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MANAGING DUALITY IN SPACE

VOLUME I, EUROPE-EURASIA WORKSHOP INSIGHTS ON ESCALATORY SPACE ACTIVITIES AND POTENTIAL RESPONSE OPTIONS



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Summary

No global framework of norms or governance mechanisms specifically addresses escalation risks in space arising from the dual-use nature of space systems, or their ability to support both civilian and military functions. To help address this gap, the RAND *Duality in Space* project convened a workshop in March 2026 in Geneva, Switzerland, that brought together stakeholders and experts from across Europe and Eurasia to examine which space activities participants viewed as escalatory and under what circumstances, what responses they considered justified, which mechanisms they believed sufficiently manage risk, and what challenges could complicate implementation of potential policy frameworks. These proceedings summarize key insights from the workshop and, alongside findings from additional workshops in Tokyo, Japan, and Washington, D.C., will inform a broader report on policy options for developing norms and governance approaches for dual-use space systems.

The workshop tested a potential approach for categorizing escalatory activities in space, distinguishing *behaviors* (observable maneuvers in space, such as a satellite performing a proximity and rendezvous operation) from *effects* (the use of system-derived data to inform Earth-based activities, such as Earth observation data informing terrestrial military operations). Guided through two scenarios—one behavior-based and one effect-based—participants characterized baseline and escalatory events as safe, problematic, or dangerous and offered perspectives on what responses were appropriate for each risk threshold.



The workshop surfaced the following preliminary insights:

- **Escalatory activities:** Participants identified **operator unresponsiveness**, **close proximity operations**, and **actions contributing to overall unclear intent or objectives** as key activities that significantly increase uncertainty and the likelihood of miscalculation. Such behaviors, especially those involving ambiguous ownership or unexplained maneuvers near other space assets, were recognized as primary drivers that can rapidly escalate crises in the orbital environment.
- **Escalatory thresholds:** Critical limits in space activities are generally crossed, and immediate responses become warranted, **once irreversible physical damage to an orbital asset becomes observable**.[1] The occurrence of material harm, such as collisions or destructive interference, offers a clearer attribution pathway and reduces the ambiguity associated with nonkinetic or information-based interference. This identification of a clear and tangible high-risk level is essential for guiding proportionate responses.
- **Governance gaps and potential norm or mechanism options:** More consistent application, interpretation, and implementation of **existing treaties and legal instruments**, such as the Outer Space Treaty and voluntary international norms, were identified as potentially more effective for risk mitigation than all-encompassing reforms. Although current frameworks remain imperfect and often lack robust enforcement mechanisms or universal adoption, they still provide adaptable mechanisms to promote responsible behavior. In parallel, the creation of targeted new norms or binding agreements may be necessary to clarify persistent specific gaps, particularly regarding operator transparency and responsiveness when being confronted about intent.

[1] Importantly, this threshold is not exclusive to kinetic action. Participants noted that nonkinetic responses, such as jamming a satellite's sensors in response to persistent, unacknowledged surveillance in sensitive areas, could trigger similar escalatory dynamics.

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CHAPTER 1

Introduction and Background



Satellites and other space systems increasingly underpin both civilian and military activities on Earth, with governments and private industry deploying them for economic, scientific, national security, and cooperative purposes. Because these systems often support both civilian and military functions, they possess an inherent duality that can create risks for the security and stability of outer space.[2] Observers could misinterpret otherwise peaceful space activities as escalatory; states that feel threatened could respond in kind, compounding misperceptions and driving an escalatory cycle that risks culminating in conflict in space. Despite these risks, no global framework, either of norms or governance mechanisms, specifically addresses escalation stemming from the dual-use nature of space systems.

These proceedings summarize key insights from a workshop hosted by RAND in March 2026 on escalatory space activities and potential norms or governance options to mitigate associated risks. Held in Geneva, Switzerland, the workshop convened eight stakeholders from across Europe and Eurasia, representing government, industry, and research communities. Through two scenarios and subsequent discussions, participants examined how to categorize escalatory activities in space, what responses might be justified, which norms or mechanisms sufficiently manage risk, and what challenges might complicate implementation.

[2] *Stability* as used in these proceedings refers to a situation in which countries retain strong reasons not to launch an attack during a crisis because their military forces and capabilities make it unlikely that striking first would confer a decisive advantage. See Forrest E. Morgan, *Deterrence and First-Strike Stability in Space: A Preliminary Assessment*, RAND Corporation, MG-916-AF, 2010; and Glenn A. Kent and David E. Thaler, *First-Strike Stability: A Methodology for Evaluating Strategic Forces*, RAND Corporation, R-3765-AF, 1989.

Duality in Space Phase 2 and Workshop Objectives

The Geneva workshop, together with additional workshops in Tokyo, Japan, and Washington, D.C., marks the second phase of the RAND *Duality in Space* project. Launched in 2024, the three-phase effort aims to provide governments, military planners, regulators, and commercial space system operators with recommendations on developing and implementing global norms or governance mechanisms to mitigate the risks of escalation in space. In the first phase (2024–2025), the project team (1) produced a baseline report on how countries approach dual-use space system development, deployment, and governance; (2) held three virtual workshops, documented in corresponding proceedings, to further analyze the global landscape of dual-use space systems; and (3) synthesized findings and recommendations in a Phase 1 report.[3]

The first phase examined system types, stakeholders, and broad governance considerations, while the second phase focuses on more precisely characterizing space escalation risks and aggregating a menu of potential norms and governance options. Phase 2 efforts include three in-person workshops—gathering insights from stakeholders across Europe-Eurasia, the Americas, and the Indo-Pacific—and a forthcoming synthesis report to inform the project's third phase, which will develop recommendations on realistic options for a global norms or governance regime. Figure 1.1 overviews *Duality in Space* publications over the project's lifespan. For a detailed explanation of the workshop design, see Appendix A.

[3] For the **baseline report**, see Bruce McClintock and David Glickstein, eds., *Exploring Duality in Space: How Select Countries Approach Dual-Use Space Systems*, RAND Corporation, RR-A4003-2, 2026.

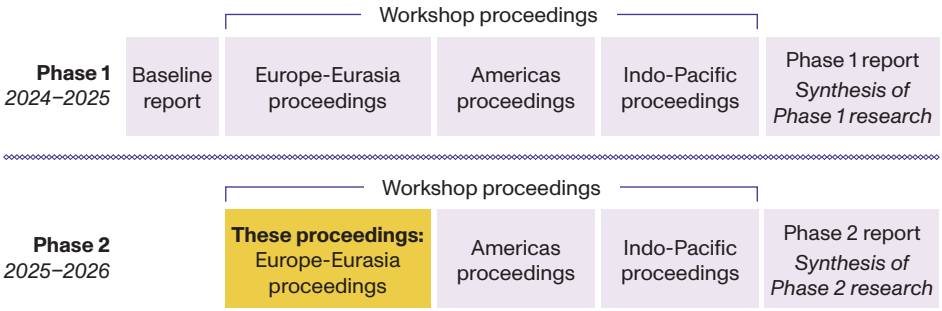
For the **Phase 1 Americas workshop proceedings**, see Anca Agachi, Krista Langeland, Amal Altwaijri, Mélusine Lebret, David Glickstein, and Bruce McClintock, *Surveying Duality in Space*, Vol. I: *Americas Workshop Insights on Developing, Deploying, and Governing Dual-Use Space Systems*, RAND Corporation, CF-A4003-1, 2026.

For the **Phase 1 Europe-Eurasia workshop proceedings**, see Mélusine Lebret, James Black, Krystyna Marcinek, Anca Agachi, Bruce McClintock, and David Glickstein, *Surveying Duality in Space*, Vol. II: *Europe-Eurasia Workshop Insights on Developing, Deploying, and Governing Dual-Use Space Systems*, RAND Corporation, CF-A4003-2, 2026.

For the **Phase 1 Indo-Pacific workshop proceedings**, see Karen Schwindt, Amanda Kerrigan, Jeffrey W. Hornung, Kristina Novakovic, Amal Altwaijri, Nicholas Kong, David Glickstein, and Bruce McClintock, *Surveying Duality in Space*, Vol. III: *Indo-Pacific Workshop Insights on Developing, Deploying, and Governing Dual-Use Space Systems*, RAND Corporation, CF-A4003-3, 2026.

For the **Phase 1 synthesis report**, see Bruce McClintock, David Glickstein, Krista Langeland, Anca Agachi, Mélusine Lebret, and Karen Schwindt, *Navigating Duality in Space: Establishing a Foundational Understanding of Dual-Use Space Activities,* RAND Corporation, RR-A4003-3, 2026.

Figure 1.1. | *Duality in Space* Project Publications



By hosting workshops across regions, RAND aims to ensure that the project's findings and recommendations reflect diverse perspectives and regional considerations. The Geneva workshop collected insights from European and Eurasian stakeholders: one each from Norway, Russia, Saudi Arabia, and the United Kingdom (UK) and four from global organizations (see Table 1.1). Four participants were from government (civilian or military), three were from the research sector, and one was from private industry.[4]

Over the course of the workshop, participants provided insights on two scenarios: one regarding rendezvous and proximity operations (RPO), in which a satellite with an unknown operator approaches a commercial satellite, and one involving an Earth observation (EO) satellite suspected of performing intelligence, surveillance, and reconnaissance (ISR). The scenarios encouraged participants to identify escalatory activities and consider how responses might diverge depending on whether systems are performing observable maneuvers in space (*behaviors*, as in the first scenario) or collecting data to inform Earth-based activities (*effects*, as in the second scenario). Overall, the workshop design focused on addressing three core objectives relevant to policymakers, space operators, commercial providers, and researchers concerned with space security and governance challenges posed by dual-use space systems:

- **Identifying escalatory activities:** Establish a shared understanding of the types of space activities that could be escalatory and pose risks to the stability and security of space.
- **Identifying escalatory thresholds:** Establish a method for classifying risks of space activities and identifying the levels at which they warrant a response.

[4] To preserve participant anonymity, we do not attribute views to specific countries or stakeholder groups. In addition, because the workshops included a relatively small number of participants, the findings reflect the informed perspectives of the workshop participants but are not necessarily representative of the space community as a whole.

Table 1.1. | Country or Region and Sector of Workshop Participants

Participant	Country or Region	Sector
1	Global	Government
2	Global	Research
3	Global	Research
4	Global	Industry
5	Norway	Government
6	Russia	Government
7	Saudi Arabia	Research
8	United Kingdom	Government

NOTE: All eight participants were selected for their expertise and senior leadership in space policy, operations, or governance. See Appendix A for further details on selection criteria.

- **Clarifying governance gaps and identifying potential norm or mechanism options:** Identify norms or governance mechanisms that could reduce risks of escalation or conflict in space that the team can evaluate and refine in Phase 3, and assess their shortcomings and implementation challenges.

Proceedings Organization

These proceedings are organized as follows:

- **Chapter 2** outlines the project team's approach to characterizing escalation risks in space. It introduces key definitions and categories, including (1) activities, divided into behaviors and effects, and (2) risk thresholds, defined as safe, problematic, or dangerous. The chapter then provides additional detail on the two scenarios: a behavior-based RPO scenario and an effect-based EO/ISR scenario.
- **Chapter 3** summarizes preliminary participant insights on what shaped their perceptions of increased risk in space. Participants described when behaviors in space escalated to levels that warranted a response, alongside a parallel analysis of risk-escalating effects.

- **Chapter 4** focuses on participant perspectives on responses to escalatory space activities. Participants shared their views on what responses might be justified depending on the nature of behaviors and effects, as well as which norms or governance mechanisms, existing or proposed, might be sufficient or insufficient to manage escalation risks. They further detailed challenges that could complicate the implementation of norms or governance.
- **Chapter 5** overviews key conclusions and previews next steps in the *Duality in Space* project.
- **Appendix A** overviews the methodological approach, including details on participant and scenario selection.
- **Appendix B** provides the language used for the workshop scenarios.

CHAPTER 2

Approach to Characterizing Escalation Risks in Space:

Defining Activities and Thresholds



Mitigating risks through coordinated responses—those shaped by norms or governance—typically depends on clear understandings of which actions warrant responses, the level of risk required to trigger them, and the types of responses suited to different actions and risk levels. Mitigation also requires feasibility: States must be able to verify compliance and impose costs for noncompliance, have appropriate measures readily available, and possess the capacity to implement those measures. However, no comparable approach currently addresses risks specific to the space domain. Adapting approaches from other domains will likely prove insufficient given the distinct operating environment and unique challenges of outer space. For instance, efforts to combat illegal fishing in international waters—where, as in space, actors might be difficult to identify—rely on maritime-specific tools (such as vessel registration, flagging, and boarding and inspection procedures) to establish attribution and assess compliance. Such mechanisms, however, are far more difficult to implement in space, where systems operate remotely; lack clear indicators of ownership, intent, or function; and are subject to technical constraints that limit states' abilities to interpret activities with confidence. These conditions, which complicate judgments about which activities are escalatory and when responses are warranted, underscore the need for a distinct approach tailored to the space domain.

To support the development of norms or governance mechanisms that address escalation risks specifically in space, the *Duality in Space* project team developed a structured approach for characterizing such risks, which could form the basis of a future risk mitigation framework. This approach defines (1) the types of space-based activities that could

be perceived as escalatory, categorized as behaviors or effects, and (2) the thresholds at which risk levels shift, characterized as safe, problematic, or dangerous.

This chapter introduces the approach used to guide workshop discussions and shape the scenarios. These scenarios, overviewed at the end of this chapter and in greater detail in Appendix B, illustrate how stakeholders could apply the framework's concepts when evaluating risks and considering potential responses.

Classifying Activities: Behaviors Versus Effects

The *Duality in Space* Phase 1 synthesis report, *Navigating Duality in Space: Establishing a Foundational Understanding of Dual-Use Space Activities*, concluded that norms or governance frameworks based on definitions of *dual use* that distinguish dual-use systems from non–dual-use systems are unlikely to prevail because no universally accepted definitions exist.[5] Rather, the findings support the recommendation that

> [s]takeholders should pursue a *behavior- and effect-based framework* based on concrete activities . . . . to mitigate risks of escalation or conflict. Stakeholders could further incorporate factors that are often difficult to discern, such as intent, user identity, and technical design, when they can be definitively established.[6] (Emphasis added.)

This project defines *behaviors* as observable maneuvers or activities conducted by space systems. Examples include maneuvering in space, servicing or refueling another system, or performing in-space assembly or manufacturing. These behaviors are characterized by observable physical activity that reflects active system use. Systems engaged in routine orbital motion or passive station-keeping, such as communication satellites maintaining assigned orbits, are not considered to be performing behaviors in this approach. Systems that perform behaviors often involve emerging capabilities, including RPO; in-space servicing, assembly, and manufacturing (ISAM); on-orbit servicing (OOS); and active debris removal (ADR).

Conversely, *effects* are the use of space-system–collected data to support or inform Earth-based activities, or the disruption of this use. Systems that provide communications or navigation services, collect imagery, monitor terrestrial activities or weather, or capture data on the space environment itself are producing effects. Unlike many behavior-conducting systems, which often involve emerging technologies, effect-producing systems

[5] McClintock et al., 2026.

[6] McClintock et al., 2026, p. 8.

are generally those with long-established capabilities, including EO/ISR; satellite communications (SATCOM); positioning, navigation, and timing (PNT); and space situational awareness (SSA).

This analysis also recognizes that certain space activities can involve both behaviors and effects. For example, an anti-satellite (ASAT) weapon that destroys an EO/ISR satellite—a clear behavior—would also disrupt the flow of data between the satellite and its operator, a resulting effect.

Distinguishing between behaviors and effects reflects differences in how risks and consequences manifest. A risky behavior could culminate in two satellites colliding and generating a large field of space debris, whereas a risk-increasing effect could involve a military using satellite-collected data to support an invasion of another country. Different activity types might therefore require different types of responses; for example, states might pursue diplomatic channels to reduce the risk of satellite collisions but might consider cyber or even kinetic actions in response to satellites perceived as directly supporting military operations. Determining the type of response could further depend on both endogenous factors, such as space system characteristics, and exogenous factors, including broader political circumstances.

Defining Risk Thresholds: Safe, Problematic, and Dangerous

Risks tend to unfold not in binary terms but along a spectrum, with different levels of risk warranting different types or degrees of response. The approach provided to workshop participants used a simple, three-tiered approach to characterize risk of escalation in space; participants characterized risk environments as one of the following:

- *safe*, or free from harm or risk
- *problematic*, or causing difficulty or uncertainty
- *dangerous*, or likely to cause harm.

Whereas a *safe* risk classification might require no response, a situation classified as *problematic* might, for example, warrant diplomatic or economic measures, and *dangerous* situations might require the most severe responses, including physical interference or kinetic action.[7]

[7] The project team kept these three tiers broad to facilitate structured workshop discussion rather than precise analytical distinctions. Using broad definitions further helped to surface a wider range of factors that might influence participants' perception of risk. Although breadth helped prevent conversations from stalling on definitional debates, a more granular framework might have better captured the full complexity of classifying escalation risk. Future analysis could consider greater specificity in classification schemes.

Two Scenarios

The *Duality in Space* project team designed two scenarios to test these concepts and elicit participants' judgments on which activities are increasing risk, when risk levels rise, the degree of risk produced, and what responses are appropriate given those risk levels. Each scenario focuses on a distinct activity type: Scenario 1 examines risks stemming from a behavior, in which a satellite of unknown identity approaches another satellite, and Scenario 2 involves risks arising from effects, in which a country perceives an adversary's EO constellation as conducting surveillance. The events in each scenario progress over two distinct phases: (1) a baseline phase, which presents the established conditions and system activities, and (2) an escalation phase, in which new developments introduce potential risk-increasing changes in behavior or effects. The full scenario text is included in Appendix B.

Scenario 1: Assessing Risks from the Behavior of a Potential RPO Maneuver

The scenario involves two primary satellites: **MYS-1**, a satellite of unknown origin, and **COM-1**, a European dual-use commercial communications satellite.

Participants first answered questions regarding the baseline phase, including how they classified the risk of the baseline dynamics—safe, problematic, or dangerous—and the factors that drove their classification. In the baseline phase:

1. A European space traffic management (STM) system spots the unknown MYS-1, which is conducting unusual maneuvers in geostationary orbit (GEO).
2. MYS-1 approaches and parks near COM-1.
3. Analysts believe that MYS-1 might be conducting an RPO, but they are uncertain.
4. COM-1's operator condemns the maneuver and shortlists possible MYS-1 operators.
5. COM-1's operator requests that the unknown MYS-1 operator reposition its satellite, but MYS-1 does not move.

Participants then answered similar questions regarding the escalation phase, including about their risk classification and driving factors. In the escalation phase:

1. COM-1's operator initiates a collision-avoidance maneuver.
2. A malfunction leaves COM-1 unresponsive and on a trajectory of possibly colliding with MYS-1.

3. COM-1's operator tries to warn MYS-1.
4. Because no communications channels exist, the signaling to MYS-1 is unsuccessful.

Scenario 2: Assessing Risks from the Effects of an EO/ISR System

This scenario involved two bordering countries, **Country W** and **Country Y**, and an EO constellation, **Seed-Vis**, which a commercial operator in Country W launched to monitor crops. The satellites in the constellation use artificial intelligence (AI) to drive their operations.

Participants first provided insights on the baseline phase:

1. Country W launches Seed-Vis, a crop-monitoring EO satellite constellation with onboard AI.
2. After months of use, Seed-Vis starts lingering over the border area near Country Y.
3. Seed-Vis's AI begins focusing on heat and signal patterns rather than crops.
4. Analysis indicates that the Seed-Vis satellites are tracking vehicles along the border.
5. Country Y's allies perceive Seed-Vis satellites as ISR assets, conducting surveillance.

Finally, participants shared their perspectives on risk classification and driving factors regarding the escalation phase:

1. Allies of Country Y alert Country Y; Country Y accuses Country W of spying.
2. Seed-Vis's purpose and ownership come under scrutiny; the company cuts the data feed to the constellation.
3. Seed-Vis's company says that an AI update caused the shift in monitoring focus and denies any intentional monitoring of movements along the border.
4. Country Y demands data from the constellation and explanations for the service cuts.
5. Country W goes quiet while satellites remain near the border, raising tensions.

Scenario and Cross-Scenario Analysis

After both the baseline and escalation phases of each scenario, participants answered questions eliciting their perceptions of the scenario narratives and reactions to specific events. The questions also assessed which response types participants judged to be proportional and which overarching norms or governance mechanisms they would use. At the end of the workshop, participants provided an overall strategic risk assessment, enabling a comprehensive evaluation of the approaches and outcomes considered across both scenarios.

CHAPTER 3

When Space Activities Appear Escalatory:

Insights on What Drives Perceptions of Increased Risk

Participants assessed risk across two categories of space activity—behaviors and effects—and how those perceptions could shift as events unfold and stakeholders undertake different actions. This chapter first reviews perspectives on behaviors, focusing on Scenario 1, involving an RPO conducted with limited transparency and communication by an unknown satellite. Participants generally viewed close-proximity maneuvering and uncertainty about operator identity or system purpose (including when driven by a lack of communication) as increasing escalation risk in space. They identified kinetic actions, such as ASAT weapons and other debris-generating capabilities, as carrying the highest strategic risk because of their potential to undermine the long-term stability and security of outer space. The chapter then turns to effects, focusing on Scenario 2, which involved an EO/ISR constellation perceived as conducting surveillance. Participants generally assessed this scenario as lower risk than the behavior-based scenario, citing the routine and lawful nature of EO/ISR activities and the absence of physical interference. Participants ranked two effect-based activities involving the use of satellite-derived data to inform military functions as the lowest strategic risk among a list of possible escalatory activities.

Behaviors: Observable Maneuvers in Space

Participants expressed a variety of views on when space activities become escalatory in Scenario 1, which involved an unknown satellite with an unresponsive operator approaching an allied satellite. Figure 3.1 illustrates how participants assessed risk at both the baseline and escalatory phases, as well as the main factors influencing their assessments. At baseline, most participants (six out of eight) classified the scenario as problematic. Of these, four participants upgraded their assessment to dangerous during the escalation phase. Factors driving this shift included heightened collision or safety risks due to maneuvering, uncertainty about the satellite's identity or purpose, the potential military role of satellite operators, and continued lack of communication from the satellite's operator.

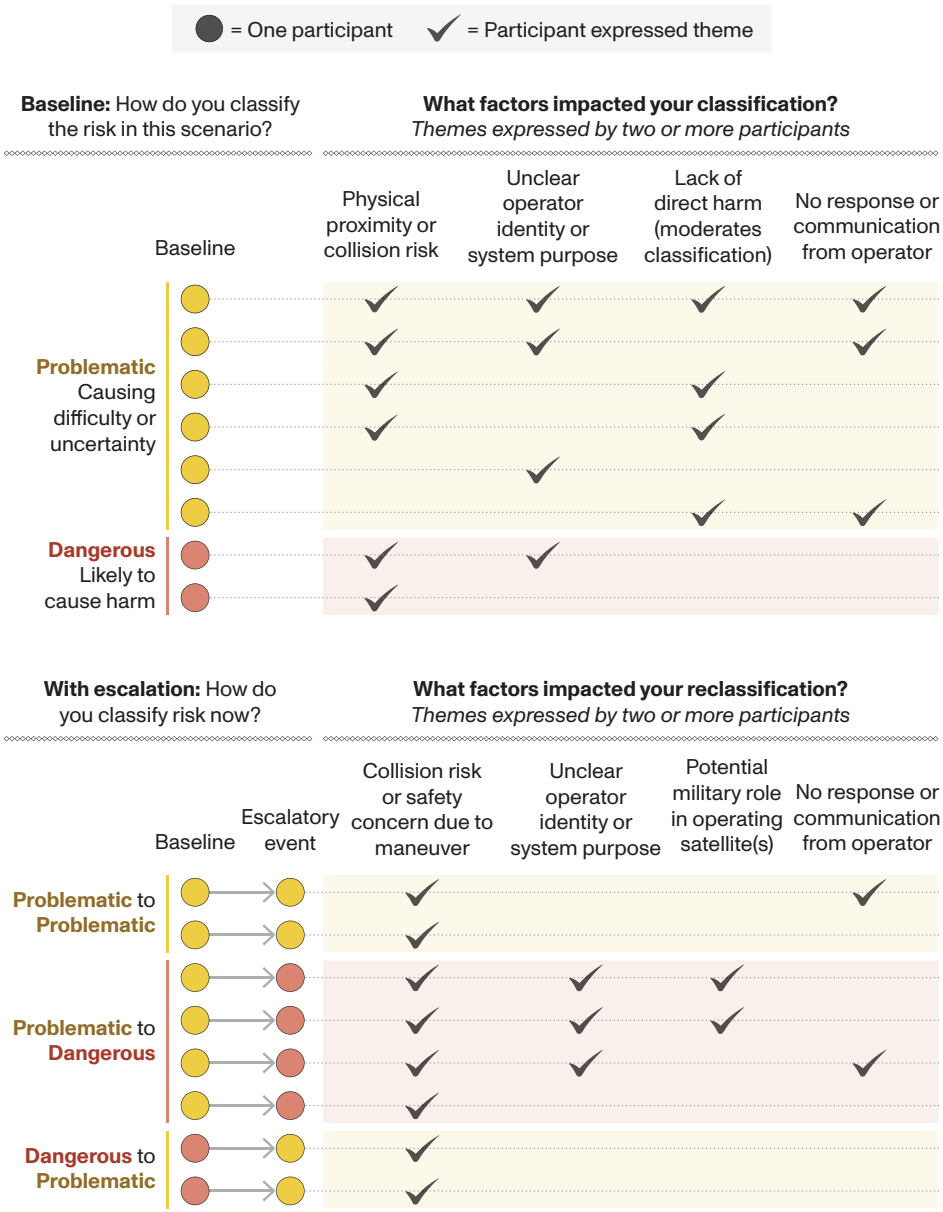
Two contributors moderated their characterization of the scenario from dangerous to problematic but insisted that the scenario still illustrated escalation risks. One of these contributors switched their classification to problematic on the grounds that all plausible system responses had been exhausted, while the other did so out of a more general concern that the situation might still generate difficulties, albeit with a slightly reduced likelihood. Overall, the group of participants agreed that the situation presented a set of elements that increased concern.

Key preliminary findings on risk-increasing behaviors include the following:

- **Close-proximity maneuvering could increase risks of escalation in space.** Participants identified close-proximity maneuvering as a key behavior that increases the risk of escalation in space. This is true particularly when satellites approach other space assets without prior identification, communication, or adherence to obligations under the Outer Space Treaty (OST) and the Liability Convention, which both require the operators' state(s) to authorize the launch and supervision of their space objects and to accept responsibility and liability, respectively, for their conduct in space.[8] Numerous participants described or affirmed the existence of de facto separation norms between space assets, in the vicinity of 10 km for satellites in GEO. They noted that operators might raise alerts when any two space objects, civilian or military, approach within 8 km in GEO or about 1 km in low Earth orbit (LEO). Participants emphasized that the GEO environment often allows three to seven days of warning time, while LEO provides only about 24 hours.

[8] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, January 27, 1967; UN General Assembly, "Convention on International Liability for Damage Caused by Space Objects," Resolution 2777 (XXVI), March 29, 1972.

Figure 3.1. | Participant Sentiments on Factors Driving Risk Assessment in a Behavior-Based RPO Scenario



NOTE: Rows are organized first by risk level: safe, problematic, and dangerous. Within each group, rows are sorted so that participants who agreed with the most commonly mentioned factors driving risk appear first.

- **Close-proximity maneuvering can cause service interruption or satellite displacement.** Although the International Telecommunication Union (ITU) assigns orbital slots to specific operators, participants noted that, in practice, operators sometimes encounter objects of unknown ownership occupying their assigned slot. In such cases, operators may contact another allied actor to briefly activate the otherwise dormant object, directing it to transmit a minimal carrier signal for roughly 30 days, which is the period typically required to demonstrate that a spacecraft remains operational and thereby satisfy the ITU formal criteria for claiming the orbital slot before relocating to a different position. One participant explained that risk increases from problematic to dangerous when close-proximity maneuvering results in either a service interruption or the displacement of a communications satellite from its assigned orbital position.
- **Unresponsive operators increase escalation risks.** Participants identified unresponsive actions as especially problematic, with escalation risk increasing when an operator refuses to communicate, clarify intent, or coordinate maneuvers. The lack of transparency in such cases could undermine STM principles developed within the United Nations (UN) Committee on the Peaceful Uses of Outer Space (COPUOS) and increases uncertainty about the situation.[9] This uncertainty, in turn, led participants to classify such behaviors as either problematic or dangerous, depending on the perceived likelihood of harm and the level of physical threat to nearby assets.
- **Unexpected satellite maneuvers could prompt perceptions of a militarized function with a conflict-oriented intent.** Participants observed that the situation appeared dangerous precisely because it seemed conflictual, with unexpected maneuvers being associated with operators conducting strategic military moves rather than routine commercial operations. Participants noted that such behavior is usually conducted by military actors, who may accept higher levels of risk, operate with limited transparency, or pursue objectives that are difficult for others to interpret because of the strategic and sensitive importance of their activities. This connection between military activity and heightened uncertainty, or potential aggression, made all the maneuvers from the scenario more concerning.

[9] Participants spoke generally about UN COPUOS efforts and did not identify specific principles developed within the committee. See UN Office for Outer Space Affairs, "Committee on the Peaceful Uses of Outer Space," webpage, undated.

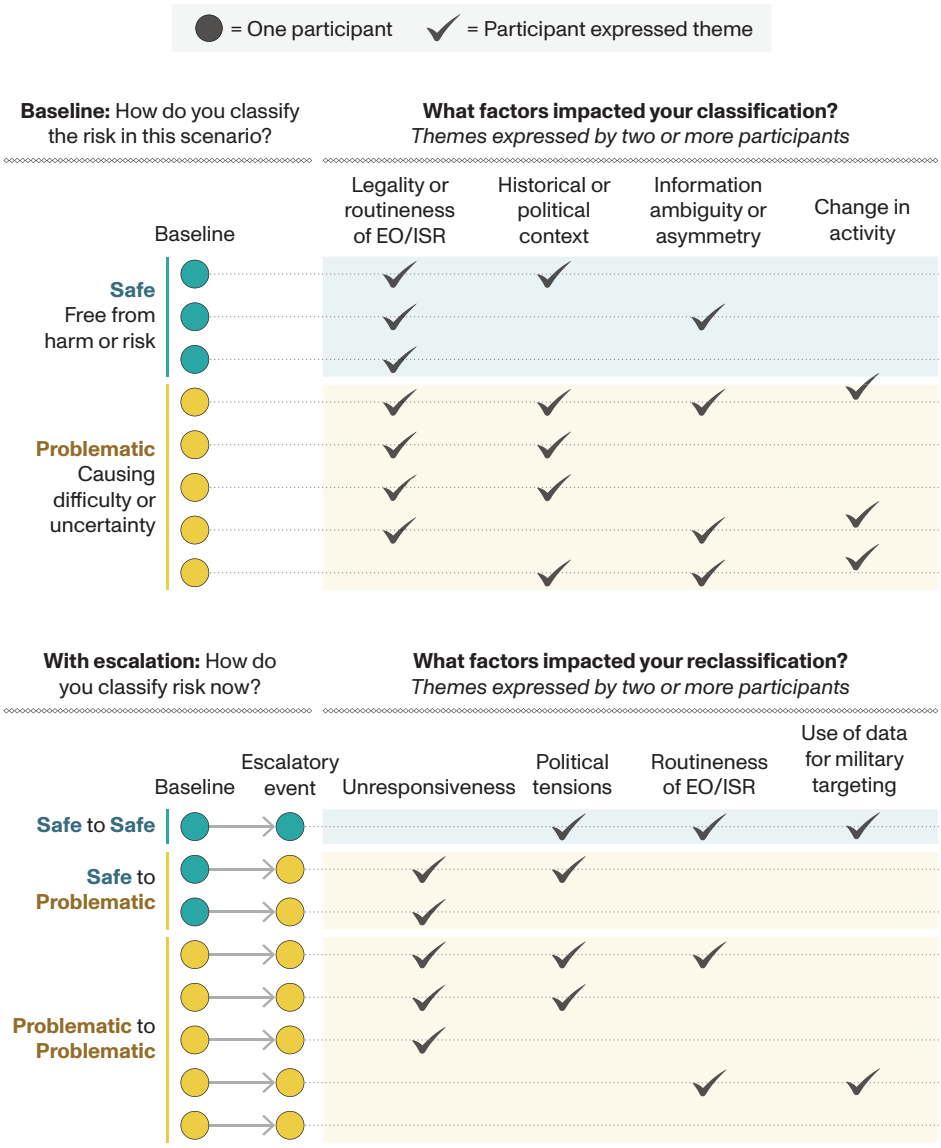
Effects: Use of Space Systems to Inform Terrestrial Activities

Participants offered key insights on when they perceived effects as becoming escalatory in Scenario 2, in which a country perceives an adversary's EO constellation as conducting surveillance. Figure 3.2 illustrates participants' risk perceptions during the scenario and what drove their assessments. At baseline, five participants classified the scenario as problematic, while three perceived the scenario as safe. Almost all participants cited the legality or routineness of EO/ISR as a factor mitigating their risk perception. Those who perceived the situation as problematic further cited historical or political context, information ambiguity or asymmetry, and unexpected changes in system activities—rather than the use of satellite data itself. Following the escalatory event, seven of eight participants perceived a problematic risk level, noting operator unresponsiveness and increased political tensions as drivers.

Preliminary insights on risk-increasing effects include the following:

- **Risk stems from how operators use data rather than from technical improvements in data collection.** Participants consistently emphasized that, when considering space-system–collected data, escalation risk does not primarily arise from technical improvements, such as higher-resolution sensors or advanced AI processing, and that such improvements do not justify elevated responses. Instead, they identified operator activities—including how operators collect, use, or distribute the data and the degree of transparency in those activities—as key drivers of escalation risk. They noted that risk perception increases markedly when actors deploy these capabilities within adversarial relationships, pair their use with opaque or surprise behaviors or communication breakdowns, or avoid diplomatic engagement. These concerning behaviors could trigger mistrust or security dilemmas, prompting potential defensive reactions that could increase space-to-ground escalation risks to levels that involve military actions.
- **Opacity in the EO/ISR data supply chain increases escalation risks.** Broader systemic risks emerge when the EO/ISR data supply chain—the end-to-end ecosystem for collecting, processing, analyzing, sharing, and interpreting EO/ISR across multiple actors—becomes opaque, fragmented, or politically contested. Participants described this chain as spanning commercial operators, onboard and AI-enabled processing, allied intelligence-sharing, and state-level interpretations. They noted that disruptions at any stage can create uncertainty about intent, reliability, and control. When states cannot verify how or by whom data are collected, processed, or repurposed, participants observed that technical anomalies, such as abnormal orbital behavior or unexpected shifts in data products,

Figure 3.2. | Participant Sentiments on Factors Driving Risk Assessment in an Effect-Based EO/ISR Scenario



NOTE: Rows are organized first by risk level: safe, problematic, and dangerous. Within each group, rows are sorted so that participants who agreed with the most commonly mentioned factors driving risk appear first. Rows without check marks indicate that the participant did not express any of the listed factors.

can be reframed as strategic signals. Participants emphasized that this dynamic intensifies when communication channels break down, increasing uncertainty, worst-case assumptions, and crisis instability.

- **Absence of physical interference mitigates risk perceptions and response needs.** Participants viewed the effect-based scenario as not escalatory enough to justify decisive action given the lack of physical damage or harmful interference and deemed that information ambiguities could be open to multiple benign explanations. Most participants emphasized the legality and routineness of EO/ISR activities, therefore not warranting a response. Some participants noted that the routine use of AI for onboard preprocessing and state use of commercial data, including for militaries, are generally considered safe and established practice. Although some participants described some data supply chain gaps (such as missing telemetry coordinates, unclear ownership structures, or unverifiable AI decisions) as heightening political sensitivity, they did not consider them evidence of hostile intent.

Comparative Risk Perceptions: Which Behaviors and Effects Are Seen as Highest Risk

In addition to scenario analysis, participants assessed how different behaviors compare in strategic risk to on-orbit safety, sustainability, and security. From a predetermined list, all eight participants identified destructive kinetic actions—including ASAT weapons and co-orbital strikes capable of generating debris fields in active orbital lanes—as posing the highest risk (see Figure 3.3), followed by the use of high-powered directed energy. Participants differed in the relative ranking of the remaining behaviors, including unclear maneuvering, uncoordinated RPO, and deliberate electromagnetic interference. However, on average, participants ranked these behaviors as posing higher strategic risk than the use of space-system–derived data. More specifically, one participant explained that the strategic use of denial and ambiguity in foreign policy permits states to avoid escalation and responsibility, often yielding greater advantage than overt offensive actions. Indeed, leveraging deniability and inaction allows countries to maintain flexibility and minimize potential repercussions stemming from overt aggression.

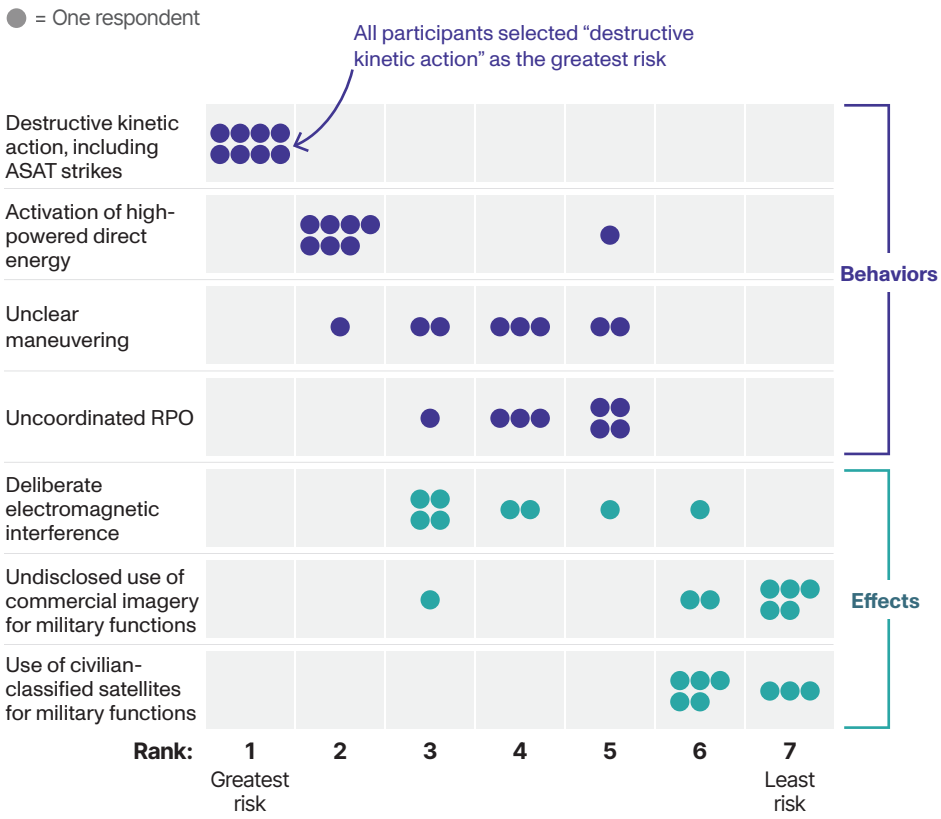
Participants noted that uncontrolled destructive kinetic actions, such as ASAT strikes, could generate persistent, uncontrollable debris that threatens all space assets and undermines the long-term sustainability of space activities. Such actions, they noted, could further pose geopolitical consequences: Observers might perceive cascading debris fields that render orbital regimes unusable as acts of war, potentially triggering arms race dynamics. Moreover, kinetic actions could cause indiscriminate harm,

affecting both civilian and military systems and undermining the shared reliance on space for security, economic, and societal functions.

Figure 3.3 illustrates how participants assessed the relative threat levels of example effects compared with select behaviors. Participants consistently ranked the use of commercial EO/ISR imagery to support military targeting or operations and the use of civilian-classified satellites for military functions as the lowest-risk activities among the predefined options. Participants noted that, in the absence of debris generation, service disruption, orbital displacement, or uncoordinated maneuvering and when operators maintain communication and clarify intent, these behaviors were assessed as non-escalatory and consistent with normal operational patterns rather than indicators of strategic risk.

Figure 3.3. | Participant Rankings of Which Behaviors or Effects Pose the Greatest Strategic Risk

Which activity, if left ungoverned, poses the greatest strategic risk to on-orbit safety, sustainability, and security, and why? Rank from greatest (1) to least (7) risk.



CHAPTER 4

Responding to and Managing Escalatory Space Activities:

Insights on What Is Justified, What Might Work, and Why Governance Is Challenging

Building on participants' assessment of which space activities are most likely to be perceived as escalatory, participants then considered a range of responses, from diplomatic to kinetic, that might be justified in addressing such risks, as well as the norms and governance frameworks that can both structure those responses and, when functioning effectively, prevent escalatory incidents from emerging in the first place. This chapter draws on those discussions across both effects and behaviors to identify cross-cutting themes regarding when responses were viewed as justified, which normative or governance approaches participants believed could effectively reduce risk, and the practical challenges that might complicate efforts to strengthen space stability and security.

Participants broadly viewed diplomatic and normative responses as justified across both behaviors and effects. They called for initial responses to more-serious incidents to prioritize restoring communications, gathering information on actor identity and intent, and issuing diplomatic condemnation, reserving cyber and electronic measures for situations in which actors could clearly justify self-defense. Throughout, participants emphasized proportionality, context sensitivity, and reversibility as defining features of justified responses, reflecting concern about inadvertent escalation and the risks of collective entanglement among multiple states.

On norms and governance for mitigating space escalation risks, participants viewed more consistent application and implementation of existing frameworks, such as the OST and voluntary international norms, as more achievable than sweeping reforms. Although existing frameworks remain imperfect and often lack robust enforcement or universal adoption, participants viewed them as providing an adaptable

foundation for promoting responsible behavior. Participants nonetheless acknowledged that targeted new norms or binding agreements might be necessary to address persistent gaps, particularly around operator transparency and responsiveness when confronted about intent.

Justified Response Options

Participants offered their assessment of what types of responses might be justified in behavior- and effect-based scenarios.[10] For both behaviors and effects perceived as escalatory, participants generally viewed diplomatic and normative responses as justified, including in lower-risk cases classified as *problematic* rather than *dangerous* (see Figure 4.1). Some participants viewed cyber and electronic responses, such as actions that use electromagnetic capabilities to target space systems without physical contact, as appropriate for responding to dangerous behaviors and problematic effects. No participants indicated that kinetic responses were appropriate for either behaviors or effects at any risk threshold.

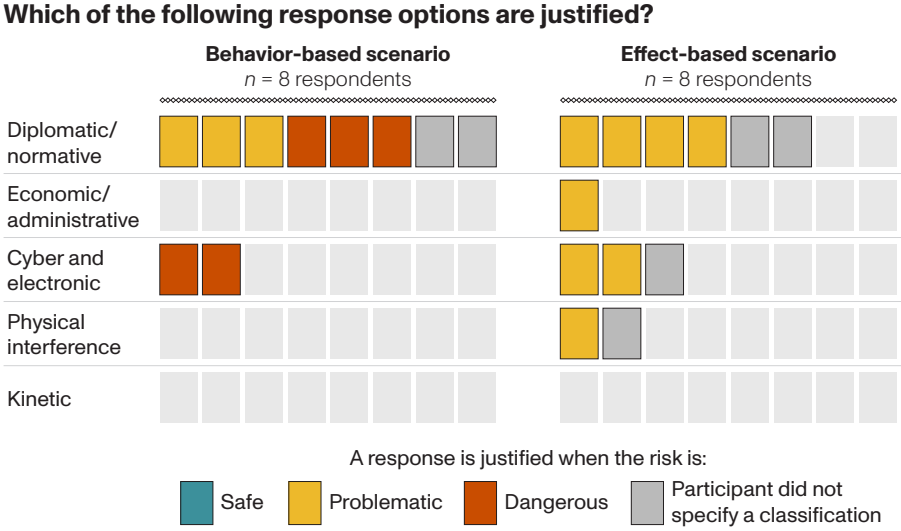
Conversation among participants surfaced numerous themes:

- **When responses are justified:** In the workshop scenarios classified as *dangerous*, participants viewed responses as justified when clear interference, service degradation, or imminent collision risk was present.
- **Which responses are justified:** Participants indicated that initial responses to dangerous activities should prioritize restoring communications, gathering information on actor identity and intent, issuing diplomatic condemnation, and, in some cases, intensified monitoring when attribution remains incomplete or intent is

[10] Within the context of the workshop, participants were offered a series of response options, captured in Figure 4.1. The following categories and definitions were provided to participants:

- **Diplomatic/normative:** actions that use political communication or shared norms to express disapproval, request changes in behavior, or reinforce expected standards.
- **Economic/administrative:** non-forceful measures that use legal, regulatory, or financial tools to impose material costs or restrictions on an actor.
- **Cyber and electronic:** actions that use digital systems or the electromagnetic spectrum to interfere with the information, communication, or control of space systems without physical contact.
- **Physical interference:** actions that use nonkinetic physical means to obstruct, manipulate, or interfere with space systems or supporting infrastructure without destroying them.
- **Kinetic:** the intentional use of physical force to damage, destroy, or permanently disable a space system or its supporting infrastructure.

Figure 4.1. | Participant Sentiments on When and Which Responses Are Justified



ambiguous.[11] More-disruptive measures, such as cyber, electronic, or, in extreme cases, physical interference, were generally reserved for situations in which self-defense could be clearly justified.

- **What effects these responses could achieve:** Participants emphasized that responses should aim to ensure service continuity and safety, deter further provocative or ambiguous actions, prompt behavioral change, and reinforce established norms of behavior in space. They also noted that diplomatic and normative measures can support deescalation while enabling identification of responsible parties, clarification of operational purpose, and potential reputational, economic, or administrative consequences when attribution is possible.
- **Features of justified responses:** Participants emphasized that justified responses to space activities that were viewed as escalatory, according to the criteria set by the participants across these workshop scenarios, should prioritize proportionality, context sensitivity, reversibility, and the exhaustion of diplomatic and normative avenues before considering more-severe measures. This restraint reflected

[11] To enhance communication between parties, participants noted that proactive intensive monitoring can be done through multilateral or international mechanisms, such as recourse to the ITU guidelines (e.g., Article 48) or COPUOS principles or invoking additional transparency under the OST (e.g., Articles VI, IX, and XI), as well as bespoke confidence-building mechanisms (ITU, *Constitution of the International Telecommunication Union*, December 22, 1992; Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 1967).

uncertainty regarding operator attribution and concern about inadvertent escalation, especially given the involvement of multiple states and the risk of collective entanglement.

- **Which responses are not justified:** Participants regarded direct or kinetic actions as excessive unless there was irrefutable evidence of intentional harm or if all lesser measures had failed. Notably, participants did not cite preemptive approaches, such as bodyguard satellites or other creative protective architectures, as appropriate long-term measures to safeguard the stability of space activities.

Considerations for Norms and Governance Mechanisms That Could Sufficiently Manage Risk

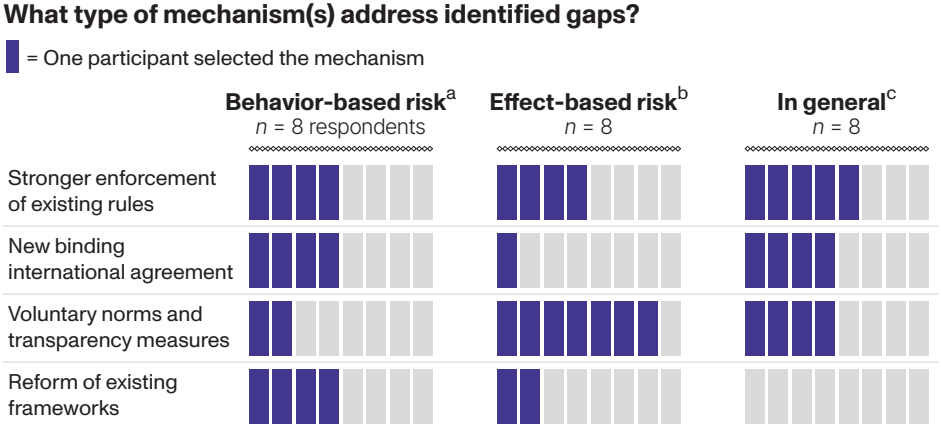
Participants shared mixed sentiments on which norms or governance mechanisms would be sufficient to manage risks of escalation in space. As Figure 4.2 shows, a majority of respondents (five of eight) generally found stronger enforcement of existing rules to be the most effective mechanisms to address governance gaps. Perspectives also varied depending on the scenario: Although seven participants viewed voluntary norms and transparency as effective for addressing effect-based risks, only two saw these measures as sufficient for behavior-based risks.

Through discussions, participants highlighted the following themes pertaining to responses sufficient for addressing space escalation risks:

- **Existing options as a useful baseline:** Participants regarded existing norms and governance mechanisms for space activities as a useful baseline (though not wholly sufficient on their own) to manage risks of escalation in space. Many current frameworks (such as the OST), other concepts emerging from COPUOS meetings, and any set of voluntary guidelines provide a conceptual foundation for risk management, but their specificity, enforcement, and universality are limited. Participants consistently identified gaps related to legal certainty, mandatory registration, information-sharing, and the patchy operationalization of consultation and notification procedures.[12]

[12] Importantly, regional governance mechanisms did not meaningfully surface in the conversation, or they did so only in a very limited and constrained manner. Actors from the Europe-Eurasia region continue to express reservations toward region-specific initiatives (e.g., the forthcoming European Union [EU] Space Act or the existing EU Space Surveillance and Tracking [EU SST] partnership), which they tend to view as either insufficiently comprehensive or overly restrictive.

Figure 4.2. | Participant Responses on Mechanisms Best Suited to Address Governance Gaps



[a] Question in Scenario 1: *What type of mechanism would most directly address the gap you identified above?*
[b] Question in Scenario 2: *What type of mechanism would most directly address the gap you identified above?*
[c] Question in strategic risk assessment: *Of the governance gaps discussed today, which is most urgent to address—and what type of mechanism would be most effective?*

- **New international agreements:** Addressing the shortcomings of existing options, participants proposed several revisions and new governance mechanisms, including new binding international agreements that contain both conceptual frameworks and clear evaluation criteria, continuous categorization of activities, and explicit prohibitive provisions. One participant said, "We are here [participating in the *Duality in Space* workshop] to help form a legally binding document that can help in the situations in which we don't know what the [other] operators' intentions are." Participants suggested that these agreements should not only mandate registration of all space systems, including operator contact information, but should also proceed with this mandate in an efficient manner and establish penalty mechanisms for noncompliance.
- **Coordination mechanisms:** Participants also recommended coordination mechanisms among all space actors to support implementation, facilitate burden-sharing and cross-checking among states, and bridge the gap until more-comprehensive legal structures are enacted.
- **Implementation of new norms:** Participants highlighted the importance of creating overarching norms that promote more consistent, rigorous, and effective implementation of existing governance mechanisms. These additions could include coordinated international, regional, or bilateral oversight; minimum information

disclosure obligations; and enhanced use of diplomatic and technical consultation mechanisms. Participants described such norms as helping to reduce risks of miscommunication or misunderstanding in high-stakes situations.

- **Frameworks for emerging technology:** Some participants described the need for mechanisms to address emerging issues, such as AI integration in space operations. Options could include updated frameworks or targeted non–legally binding instruments and confidence-building measures.

How Norms or Governance Mechanisms Could Be Insufficient for Managing Risks

Participants further identified areas in which norms or governance mechanisms might fall short in addressing risks of on-orbit escalation. Themes included the following:

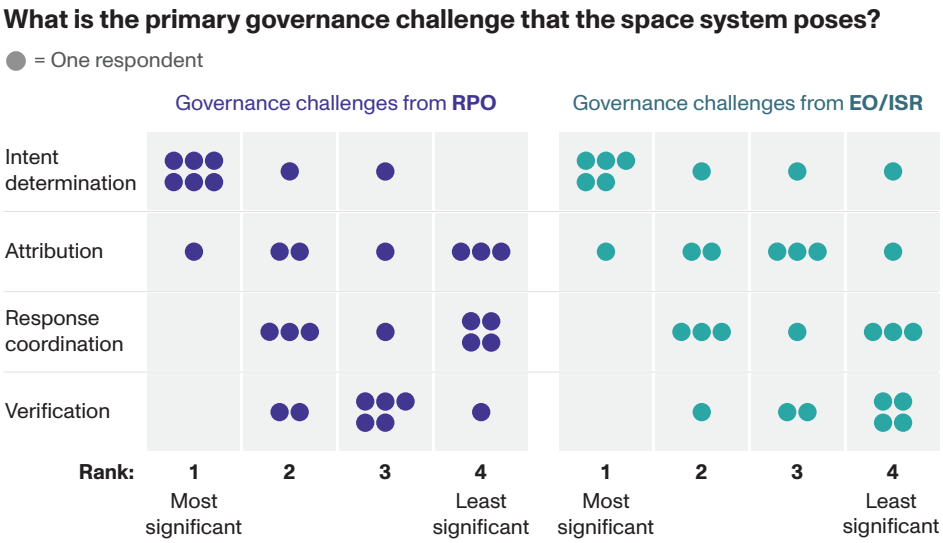
- **Uneven global enforcement:** Participants expressed that enforcement of existing rules remains sporadic or largely constrained to individual nations rather than following an international approach.
- **Limits of voluntary norms when operators do not engage:** Participants noted that existing and proposed norms provide no reliable means to manage risks when operators become unresponsive or refuse to engage. They emphasized that noncooperation, despite contravening COPUOS principles against interference, undermines transparency and trust, while voluntary norms and transparency measures remain ineffective because both state and nonstate actors can disregard inquiries without consequence. In such cases, tensions could escalate because of the absence of binding obligations and effective avenues for clarifying intent or responsibility.
- **Risks in reforming existing rules:** Some participants noted potential risks in reforming existing frameworks, leaving space for contentious renegotiation within space governance regimes. One participant cautioned, "Opening what has so well been negotiated is like opening Pandora's box"—suggesting that unintended or difficult-to-contain consequences could emerge from new negotiations. Perspectives underscored that existing mechanisms often lack enforceable provisions and are ineffective in compelling information-sharing or restraint in high-stakes environments.

- **Failure of existing rules to account for innovation:** In addressing effect-based risks in particular, participants highlighted gaps in existing legal frameworks, such as Principle XII of the UN General Assembly Relating to Remote Sensing of the Earth from Outer Space, noting that these frameworks have not kept pace with evolving capabilities, such as AI integration.[13]

Governance Challenges

The workshop surfaced varied views on the governance challenges that key space systems pose to the stability and security of outer space. For both RPO and EO/ISR systems, most participants identified intent determination as the primary challenge, while opinions diverged across the other categories: attribution, response coordination, and verification (Figure 4.3).

Figure 4.3. | Participant Rankings of Governance Challenges



NOTE: Some categories show fewer than eight respondents because not all respondents provided rankings for all possible options.

[13] UN General Assembly, "Principles Relating to Remote Sensing of the Earth from Outer Space," Resolution 41/65, December 3, 1986.

For RPO systems, the primary governance concern centers on intent determination, which was consistently ranked highest by participants. This reflects the difficulty of characterizing whether the inherently dual-use technologies used in RPO are being operated for benign, commercial purposes or potentially aggressive military objectives. This complexity is compounded by attribution issues—because operators can obfuscate or misrepresent their motives prior to registration—making it challenging to ascribe responsibility or establish accountability. Although response coordination and verification remain secondary, participants assessed that these are still notable concerns given the rapid escalation potential of RPO activities.

Although participants also ranked intent determination highly as a challenge for EO/ISR systems, many participants articulated that the key governance challenge pertains to the perception and understanding of system activities rather than their aggressive use. For those systems, verification and attribution are considered less problematic because their capabilities are generally seen as enabling rather than directly threatening. However, there still remains a need to manage perceptions and clarify norms to avoid inadvertent escalation or misunderstanding.

Overall, the inherent duality of space systems presents numerous interconnected governance challenges. Participants emphasized that tolerated risk is shaped less by technical capacity and more by ambiguity regarding operator intent, purpose, and context of use. Considering the two scenarios, participants assessed that RPO activities are most prone to escalation dynamics, highlighting that their maneuverability and limited transparency make intent determination and attribution inherently uncertain, allowing routine maneuvers to be interpreted as potentially hostile when communication is absent. Participants placed EO/ISR activities further from these dynamics, given that their functions are more often perceived as legal and routine, although misperception of data collection patterns can still generate tension in sensitive contexts. Across both activity types, participants argued that risk becomes intolerable when uncertainty prevents actors from distinguishing benign activity from potential interference, underscoring that ambiguity rather than capability is the primary driver of escalation concern.

As a general point, participants brought attention to the fragmented nature of the "new world order." This context is considered to diminish the effectiveness of multilateral solutions, ultimately undermining efforts of global governance for dual-use space systems. As this order reinforces the competitive aspect of space, it pushes countries to perceive international robust mechanisms as constraining their own strategic interests, resulting in stalled space governance and increased threats to space stability.

CHAPTER 5

Conclusion and Next Steps



These proceedings summarize the principal findings from the Geneva workshop, with an emphasis on the risks and response options related to escalation in the space environment. The workshop aimed to establish a shared understanding of escalatory activities, thresholds, and potential responses for mitigating risks. Overall, the workshop surfaced the following key preliminary insights:

- **Escalatory activities:** The types of escalatory space activities—those most likely to increase uncertainty, prompt miscalculation, trigger escalation, and threaten the stability and security of the space domain—include
  - operator unresponsiveness (behaviors)
  - close proximity operations (behaviors)
  - actions that contribute to overall unclear intent or objectives (behaviors and effects).

  Such activities, especially those involving ambiguous ownership or unexplained maneuvers near other space assets, were recognized as primary drivers that can rapidly escalate crises in the orbital environment.
- **Escalatory thresholds:** Critical limits in space activities are generally crossed, and immediate responses become warranted, once **irreversible physical damage** to an orbital asset becomes observable. The occurrence of material harm, such as collisions or destructive interference, offers a clearer attribution pathway and reduces the ambiguity associated with nonkinetic or information-based interference. This identification of a clear and tangible high-risk level is essential for guiding proportionate responses.

- **Governance gaps and potential norm or mechanism options:** Participants described current frameworks as often lacking robust enforcement mechanisms and failing to achieve universal adoption, with uneven adherence limiting their effectiveness. To fill these gaps, they proposed options that could be included in a future norms or governance regime (see Table 5.1).

Participants perceived **consistent application, interpretation, and implementation of existing treaties and legal instruments**, such as the OST and voluntary international norms, as potentially more effective for risk mitigation than all-encompassing reforms. Although current frameworks remain imperfect and often lack robust enforcement mechanisms or universal adoption, they still provide adaptable mechanisms to promote responsible behavior. In parallel, the creation of targeted new norms or binding agreements may be necessary to clarify persistent specific gaps, particularly regarding operator transparency and responsiveness when being confronted about intent.

Table 5.1. | Potential Norms or Governance Options for Responding to Escalatory Activities

Activity Type	Options
Behaviors	▪ Common standards for conjunction avoidance, maneuvers, and baseline operator qualifications ▪ High-accuracy SSA and space domain awareness data-sharing across actors ▪ Mandatory registered contact details for every space object, including 24/7 operational points of contact ▪ Phase-specific contacts for launch, routine operations, and emergencies, feeding into a global STM notification system ▪ Rules against irreversible harmful actions in peacetime ▪ Improved registration requirements linking satellite identity, ownership, mission data, operator contacts, and maneuver status in a politically neutral, accessible system
Behaviors or effects	▪ Operationalization of existing treaty obligations, including Article IX of the OST, through existing forums, such as COPUOS ▪ Advancement of space risk-reduction dialogue ▪ National implementation and enforcement of internationally agreed rules through licensing, regulatory, and accountability mechanisms

Collectively, these conclusions support a more structured approach to identifying and classifying escalation risk in the space domain, based on observable activities and clear thresholds, paired with adaptive governance strategies. These key takeaways will guide subsequent work in the project's third phase, including comparative gap analysis and the testing of candidate norms and governance mechanisms for mitigating escalation risks associated with dual-use space systems.

Next Steps

The second phase of *Duality in Space* prioritized identifying governance gaps and challenges across regions by synthesizing participant feedback and systematically mapping key governance and risk areas associated with space activities. Comparative analysis across the three regional workshops will help identify areas in which existing governance arrangements remain insufficient or risks remain unaddressed. This process aims to highlight priority areas requiring further development of norms or governance mechanisms to manage emerging challenges in the space domain.

Building on these findings, Phase 3 will focus on developing and testing practical norms and governance mechanisms through additional regional workshops. This final phase aims to propose a robust normative and governance framework to mitigate escalatory risks and inform actionable interventions. RAND researchers will integrate detailed analyses from all regional workshops to ensure that proposed approaches address both global and region-specific needs. Phase 3 will also continue to prioritize stakeholder engagement, providing a structured platform for testing, feedback, and iterative refinement of governance mechanisms in selected areas. Overall, these activities support the goal of advancing practical solutions that strengthen governance, enhance resilience, and reduce escalation risks in space.

APPENDIX A

Methodological Approach



RAND held three workshops in spring 2026 that convened experts and stakeholders across government, industry, and the research sector to solicit their perspectives on escalatory activities in space and potential response options. This appendix outlines the design of the Europe-Eurasia workshop held in Geneva, Switzerland, in March 2026.

Participant Selection

The research team aimed to recruit participants who would together represent a broad variety of perspectives and experiences across the dual-use space system ecosystem. Participants included those from multilateral organizations, national civilian and military agencies, private industry, and research organizations from Europe and Eurasia.

Researchers selected participants using targeted outreach and used the *Duality in Space* Phase 1 research as a guide for identifying nations and organizations of interest.

Eight participants joined the workshop in Geneva representing each relevant sector—government, industry, and research—and included both national and multilateral perspectives. The project team determined the size to be adequately inclusive of organization types yet small enough to allow for in-depth conversations, high detail analysis, and involvement from all participants. The workshop participant count aligns with UK government guidance, which suggests that workshops with three to eight participants support easier facilitation and allow sufficient time for "detailed, individual contributions."[14]

[14] Government of the United Kingdom, "User Research: Researching in Small Group Workshops," webpage, June 28, 2018.

Participants received advance materials, including questions and scenario text, and were encouraged to familiarize themselves with the *Duality in Space* Phase 1 publications.

Workshop Design

The workshop took place over two days and was structured in four parts: (1) a scenario based on *behaviors,* or observable maneuvers, of space systems; (2) a scenario based on *effects*, or the use of space-system–collected data to inform terrestrial activities; (3) a cross-scenario synthesis; and (4) a strategic risk assessment. Precise question and scenario language is provided in Appendix B.

Moderators solicited perspectives through a variety of channels:

- **Online tool:** Certain closed-ended questions were collected on a platform called Mentimeter to allow for participants to view each other's responses, guide discussion, and support standardized analysis following the workshop.[15]
- **Paper handbooks:** Participants handwrote answers to other closed-ended questions, as well as open-ended questions, in paper handbooks. Following the workshop, the project team digitized the handwritten responses and aggregated results in a spreadsheet for cross-participant analysis.
- **Moderated discussion:** Moderators encouraged participants to share their insights with their neighbors and at times collectively as a full group. For some questions, moderators asked all participants to share their insights verbally. Notetakers recorded responses and attributed them to individual participants for the purposes of standardized and cross-participant analysis. Verbal contributions were otherwise not recorded.

The workshop operated under the Chatham House Rule, permitting participants to share content raised during the event without attribution to specific individuals or organizations.[16] Moderators instructed participants to adopt the perspective of "external analysts" rather than representing their country or organization and to use generic actor designations in the scenarios, while allowing references to real-world cases when useful for contextualizing insights.

To better contextualize the workshop, the moderators briefly overviewed the overall *Duality in Space* project, key findings from the project's first

[15] Mentimeter, homepage, undated.

[16] Chatham House, "Chatham House Rule," webpage, undated.

phase, and the research objectives of the project's second phase.[17] The moderators then walked participants through a test scenario to familiarize them with the structure of the scenarios and the platforms used to collect their insights.

Scenario Selection and Development

The project team designed scenarios to incorporate numerous considerations and ensure that each

- **supported an analysis comparing distinct space activity types**, with one scenario focused on behaviors and the other on effects
- **reflected geopolitical challenges relevant to Europe-Eurasia** and **corresponded to real-world precedent**
- **explored the escalation ladder**, with some developments that at least some participants would likely perceive as safe, others as problematic, and others as dangerous
- **examined the role of the commercial space industry** in developing or deploying space systems and the relationship between commercial and state actors.

The team tested the scenarios internally prior to the workshop with researchers both involved and not involved in *Duality in Space* efforts. These test runs informed iterative refinements to the scenario text and sequencing, with adjustments to ensure clarity, accessibility, and alignment with the above considerations.

Participants did not receive exhaustive contextual information about the actors involved in the scenarios or the technical characteristics of certain activities. This ambiguity allowed participants to explore a variety of plausible interpretations and discuss which factors shaped their risk perceptions based on the available information. The limited contextual detail also reflected the operational realities of space, where intent, capabilities, ownership, and operator identity are often uncertain or difficult to determine. Although the workshop findings provide a useful baseline for understanding escalation dynamics under conditions of ambiguity, participants' assessments and the applicability of the findings could differ in more highly contextualized scenarios involving additional political, strategic, or technical information.

[17] The workshop took place before the publication of the Phase 1 synthesis report (McClintock et al., 2026). Moderators shared preliminary findings and recommendations from the report during the workshop introduction and clarified that these insights were still undergoing peer review.

Post-Workshop Analysis

Following the workshop, the project team digitized handwritten responses and compiled results across all methods to enable standardized, cross-participant analysis. The team performed quantitative analysis of closed-ended questions and a qualitative approach enabled by AI for open-ended responses.

To characterize sentiments across participant responses, the project team used an internal RAND large language model (LLM). The team provided the LLM with participant responses and then instructed it to identify distinct sentiments and provide characterization language broad enough to apply across responses rather than to a single participant. The team used the following prompt, with slight modifications to the text depending on which question was being analyzed:

> The following data represents how participants answered the questions, "How do you classify this scenario" and "What factors impacted your classification?"
>
> Using the "What factors . . ." column, produce new "coding" columns that each represent a sentiment expressed by at least one workshop participant. Values in these coding columns should take the value of 1, indicating the participant expressed that sentiment, and 0, indicating the participant did not express that sentiment. When identifying sentiments, they should not be so narrow and tailored to any one specific response such that they cannot be generalized across multiple responses, but they should also not be so broad that they lack a clear, distinct insight.
>
> Aim to have no more than 6 coding columns; fewer are acceptable. Ideally, each coding column will have at least 2 participants who shared that sentiment. Simply noting that a participant mentioned a topic is insufficient; a sentiment should only be coded if the participant provided insight into their perspective or reasoning regarding that topic.

The team then evaluated the LLM's output and manually reviewed all responses to ensure that the sentiment characterizations accurately reflected participants' perspectives. In some cases, the team refined the phrasing of characterization schemes, consolidated multiple categories to streamline interpretation, and removed categories that were overly broad or not relevant to the specific question posed.

APPENDIX B

Scenario Language



Scenario 1

In July 2027, a European regional STM regime tracks a single satellite, designated MYS-1, conducting unusual proximity maneuvers in GEO. MYS-1 is classified as unidentified because its incomplete signature data temporarily prevents correlation with any known satellite registry entry. Over several hours, whilst verifications are occurring, MYS-1 moves eastward and stabilizes within approximately 10 kilometers of a commercial satellite (COM-1), operated by a licensed European company, which also supports dual-use communications services for civilian and defense customers.

Based on past patterns of space object behavior, which include inspector-type missions and possible signal or imaging intelligence (SIGINT/IMINT) activities, analysts suggest that MYS-1 may be performing rendezvous and proximity operations (RPO). Given that the satellite identification is difficult, the purpose of its operations remains unclear—possibilities include on-orbit inspection, signal monitoring, or debris-removal testing.

The commercial operator publicly condemns the close proximity maneuver, citing risks to satellite safety and spectrum interference. After shortlisting a few potential operators for MYS-1, COM-1 owners request MYS-1 to reposition. No orbital adjustment is made by MYS-1.

After one hour, given there is still no response from MYS-1, the European commercial operator initiates a collision-avoidance maneuver for COM-1. During the burn sequence, a propulsion malfunction occurs, leaving the COM-1 partially unresponsive and stranded in a new trajectory that increases its collision probability with MYS-1.

Following standard European regional STM safety procedures, the commercial operator issues an immediate collision warning notice to nearby operators and uploads data to the shared situational awareness network. However, no direct communication channel exists for contacting the operator of MYS-1, whose registration and point of contact remain undisclosed under international reporting frameworks.

Scenario 2

In August 2027, a small commercial enterprise from Country W deploys an EO satellite constellation, Seed-Vis, which is equipped with onboard AI for automated crop assessment. The system's neural network is authorized to autonomously select imaging targets and pre-process data before downlink, enabling near-real-time evaluations of soil moisture and yield. For one month, operations appear routine.

Then, in the last 24 hours of that month, allied tracking centers detect abnormal orbital dwell times: Seed-Vis is abnormally lingering over sparsely cultivated terrain along the border with Country W's historic regional adversary, Country Y. Further analysis reveals that the AI's task-selection module has begun prioritizing electromagnetic and thermal signatures inconsistent with farming, which can for instance track convoys, vehicles under camouflage, and heat anomalies near transportation nodes at the border. What was known to be an automated EO platform for precision agriculture is discovered to be an unacknowledged ISR asset.

Allies inform Country Y, who in turn accuses Country W of covert intelligence-gathering. The Seed-Vis company's ownership is questioned and its data feed is cut off amid cascading diplomatic statements. Seed-Vis company's board claims the AI "malfunctioned," or "went rogue," arguing that a firmware self-update occurring at the end of the month caused its targeting algorithms to broaden recognition parameters beyond approved agricultural features, which explains the lingering on the border when it was detected. They insist no employee intentionally redirected the satellites and that the data pipeline, a mix of SAR [synthetic aperture radar], multispectral, and thermal imagery fused by machine learning, acted on emergent logic, not human instruction, and that this data was not going to be used anyway.

Whilst Country Y demands satellite telemetry records, Country W becomes unresponsive and keeps Seed-Vis at the border where tension increases.

Abbreviations

AI	artificial intelligence
ASAT	anti-satellite
COPUOS	Committee on the Peaceful Uses of Outer Space
EO	Earth observation
EU	European Union
GEO	geostationary orbit
ISR	intelligence, surveillance, and reconnaissance
ITU	International Telecommunication Union
LEO	low Earth orbit
LLM	large language model
OST	Outer Space Treaty
RPO	rendezvous and proximity operations
SSA	space situational awareness
STM	space traffic management
UK	United Kingdom
UN	United Nations

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About These Conference Proceedings

As part of the second phase of the three-phase RAND *Duality in Space* project, RAND convened a two-day workshop in Geneva, Switzerland, in March 2026 that brought together stakeholders from across Europe and Eurasia. The workshop examined which space activities participants perceived as escalatory and capable of threatening the stability and security of outer space. It also tested an approach for classifying risk thresholds in space and identifying when responses might be warranted. Participants further identified gaps in existing space governance and shortlisted potential norms and governance mechanisms that could help mitigate escalation risks. Overall, participants identified key space activities most likely to trigger escalation in space: operator unresponsiveness, close-proximity maneuvers, and any action conducted with unclear intent or contributing to the ambiguity of those intentions. Together, these activities form the primary drivers of uncertainty and crisis in the orbital environment. Additionally, escalatory thresholds are generally crossed, and immediate responses become warranted, when irreversible physical damage to an orbital asset occurs, providing clearer attribution and reducing ambiguity in risk assessment. Finally, addressing governance gaps, participants found that consistent implementation of existing treaties and norms offers adaptable tools for implementing responsible behavior, although targeted new agreements might be needed to address persistent issues of transparency and intent. The findings presented here are intended to inform policymakers, space operators, commercial providers, and researchers concerned with space security and governance challenges posed by dual-use space systems.



RAND National Security Research Division

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