting domain necessitates changes to policy, funding, understanding, and operational capabilities. It is important to emphasize, that this is not a course the U.S. wanted, but instead something our adversaries drove. Dealing with this reality in a competent, responsible fashion requires the United States to develop a national policy that allows the Space Force to possess and employ weapon systems capable of defending its vital interests in space and denying potential adversaries the means to close their space-enabled kill chains. Hesitating to shift this policy only gives our adversaries more time to advance their offensive capabilities and cede any advantage once possessed by the United States.

For the Space Force to pursue these new objectives, it is crucial that the Department of Defense and Congress provide the Space Force with adequate resources. The service must field new capabilities and grow its required end strength. It comes down to a basic ends-ways-means set of decisions in an era where more is being asked of the Space Force.

While some fear such developments could drive a destabilizing arms race in space, it is important to recognize that credible deterrence is the only viable path given adversary decisions. Peace through strength needs to become the new mantra for twenty-first century spacepower. This leads to the third aspect of normalization—understanding. The reality is that U.S. adversaries are already fielding weapons in space and will continue to do so—regardless of U.S. restraint. The military, Congress, national leaders, and American citizens must understand the criticality of operations to secure our military *and* civil assets on-orbit. The need to achieve superiority in the space domain is the same as the need to pursue superiority in the air, at sea, and on land. Space Force must field operational capabilities that deliver the effects needed to preserve a spacepower advantage and achieve space superiority. In fact, weak American spacepower would incentivize adversaries to project hostile power in space because they would face few tangible adverse consequences.

There is no question that evolving from a peaceful space domain to one that is contested represents a major intellectual and emotional shift. Education is the best way to manage this transition. Effective policy and budget decisions depend on this informed understanding. An erosion of support for the Space Force weakens the defensive posture of the United States and the ability to prevent conflict in space. As the ancient adage states, “If you want peace, prepare for war.”<sup>16</sup> Normalizing space as a warfighting domain and ensuring equity for the Space Force in relation to its sister services requires surmounting additional barriers beyond policy, funding, and end strength. Overly restrictive security classification stymies cooperation and generating support. The inability to openly discuss important space operations with the American people exacerbates the lack of understanding about the criticality of the mission of the Space Force.

Similarly, the inability to directly observe activities in space is another hindrance to the development of a strong understanding of space operations. Much like undersea warfare, what happens in space is largely out of sight and mind. While the importance of undersea warfare is understood thanks to operations demonstrated in major conflicts and as portrayed in popular culture, space has not yet achieved the same level of familiarity—and resulting support. Unlike other military operations and services, the Space Force has not participated in a major conflict or World War that demonstrated the importance of not only space services but also offensive and defensive space capabilities. The proactive establishment of the Space Force and U.S. Space Command was intended to *prevent* a major peer conflict.

The lack of military members physically in the domain presents another barrier to normalization. The mission of the Space Force does not currently require Guardians in orbit. Much like remotely piloted aircraft (RPA), space operators execute decisive action and deliver space effects at a distance. Even with the analogy of RPA pilots, this mode of operations is foreign to what most Americans associate with military services, where human life is perceived as imminently and directly at stake in conflict. The Space Force must recognize this perception and actively communicate the importance of its mission and the seriousness of threats on par with the other services to maintain and grow the support it will need to deliver an enduring spacepower advantage.

### **An Overreliance on Commercial Space May Be Detrimental**

The role of commercial space capabilities in an enduring competition presents the Space Force with a double-edged sword. On one side, commercial space greatly expands access to rapid innovation and an increasing set of services available for integration. On the other, an overemphasis on the capabilities commercial entities can ostensibly provide detracts from the critical roles of the Space Force, which is dedicated to national space security in ways private entities are not.

Commercial companies must continue to provide essential supporting capabilities, and the 2024 USSF Commercial Space Strategy and DOD Commercial Space Integration Strategy both highlight the operational utility of the military leveraging existing and emerging space services.<sup>17</sup> In fact, the preponderance of the workshop discussion related to commercial space was on the utility they provide and how the military should follow the lead of commercial innovation. This leads directly to the other side of the proverbial sword—an overreliance on commercial services. The dimension of commercial space activities within military space operations has yet to be clearly defined. This results in a passive, default position of “let commercial providers solve it.” This approach undermines the rationale for a separate *military service* dedicated to the space domain. Further, some

missions must remain exclusively military functions. While the DOD's strategy enumerates the mission areas that will remain the primary responsibility of the government, many industry participants voiced a need to better understand their roles, responsibilities, and risks throughout the spectrum of conflict, including enduring competition. The Space Force should take a greater public leadership role in shaping commercial development activities that are distinct from the military capabilities and missions they must execute.

### **Guardians Must Adopt a Space Warfighting Mindset**

The lack of defined and clearly articulated roles and missions, the lingering view of space as a benign domain, and the encroachment of commercial entities in space security roles have a compounding effect on the ethos of America's Guardians. They operate in a service unlike any other, in a domain few understand, and commercial services, not the military, are on the cutting edge. For those same reasons, participants prioritized diplomatic or commercial solutions over military options in multiple workshop crises. This may be justified in the context of a workshop focusing on controlling escalation and remaining in competition, but it is out of sync with military operations in other domains or in full conflict.

The theory of Competitive Endurance is emblematic of this distinction. The objective of the U.S. Space Force's Competitive Endurance approach is to complicate adversary attack options to perpetually delay that attack—not pursue war-winning capabilities and force structure. Allowing Guardians to take a backseat to commercial services and not empowering them to seek victory stand in stark contrast to how other services organize, train, and equip their Airmen, Soldiers, Sailors, and Marines. For any potential threat to space security, Guardians must be able to articulate a range of military options to decision-makers, from reversible and non-kinetic to irreversible and kinetic. Informed by their unique understanding of the domain, Guardians must be able to explain the likely effects and risks of all available options. Armed with a firm understanding of their assigned missions, roles, and responsibilities, Guardians must be their own best advocates, championing the Space Force and its capabilities.

Space Force leadership has long recognized the importance of having a warfighting mindset and is actively working to instill and reinforce the warrior ethos. For new officer accessions, the Space Force has established a year-long Officer Training Course to prepare officers to meet and overcome a range of challenges that may emerge in prolonged competition. Additionally, Azimuth is a space education and training program to give future Guardians increased understanding to prevail in competition and conflict. Space Force leadership has also instituted the Space Force Generation (SPAFORGEN) model to build sustainable combat-ready units. SPAFORGEN established a deliberate cycle of preparation, readiness, and operational commitment to hone Guardian warfighting expertise. Finally, the Chief of Space Operations recently unveiled Space Force Truths, six core facts that shape the Guardian identity and the service's purpose as warfighters. These efforts move the needle in the right direction and should continue.

### **Improved Space Domain Awareness Is Critical**

Each of the six crises underscored the importance of space domain awareness and shed additional light on its application. Detailed and exquisite levels of domain awareness were crucial to successfully resolving several challenges, characterizing threats, and understanding their capabilities, limitations, vulnerabilities, and intentions to inform response option generation. Workshop participants recommended using a variety of phenomenologies, including visual, infrared, radar, and signals.

The ability to share domain awareness information with allies, partners, and the American public proved to be essential in coordinating options, securing the necessary support, and bolstering national will to brace for prolonged competition and execute appropriate response options as necessary. Continuing the advancement of space domain awareness collection methods and phenomenologies, adopting advanced processing tools that leverage artificial intelligence and machine learning, and reforming security classification are vital foundational steps to establish the conditions necessary for future response options to succeed.

### **Allied and Partner Cooperation & Integration Are Essential**

Cooperation and integration with allies and partners proved essential for successfully addressing each of the workshop's six crises. Like the discussion on commercial space capabilities, workshop participants asserted that the Space Force needed to take a proactive leadership role in defining what effects and necessary contributions each ally and partner could provide. Improving cooperation and integration means sharing space domain awareness information and extending collaborative efforts to some aspects of offensive and defensive space operations. For example, to prevent the Chinese invasion of the DRC, information about how the PLA employed space to enable its expeditionary force and how that access might be disrupted by the DRC or other African nations was pivotal. Workshop participants also viewed foreign launch sites as a viable means to preserve the launch manifest during the triple threat crisis.

There are several measures the United States can take to grow the level of ally and partner cooperation and integration that a prolonged space competition requires. First, the set of trusted partners must grow beyond the traditional Five Eyes nations. Security classification reform must likewise continue and accelerate to help enable these efforts. Space Force must also increase the number of its Guardians to help strengthen allied relationships and host more frequent combined exercises. Enabling more foreign military sales would likewise improve interoperability. These initiatives are sound investments for the Space Force and the United States.

### **Improved Space Warfighting Training Infrastructure is a Critical Enabler**

The future operating environment and the associated challenges the United States, allies, and partners will face are uncertain. The ability to prepare and train for a wide range of contingencies is essential. Workshop participants identified that, as crises unfold, the ability to practice planned operations was a prerequisite for rapid response options and mission success. The Space Force and U.S. Space Command require a robust training and exercise infrastructure, to include advanced simulators at the tactical and operational levels of warfare. This will enable integration with terrestrial warfighting simulators to prepare Guardians, Joint Force Commanders, allies, and partners for combined operations. Keeping this infrastructure accessible to international allies and commercial partners is an essential near-term step to establishing an enduring spacepower advantage.

### **International Norms Are Key to Responsible Space Behaviors**

Workshop participants identified that the United States must continue to lead the establishment of international norms and governance of space activities to define responsible behavior and consequences for irresponsible or hostile actions. By proactively defining which actions in space are acceptable and which will lead to the escalation of tensions, the United States will be positioned to rally international support to counter hostilities. Workshop participants agreed that this approach could help develop international



standards and interfaces, improving integration with allies. Increased commonality proved essential when exploring options for rescue and evacuation operations. As human presence in space grows, the Space Force's role of establishing standards and leading their development will also grow.

## The Role of Competitive Endurance

A key objective of the Space Endurance Workshop was to evaluate the utility and execution of Competitive Endurance across a prolonged timeframe. It is important to address how each tenet supported the resolution of each crisis and examine the varying application of the tenets across the groups. This offers insights into the criticality of each as well as potential investment areas. Identifying the required capabilities to meet increasing demands as U.S. interests in space continue to grow and evolve can help sustain their development.

### **Avoid Operational Surprise**

Nuclear ASAT: Space domain awareness was key. The ability to detect, monitor, and attribute the ASAT was essential in negotiations to garner international condemnation against Russia's deployment of an indiscriminate weapon. This drove requirements for the information to be unclassified, clear, and compelling. Higher levels of awareness and intelligence enabled the United States to pursue counterspace options to negate the threat or prevent its use. A detailed understanding of the structure, command and control, capabilities, and limitations of the weapon was critical to enabling a range of options for decision-makers.

Triple Threat: This crisis highlighted the need for both awareness of the space domain and from the space domain. The ability to monitor the evolving debris field was essential to response options, including the use of alternate orbits and capabilities. With the space-based assets remaining, the ability to continuously monitor Chinese activities in the Indo-Pacific supported terrestrial stability operations.

Expeditionary China: Space domain awareness and intelligence enabled the United States and allies to develop options to non-kinetically disrupt PLA operations dependent on their own space assets. The ability to share information on Chinese operations, capabilities, limitations, and vulnerabilities enabled the Democratic Republic of Congo to conduct counterspace operations as part of its national defense.

Space Surge: Releasable and exquisite space domain awareness were both critical for managing the high risk of escalation. The key distinctions are in scale and scope. Rather than a single threat in LEO, this crisis required tracking and understanding in all orbital regimes, including cislunar. It extended to understanding ground support elements and links used by the PLA to command and control the satellites. The multiple orbits and requirements for ground and link insights stressed the capacity of the combined space domain awareness architecture of the United States, allies, and partners.

Satellite Hijacking: The threat posed by a terrorist organization hijacking a satellite drove requirements to understand the telemetry, tracking, and command (TT&C) used to commandeer the spacecraft. TT&C information aided response options and geolocating the hijackers. The ability to assess the maneuvering capability of the satellite informed threat windows and timing for a potential ramming of or evacuation and rescue from the space hotel.

Lunar Rescue: A humanitarian rescue from the lunar surface posed unique challenges for space domain awareness. The ability to understand the nature and location of the lunar emergency and the condition of the taikonauts was foundational to rescue operations. A detailed understanding of communication and docking interfaces was required to reach the taikonauts and accelerate their safe return.

## **Deny First Mover Advantage**

Nuclear ASAT: The perceived ability to continue operations after the use of a nuclear ASAT contributed to the strong position of the U.S.-led coalition and aided a negotiated resolution. The resilience of the combined space architecture was used to highlight the futility of detonating a nuclear weapon in space and bolstered international condemnation for such a reckless and indiscriminate attack.

Triple Threat: This crisis stressed architectural resilience both on-orbit and in the launch infrastructure. Multi-orbit diversification supported continued space operations despite the debris event. The use of multiple launch sites, including foreign launch locations and services, supported the sustainment of the launch manifest after the hurricane caused significant damage to the primary launch locations in Florida.

Space Surge: Resilience, reconstitution, and defensive operations were essential to complicate adversary planning and execution of an overwhelming first strike. This increased the coalition's confidence in victory in the event China initiated attack and provided additional time for a negotiated de-escalation of tensions.

## **Conduct Responsible Counterspace Campaigning**

Nuclear ASAT: Possessing a range of kinetic and non-kinetic options to neutralize the ASAT and prevent the detonation command signal enabled both military and diplomatic approaches to this crisis. The ability to provide senior leaders with multiple courses of action strengthened the position of the United States and allies.

Expeditionary China: A range of counterspace capabilities enabled Coalition forces to disrupt the PLA's expeditionary campaign. The Coalition decreased PLA confidence in their operations by covertly disrupting their access to space, which proved pivotal in preventing the invasion of the Democratic Republic of Congo. Foreign military sales of some counterspace systems to the DRC increased its self-defense capability, further complicating PLA planning.

Space Surge: This crisis highlighted the need for both defensive and offensive counterspace capabilities. Active defense systems coupled with increased architectural resilience collectively reduced the effectiveness of any potential PLA attack. The demonstrated and perceived ability to reciprocate hostile action strengthened the position of the United States and enabled a negotiated solution, preventing escalation to conflict. The range of threat types and locations in this crisis also underscored the need for increased counterspace capacity and options.

Satellite Hijacking: A range of options to regain control or neutralize the hijacked North Korean satellite proved essential to peacefully resolve this crisis. While non-kinetic and reversible options were preferred by workshop participants, the ability to assure mission success and preserve human life was paramount.

## Other Considerations

Several additional topics emerged that generated insightful discussion during the workshop. These topics amplify the overarching themes or represent unique elements of their own.

### **Guardians in Space Are Not Necessary...Yet**

Today, Space Force missions can be achieved without putting Guardians in the domain. This will likely change as U.S. interests in space continue to grow and evolve, particularly as human presence in space increases in general. Within the crises presented during the workshop, participants identified potential crewed solutions to both the nuclear ASAT threat and lunar rescue challenges. Workshop participants also considered robotic missions for both scenarios. Some participants highlighted the importance of having Guardians in the domain to help normalize it with the other warfighting domains. The thought of putting Guardians in harm's way simply to be like other domains seems unreasonable and unlikely, but recognizing that this is a unique detractor from normalization suggests this is an area the Space Force should proactively address. Just as pilots who fly remotely piloted aircraft are warfighters, Guardians can be warfighters without being in the domain. As a thought exercise, the Mitchell Institute asked workshop participants to consider what missions or trip wires would be required to necessitate having Guardians in space for mission execution. While participants could not agree on a definitive benchmark event, most agreed there would come a time when it would be necessary.

For example, most workshop participants recognized a crewed solution would be necessary for the lunar rescue mission. However, there was disagreement on whether the rescuers should be Guardians or not. Some suggested NASA astronauts would be an appropriate choice. Other participants saw the military as more viable. Recognizing that Article IV of the Outer Space Treaty states, "The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited," these participants expressed that, like terrestrial Noncombatant Evacuation Operations (NEO), a military operation would be appropriate.<sup>18</sup> Some suggested this might be performed by the Army or Marine Corps since it involved lunar surface operations. But, just as all military services can have an air component when necessary, the Space Force could have Guardians in a "surface component" trained for operations on celestial bodies. The competencies, expertise, and resources for space operations are best aligned under one service. When services branch too far from core missions, it creates gaps, redundancies, and inefficiencies. The Mitchell Institute believes the Space Force should have the lead when the need arrives for military members to execute operations on celestial bodies.

### **Security Classification Reform Cannot Stall**

The prevalence of security classification reform in workshop discussions and the ubiquity of the impact it has on sustaining an enduring spacepower advantage warrant additional deliberation on this important topic. U.S. government classifying authorities must maintain a delicate balance between security and operational effectiveness. Currently, that balance does not exist. According to workshop participants, overclassification hinders collaboration among cleared Guardians because of insufficient network and machine-to-machine connectivity. Some participants familiar with intelligence reports indicated they probably knew more about adversary space capabilities than U.S. systems. This propagates planning and operational employment challenges caused by Guardians, allies, and partners not sharing the same complete picture of threats and possible response options. One workshop participant noted that the dual classification system maintained by the DOD and Intelligence Community (IC) presented an unnecessary bureaucratic hurdle. Industry partners must currently maintain two sets of clearances, which increases cost and

administrative burden. Simplified rules and guidance on reciprocity between the two systems could alleviate these burdens and help accelerate the fielding of critical space capabilities. DOD and IC security classification reform and potential integration will be essential steps to ensuring an enduring spacepower advantage. Failure to make these adjustments will risk the effective synchronization of efforts, prevent new entrants from expanding the industrial base, and hinder the delivery of needed capabilities.

### **Artificial Intelligence & Machine Learning (AI/ML) Are Key Enablers**

Workshop participants identified capabilities using AI/ML as extremely valuable to space operations. AI/ML would enable future missions that are currently not executable. Given the distances, volume, and number of resident space objects, keeping track of activities will continue to drive the importance of AI/ML tools for space domain awareness. Uncrewed missions further from Earth will also increase the demand for AI/ML to facilitate operations where communication delays might impact mission success. The Space Force must continue to invest in the technology maturation and application of AI/ML and trusted autonomy.

### **Spacecraft Refueling Is Another Enabler for Mission Success**

Future Space Force counterspace mission execution requires advanced spacecraft refueling options. Maneuvering in space will most likely require expelling mass to change a spacecraft's momentum, regardless of whether an asset uses traditional, electric, or even nuclear propulsion. As a result, sustaining frequent maneuvers will require replenishing that mass. While workshop participants identified that out-maneuvering Chinese ASATs offered a potential solution in the "space surge" crisis by effectively preventing the enemy from targeting and closing the kill chain, it would require some type of refueling to prolong the spacecraft's fuel-based lifespan.

### **Space Debris Mitigation Is Not a Military Mission**

In the ongoing evolution of Space Force responsibilities and missions, certain activities in space will need to fall beyond the scope of the military. Debris mitigation is a prime example. When confronted with a debris event in the "triple threat" crisis, workshop participants chose to monitor and work around the debris field rather than attempt a rapid clean-up effort. Most felt this mission was better handled by a third-party organization funded by a collective investment of space-faring nations or those responsible for debris generation. Like a terrestrial sanitation service, a private organization may be able to develop the technologies, concepts of operations, and infrastructure necessary to close the business case in space.

### **Increased Military-to-Military Engagement is Needed**

In the coming years, the need to conduct robust military-to-military engagements with a wide range of nations will place additional requirements on Space Force personnel and strength. These interactions will be essential in growing and maintaining a strong alliance of nations to counter aggression in space. Many of these will follow traditional alliances and activities, such as foreign military sales and combined exercises. As more countries become space-faring nations, the need to proactively engage with these emerging players is critical. Frequent engagements can promulgate acceptable norms of responsible behavior and common standards. Strong norms and standards can, in turn, accelerate future integration of space capabilities and effects. As demonstrated in the "expeditionary China" crisis, the ability to coordinate activities, share information, and defend legitimate governments will depend on developing relationships between space professionals around the globe.

## Post-Workshop Observations

The ability of the Space Force, U.S. Space Command, allies, and partners to have an enduring spacepower advantage hinges on maintaining popular support and national will. This is true for military operations in any domain, but the lack of a clear understanding of the roles, missions, and importance of the Space Force threatens its base of support at a fundamental level. This may seem like an intangible challenge to tackle in the future, when space as a warfighting domain becomes undeniable in an existential way. However, it would be catastrophic for leadership to ignore that space is already a warfighting domain and allow current thinking to shape the resources needed to organize, train, and equip the U.S. Space Force. Failure to act decisively now will establish patterns of behavior that lead to confusion and decreased mission effectiveness.

This lack of understanding, restrictive national policy, and a congressionally limited budget and end strength compel the Space Force to develop an approach different than all other military services. Given current limitations, Competitive Endurance is a sound approach that may help avoid conflict, but it has unintended consequences that could prove fateful for the Space Force. At a time when the newest service is establishing its identity, removing “winning” from Guardian vocabulary is stifling the development of a warfighting mindset. Furthermore, the popular support and national will required for an enduring spacepower advantage is difficult to sustain if it is not viewed as a matter of life-or-death. Fundamentally, the American taxpayer will not support a military service it does not understand and that does not plan to “win.” This will lead to decreasing budgets and the inability to field the capabilities critical to Space Force success. To truly accept space as a warfighting domain—like other warfighting domains—the U.S. Space Force must have a demonstrated ability and perceived will to achieve victory. It cannot exist just to maintain a stasis of competition.

# Recommendations & Conclusions

Maintaining a spacepower advantage over time and across a diverse set of potential challenges will require the timely execution of specific actions to create desired effects and foster the best conditions. The actions, effects, and conditions needed to face the realities of the future may differ from those identified during the workshop, but the foundational steps that must start today are undeniable and needed to prepare the United States, allies, and partners to meet any challenge.

The administration and Congress must first adjust national policy to allow the Space Force and other services to field the weapons systems needed to secure national interests in space. By loosening the current policy restrictions, national leaders will enable a stronger defense posture and normalize space to other warfighting domains. Not only will this policy shift convince potential adversaries of the United States' commitment to preserving a spacepower advantage, it will also lead to the development and fielding of new capabilities that credibly counterbalance adversary aggression. Congress must *consistently* fund the Space Force to grow its capabilities and end strength. The Space Force must have personnel and equipment with the right capabilities and capacity to overcome future space challenges. These will enable the Space Force to offer military options that impose costs on China or any other adversary, not just endure in competition indefinitely. Preventing conflict in space, and in general, remains the objective. Weakness will invite a greater risk of conflict and place core U.S. interests at risk. Wielding the demonstrated capability, capacity, and willingness to win will be a far more effective approach than maintaining an indefinite stasis.

The Department of Defense must update the space-related roles and missions among the services. A thorough review of existing and potential space missions for all armed forces and government agencies is overdue. The establishment of the Space Force and expanding interests in space drive this imperative. Clearly defined and agreed-upon missions are essential to aligning resources, avoiding unwanted duplication of effort, and synchronizing effects. As the workshop identified, some missions in space, e.g., debris mitigation, may fall outside the DOD. A documented position on where the DOD does and does not have mission responsibilities will signal commercial, civil, and international partners of a potential opportunity. As capabilities and interests in space mature, the DOD must regularly update these roles and missions to ensure the preservation of an enduring U.S. spacepower advantage.

Adopting a strategy to win will also impact the training and education of Guardians. By cultivating a more assertive warfighting ethos, the Space Force will be on a more normalized footing with the other services of the DOD. Guardians require a training and education enterprise capable of imparting the unique aspects of operations in the space domain as well as the similarities of operations in other warfighting domains. They must be able to present a range of military options and fully articulate the likely effects and risks associated with each. This is a key for success when it comes to engagement with their joint counterparts and in the policy realm.

The ongoing engagements with commercial and international partners must continue and grow to present a consolidated front against aggression and expand the scope and scale of potential responses. With reformed security classification guidance, a more open exchange of capabilities and data can occur. This will enable the

Space Force to proactively identify where and how allies and partners can best integrate into a consolidated tapestry. This will decrease unintended duplication and enable our allies and partners to more effectively and efficiently invest their time and resources.

Finally, the Space Force must proactively engage the American people and Congress to convey the criticality of the Space Force and the threats we face—or risk losing support and eroding national will. The American taxpayer will not support a military service whose mission they do not understand or associate with the other military services. Failure to simply and clearly relay the importance of space operations and the missions of the Space Force risks declining budgets and volunteers for service.

## Conclusions

The Space Force is on an evolutionary path. It contends with a domain that has endless potential, and it is only five years old. Constrained by policy, budget, and end strength, Space Force leadership has nonetheless put forward an approach that will complicate adversary options, control escalation, and could perpetually delay conflict. The three tenets of Competitive Endurance, and the resulting activities to improve space domain awareness, architectural resilience, and conduct responsible counterspace campaigning, demonstrate significant utility in a series of hypothetical future crises. However, it does not normalize space as a warfighting domain or allow Guardians to pursue victory and space superiority. This prevents the public and Congress from fully understanding the criticality of the Space Force as a full military service. If this loophole is not addressed, the Space Force and U.S. Space Command could find itself in a death spiral of waning support and funding, ultimately precluding the fielding of capabilities and conducting of operations necessary to secure U.S. interests in space.

By adjusting policy and increasing funding, the administration and congressional leaders can unshackle the Space Force to execute the very mission they established it to do. The Space Force must engage in a constant and compelling public relations campaign to clearly explain the importance of that mission. Ultimately, improved awareness and understanding is vital to success in the ongoing competition with China or a future conflict in space. In other words, these actions are foundational to the development of the Space Force.

Space domain awareness is essential to the success of many current and future operations. This was abundantly evident in all six of the workshop crises. The scope and scale of domain awareness information needed was expansive, from releasable unclassified data to detailed knowledge of adversary satellite command and control. Additional investment in the technologies, number of systems, and phenomenologies used for awareness is critical. The ability to fuse space domain awareness data through artificial intelligence and machine learning tools will also be indispensable as the complexity of the awareness mission continues to grow.

Security classification reform to enable the ability to share domain awareness and other information with allies and partners—and even among different elements of the DOD—will be a critical facet of future operational success. An increased ability to share information at an unclassified level is likewise imperative to increasing popular and congressional support for the growth of the Space Force. While classification

must be balanced with the need for operational security and the preservation of warfighting capability, most workshop participants strongly believe this balance does not currently exist and overclassification is currently a huge barrier to the delivery of spacepower.

Commercial companies will continue to provide essential supporting capabilities, but the Space Force needs to demonstrate leadership and not simply follow industry's evolutionary path. Current discussion related to commercial space focus on the utility industry can provide and how the military should follow the lead of commercial innovation. This results in a default position of "let commercial solve it" that undermines the rationale for a separate military service dedicated to the space domain. The Space Force should take a greater, publicly recognized leadership role in shaping commercial development activities that are distinct from the military capabilities and missions they must execute.

The continued integration of allied capabilities will be essential to an enduring spacepower advantage and requires the Space Force and U.S. Space Command to take a leadership role in identifying what capabilities from which ally will be best for the combined force posture. Directing another sovereign state to develop specific capabilities may prove a delicate task, but, through open dialogue, this approach will increase the effectiveness of each state and avoid unintended duplication of effort and wasted resources.

Another similar effort workshop participants clearly identified was the need for a robust and comprehensive training infrastructure. The imperative to prepare Guardians, allies, and partners for the variety of uncertain challenges facing future coalitions reverberated across all workshop scenarios. This infrastructure not only prepares crews for upcoming missions but also strengthens the ties between allies and partners and helps synchronize needed effects among the entire coalition.

Clearly understood and internationally agreed-upon norms and standards are key to stability in future crises. The United States must, again, continue to lead these efforts that will establish a framework for what is acceptable behavior in space and what will be considered hostile or even an act of war. Another facet of international norms and standards is the development of common interfaces to facilitate communication and potentially life-saving measures. It will also help us better integrate with our allies and partners.

The uncertainty of the future drives the urgent need for preparation today. The creation of the U.S. Space Force was a proactive step toward a safe and secure space domain. However, Guardians must be resourced and empowered to win. There are other proactive steps the United States, allies, and partners can take to build up the foundation for an enduring spacepower advantage. New technologies, policies, and operational concepts are important, but the most critical next step is, arguably, for the Space Force to define its roles and missions and clearly articulate them to the American people and Congress. Space is indispensable to modern life and will only continue to grow in importance. There are adversaries today that threaten our access to space, and they intend to continue challenging our space advantage. The more people who understand this fact, the more likely the Space Force will be able to gain the support it needs to grow into the service the nation needs. 🌟



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## Endnotes

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