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MANAGING DUALITY IN SPACE

VOLUME II, INDO-PACIFIC 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 April 2026 in Tokyo, Japan, that brought together stakeholders and experts from across the Indo-Pacific 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 Geneva, Switzerland, 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 from effects. *Behaviors* refers to observable maneuvers in space, such as a satellite performing a proximity and rendezvous operation, while *effects* refers to 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 effect-based and one behavior-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 these preliminary insights:

- **Escalatory activities:** Participants identified several activities as potentially escalatory, particularly when they unfolded in ambiguous or conflict-linked contexts. These included **commercial or civilian space services supporting military operations**; **nonconsensual close approaches** or rendezvous and proximity operations (RPO) involving uncertain intent; **failure to respond to requests for clarification or repositioning**; and the **generation of serious physical hazard** on orbit, including collision risk. Participants repeatedly noted that activities not clearly prohibited under existing law could nonetheless be viewed as strategically destabilizing.
- **Escalatory thresholds:** Participants generally assessed escalation as context-dependent rather than binary. In both scenarios, activities were more likely to shift from safe to problematic or dangerous when ambiguity persisted, communication failed, military relevance increased, or the risk of harm became more concrete. In the effect-based scenario, participants frequently emphasized that a nominally commercial system could be reclassified as more threatening once it was perceived to materially support military operations. In the behavior-based scenario, participants more often emphasized that unsafe proximity behavior and the emergence of concrete physical danger could themselves justify treating a situation as dangerous even if hostile intent remained uncertain.
- **Governance gaps and potential norm or mechanism options:** Participants broadly agreed that existing governance mechanisms are not absent but are partial and insufficient for managing escalation risks associated with dual-use systems. Participants highlighted gaps in procedures for communication, notification, and deconfliction during close approach operations; insufficient tools for managing the military use of commercial systems; and limits of existing voluntary transparency and confidence-building measures when attribution, compliance, or enforcement is weak. Participants frequently pointed to communication channels, practical operating expectations, transparency measures, and more-specific norms for nonconsensual RPO and dual-use commercial support as promising areas for further testing in Phase 3.

Across both scenarios, participants consistently emphasized that ambiguity itself can be destabilizing and that governance gaps are often most acute not in clearly hostile cases but in situations in which intent, status, and acceptable conduct remain contested.

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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.[1] 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 cohosted by RAND and Keio University in April 2026 on escalatory space activities and potential response options to mitigate associated risks. Held in Tokyo, Japan, the workshop convened ten stakeholders from across the Indo-Pacific, 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.

[1] *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 Tokyo workshop, together with additional workshops in Geneva, Switzerland, 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.[2]

The first phase examined system types, stakeholder perspectives, 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 the Indo-Pacific, the Americas, and Europe-Eurasia—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.

[2] 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.

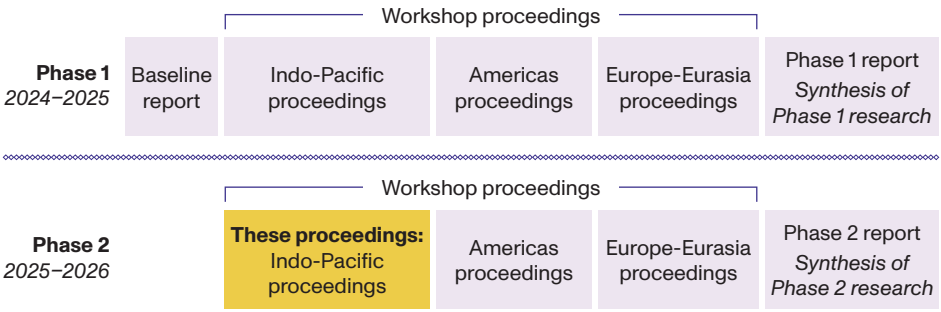
For the **Phase 1 Americas workshop proceedings**, see Anca Agachi, Krista Langeland, Amal Altwaijri, Mélusine Lebret, David Glickstein, and Bruce McClintock, *Surveying Duality in Space*: Vol. I, *Americas Workshop Insights on Developing, Deploying, and Governing Dual-Use Space Systems*, RAND Corporation, 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 Tokyo workshop collected insights from ten Indo-Pacific stakeholders (see Table 1.1). Three participants were from government (civilian or military), three were from the research sector, and four were from private industry.[3]

Over the course of the workshop, participants provided insights on two scenarios. The first scenario involved a country using an Earth observation (EO) commercial satellite constellation suspected of performing intelligence, surveillance, and reconnaissance (ISR) and guiding military maneuvers; the second scenario examined rendezvous and proximity operations (RPO) in which a known servicing satellite from a space power is observed conducting unusual maneuvers in geostationary orbit (GEO). The scenarios encouraged participants to identify escalatory activities and consider how responses might diverge depending on whether systems are collecting data to inform Earth-based activities (*effects*, as in the first scenario) or performing observable maneuvers in space (*behaviors*, 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 could pose risks to the stability and security of space.
- **Identifying escalatory thresholds:** Establish an approach for classifying risks of space activities and identifying the levels at which they warrant a response.

[3] 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 and Sector of Workshop Participants

Participant	Country	Sector
1	Australia	Industry
2	Australia	Research/academia
3	India	Industry
4	Japan	Government
5	Japan	Government
6	Japan	Industry
7	Japan	Research/academia
8	Singapore	Research/academia
9	Republic of Korea	Government
10	Republic of Korea	Industry

NOTE: All ten 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 those mechanisms' 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 effects and behaviors, and (2) risk thresholds, defined as safe, problematic, or dangerous. The chapter then provides additional details on the two scenarios: an effect-based EO/ISR scenario and a behavior-based RPO scenario.
- **Chapter 3** summarizes preliminary participant insights on what shaped their perceptions of increased risk in space. Participants described when effects escalated to levels that warranted a response, alongside a parallel analysis of risk-escalating behaviors.

- **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 effects and behaviors, 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.

Regional Workshops on Escalatory Space Activities and Response Options

These proceedings are part of a three-volume series based on RAND-hosted regional workshops covering the Indo-Pacific, the Americas, and Europe-Eurasia. Because each workshop employed a common structure and methodology, the volumes share certain background material, terminology, and descriptions of the project's broader objectives while tailoring findings and analysis to regional contexts. This volume builds on themes introduced in *Managing Duality in Space*: Volume I, *Europe-Eurasia Workshop Insights on Escalatory Space Activities and Potential Response Options*.[4] Although some findings overlap across volumes, the insights presented here reflect discussions and perspectives specific to the Indo-Pacific workshop.

[4] Mélusine Lebret, Marissa Martin, Angus Cooper, James Black, Bruce McClintock, and David Glickstein, *Managing Duality in Space*: Vol. I, *Europe-Eurasia Workshop Insights on Escalatory Space Activities and Potential Response Options*, RAND Corporation, CF-A4003-4, 2026. This series also includes Anca Agachi, Mack Rodgers, Jan Osburg, Amal Altwaijri, Krista Langeland, David Glickstein, and Bruce McClintock, *Managing Duality in Space*: Vol. III, *Americas Workshop Insights on Escalatory Space Activities and Potential Response Options*, RAND Corporation, CF-A4003-6, 2026.

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 a clear understanding 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 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: Effects Versus Behaviors

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 *effects* as the use of space systems 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. Effect-producing systems are generally those with long-established capabilities, including EO/ISR; satellite communications (SATCOM); positioning, navigation, and timing (PNT); and space situational awareness (SSA).

Conversely, *behaviors* are 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. Unlike many effect-producing systems, which often involve long-established technologies, systems that perform behaviors often involve emerging capabilities, including RPO; in-space servicing,

[5] McClintock et al., 2026.

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

assembly, and manufacturing (ISAM); on-orbit servicing (OOS); and active debris removal (ADR).

This analysis also recognizes that certain space activities can involve both effects and behaviors, thereby blurring the line between risks and consequences of effects and behaviors. 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, which would be a resulting effect.

Distinguishing between effects and behaviors reflects differences in how risks and consequences manifest—suggesting that each activity type could prompt different sets or intensities of responses. 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 they 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 instead along a spectrum, with different levels of risk warranting different types or degrees of response. Our approach uses a simple, three-tiered approach to characterize risk of escalation in space; stakeholders could characterize 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 effects, in which a country uses commercial satellites from another country to guide military maneuvers against a third country; Scenario 2 involves risks arising from behaviors, in which a known servicing satellite from a space power is observed conducting unusual maneuvers in GEO. 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 effects or behavior. The full scenario text is included in Appendix B.

Scenario 1: Assessing Risks from the Effects of an EO/ISR System

The scenario involves three countries and an EO/ISR commercial satellite constellation: **Country A**, a large power with strong space and maritime capabilities that is a rival to Country B and Country C; **Country B**, a small power with no satellites that is forced to contract space services from Country C; and **Country C**, a large power that is home to commercial space companies and allied with Country B.

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. Both Country A and Country B use satellites to monitor disputed waters; satellites provide information only with no direct military control.
2. Country B's commercial satellites are often seen over a disputed area during Country A's operations.
3. Country B uses real-time satellite data from Country C's provider to guide naval maneuvers.
4. Country A detects radio frequency signals and observes that Country B is using space-based intelligence to inform tactics.
5. Country B's commercial satellites now directly support its military operations; it is unclear whether Country C's provider is aware of this.

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

1. Country A declares commercial operators aiding Country B's military as military targets.
2. Country A jams the commercial satellite network, disrupting service for all users.
3. Country A denies responsibility.
4. Farmers, weather agencies, and businesses lose access.[8]

Scenario 2: Assessing Risks from the Behavior of a Potential RPO Maneuver

This scenario involved two countries and two satellites. **Country A** is a large, regional space power, and **Country B** is a large, multinational space power with extensive space capabilities. **MYS-1** is a known servicing satellite from space power Country A, while **COM-1** is a dual-use commercial satellite from Country B. One of the satellites is observed conducting unusual maneuvers without communication.

Participants first provided insights on the baseline phase:

1. MYS-1, a known servicing satellite from space power Country A, is observed conducting unusual maneuvers in GEO.
2. MYS-1 approaches and parks near dual-use commercial satellite COM-1 from Country B.
3. Analysts believe that MYS-1 might be conducting RPO but are uncertain.
4. COM-1's operator condemns the maneuver, while MYS-1's operator offers no response.
5. COM-1's operator requests MYS-1's operator to reposition their satellite, but MYS-1 does not move.

[8] This scenario intentionally excluded contextual information that might have biased participants' perceptions or prompted certain considerations—for example, whether Country C was a nuclear armed state or whether the commercial space system in question was also used by Country C as part of the country's national strategic assets, which may increase the consequences of interference or jamming of such systems. This deliberate ambiguity allowed participants to explore a range of possible interpretations and to discuss which factors they saw as most important in driving risk and escalation.

Finally, participants shared their perspectives on risk classification and driving factors regarding 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. No communication channels exist; signaling to MYS-1 is unsuccessful.

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. Those perceptions and reactions are presented in the next two chapters.

CHAPTER 3

When Space Activities Appear Escalatory:

Insights on What Drives Perceptions of Increased Risk

Participants assessed risk across two categories of space activity—effects and behaviors—and how those perceptions could shift as events unfold and stakeholders take different actions. This chapter first reviews perspectives on effects, focusing on Scenario 1, involving an EO/ISR commercial satellite constellation suspected of performing ISR and guiding military maneuvers. The chapter then turns to behaviors, focusing on Scenario 2, which involved a known servicing satellite from a space power being observed conducting unusual RPO maneuvers in GEO.

Participants generally viewed risk as emerging through ambiguity, context, and consequences rather than through technical specifications alone. In the effect-based scenario (Scenario 1), participants emphasized that systems nominally framed as commercial or civilian could appear more escalatory when participants perceived those systems' outputs as materially supporting military action. In the behavior-based scenario (Scenario 2), participants differed in how they judged the baseline activity, but many stressed that unclear intent, lack of communication, and the possibility of nonconsensual proximity operations elevated concern even before clear harm occurred. Across both scenarios, ambiguity—over intent, use, and consequence—was the most frequently cited driver of concern, with seven participants identifying unclear intent, nonresponse, or lack of procedural norms as central to their risk assessments. Additionally, participants frequently distinguished legality from strategic acceptability, noting that acts not clearly prohibited under existing law could still be destabilizing.

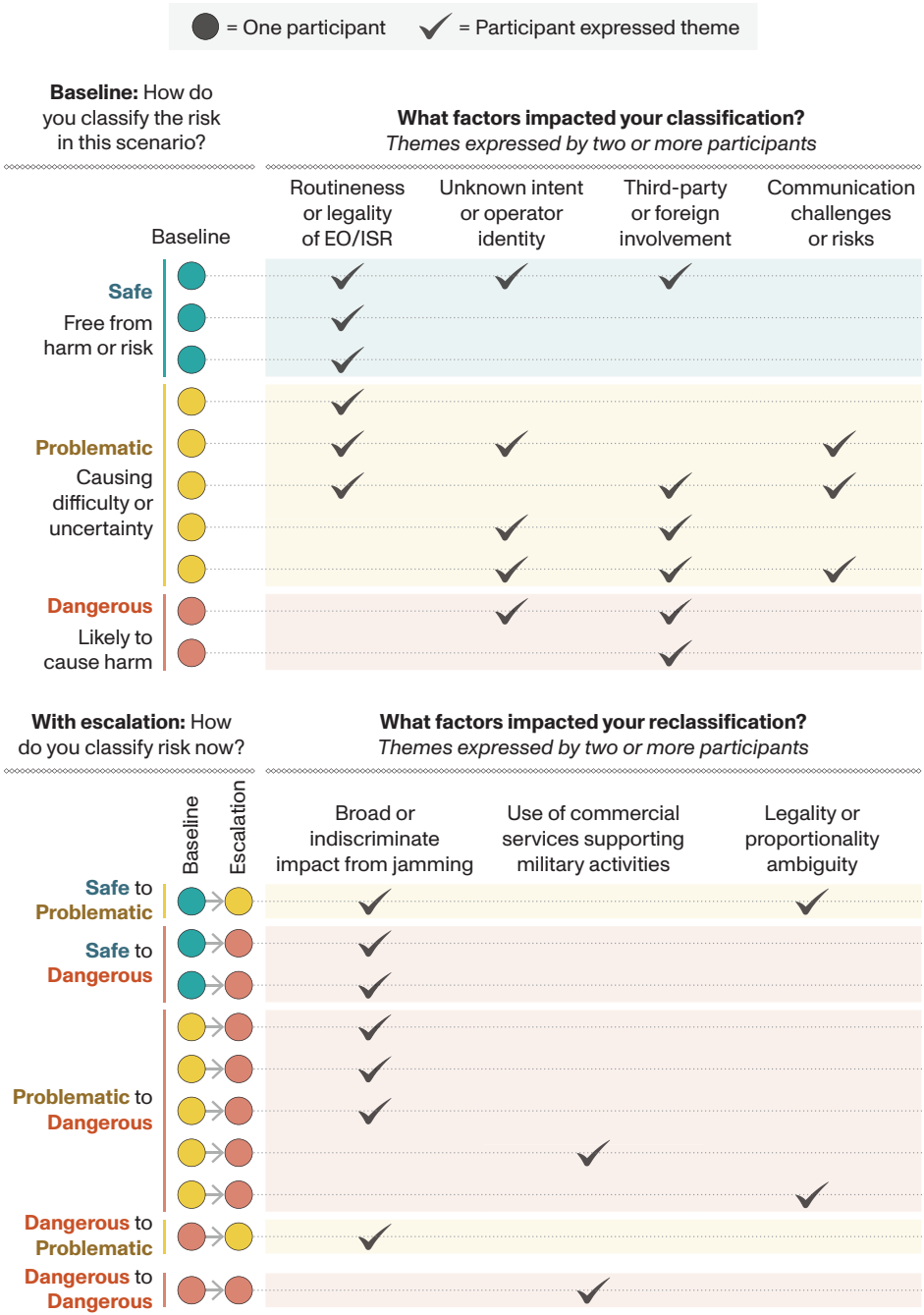
Effects: Use of Space Systems to Inform Terrestrial Activities

Participants offered key insights on when they perceived effects as becoming escalatory in Scenario 1, in which a country suspects that an adversary is using commercial satellites from another country to support military command and control and guide military maneuvers. Figure 3.1 summarizes the participants' sentiments on factors driving their risk assessments in this scenario. At baseline, three participants classified the scenario as safe, five as problematic, and two as dangerous. All participants who perceived the scenario as safe cited the routine use or the legality of commercial EO/ISR for military intelligence. Those declaring the situation problematic or dangerous discussed ambiguities in operator intent or identity and the involvement of foreign or third parties as elevating risk. Some participants who classified the scenario as problematic further cited communication challenges, including the risk of miscommunication, as potentially escalatory. Following the escalatory event, in which a country jams the network of the commercial satellites perceived as performing military activities, all participants classified the scenario as problematic or dangerous, with most citing the broad or indiscriminate impact from jamming.

Preliminary insights on risk-increasing effects include the following:

- **Participants frequently assessed risk in terms of how a system's outputs were being used, not how the system was formally categorized.** Participants assessed that even if an event did not violate international law, an event could be problematic because of uncertainty, misperception, imbalance, or escalation potential. A recurring theme was that systems described as commercial or civilian could be reinterpreted as more threatening once their outputs appeared to materially support military operations. Participants therefore often treated classification as context-driven rather than fixed by ownership or stated mission. Several participants identified uncertainty about actors' intent as a key factor that made the scenario problematic, shaping both how they classified the situation and how willing they were to escalate in response.
- **Peacetime normalization moderated some baseline responses.** Several participants said that commercial satellites providing information to militaries is already common in peacetime, which pushed those participants' baseline responses away from dangerous. Once commercial support appeared tied to operational military effects, an event intentionally explored in the scenarios, several participants characterized the situation as problematic or dangerous.
- **Commercial and military entanglement emerged as a major escalation concern.** Participants repeatedly noted that the military

Figure 3.1. | 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.

use of commercial services can blur distinctions between civilian and military targets, complicate attribution and accountability, and generate wider risks of retaliation or spillover. Several participants observed that the danger lies not only in the initial provision of data or services but also in how adversaries might respond once they perceive those services as operationally consequential.

- **Participants often focused on escalation pathways rather than isolated acts.** In discussing the scenario, many looked beyond the immediate permissibility of data collection or dissemination to consider how such support could widen conflict, expose commercial actors to countermeasures, or increase pressure for retaliation. In particular, participants highlighted the effects on farmers, weather agencies, disaster response organizations, and businesses. For most participants, the harm inflicted on these civilian and commercial users led them to reclassify the scenario as dangerous when they had previously classified it as problematic, citing the indiscriminate impact from the jamming. During the discussion, participants also cited the potential for broader escalation given the scale and severe impact of the event as contributing to a "dangerous" reclassification. Notably, participants focused more on the overall impact on commercial and civilian populations than on the differences in risk associated with specific means of jamming (such as targeted jamming to disrupt data downlinks versus interference with command and control links or telemetry), even though these distinctions could significantly alter perceived risk dynamics.
- **Sectoral patterns were evident.** Industry participants tended to focus on the operational consequences for commercial providers and users, such as business loss and liability. Government participants were more likely to emphasize diplomacy, accountability, and the need for state-level response, while academic participants often highlighted the importance of evidence, attribution, and the challenge of interpreting ambiguous intent.

Behaviors: Observable Maneuvers in Space

Participants expressed a range of views on when observable behaviors become escalatory in Scenario 2, which involved an unresponsive commercial satellite performing an unusual maneuver. Figure 3.2 illustrates how participants assessed risk at both the baseline and escalatory phases, as well as the main factors influencing their assessments. At baseline, eight of the nine participants who responded to this question classified this scenario as problematic, and one participant classified it as safe, citing technical unknowns.[9] Key factors driving participants'

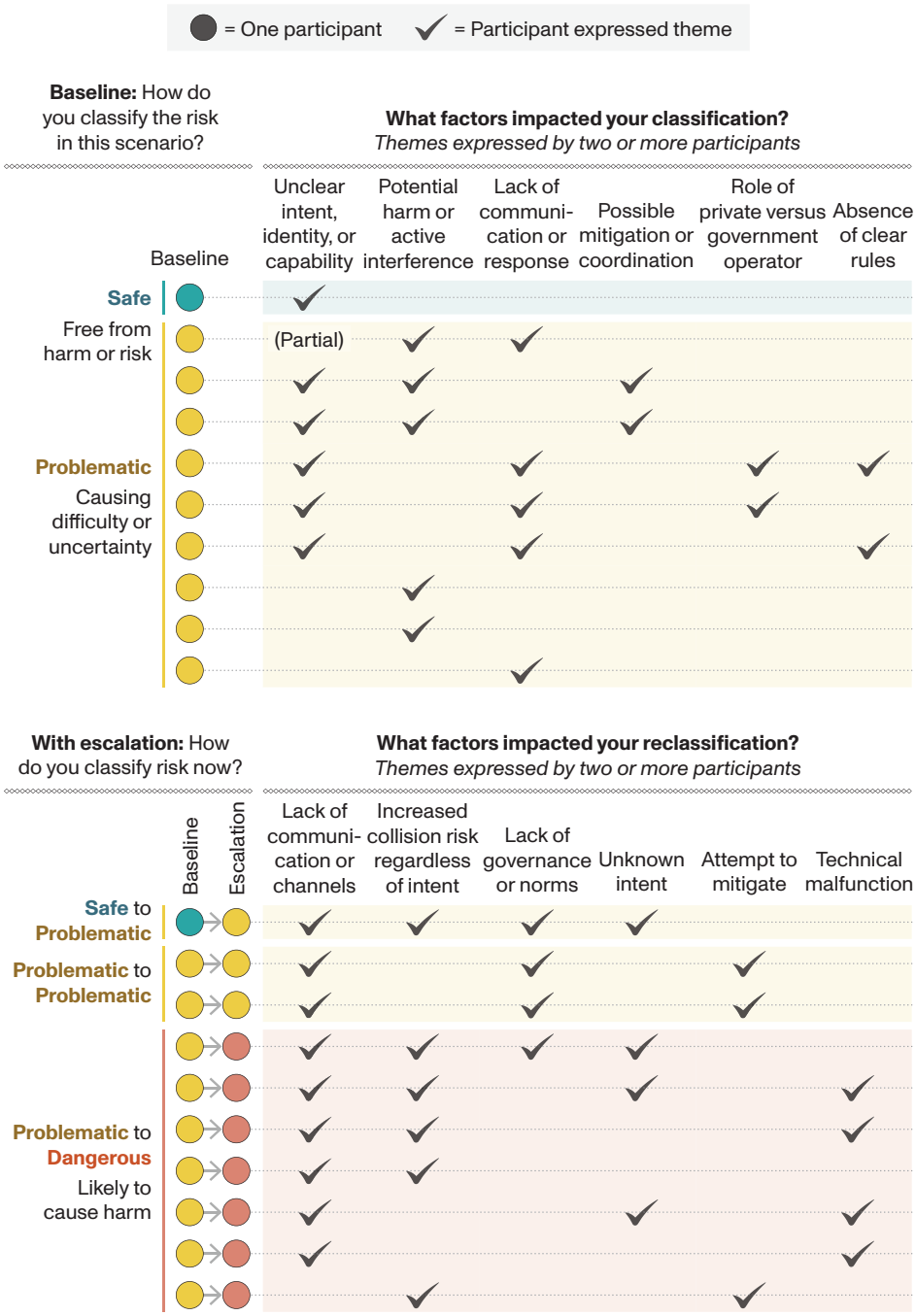
[9] One participant could not participate in the entire event and, as a result, was not in the room at the time this question was asked. One additional participant also did not respond to this question.

"problematic" classification include unclear operator intent, operator identity, or system capability; the potential for harm or active interference; and communication failures. After escalating events, most participants who described the baseline as problematic (six of eight) increased their classification to dangerous, citing increased collision risks and technical malfunctions.

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

- **Participants often viewed ambiguity as a central challenge that increases risk of escalation.** Several participants stressed that a satellite's close approach to another satellite or possible RPO did not need to be clearly hostile to raise concern, but because the purpose of the satellite was unclear, the ambiguity led many participants to classify the baseline event as problematic. One participant observed that an activity may not be clearly unlawful but can nonetheless be strategically unacceptable if it creates uncertainty or the conditions for escalation. This view appeared especially among participants who distinguished legal permissibility from operational or strategic safety.
- **Lack of communication and nonresponsiveness were widely treated as important escalatory indicators.** Participants frequently noted that the inability to discern a satellite's intent, compounded by the operator's failure to clarify or reposition the satellite, increased the risks of escalation. Participants emphasized that an operator's nonresponse could heighten suspicion, undermine trust, and increase the chance of misinterpretation.
- **Concrete physical danger was a critical threshold for many participants.** Although views varied on when exactly the scenario shifted from problematic to dangerous, several participants emphasized that once behavior created meaningful collision risk or a serious on-orbit hazard, the situation warranted a much more severe assessment. In particular, propulsion malfunction and the inability to maneuver became a major technical turning point for participants. In this sense, participants often judged danger in terms of realized or imminent impacts, not only presumed malicious intent. That said, some participants argued that the realization of risk does not automatically prove malign intent because the event may still reflect accident, poor standards, or governance failure.
- **Participants highlighted procedural governance gaps surrounding close approach and RPO.** Discussion repeatedly returned to the absence of clear expectations for notification, communication, consent, and deconfliction in nonconsensual proximity situations, including operator-to-operator procedural expectations. Participants suggested that broad principles alone are insufficient if operators

Figure 3.2. | 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.

lack practical channels or accepted procedures for managing close approaches in real time. Several participants also noted that the scenario sat between definitions, with the point at which the situation became dangerous not always clearly defined or crossed, and therefore unlikely to spark immediate alarm. While legal frameworks may exist, many participants emphasized that the absence of detailed, practical procedures for communication, attribution, and escalation management remains a significant gap.

- **Sectoral patterns were evident.** Industry participants tended to focus on practical intervention, operational consequences, and the need for clear procedures to protect assets and users. Government participants were more likely to stress diplomacy, accountability, and the importance of state-level responsibility, while academic participants often highlighted the challenge of evidence, attribution, and the interpretation of ambiguous intent.

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

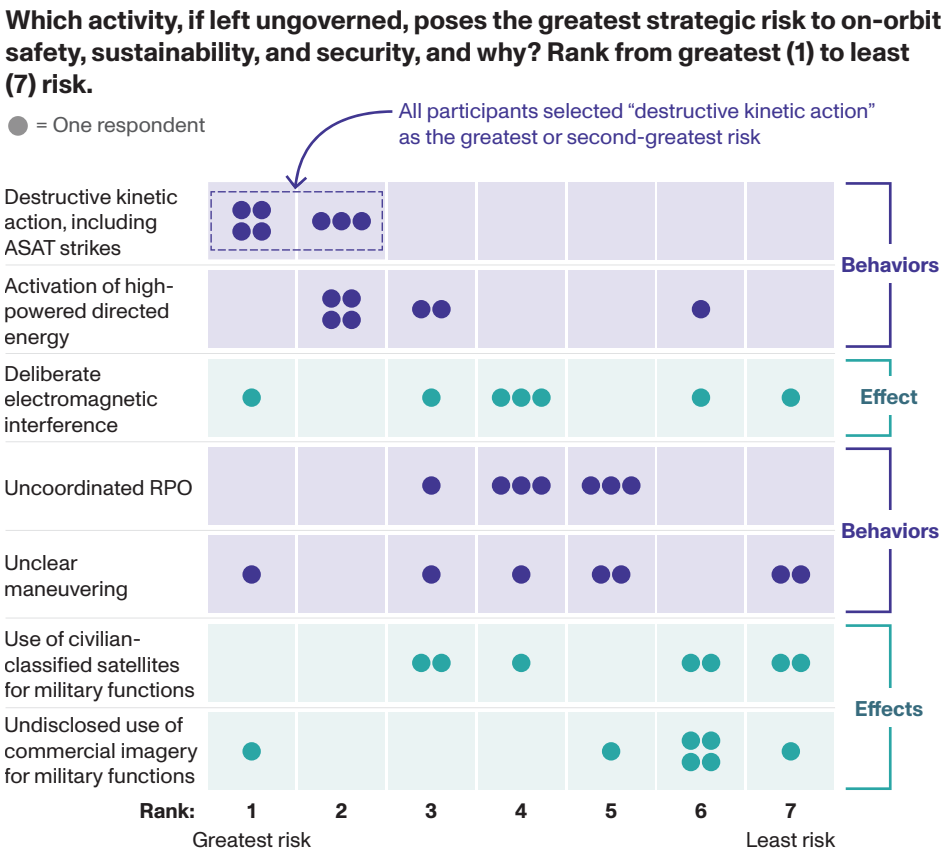
In addition to scenario analysis, participants were asked to rank which space system effects and behaviors, if left ungoverned, would pose the greatest strategic risk to on-orbit safety, sustainability, and security. Most participants collectively viewed key effects, including the undisclosed use of commercial satellite imagery for military functions and the use of civilian-classified satellites for military functions, as posing the least amount of risk compared with destructive behaviors. Participants generally explained that while these effects can blur the line between civilian and military activity and create escalation pathways, they are less likely to cause immediate, irreversible harm to the space environment.

However, in one case, a participant ranked the undisclosed use of commercial imagery as the activity posing the highest risk. The participant noted that such data-gathering to support military operations could lead to irreversible or destructive actions because intelligence asymmetry could drive broader and more prolonged conflicts or be used to inform troop movements or kinetic strikes. Figure 3.3 captures participant rankings across these activities.

Participants ranked the use of destructive kinetic action—including ASAT weapons and co-orbital strikes capable of generating debris fields in active orbital lanes—as posing the highest or second-highest risk. These behaviors were seen as uniquely destabilizing because of their potential for irreversible harm, cascading debris, and triggering broader conflict. One participant noted, "Destructive kinetic action presents the greatest risk of escalation and can turn space into a domain that cannot be safely used." The use of high-powered direct energy actions and deliberate electromagnetic interference were also ranked as high risk, particularly

when they could affect third-party civil or commercial users. Several participants highlighted the risk of spillover effects and the difficulty of attribution, which could lead to misperception and escalation. Participants also highlighted uncoordinated RPO and unsafe proximity operations as creating significant risk, especially when conducted without prior notification, with intent declaration, or within agreed rules of approach. On this finding specifically, industry participants focused more on the operational and business risks of interference and uncoordinated RPO, whereas government participants emphasized escalation potential and destructive action. Academic participants highlighted the importance of evidence in distinguishing between routine and escalatory conduct. Finally, participants emphasized that the absence of transparency and behavioral norms makes it difficult to distinguish between benign and hostile intent, which increases the risk of miscalculation.

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



NOTE: The research team made limited, informed adjustments to participant rankings when responses were ambiguous or inconsistent to reflect participants' intent.

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 crosscutting 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 identified diplomatic and normative responses as justified across both effects and behaviors, particularly amid uncertainty around attribution, intent, and proportionality. They favored early responses that prioritized communication and clarification, reserving stronger measures, including cyber, electronic, or physical interference, for situations in which ambiguity persisted, communication failed, or physical danger increased.

On norms and governance for mitigating space escalation risks, participants broadly agreed that existing mechanisms only partially address such risks. They identified notable gaps in communication and deconfliction procedures for close approach operations, in the governance of military use of commercial systems, and in the effectiveness of voluntary transparency measures where compliance and enforcement remain weak. Rather than sweeping reforms, participants pointed to targeted improvements as the most promising near-term path forward, particularly improved communication channels, practical norms

for proximity operations, and clearer rules governing the responsibilities and liabilities of commercial providers when their services support military activities.

Justified Response Options

Participants offered their assessment of what types of responses might be justified in effect- and behavior-based scenarios.[10] Regardless of whether risks emerge from effects or behaviors, participants broadly identified diplomatic or normative measures as justified to mitigate risks (nine of ten participants for both scenarios; see Figure 4.1), particularly amid uncertainty around attribution, intent, capability, and what is legal or proportional. In the effect-based scenario involving EO/ISR, participants were further likely to support economic and administrative measures, cyber and electronic measures, and physical interference, particularly in response to jamming commercial satellite networks.

Conversation among participants surfaced numerous themes regarding responses:

- **When responses are justified:** Participants generally suggested that responses become more justified as ambiguity persists, communication fails, military relevance becomes clearer, or physical danger increases. In the behavior-based scenario, participants more often emphasized that concrete safety hazards, especially collision risk or unsafe proximity behavior, could themselves justify a stronger response even absent definitive proof of malicious intent.
- **Which responses are justified:** A common theme across both scenarios was that diplomatic or normative responses are often justified, especially as first steps, particularly while attribution, intent, and proportionality remain uncertain. Participants often favored responses that could help reduce these uncertainties, such as enhanced communication, clarification, and requests for explanation.

[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 workshop 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 Which Responses Are Justified



In the EO/ISR scenario, a majority of participants perceived harsher responses, including cyber or electronic measures, as potentially justifiable to address jamming satellite networks.

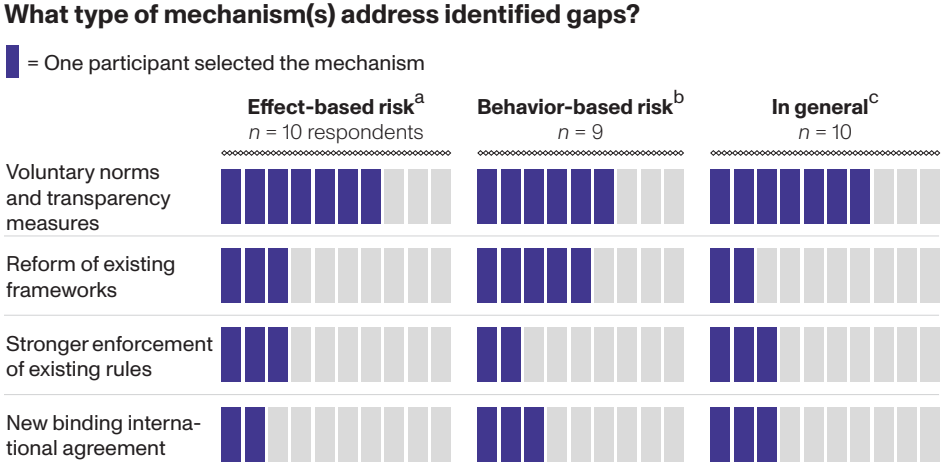
- **What effects these responses could achieve:** Participants viewed early-stage responses primarily as tools to manage uncertainty, establish a record of concern, and signal thresholds without immediately escalating the situation. More-severe responses were generally discussed in terms of halting dangerous conduct, protecting assets, or preventing wider escalation.
- **Features of justified responses:** Participants often described justified responses as proportional, information-seeking where possible, and attentive to downstream effects on broader users and the space environment. Several participants implicitly distinguished between responding to ambiguous conduct and responding to realized danger, suggesting that the latter permits a narrower range of restraint. One participant noted that the more warnings delivered to a state about violations of its obligations, the stronger the justification for a countermeasure if those warnings do not result in changed behavior.
- **Which responses elicited hesitance:** Participants were generally more cautious about coercive or disruptive measures, although some suggested that more-forceful responses could become justified when operators remain unresponsive, when harmful effects become operationally significant, or when a situation appears likely to cause concrete harm. The general consensus was skepticism toward immediate resort to highly escalatory measures in situations still characterized

by substantial uncertainty, especially when communication and deconfliction options had not yet been exhausted. In the RPO scenario, only a few participants supported harsher measures, such as physical interference or kinetic options, to manage risks stemming from space systems conducting unusual maneuvers.

Considerations for Norms and Governance Mechanisms That Could Sufficiently Manage Risk

Figure 4.2 illustrates which mechanisms participants felt were best suited to address governance gaps. Participants offered varied perspectives when considering effect-based versus behavior-based risk. For both effect- and behavior-based risks, most participants identified voluntary norms and transparency measures as well-suited options. For behavior-based risks in particular, a majority of participants (six of eight) supported the reform of existing frameworks. Neither stronger enforcement of existing rules nor a new binding international agreement elicited strong support among participants for either risk category.

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?*

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

- **Improved communication and clarification channels:** Participants frequently identified direct communication mechanisms, requests for explanation, and pathways for deconfliction as among the most immediately useful tools for managing ambiguity and reducing the risk of misinterpretation. In the effect-based scenario, these included mechanisms for better attribution, neutral monitoring, and being able to verify harmful interference or responsibility. In the behavior-based scenario, these meant more-specific rules on approach behavior, orbital safety thresholds, emergency coordination, and operator conduct. Notably, one participant distinguished between informal communication channels and formal reporting obligations, emphasizing that mandatory reporting requirements, in which operators are required to report certain actions or incidents to their national authorities, would be a useful governance tool and would provide a foundation for transparency, attribution, and escalation management that goes beyond informal operator-to-operator communication.
- **Practical norms and procedures for close approach and nonconsensual RPO:** Participants repeatedly suggested that broad principles should be complemented by more-specific expectations regarding notification, communication, safe separation, and operator responsibilities during close-approach events. Several participants suggested pre-notification rules, Notice to Air Missions (NOTAM)–like systems, notices to operators, or broader space-traffic–management procedures. One participant emphasized the value of national regulatory frameworks that clearly articulate each country's thresholds, specifying which distances call for notification and coordination versus those that constitute "warning" or "self-defense" zones. Such frameworks could ensure that other states and operators understand a country's sensitivities and what responses it would consider proportional at each threshold.
- **Measures that clarify civilian-military use and responsibilities:** Participants emphasized the need for greater transparency around military use of commercial systems, such as more-explicit norms, expectations, or governance tools addressing when and how commercial systems provide support with direct military significance. They further argued for clearer expectations regarding how much responsibility lies with commercial operators versus the state, especially in a commercial context in which the state still bears international responsibility.

- **Limits of voluntary norms and the need for flexible governance approaches:** Participants widely recognized the practical value of voluntary norms and transparency measures as confidence-building tools, especially where binding agreements are politically challenging or difficult to achieve because of consensus problems, geopolitics, or the realities of dual-use behavior. However, many stressed that such nonbinding approaches are limited when compliance is voluntary and incentives favor concealment or ambiguity. As a result, participants favored reforming or clarifying current frameworks to introduce more-flexible, context-sensitive governance, such as establishing coordinated and tiered "safe zones" in orbit with rules for coordination and response, rather than relying on rigid binary definitions or expecting new binding agreements to be easily achieved.
- **New or reformed multinational institutions:** Across both cases, participants voiced support for neutral, multinational bodies. For effect-based risks, they suggested that an international or independent body could support attribution, monitoring, or evidence collection, analogous to the International Atomic Energy Agency and its role in managing risks of nuclear proliferation. For behavior-based risks, participants suggested a space equivalent of the International Civil Aviation Organization, a revised liability convention, or stronger coordination architecture.

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 include the following:

- **There is overreliance on broad principles without operational procedures.** Most participants saw existing norms or governance as inadequate in practice and were skeptical that voluntary or nonbinding mechanisms alone could manage dual-use risks. Broad legal and normative principles, such as due regard, liability, responsibility, transparency, and attribution, often lack the specific, operational procedures needed for real-time communication, notification, and deconfliction. As one participant noted, normative discussions are too late once an event has occurred. Some described voluntary or nonbinding mechanisms as only partially sufficient, while others said that they are clearly insufficient. Participants repeatedly suggested that such norms or legal principles are inadequate when operators lack clear procedures for how to communicate, notify, warn, or deconflict during risky situations.

- **Existing mechanisms are partial, weak, or insufficient.** A recurring theme was that many current mechanisms, such as international treaties (e.g., the Outer Space Treaty, Liability Convention), voluntary norms and transparency measures (e.g., transparency and confidence-building measures [TCBMs], responsible behavior norms), fragmented national laws, export controls, and informal operator communication channels, are nonbinding and therefore unreliable, especially when major powers or security interests are involved. Likewise, several participants said that there are also problems with weak compliance, weak enforcement, and failure to use the rules that already exist. The Chinese participant specifically called for mutual understanding and bilateral agreements between the United States and China rather than broader rules of international space governance.
- **Voluntary measures do not offer credible compliance incentives.** Participants often viewed TCBMs as useful but fragile, particularly where attribution is difficult, trust is low, or actors perceive strategic benefits in maintaining ambiguity.
- **Mechanisms that do not account for downstream escalation effects are less helpful.** Participants frequently noted that governance tools should be evaluated not only by whether they address the immediate act but also by whether they reduce the risk of retaliation, spillover, and broader instability.

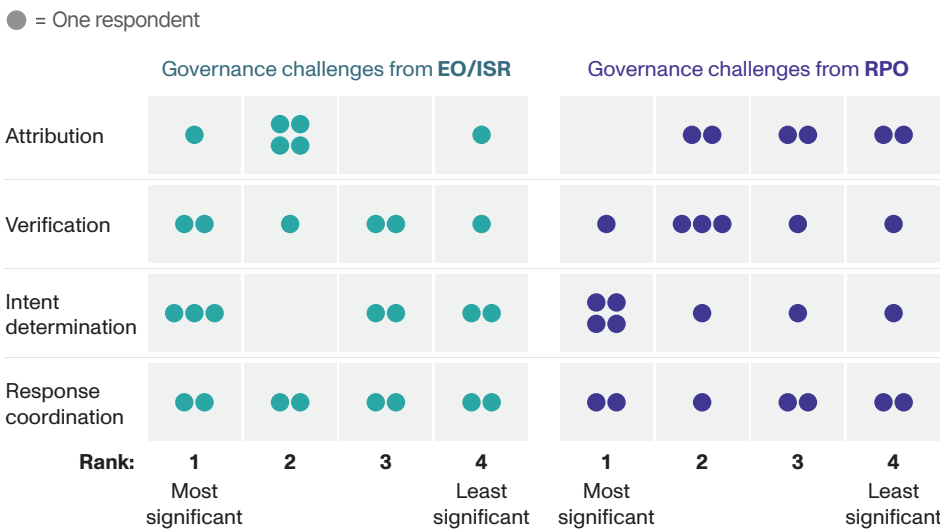
Governance Challenges

The workshop surfaced varied views on the governance challenges that key space systems pose to the stability and security of outer space. Across scenarios, participants widely viewed current governance as incomplete rather than nonexistent but stressed that existing mechanisms remain too partial, too general, or too weakly enforceable to manage many dual-use escalation risks effectively. To that end, participants distinguished between the existence of legal frameworks and the lack of practical tools for managing ambiguity and risk in real time.

Figure 4.3 summarizes participants' rankings of their perceived governance challenges. Although their relative importance varied by scenario, participants were nearly equally split in terms of the most significant governance challenges. A brief description of each of the responses connected to each of the scenarios follows.

Figure 4.3. | Participant Rankings of Governance Challenges

What is the primary governance challenge that the space system poses? Rank from greatest (1) to least (4) risk.



NOTE: Eight participants responded to this question; however, not all participants ranked every governance challenge. Therefore, not all rows total eight responses.

For EO/ISR systems, participant rankings reveal a notable divergence in views regarding the primary governance challenge. Discussion among workshop participants suggests that this split may reflect differing perspectives on the feasibility and importance of intent determination. Some participants argued that understanding intent is central to managing escalation and legal accountability—especially in ambiguous scenarios—while others viewed intent as too difficult to use to ascertain reliability and instead preferred to focus on more-observable challenges, such as attribution or verification. Attribution itself was frequently discussed as a core challenge, with participants highlighting the technical and political complexities of determining responsibility in a dual-use environment. Participants also noted that the speed of escalation in the EO/ISR scenario, the current governance systems' reliance on major powers for authority and compliance, and the lack of an empowered independent agency to intervene when a major power breaks from governance all contribute to the difficulty of reliably determining intent and attribution. Additionally, the legal ambiguity surrounding commercial actors further complicates efforts to assign responsibility and coordinate effective responses. Verification was also recognized as important and was often seen as a necessary step for both attribution and intent determination, even though it was not as frequently ranked as a top challenge. Finally, while response coordination was valued by some, this option was generally seen as

less urgent; several participants noted that effective coordination depends on first resolving attribution and intent.

Country-level variation shaped how participants prioritized these challenges. Japanese participants were especially consistent in emphasizing dual-use ambiguity, peacetime versus wartime reclassification dynamics, and the role of communication in de-escalation. Australian participants more often stressed the distinction between legal ambiguity and strategic risk when attacking commercial versus government assets, focusing on practical consequences and governance shortfalls. South Korean participants more strongly highlighted the need to combine bilateral agreements and increase government-to-government dialogues and communication pathways. The Singapore and India participants underscored, respectively, the importance of practical procedural tools and the wider escalation pathways that can emerge when governance fails. The Chinese participant emphasized the need for commercial actors to report to government agencies and await instructions on how to proceed, highlighting the notion that all space activities should be subject to centralized control.

For RPO systems, participants most often emphasized the lack of sufficiently clear procedures for notification, communication, consent, and deconfliction during close-approach operations. Several suggested that the main challenge is not determining whether a maneuver is hostile but instead managing situations in which intent remains uncertain while safety risks rise. There was broad uncertainty on how close becomes too close for proximity operations and observation, with no participant providing a clear line. The participants recognized that "too close" varies depending on the relationship between the two entities, their level of communication, the roles and capabilities of each spacecraft, and the degree to which observers can verify each spacecraft's location.

Participant responses varied by profession instead of by nation. Industry representatives desired more clearly defined norms for them to operate in and for them to point to when under duress. They sought a framework for solving communication and intent issues between operators and standards or guidelines that, if followed, demonstrate peaceful intentions. Those in academia or government put emphasis on the role of the national government and liability and on who bears responsibility for damages and for facilitating information-sharing, particularly SSA information.

CHAPTER 5

Conclusion and Next Steps



These proceedings summarize the principal findings from the Indo-Pacific team's workshop in Tokyo, Japan, emphasizing the risks and response options related to escalation in the space environment. The findings reflect participant responses to the two workshop scenarios and subsequent group discussions. Insights on escalation pathways and risk classifications were informed by scenario-specific analysis, while conclusions regarding potential response options, governance gaps, and new or revised governance mechanisms were shaped by both scenario discussions and the final wrap-up phase of the workshop. Through this process, the workshop aimed to establish a shared understanding of escalatory activities, thresholds, and potential responses for mitigating risks.

Both scenarios highlighted ambiguity and communication failures as driving escalation risk but surfaced distinct insights. The effect-based scenario (Scenario 1, EO/ISR) emphasized commercial-military entanglement and risks to third parties, while the behavior-based scenario (Scenario 2, RPO) underscored intent and capability ambiguity and the need for practical, real-time communication and deconfliction procedures. Response and mitigation mechanisms discussed were tailored to each scenario, but some were broadly applicable, including reporting requirements, improved communication channels, and neutral multinational bodies. These findings suggest that governance might require both general principles and activity-specific mechanisms. Testing this hypothesis will be a central focus of the final phase of this project.

Overall, analysis of workshop activities surfaced these key preliminary insights:

Escalatory activities: Participants identified specific activities that could prompt escalation and conflict in space. Key activities are summarized in Table 5.1.

Escalatory thresholds: Participants generally assessed escalation as context-dependent rather than binary. Across both effects and behaviors, they identified several conditions under which risks were more likely to reach unacceptable levels (see Table 5.2).

Table 5.1. | Effects or Behaviors Identified as Potentially Escalatory

Activity Category	Escalatory Activity
Effects	Broad or indiscriminate impact from jamming
Behaviors	Close approach or possible RPO without adequate communication
	Persistent failure to respond to requests for clarification or repositioning
	Actions that could generate concrete physical danger or significantly increase the likelihood of retaliatory action, such as uncoordinated proximity operations, kinetic activities, or ASAT tests

Table 5.2. | Potential Thresholds When Effects or Behaviors Warrant a Response

Activity Category	Escalatory Threshold
Effects and behaviors	Persistent or compounding ambiguity about operator behaviors, identity, or other factors
	Failure of communication among involved parties
	Increased military relevance or involvement
	Occurrence of physical harm

In the effect-based scenario, participants frequently emphasized that a nominally commercial system could be reclassified as more threatening once it was perceived to materially support military operations. In the behavior-based scenario, participants more often emphasized that unsafe proximity behavior and the emergence of concrete physical danger could themselves justify treating a situation as dangerous even if hostile intent remained uncertain.

Governance gaps and potential norm or mechanism options: During both scenarios and in group discussions, participants distinguished between an action that may not clearly violate international law from one that is still strategically risky or destabilizing. In those situations, participants broadly agreed that current governance mechanisms are partial or insufficient for many escalation risks. They highlighted gaps in communication and deconfliction procedures for close approach operations (behaviors), shortcomings in governance of military use of commercial systems (effects), and the limited effectiveness of voluntary transparency measures when compliance or enforcement is weak (effects and behaviors). Participants identified several norms or governance mechanisms as potentially effective to mitigate risks; these norms serve as promising areas for further testing in Phase 3 of this project. These are overviewed in Table 5.3.

Table 5.3. | Potential Norms or Governance Options for Responding to Escalatory Activities

Activity Category	Option
Effects	Clarifying the responsibilities, obligations, and potential liabilities of commercial providers when their services support military activities through explicit governance rules and procedures
Behaviors	Practical norms for proximity operations
Effects and behaviors	Improved communication channels

Collectively, these conclusions suggest that the most acute governance gaps in space may arise not only in cases of clearly hostile behavior but also in ambiguous situations in which status, intent, use, and acceptable conduct remain contested. Participants' responses across both scenarios indicate that future governance efforts may be most effective if they focus on reducing ambiguity, clarifying thresholds, and creating practical procedures for communication and deconfliction before crises intensify.

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 Indo-Pacific workshop held in Tokyo, Japan, in April 2026.

Participant Selection

The research team aimed to recruit participants who would together represent a broad range of perspectives and experiences across the dual-use space system ecosystem. Selection criteria included (1) seniority in their respective organizations; (2) demonstrated experience in space policy, operations, or governance; (3) prior involvement in national or international space governance, commercial operations, or notable academic research and contributions on space security; and (4) representation from government, commercial industry, and the research and academic sectors. The final group of participants included senior officials from national space agencies, executives from leading commercial space companies, and recognized academic experts in space law and policy. This distribution of participants ensured that workshop discussions reflected both operational realities and policy-level considerations. Participants were from Australia, India, Japan, the Republic of Korea, and Singapore. 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.

Ten participants joined the workshop in Tokyo representing each relevant sector—government, industry, and research perspectives.[11] 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."[12]

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 *effects*, or use of space-system–collected data to inform terrestrial activities; (2) a scenario based on the *behavior*, or observable maneuvers, of space systems; (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.[13]
- **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.

[11] One person could not attend the entire event. As a result, some questions elicited only nine responses from the nine participants in attendance (instead of ten).

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

[13] Mentimeter, homepage, undated.

The workshop operated under the Chatham House Rule, permitting participants to share content raised during the event without attribution to specific individuals or organizations.[14] 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 phase, and the research objectives of the project's second phase.[15] 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 scenario

- **supported an analysis comparing distinct space activity types**, with one scenario focused on behaviors and the other on effects
- **reflected geopolitical challenges relevant to the Indo-Pacific** 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,

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

[15] This 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.

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.

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 artificial intelligence, 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. The team then instructed the LLM to identify distinct sentiments and provide characterization language that was 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: Earth Observation (EO)/ Intelligence, Surveillance, and Reconnaissance (ISR)

Country A: Large power, strong space and maritime capabilities; rival to Country B and Country C

Country B: Small power, no satellites, contracts space services from Country C

Country C: Large power, home to commercial space companies, allied with Country B

Ongoing maritime disputes between Country A and Country B; tensions are high but stable.

In a contested maritime region, **Countries A and B** have had confrontations for ten years stemming from an unresolved territorial dispute. Today, tensions remain high but stable. Both **Country A** and **Country B** use satellites for space-based sensing, including ISR, SAR [synthetic aperture radar], and EO satellites to monitor activities and collect evidence about "violations" of their claimed maritime boundaries. **Right now, these systems only provide information to users. They do not control or direct military or coast guard actions.**

Country A uses both civil and military satellites; **Country B does not have its own satellites.** Instead, **Country B** contracts commercial providers from **Country C**. These commercial satellites from **Country C** are often observed over the disputed maritime area during **Country B's** military operations. **Country B** says it uses the satellites only for

environmental monitoring and maritime safety. However, independent analysis notes that the satellites often fly over Country A's territory and military operation areas.

During a maritime operation, **Country B** starts using real-time satellite information from the contracted commercial provider in **Country C** to guide naval maneuvers. **Country A** soon detects radio frequency (RF) signals and observes that **Country B** is using space-based intelligence to inform its tactics. **Country B's** commercial satellites now directly support its military operations.

With the commercial provider's intelligence, **Country B** damages **Country A's** regional naval force. However, it remains unclear whether the commercial provider knew its data was being used by **Country B** for live military operations or whether **Country B** repurposed the data feed without disclosing that end-use or seeking authorization.

Country A publicly announces that it will treat any commercial operators helping **Country B's** military activities as military targets. To demonstrate resolve, **Country A** jams the commercial constellation used by **Country B**, disrupting services across the entire network, including farmers, weather agencies, disaster response organizations, and international businesses.

Country A denies responsibility and says technical problems caused the failure.

Scenario 2: Rendezvous and Proximity Operations (RPO) and In-Space Assembly and Manufacturing (ISAM)

MYS-1, a known servicing satellite from space power Country A, is observed conducting unusual maneuvers in GEO. MYS-1 approaches and parks near a dual-use commercial satellite—COM-1—from country B.

Based on pattern of life analysis, analysts believe MYS-1 may be conducting RPOs but cannot be sure. Analysts also are uncertain about the purpose of MYS-1's operation.

COM-1's operator publicly condemns the assumed RPO maneuver, citing risks to satellite safety and spectrum interference. COM-1's operator requests they reposition their satellite—but MYS-1 does not move.

After no response from MYS-1, COM-1's operators initiate a collision-avoidance maneuver. During the burn sequence, the propulsion malfunctions, leaving COM-1 unresponsive and stranded on a trajectory that increases its collision probability with MYS-1.

COM-1's operator issues an immediate collision warning notice to nearby operators, including MYS-1. However, no direct communication channels exist for contacting the operator of MYS-1, and attempts to signal to MYS-1 are unsuccessful.

Abbreviations

ASAT	anti-satellite
EO	Earth observation
GEO	geostationary orbit
ISR	intelligence, surveillance, and reconnaissance
LLM	large language model
RPO	rendezvous and proximity operations
SSA	space situational awareness
TCBM	transparency and confidence-building measure

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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 Tokyo, Japan, in April 2026 that brought together stakeholders from across the Indo-Pacific. 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 emphasized that escalation risks in space often stem less from clearly unlawful acts than from ambiguity surrounding the status, purpose, and consequences of dual-use space activities. Discussions highlighted broad concern that existing governance arrangements remain partial and insufficient for managing such ambiguity, especially when commercial systems become entangled in military operations or when unsafe on-orbit behavior creates physical danger in the absence of clear communication or accepted operating procedures. 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.

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For more information on the RAND International Security and Defense Policy Program, see www.rand.org/nsrd/isdp or contact the director (contact information is provided on the webpage).

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