RAND

Conference Proceedings

Anca Agachi, Mack Rodgers, Jan Osburg, Amal Altwaijri,
Krista Langeland, David Glickstein, Bruce McClintock

MANAGING DUALITY IN SPACE

VOLUME III, AMERICAS WORKSHOP INSIGHTS ON ESCALATORY SPACE ACTIVITIES AND POTENTIAL RESPONSE OPTIONS



This work was sponsored by Founders Pledge.

For more information on this publication, visit **www.rand.org/t/CFA4003-6**.

About RAND

RAND is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest. To learn more about RAND, visit www.rand.org.

Research Integrity

Our research integrity is grounded in RAND's core values of quality and objectivity. Rigorous quality assurance procedures, conflict of interest screening, and transparency in funding ensure that every study is objective and nonpartisan. Learn more at www.rand.org/integrity.

RAND's publications do not necessarily reflect the opinions of its research clients and sponsors.

Published by the RAND Corporation, Santa Monica, Calif.

© 2026 RAND Corporation
RAND® is a registered trademark.

Cover: loops7/Getty Images, Archara/AdobeStock, ISC/AdobeStock, and Agata/AdobeStock; composite image created using multiple outputs from the Adobe Firefly image generator.

Limited Print and Electronic Distribution Rights

This publication and trademark(s) contained herein are protected by law. This representation of RAND intellectual property is provided for noncommercial use only. Unauthorized posting of this publication online is prohibited; linking directly to its webpage on rand.org is encouraged. Permission is required from RAND to reproduce, or reuse in another form, any of its research products for commercial purposes. For information on reprint and reuse permissions, visit www.rand.org/about/publishing/permissions.

CF-A4003-6

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 May 2026 in Washington, D.C., that brought together stakeholders and experts from across the Americas 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 Tokyo, Japan, 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 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 these preliminary insights:

- **Escalatory activities:** Participants identified the following to be escalatory activities: undisclosed or ambiguous space operations where intent is unclear and maneuver is not signaled in advance; situations in which communication is lacking, restricted, or impossible; unilateral or uncoordinated maneuvers by satellites, such as unannounced maneuvers; and space activities that threaten space objects or loss of life.
- **Escalatory thresholds:** Participants found that thresholds are context-dependent and shaped by factors that include compounded and continued uncertainty about an incident and the intent of actors involved; the identity and capability of stakeholders; involvement of multiple actors, whose participation can produce spillover effects and increase the unpredictability of responses; loss of life and physical or kinetic impacts; and broader geopolitical tensions and strategic competition between parties.
- **Governance gaps and potential norm or mechanism options:** Governance frameworks exist, but they are insufficient and often not enforced. Norms and voluntary mechanisms can represent a starting point for progress, especially if combined with additional operational standards and rules. Potential governance solutions advanced by the participants include maneuver and collision-avoidance standard operating procedures, which can be orbit-specific; "rules of the road" for space navigation, akin to those that exist for the sea domain;[1] standard operating procedures for incident prevention; commonly agreed safety zones; improvement of registration of space objects, in support of the 1976 Registration Convention;[2] legal reporting requirements for commercial actors, such as end-user license agreements and "know your customer" rules, meant to mitigate potential malicious activity and clarify provider responsibility; enforcement of norms and public statements; and application of non-space frameworks to space incidents (e.g., criminal management frameworks) or development of space-specific architectures to minimize space-based harm.

The space domain is changing rapidly, and participants noted that governance gaps are only likely to grow as access to technology becomes more democratized, the number of actors launching assets into orbit grows, and the commercialization and securitization of space continues. Tomorrow's governance architecture is being developed today, through each decision made by policymakers, industry leaders, academics, and civil society members. Therefore, we, the international community, need, as one participant put it, "far-seeing paradigms and frameworks" that can enable ambitious action and support space sustainability, safety, and security for all.

[1] For example, see United Nations Convention on the Law of the Sea, 1994.

[2] Convention on Registration of Objects Launched into Outer Space, 1976.

Contents

SUMMARY iii

FIGURES AND TABLES vii

CHAPTER 1. INTRODUCTION AND BACKGROUND 1

Duality in Space Phase 2 and Workshop Objectives 2
Proceedings Organization 4
Regional Workshops on Escalatory Space Activities and Response Options 5

CHAPTER 2. APPROACH TO CHARACTERIZING ESCALATION RISKS IN SPACE: DEFINING ACTIVITIES AND THRESHOLDS 7

Classifying Activities: Effects Versus Behaviors 8
Defining Risk Thresholds: Safe, Problematic, and Dangerous 9
Two Scenarios 10

CHAPTER 3. WHEN SPACE ACTIVITIES APPEAR ESCALATORY: INSIGHTS ON WHAT DRIVES PERCEPTIONS OF INCREASED RISK 13

Effects: Use of Space Systems to Inform Terrestrial Activities 14
Behaviors: Observable Maneuvers in Space 17
Comparative Risk Perceptions: Which Effects and Behaviors Are Seen as Highest Risk 20

CHAPTER 4. RESPONDING TO AND MANAGING ESCALATORY SPACE ACTIVITIES: INSIGHTS ON WHAT IS JUSTIFIED, WHAT MIGHT WORK, AND WHY GOVERNANCE IS CHALLENGING 23

Justified Response Options 24
Considerations for Norms and Governance Mechanisms That Could Sufficiently Manage Risk 26
How Norms or Governance Mechanisms Could Be Insufficient for Managing Risks 28
Governance Challenges 29

CHAPTER 5. CONCLUSION AND NEXT STEPS 33

Next Steps 36

APPENDIX A. METHODOLOGICAL APPROACH 37

APPENDIX B. SCENARIO LANGUAGE 41

ABBREVIATIONS 43

REFERENCES 44

ABOUT THESE CONFERENCE PROCEEDINGS 46

Figures and Tables

FIGURES

Figure 1.1. *Duality in Space* Project Publications 3
Figure 3.1. Participant Sentiments on Factors Driving Risk Assessment in an Effect-Based EO/ISR Scenario 15
Figure 3.2. Participant Sentiments on Factors Driving Risk Assessment in a Behavior-Based RPO Scenario 18
Figure 3.3. Participant Rankings of Which Behaviors or Effects Pose the Greatest Strategic Risk 21
Figure 4.1. Participant Sentiments on When and Which Responses Are Justified 25
Figure 4.2. Participant Responses on Mechanisms Best Suited to Address Governance Gaps 26
Figure 4.3. Participant Rankings of Governance Challenges 30

TABLES

Table 1.1. Country and Sector of Workshop Participants 4
Table 5.1. Effects or Behaviors Identified as Potentially Escalatory 34
Table 5.2. Potential Thresholds When Effects or Behaviors Warrant a Response 34
Table 5.3. Potential Norms or Governance Options for Responding to Escalatory Activities 35

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.[3] 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 May 2026 on escalatory space activities and potential response options to mitigate associated risks. Held in Washington, D.C., the workshop convened nine stakeholders from across the Americas, representing government, industry, and research communities. Through two scenarios and subsequent discussions, participants examined how to characterize escalatory activities in space, what responses might be justified, which norms or mechanisms sufficiently manage risk, and what challenges might complicate implementation.

[3] *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 Washington, D.C., workshop, together with additional workshops in Geneva, Switzerland, and Tokyo, Japan, 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.[4]

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 the Americas, Europe-Eurasia, 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.

[4] 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.

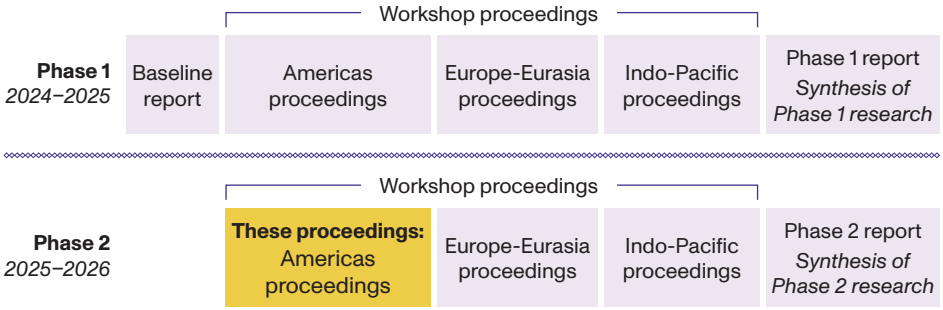
For the **Phase 1 Americas workshop proceedings**, see Anca Agachi, Krista Langeland, Amal Altwaijri, Mélusine Lebret, David Glickstein, and Bruce McClintock, *Surveying Duality in Space*: Vol. I, *Americas Workshop Insights on Developing, Deploying, and Governing Dual-Use Space Systems*, RAND Corporation, 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 and with participants spanning multiple sectors, RAND aims to ensure that the project's findings and recommendations reflect diverse perspectives and regional considerations. The Washington, D.C., workshop collected insights from Americas stakeholders representing national armed forces, civilian space organizations, space agencies, private-sector academia, and the think-tank and research community (see Table 1.1).[5]

Over the course of the workshop, participants provided insights on two scenarios: one in which Earth observation (EO) and radio frequency (RF) spectrum information is provided by a private company to a nonstate organization involved in a violent incident against state institutions and one involving rendezvous and proximity operations (RPO) in which an unidentified satellite 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.

[5] 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	United States	Academia/research
2	Brazil	Industry
3	Canada	Academia/research
4	Mexico/Argentina	Academia/research
5	Peru	Government
6	United States	Government
7	United States	Government
8	United States	Government
9	United States	Industry

NOTE: All nine 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 detail on the two scenarios: an effect-based EO/intelligence, surveillance, and reconnaissance (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 Americas, Europe-Eurasia, and the Indo-Pacific. 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*.[6] Although some findings overlap across volumes, the insights presented here reflect discussions and perspectives specific to the Americas workshop.

[6] 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 Karen Schwindt, Jeffrey W. Hornung, Mack Rodgers, Weilong Kong, David Glickstein, and Bruce McClintock, *Managing Duality in Space*: Vol. II, *Indo-Pacific Workshop Insights on Escalatory Space Activities and Potential Response Options*, RAND Corporation, CF-A4003-5, 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 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: 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.[7] 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.[8] (Emphasis added.)

This project defines *effects* as 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. Effect-producing systems are generally those with long-established capabilities, including EO and 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

[7] McClintock et al., 2026.

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

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, 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. 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. Because these activities create potentially distinct forms of harm and escalation risk, stakeholders might view different response options as appropriate. 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 along a spectrum, with different levels of risk warranting different types or degrees of response. This 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.[9]

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 involves risks arising from effects, in which a country is affected by a nonstate criminal organization within its territory leveraging EO information from a private-sector company. Scenario 2 examines risks stemming from a behavior, in which a satellite of unknown identity approaches another satellite and conducts unusual maneuvers. 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 behaviors. The full scenario text is included in Appendix B.

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

The scenario involves two countries, a criminal organization, and a private EO/ISR provider: **Country A**, a midsized country in the Americas experiencing an internal security crisis; **Organization**, a criminal organization driving the security crisis from Country A; **Country B**, a technologically advanced state also in the Americas that is home to a major commercial EO company; and **Company**, located in Country B, providing submeter resolution imagery on a subscription basis to various clients.

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. The Organization, from Country A, obtains EO and RF data from the Company (from Country B) to track Country A's security and police forces.

[9] 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.

2. Country A sends a special operations team to capture a senior Organization leader.
3. The Organization ambushes and eliminates the Country A team using the EO and RF data.
4. Country A demands that Country B prevent the Company from selling its EO and RF data to the Organization or its intermediaries.
5. Country B claims that its limited authority to restrict commercial sensor data does not apply in this context.

Participants then answered similar questions regarding the escalation phase:

1. The Company refuses to cut off the Organization's access to EO and RF data.
2. Country B maintains its claim that this is solely a domestic issue of Country A.
3. Country A starts jamming and dazzling the Company's satellites as they pass over the region.
4. This also affects the Company's legitimate customers both in Country A and surrounding countries.
5. The governments of the surrounding countries demand that Country A stop its interference.

A detailed scenario description is available in Appendix B.

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

The scenario involves two primary satellites: **MYS-1**, a satellite of unknown origin and ownership, and **COM-1**, a GEO communications satellite developed in partnership by Country A and Country B. Country A is a country outside the Americas that is expanding relations with South America, while Country B is a South American country.

Participants first provided insights on the baseline phase:

1. Country A is developing a dual-use GEO communications satellite (COM-1) with South American Country B, which also launches it.
2. Soon after the launch, MYS-1 is observed conducting unusual maneuvers in GEO.
3. Analysts believe that MYS-1 might be conducting an RPO, but they are uncertain.
4. Country B reaches out to MYS-1 but receives no response as MYS-1 gets closer to COM-1.

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

1. COM-1 initiates an unscheduled collision avoidance maneuver.
2. COM-1's thrusters malfunction, leaving it stranded on a trajectory that greatly increases collision risk.
3. COM-1 issues a collision warning, forcing other satellites to burn fuel to reduce collision potential.

A detailed scenario description is available in Appendix B.

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—effects and behaviors—and how those perceptions could shift as events unfold and stakeholders undertake different actions. This chapter first overviews perspectives on effects, focusing on Scenario 1, involving commercial EO/ISR data exploited by a criminal organization to enable lethal action against state security forces. Participants generally viewed the baseline scenario as problematic rather than dangerous on the basis that existing tools and diplomatic channels were partially available to respond to the situation, although the loss of life and existence of geopolitical tension made the context escalatory. After the escalating event, the participants hedged between problematic and dangerous, weighing Country A's choice to unilaterally jam and dazzle the commercial satellite against the collateral damage experienced by legitimate businesses and surrounding nations.

The chapter then turns to behaviors, focusing on Scenario 2, which involved an unidentified satellite (MYS-1) conducting proximity operations near a jointly owned GEO communications satellite (COM-1). Participants assessed the context as problematic, primarily because of the unknown identity and capabilities of the mystery satellite, which foreclosed most benign response options. However, opinions shifted sharply toward the context being dangerous once COM-1's technical failure compounded the behavioral uncertainty and physically endangered surrounding satellites in orbit.

Across both scenarios, several factors shaped the overall risk assessment: the level of uncertainty resulting from the available information; the scale and impact of the incident, especially if multiple regional actors were involved; the existence and utility of governance tools; Earthly

geopolitics and tension; and the potential for loss of life and physical destruction. Participants assessed risks on the basis of impact and probability, noting that uncertainty and geopolitical tensions could shape the ultimate probability of an escalatory event, while the existence of policies could determine the ultimate scale and impact of the event.

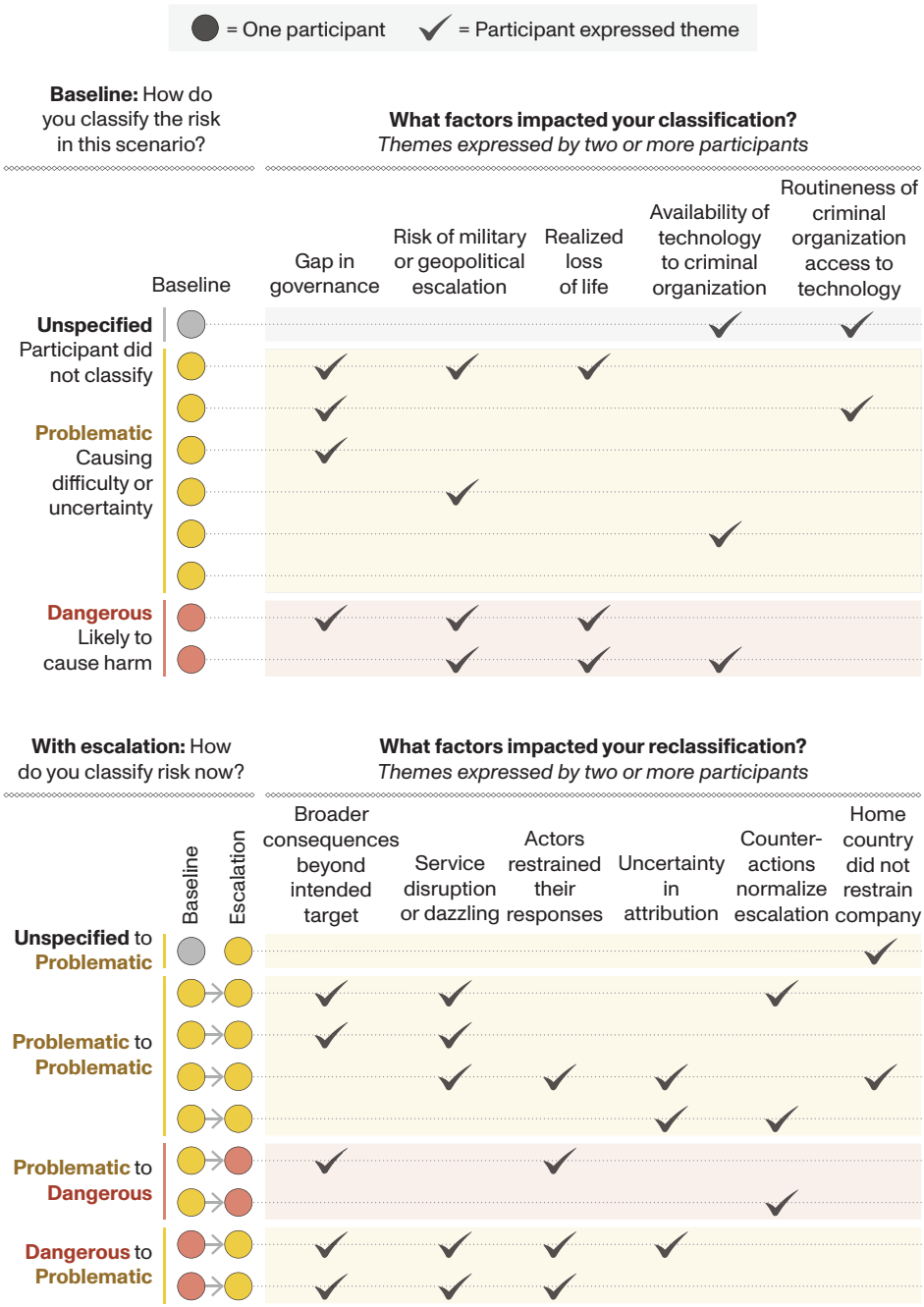
Effects: Use of Space Systems to Inform Terrestrial Activities

Participants expressed insights on when space activities become escalatory in Scenario 1, in which commercial EO/ISR data are used by a nonstate criminal organization for a lethal action against a state force. Figure 3.1 illustrates how participants assessed risk at both the baseline and escalatory phases, as well as the main factors influencing their assessments. In the initial stages, most participants (six out of nine) classified the scenario as problematic for several reasons, including a lack of governance mechanisms to prevent and address the crisis, risks of geopolitical escalation, and the sophistication and impact of the criminal organization's actions. Following the escalatory event, some participants elevated their risk classification, while others downgraded it. Such factors as the spillover of the initial incident beyond its initial target and country, the service disruption elicited by the jamming of the commercial satellite, and continued attribution uncertainty shaped their ultimate assessment.

Key findings on risk-increasing effects include the following:

- **Escalation risks can increase because of governance gaps.** Participants noted that the scenario escalated because of a governance gap at the domestic level, whereby the company providing the commercial data did not conduct due diligence about the ultimate user of its service. Participants suggested that primary responsibility sat with the company, which failed in following proper licensing and due diligence protocols and thus contributed to the problematic nature of the context. A participant suggested borrowing regulations from the financial sector that require companies to "know their customer" and applying those regulations to space supply chains to increase transparency and prevent misuse of commercial data by nefarious actors.
- **Broader consequences beyond the intended target elevate escalation risks.** Several participants noted that the cross-border nature of the incident and its regional spillover raised the perceived level of risk. This was especially true in the escalatory phase of the scenario, when one of the countries used jamming and dazzling to stop the company's provision of services, thus prompting a regional service disruption and further destabilizing the situation. One participant noted, "There are too many stakeholders to keep [the situation] predictable," suggesting that responses by affected

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. Rows without check marks indicate that the participant did not express any of the listed factors.

actors could compound one another and further escalate tensions. This insight emphasizes the importance of considering secondary and tertiary consequences when judging a response to an incident involving dual-use space systems.

- **Loss of life represents a red line.** Several participants judged the situation as problematic because the use of commercial data ultimately led to the death of members from a country's armed forces, which further invited retaliatory military responses. The escalatory nature of this development is particularly related to the fact that this resulted from the actions of a criminal actor. Notably, all participants who considered loss of life as being a critical threshold were from North America, raising the question about whether other countries share the same escalatory ladder or may judge severity differently even in cases in which incidents turn lethal.
- **Difficulty in characterizing an incident can advance uncertainty and, therefore, can increase escalation risks.** The scenario dynamics underscored the importance of early-stage classification of the type of incident taking place and the nature of the actors involved. When nonstate actors use space-derived data to support illicit activities, participants noted that states must determine whether such use constitutes a criminal act that warrants a law enforcement response or a terrorist act or insurgency that becomes a national security issue. These classifications not only help shape perceived risk, commercial provider responsibility, and appropriate response options but can also affect analytical and conceptual frameworks used by policymakers in managing the incident. In particular, depending on the classification being used, existing frameworks covering criminal, terrorist, or insurgent activities may extend to space-enabled harm, or new, space-specific rules may be required. This suggests that the initial characterization and framing of an incident involving dual-use space systems is important in determining responses, especially when it involves nonstate actors and whether they are commercial service providers, benign organizations, or transnational criminal groups.
- **Unilateral action outside of agreed-upon governance frameworks can lead to escalatory responses becoming normalized.** Multiple participants flagged the jump to jamming and dazzling by Country A as potentially normalizing electromagnetic–and to a lesser extent cyber–activities as a baseline reaction to dual-use aggression. In particular, one participant noted the reversible nature of low-to-medium-powered electromagnetic effects being appealing to a nation claiming protective rights, but that same reversible nature could encourage an affected third-party nation to use electromagnetic or cyber effects in response. Governance, which could include best practices or a dedicated discussion forum, would provide

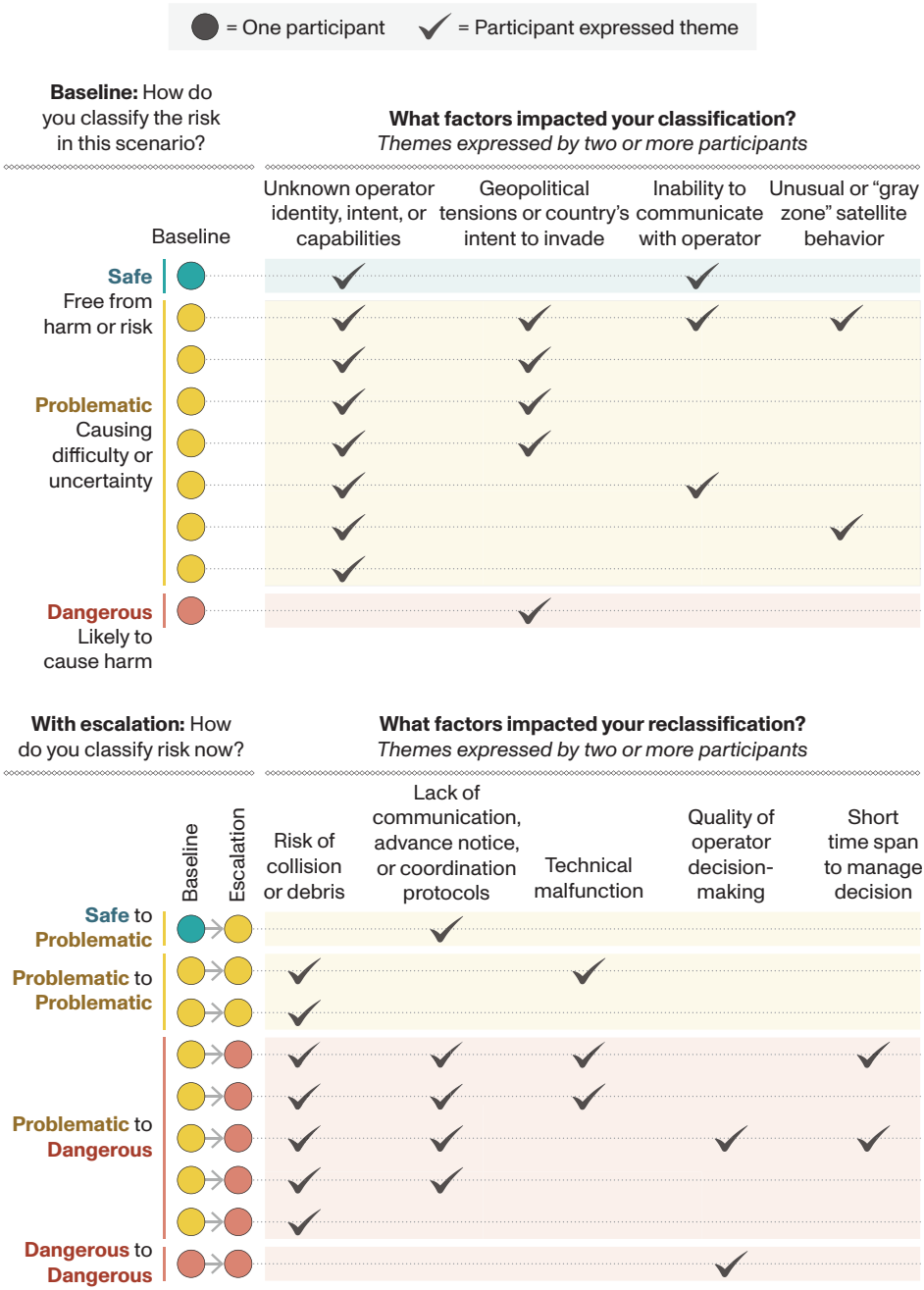
nations with ways to communicate intent and signal purpose before potentially escalatory actions are taken and normalized.

- **Asymmetry in capability and response options shapes perceived risk.** Participants noted that escalation dynamics depend on the relative space and military capabilities of the states involved. A South American participant noted that incidents between emerging space nations and major powers are fundamentally different from those between more evenly matched actors. Other participants echoed this view, noting that more-capable countries may have access to a wider range of non-escalatory options (such as diplomatic overtures or sanctions), while less-capable states may have only blunt or escalatory tools available, increasing the likelihood of escalation between two low-capability countries. This suggests that risk assessments of escalatory activities cannot be made independently of relative state capability because similar actions could carry different escalation implications depending on available response options.

Behaviors: Observable Maneuvers in Space

Participants offered key insights on when they perceived observable behaviors as becoming escalatory in Scenario 2, in which an unidentified satellite (MYS-1) conducts unusual proximity operations near a GEO communications satellite. As Figure 3.2 illustrates, seven out of nine participants characterized the context as problematic, and one considered it dangerous. Key factors driving the classification included the unknown satellite origin and operator intention, unclear system capability, and the complicated geostrategic relationships serving as a backdrop for this incident. After escalation, most participants considered the situation dangerous, citing the increased risks of collision and debris creation, the continued lack of communication, the technical malfunction, and issues affecting operator decisionmaking and the short time span to manage decisions.

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.

Preliminary insights on risk-increasing behaviors include the following:

- **The unknown nature of the operator's identity, intent, and capabilities elevates the risk of escalation.** Most participants considered the fact that the origin of the satellite and its capabilities were unknown to be problematic, and they could not determine the ultimate intent of the satellite's maneuver. The ambiguity was particularly challenging given the tense geopolitical context in which the satellite approach was taking place, making it easy to assume malign intent on the part of the mystery satellite operator. Participants highlighted that the lack of clarity could increase suspicion, limit the ability to respond with "escalatory precision," and enhance security dilemmas overall. They identified specific best practices that could help in these situations, such as advance notice and coordination protocols, which are captured in Chapter 4.
- **Lack of communication compounded risk.** As the scenario unfolded, the inability to communicate with the mystery satellite gained additional importance. While lack of communication initially limited intent determination and attribution, as the situation developed, the absence of communication actively hindered coordination to avoid a physical impact and the creation of debris. COM-1 interpreted the lack of communication from the mystery satellite as permission to move, and COM-1's orbital shift elicited the chain of events that increased conjunction risks as the incident developed. As one participant noted, "One uncooperative, maneuvering object is problematic; two [such objects] plus no communication is dangerous."
- **The potential for a collision was a watershed factor for participants.** Participants considered that a potential physical impact would put all stakeholders involved in the incident in a dangerous situation, thus elevating the severity of their risk assessment. Both technical and behavioral factors played a role in this assessment: Even though the unplanned maneuver and thruster failure were immediate factors that increased the possibility for a conjunction, it was the hazard they created and the enhanced risk of contact that drove risk assessments. Overall, the lack of contact and prenotification from the mystery satellite created an unstable and unpredictable environment.
- **Geopolitics on Earth matter for threat assessments in space.** The maneuver was considered particularly risky given the broader geopolitical context on Earth, where one of the owners of the communications satellite was preparing to invade another country. Several participants explicitly considered this aspect as part of their assumptions in making their threat assessment and factored it particularly into their intent determination. This suggests that

conventional political dynamics cannot be dissociated from the ways in which dual-use space systems are being used—indeed, these dynamics may factor in especially in the early stages of a crisis, when information is limited and stakeholders may seek to use proxy indicators, such as the level of tension in a bilateral relationship, to extrapolate intent.

- **Technical characteristics matter in context.** Participants considered technical characteristics of dual-use space systems and their environment as part of a holistic determination of risk. For example, the nature of an orbit and how slots are being assigned were not incontrovertible evidence by themselves, but in the context of the incident, they raised the perception of the gravity of the situation. This suggests that the assessment of incidents involving dual-use systems may require a layered approach, which combines technical system characteristics with unique behavior analysis and strategic geopolitical assessments.

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

Participants were asked to generalize their scenario analysis and rank overall strategic risks posed by a range of space system effects and behaviors in order to determine the greatest challenges to on-orbit safety and sustainability. Most participants viewed the undisclosed use of commercial imagery for military functions and the use of civilian-classified satellites for military functions as posing a much lower risk than other categories of threats, such as direct ascent ASAT weapons or high-powered directed energy. Figure 3.3 captures participant rankings across these activities.

The use of commercial and civilian systems for military purposes was considered commonplace in the current operating environment, and participants therefore ranked this as lower risk compared with other activities. However, participants noted that despite the ubiquitous presence of these systems, this blurring of lines between civilian and military uses and the increased presence of activities below the threshold of the use of force should not become normalized. Spacefaring nations should take action to publicly call out and delegitimize these disruptive activities and continue cooperating to find ways to curb their impact.

Figure 3.3 further captures the behaviors that participants considered to pose the greatest strategic risk to on-orbit safety, sustainability, and security. ASAT weapons and co-orbital strikes were almost unanimously viewed as posing the greatest risk because of their kinetic, irreversible

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.



nature, which generates debris that affects the sustainable utilization of orbital slots. The second-highest risk was judged to be posed by the activation of high-powered directed energy, which was considered a relatively novel capability. As one participant noted, "They both change the perspective of what could be in the dual-use toolbox." Unclear maneuvering and uncoordinated RPO were considered medium-range risks, and participants identified particular best practices throughout the discussion that could reduce the threat that these risks pose. These are discussed at length in Chapter 4.

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.

Overall, the participants favored responses that were calibrated to the seriousness and scope of the incident, seeking to undertake proportional, targeted, and (when possible) coordinated action. They preferred diplomatic or normative responses as a baseline and deployed more severe measures only when the level of information available or the gravity of the situation demanded it.

On governance, participants acknowledged that existing frameworks are generally insufficient and often poorly enforced, yet they remained skeptical that new binding mechanisms are achievable in the current geopolitical environment. Instead, they coalesced around approaches that they perceived as more pragmatic, including voluntary norms and operational standards that build on and reinforce existing frameworks, such as the Registration Convention,[10] rather than replace them. Other norms and mechanisms identified include common maneuver and

[10] Convention on Registration of Objects Launched into Outer Space, 1976.

collision avoidance procedures, rules of the road for space navigation, safety zones, and clearer legal reporting requirements for commercial actors. Participants also noted the potential to apply non-space frameworks, such as criminal law and financial liability regulations, to space incidents where purpose-built governance would be duplicative or does not yet exist.

Justified Response Options

Participants offered their assessment of what types of responses might be justified in effect- and behavior-based scenarios (Figure 4.1).[11] Across both scenarios, participants broadly agreed that diplomatic and normative responses can help mitigate the risks posed by dual-use space systems. In the case of the effect-based scenario, all participants considered that some form of economic and administrative responses would be warranted; most mentioned penalties and sanctions for companies failing their due diligence responsibilities as a potential recourse.

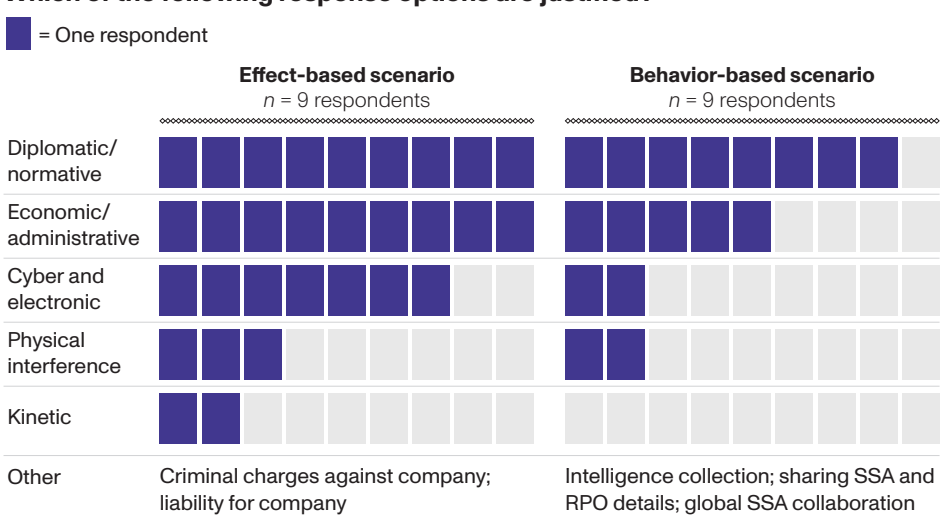
Conversation among participants surfaced numerous themes:

- **When responses are justified:** Participants suggested that uncertainty and immediate (physical) danger may make responses justified. They advised caution and thoughtful judgment of a situation before acting, but they also noted that *justifiable* does not equal *advisable* or *non-escalatory*. This important differentiation suggests that responses to dual-use space incidents should be judged based on multidimensional criteria, which consider not only acceptability or necessity but also proportionality.
- **Which responses are justified:** Participants agreed almost unanimously that diplomatic and normative responses are preferred initial actions, as are economic and administrative options. They offered specific suggestions:
  - **Diplomatic and normative** responses included denunciation of the irresponsible behavior, reinforcement of principles of "due

[11] 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



regard" contained in Article IX of the Outer Space Treaty,[12] increased information- and intelligence-sharing, and legal action against the operator.

- **Economic and administrative** options included sanctions and/or penalties for commercial providers of data who failed their due diligence responsibilities.
- **Cyber and electronic** actions (used primarily in the EO/ISR scenario) were aimed at degrading support for the criminal group and limiting the spillover effect from the original incident.

The exact choice of response, however, depends not only on the incident under consideration but also on the timeline available to respond, the ability to control secondary consequences, and the space capabilities within the target country's toolbox. Because of these differences, not all countries will have the same options at their disposal, which may limit the escalatory range available to a state: "A more developed and technically capable country may have more non-escalatory options than someone who only has a hammer or a gun," said one participant.

- **What effects these responses could achieve:** In the case of the effect-based scenario, participants sought to avoid further escalation, reinforce norms of behavior, and foster cooperation and coordination of responses. In the behavior-based scenario, the main goal was to deter further malicious (or unintentionally damaging) action, reinforce existing norms and treaties, and improve transparency and attribution.

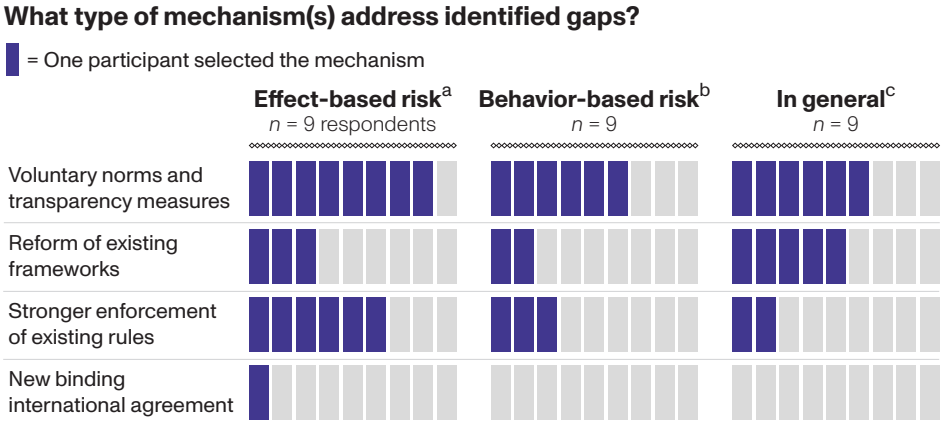
[12] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, January 27, 1967.

- **Features of justified responses:** Justified responses should be proportionate (for example, not using kinetic options when the incident is still below the threshold of the use of force), should not create undue escalation, and ideally should remain targeted and should not create unintended secondary or tertiary consequences. Additionally, when possible, stakeholders undertaking action should follow norms and coordinate with affected third parties.
- **Which responses are not justified:** Participants were reluctant to turn to physical interference and kinetic responses, which were considered to run the risk of "escalating things out of proportion." When participants did turn to these options, they were often a last-resort effort, meant to either stop a malicious activity or regain control when other measures did not work.

Considerations for Norms and Governance Mechanisms That Could Sufficiently Manage Risk

Figure 4.2 illustrates the governance mechanisms that participants considered to be most appropriate for addressing risk. On average, participants turned to voluntary norms and transparency measures for both the effect- and behavior-based scenarios. Other measures, especially reformed frameworks or new binding international agreements, were judged to be not only potentially not suited for the challenges considered but also difficult to implement in the current geopolitical environment.

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 norms and governance mechanisms sufficient for addressing space escalation risks:

- **There is no governance silver bullet.** Participants repeatedly highlighted that a combination of measures is necessary to help mitigate the challenges posed by dual-use space systems. They suggested using a combination of voluntary norms, enforcement of existing treaties, formalization of new frameworks, and other measures. Individually, none is sufficient, but together they can create an essential scaffolding for predictability and stability in space.
- **Voluntary norms and transparency measures hold promise but are imperfect.** Voluntary norms and transparency measures were viewed as important mechanisms that have a high likelihood of achieving tangible progress in providing stability and sustainability to on-orbit space activities, even if they fall short as perfect solutions; one participant observed that implementing such norms "doesn't necessarily stop someone if they are a determined bad actor, but it makes it easier for everyone else to determine who is a bad actor."
- **Norms and best practices should focus on practicality.** To manage space-based effects, countries could improve information exchange norms, utilize end-user license agreements (EULAs) and "know your customer rules" to increase early detection of malicious activity, set reporting requirements and standards of behavior for private-sector operators, and develop frameworks (such as those used for data latency). To increase transparency of space-based behaviors, participants suggested developing maneuver and collision-avoidance best practices; rules of the road for space navigation and incident prevention; standards for space safety zones and proximity thresholds; consent, notification, and communication requirements; maneuverability and trajectory tracking; and improved registration of space objects.[13]
- **Application of non-space mechanisms shapes space-based outcomes.** Participants noted that non-space frameworks could apply for space incidents and represent an important part of a broader governance framework for mitigating risks of escalation posed by dual-use space systems. For example, participants mentioned standard criminal law, financial liability regulation, and export

[13] Participants suggested using the conceptual framing provided by maritime frameworks and translating it to the space domain. For rules of the road, participants suggested using the model provided by the Convention on the International Regulations for Preventing Collisions at Sea (October 20, 1972), and for incident prevention and response in the military domain, the Incidents at Sea Agreement (Agreement on the Prevention of Incidents On and Over the High Seas, May 25, 1972) was mentioned.

controls as potential instruments that could be part of the policy toolkit for incidents similar to the one in the effect-based scenario. This suggests that, in considering the governance regimes needed for dual-use space systems, states should include space-specific and general regulatory, normative, and legal mechanisms.

- **Multilateral institutions offer space governance inspiration.** Participants pointed to existing international institutions, including the International Telecommunication Union and the International Civil Aviation Organization (ICAO), as examples of functional multilateral bodies whose structures and enforcement mechanisms could inform the development of more-effective space governance frameworks and could be used to execute responses to space-based risks. Latin American participants in particular—representing a region that lacks a regional coordination mechanism—advocated for an ICAO-style model for managing orbital space.
- **Geopolitics limits use of binding governance mechanisms.** Multiple participants noted that binding agreements and stronger enforcement mechanisms could have the highest impact on space stability. However, these participants noted that such mechanisms face a minimal likelihood of implementation because of the tense geopolitical context shaped in particular by Sino-American strategic competition. Therefore, multiple participants suggested focusing on a stronger application and implementation of *existing* treaties, such as the Registration Convention or the principle of "due regard" contained in Article IX of the Outer Space Treaty.

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 limited practical applicability and enforcement.** Participants noted that although frameworks are in place at the multilateral, regional, and national levels, these frameworks' lack of practical applicability and enforceability limits their utility. For example, one participant noted that the Registration Convention should support tracking of objects in orbit and thus increase transparency and awareness. However, the poor state of the registry maintenance limits the registry's effectiveness. Participants provided similar examples of multilateral and domestic governance frameworks that lack the granularity and "teeth" necessary to make an impact.

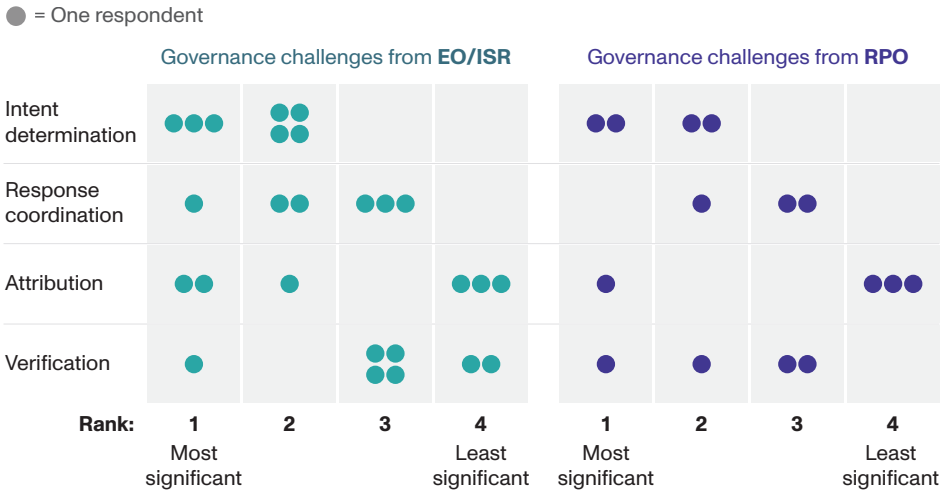
- **There is an absence of common operational standards.** Participants identified the failure of existing frameworks to set common standards and norms that could support predictability and stability in space activities. Without clear expectations for responsible behavior, actors might interpret similar activities differently, increasing uncertainty and complicating efforts to manage escalation risks.
- **Technology is moving faster than policy can adapt.** A central challenge of the current governance regime is the fact that the technology is advancing much faster than governance mechanisms can adapt. This means that normative and governance gaps exist, which can be exploited by nefarious actors. Limiting the technology is not an option, however, because lack of access would not change malicious intent—rather, the solution lies in proper regulation and policy. Using a mundane example to illustrate this point, one participant stated that just because criminals use cars to undertake illegal activities or escape, it does not mean that governments should stop the sale of cars altogether—rather, states need to find other ways to enforce the law while allowing law-abiding citizens to access this good.
- **Solutions requiring broad international agreement are challenging:** Although participants noted the potential utility of multilateral treaties, citing the Registration Convention and the Outer Space Treaty as examples, they emphasized the difficulty of developing new mechanisms or even reforming existing ones. In the current geopolitical environment, one participant noted that there are "no methods to get" to the point of signing new binding documents. Because international consensus is difficult and takes years, participants suggested focusing on immediate needs and building cooperative momentum via voluntary processes first.

Governance Challenges

The workshop surfaced varied views on the governance challenges that key space systems pose to the stability and security of outer space. Figure 4.3 summarizes the participants' rankings of the perceived governance challenges posed by EO/ISR and RPO systems. While no clear pattern emerges from the analysis, and the total number of respondents is too low to draw definitive conclusions, participants considered intent determination to rank higher than the other options. Brief descriptions follow.

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.



For EO/ISR systems (which produce effects), participants ranked intent determination highest in the overall response scoring, noting its importance for providing proportional responses. In the subsequent discussion, participants raised additional key challenges that might impede the development or implementation of a norms or governance framework:

- **The commercial nature of satellite data complicates attribution.** The ubiquity of commercial data and ease of access, as noted by South and Central American participants, have made it easier than ever for nonstate actors to use space data for criminal or terrorist purposes. Currently no system or standard protocols exist to track that data's use, so geospatial data sold to a shell or front company could be passed along to criminal organizations without the provider's approval. These transactions happen daily, and participants did not feel confident that current space governance sufficiently covers data sale and use attribution.
- **The Americas lack established regional mechanisms for coordinating responses to space incidents.** Participants noted that the effects of space incidents can extend across national borders, creating coordination challenges for neighboring states. Unlike in Europe and Asia, which have long-standing regional governance structures, such as the European Union and the Association of Southeast Asian Nations, the Americas lack a comparable forum for coordinating responses to space incidents.

- **Uncertainty around transnational liability complicates efforts to assign responsibility.** The cross-border nature of space incidents could further complicate efforts to develop effective norms and governance mechanisms. Participants noted that when incidents involve both states and commercial space operators, responsibility and accountability can become difficult to assign. Uncertainty over attribution and fault can blur the distinction between domestic, international, and commercial issues, creating challenges for determining appropriate responses and managing escalation risks.

For RPO systems (which perform behaviors), intent determination ranked highest among the priorities of participants, noting that intentionality had the largest impact on escalatory responses. As one stakeholder put it, "Intent itself is a black box, the only way to approximate it is behavior, so the more we can identify, verify, and attribute behavior, the better." Additional themes that emerged during the discussion include the following:

- **The lack of common understanding of how close is too close could complicate governance.** Participants noted that the lack of commonly shared definitions or understandings on the precise distances to distinguish close approaches, proximity operations, and rendezvous, as well as what distances or actions signal routine observation, inspection, or potentially threatening activity, could make it difficult to establish clear norms for responsible conduct in space. Because few precedents exist in space and international discussions have not established normative distances beyond those based on discernable limits of ground-based radars and telescopes, participants expressed concern that this gap could complicate efforts to develop and implement norms or governance mechanisms.
- **Regional divergence could complicate governance.** Throughout the workshop, differences emerged between North American participants and those from South and Central America, pointing to potential challenges in achieving regional agreement on how to manage risks of escalation in space. North American participants tended to prefer domestic governance and bilateral or nonbinding agreements, while those from South and Central America pushed for more regional and international governance and the creation of new bespoke organizations. Differences often arose because of perceived asymmetries in capabilities and governance access, as participants noted that international and multilateral bodies equalize those countries with significant space capabilities and those with emergent or nascent capabilities. North American participants focused on the separation of state and commercial responsibilities—reflecting their more developed space economies—while South and Central American participants directly tied commercial actions to state governance when such potential levers of influence exist.

CHAPTER 5

Conclusion and Next Steps



These proceedings summarize the principal findings from the Americas workshop, emphasizing the risks and response options related to escalation in the space environment. The findings are derived from both scenario-specific discussions (and are noted accordingly when that is the case) and from cross-scenario syntheses and conversations about strategic risk. The workshop aimed to establish a shared understanding of escalatory activities, thresholds, and potential responses for mitigating risks.

Overall, the workshop surfaced these key preliminary insights:

Escalatory activities: Throughout the discussions, specific activities were identified as potentially prompting escalation and instability. We summarize these in Table 5.1.

Escalatory thresholds: Escalatory thresholds are context-dependent and result from an assessment of both technical and behavioral factors. These thresholds are rarely crossed because of a single incident but rather follow multiple, diverse developments. Participants identified a series of factors that, taken together, might warrant a response (see Table 5.2).

Table 5.1. | Effects or Behaviors Identified as Potentially Escalatory

Activity Category	Escalatory Activity
Behaviors	Operations where intent is unclear and maneuver is not signaled in advance
	Activities that create threats to space objects or loss of life
	Unilateral uncoordinated actions, such as unannounced maneuvers
Effects and behaviors	Lack of, restricted, or impossible communication

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

Activity Category	Escalatory Threshold
Effects	Involvement of multiple actors, which can have a spillover effect and increase the complexity of predicting actions
	Loss of life and physical or kinetic impacts
Effects and behaviors	Compounded and continued uncertainty about an incident and intent of actors involved
	Geopolitical tensions and an environment of strategic competition

Governance gaps and potential norm or mechanism options: Governance frameworks exist but are insufficient and often not enforced. Participants agreed that norms and voluntary mechanisms can represent a starting point for progress, especially if combined with additional operational standards and rules. However, the discussions revealed skepticism about the development of enforceable mechanisms, although participants were generally supportive of voluntary or ad hoc efforts that can reinforce existing frameworks (e.g., the Registration Convention). Table 5.3 overviews specific suggestions of governance mechanisms that could be developed.

Given the small sample size of participants, additional research is required to validate these preliminary insights, determine the generalizable nature of their content, and explore how they may be implemented via existing or novel policy frameworks. However, collectively, these findings suggest that the road toward a governance architecture for dual-use space systems is a marathon, not a sprint. No single institution nor mechanism will solve escalatory challenges—rather, a combination of tools and standards that address ambiguity, help identify thresholds, and assist with coordinating responses may represent a way forward. As one participant put it, governance can be used to bridge the gap, to "start people in doing the right thing, even if for the wrong reasons. If we can build enough governance or incentives for people to build the right habits, we can build towards societal change."

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

Activity Category	Option
Effects	Application of non-space frameworks to space incidents (e.g., criminal management frameworks) or development of space-specific architectures to minimize space-based harm
	Legal reporting requirements for commercial actors, explicitly stated in such documents as a EULA and "know your customer" rules, meant to mitigate potential malicious activity and clarify provider responsibility
Behaviors	Maneuver and collision-avoidance standard operating procedures, which can be orbit-specific
	Rules of the road for space navigation, akin to those that exist for the sea domain
	Standard operating procedures for incident prevention
	Commonly agreed safety zones
Effects and behaviors	Enforcement of norms and public statements

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 Americas workshop held in Washington, D.C., in May 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. Participants were from Argentina, Brazil, Canada, Mexico, Peru, and the United States.

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.

Nine participants joined the workshop in D.C. representing each relevant sector—government (both military and civilian organizations), industry, and academia/research. 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 scenario

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

Organization: Criminal organization from **Country A**; purchases data from **Company** via front company.

Company: Large space company from **Country B**; sells EO and RF data to **Organization's** front company.

A criminal organization based in Central American **Country A** begins to access near-real-time commercial Earth observation (EO) and radio frequency (RF) signal data sourced from a large space company based in **Country B**, through several of its legitimate business fronts, for the purpose of keeping tabs on **Country A**'s security and police forces. When **Country A** sends a special operations team on a mission to capture one of the **Organization**'s leaders, the **Organization** then uses this data to ambush and eliminate the team. **Country A**'s government subsequently demands that **Country B** order the **Company** to stop providing data to the **Organization**'s fronts. **Country B** claims that it lacks the legal authority to do so since its limited authority to restrict the sale of commercial sensor data does not apply here.

The **Company** refuses to cut off data access, and **Country B** maintains its claim that this is solely a domestic issue of **Country A**. **Country A** then starts jamming and dazzling the **Company**'s satellites as they pass over the region. However, this also affects the data access of legitimate commercial and government customers in surrounding nations, which subsequently demand that **Country A** stop its interference.

Scenario 2

COM-1: GEO communications satellite from **Country A** and **Country B**

Country A: Non-American country expanding relations with South America

Country B: South American country that develops and launches **COM-1** with **Country A**

MYS-1: A satellite of unknown ownership

Decreasing costs have led to a large increase both in spacefaring nations and in the number of objects in space, but SSA has not kept pace with this growth. While a major non-American power, **Country A**, has been ramping up its bellicose rhetoric regarding one of its neighbors that it is preparing to invade, it has also been increasing its collaborative efforts with Central and South American countries. This includes **Country B**, with whom **Country A** has jointly developed a GEO communications satellite (**COM-1**), which was launched and is operated by **Country B**. Now another satellite, of unknown ownership (**MYS-1**), has started conducting RPO around the joint satellite **COM-1**. **Country A** and **Country B** publicly condemn this activity, and **Country B** reaches out to potential owners of **MYS-1** demanding that they stop its maneuvering. However, no entity admits to owning the RPO satellite, and its operations continue.

After a few hours, there is still no change in behavior of the **MYS-1** satellite, and it is getting closer and closer to the joint satellite **COM-1**. Thus, **COM-1** initiates an unscheduled collision-avoidance maneuver, but a thruster malfunction occurs, leaving it partially unresponsive and stranded in a new trajectory that greatly increases its likelihood of collision with other GEO satellites. **COM-1** operators from **Country B** issue an immediate collision warning notice to the operators of nearby satellites. Some of these other satellites now have to burn valuable fuel to reduce the collision potential.

Abbreviations

ASAT	anti-satellite
EO	Earth observation
EULA	end-user license agreement
GEO	geostationary orbit
ICAO	International Civil Aviation Organization
ISR	intelligence, surveillance, and reconnaissance
LLM	large language model
RF	radio frequency
RPO	rendezvous and proximity operations
SSA	space situational awareness

References

Agachi, Anca, 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. As of May 5, 2026: https://www.rand.org/pubs/conf_proceedings/CFA4003-1.html

Agreement on the Prevention of Incidents On and Over the High Seas, May 25, 1972.

Chatham House, "Chatham House Rule," webpage, undated. As of May 5, 2026: https://www.chathamhouse.org/about-us/chatham-house-rule

Convention on Registration of Objects Launched into Outer Space, 1976.

Convention on the International Regulations for Preventing Collisions at Sea, October 20, 1972.

Government of the United Kingdom, "User Research: Researching in Small Group Workshops," webpage, June 28, 2018. As of September 25, 2026: https://www.gov.uk/service-manual/user-research/research-small-group-workshops

Kent, Glenn A., and David E. Thaler, *First-Strike Stability: A Methodology for Evaluating Strategic Forces*, RAND Corporation, R-3765-AF, 1989. As of September 25, 2026: https://www.rand.org/pubs/reports/R3765.html

Lebret, Mélusine, 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. As of May 5, 2026: https://www.rand.org/pubs/conf_proceedings/CFA4003-2.html

Lebret, Mélusine, 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. As of October 2026: https://www.rand.org/pubs/conf_proceedings/CFA4003-4.html

McClintock, Bruce, and David Glickstein, eds., *Exploring Duality in Space: How Select Countries Approach Dual-Use Space Systems*, RAND Corporation, RR-A4003-2, 2026. As of May 5, 2026: https://www.rand.org/pubs/research_reports/RRA4003-2.html

McClintock, Bruce, 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. As of May 5, 2026: https://www.rand.org/pubs/research_reports/RRA4003-3.html

Mentimeter, homepage, undated. As of May 5, 2026: https://www.mentimeter.com/

Morgan, Forrest E., *Deterrence and First-Strike Stability in Space: A Preliminary Assessment*, RAND Corporation, MG-916-AF, 2010. As of September 25, 2026: https://www.rand.org/pubs/monographs/MG916.html

Schwindt, Karen, Jeffrey W. Hornung, Mack Rodgers, Weilong Kong, David Glickstein, and Bruce McClintock, *Managing Duality in Space*: Vol. II, *Indo-Pacific Workshop Insights on Escalatory Space Activities and Potential Response Options,* RAND Corporation, CF-A4003-5, 2026. As of October 2026: https://www.rand.org/pubs/conf_proceedings/CFA4003-5.html

Schwindt, Karen, 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. As of May 5, 2026: https://www.rand.org/pubs/conf_proceedings/CFA4003-3.html

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.

United Nations Convention on the Law of the Sea, 1994.

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 Washington, D.C., in May 2026 that brought together stakeholders from across the Americas. 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 highlighted that escalation risks are contextual and stem from ambiguity, the potential for negative externalities, and the ability of existing governance frameworks to manage impacts, among other factors. No single governance mechanism or framework can address these challenges—rather, a combination of voluntary norms and standards, in support of existing binding treaties and enforceable structures, can support progress toward a safer, more sustainable space for all. 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

This work was conducted within the International Security and Defense Policy Program of the RAND National Security Research Division, which conducts research and analysis for the Office of the Secretary of War, the U.S. Intelligence Community, the U.S. State Department, allied foreign governments, and foundations.

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).

Funding

This research was sponsored by Founders Pledge.

Acknowledgments

Good research is a community effort, and we would like to acknowledge the community that made this document, and the broader RAND *Duality in Space* project, possible.

First, we are grateful to the participants of the Americas workshop, who shared their thoughtful and candid perspectives with us. As Miles's law notes, "Where you stand depends on where you sit," meaning that one's environment and role determine one's perspective. We understand better where the Americas region stands because of our participants who explained where they sit, and why.

We would like to thank our peer reviewer, Ana Maricela Ávila Becerril, whose expertise and critical eye significantly improved the final document.

We would also like to extend our gratitude to our RAND colleagues, Karen Schwindt and Mélusine Lebret, who serve, respectively, as the leads for the Indo-Pacific and Europe-Eurasia regional workshops held in parallel with the Americas workshops throughout the *Duality in Space* project. Both have played significant roles in the design, organization, and delivery of the Americas workshop. The entire *Duality in Space* team gratefully acknowledges their vision, expertise, collegiality, and invaluable methodological contributions, all of which have been essential to ensuring the overall coherence and depth of this study.

Finally, we thank all those other colleagues, advisors, and participants, within and beyond our respective institutions, who offered their perspectives and support throughout the research process. Their collective engagement improved the quality of our research and is advancing the community of practice on space governance and sustainability.