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Stability, sustainability, and crises: The role tabletop exercises in space crisis dynamics can play in ensuring the long-term sustainability of space

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Abstract

As more countries integrate space into their national capabilities and rely on space-based information for national security, there is an increased chance that any interference with satellites could spark or escalate a crisis or conflict. At the same time, the growing reliance on space for national security capabilities creates incentives for attacks on space capabilities as part of a conflict on Earth. To help address these issues, the Secure World Foundation (SWF) and the Center for Strategic and International Studies (CSIS) co-hosted a tabletop exercise (TTX) on Space Crisis Dynamics and Uncertainty in Washington, DC, in November 2016. A second TTX was held in New Delhi, India, by the Observer Research Foundation in February 2017 and which had very similar discussions. The goals of the TTXes were to raise awareness about the risks of escalation and crisis stability, and to identify gaps or shortcomings in existing national and international policies, strategies, communication channels, and political/legal mechanisms.

This paper will discuss the output of the two TTXes, explain how it could be used to inform future work on developing new mechanisms to enhance space stability, and reduce the risk of a crisis involving space capabilities escalating to armed conflict. The discussions sparked by these TTXes could be very helpful for seeking to advance SDG 16: Peace, Justice and Strong Institutions, by exploring ways in which conflict in or over space might be avoided with appropriate guidelines and protocols in place.

Keywords: security, sustainability, crisis escalation, tabletop exercises

1. Introduction

As more countries integrate space into their national capabilities and rely on space-based information for national security, there is an increased chance that any interference with satellites could spark or escalate a crisis or conflict. At the same time, the growing reliance on space for national security capabilities creates incentives for attacks on space capabilities as part of a conflict on Earth. The situation is further complicated by the increasing dependence on commercial and civil space systems supporting the global economy, and the challenge of determining the exact cause of a satellite malfunction: whether it was due to a space weather event, impact by space debris, unintentional interference, or deliberate aggression.

To help address these issues, the Secure World Foundation (SWF) and the Center for Strategic and International Studies (CSIS) co-hosted a tabletop exercise (TTX) on Space Crisis Dynamics and Uncertainty in Washington, DC, in November 2016.[1] A second TTX was held in New Delhi, India, by the Observer Research Foundation in February 2017 and which had very similar discussions.[2] The discussions

held at the TTXes were intended to raise awareness about the risks of escalation and crisis stability, and to identify gaps or shortcomings in existing national and international policies, strategies, communication channels, and political/legal mechanisms.

There were several goals in hosting the TTXes. The first was to raise awareness among national policymakers of the impact specific national policies, strategies, doctrine, and capabilities have on crises involving space capabilities. The second was to identify gaps in existing policy, legal, communication, and multilateral mechanisms, as well as capabilities for stabilizing crises and deterring conflict involving space capabilities. While the U.S. military has been holding its Schriever Space Wargames since 2000 to explore some of these issues, these TTX' approaches differed in several significant ways. First, they would focus on the crisis that could lead up to a conflict, and not on the conflict itself. Second, they would involve a broader range of international and commercial perspectives. Third, they would be unclassified and the results would be widely shared among all space actors.

2. Washington, DC TTX

2.1 Standard Operating Procedures

The primary entities in the TTX were teams, each of which represented a fictional state actor. The teams were designated by a color code -- Red, Orange, Yellow, and Blue. Each team was provided with a background briefing that outlined their national objectives, capabilities, and diplomatic relationships, which was intended to largely be consistent throughout the TTX. Participants were assigned to a specific team for the duration of the TTX and were assigned such that each team had a breadth of expertise in national security/military, diplomacy/policy, civil, and commercial space.

The TTX was run by the Control (White) Cell, which consisted of four individuals from SWF and CSIS, two outside observers, and four rapporteurs. Each of the rapporteurs was embedded with one of the teams, and were responsible for handling communications between that team and the Control Cell and answering questions. The Control Cell was responsible for adjudicating the actions taken by each team.

All discussions and deliberations during the TTX were for non-attribution.

Each scenario consisted of three moves over a three hour period. All four teams were playing in each scenario. At the start of Move 1, organizers inbriefed each of the teams on the background information and starting status, and informed them of how much time they had to make their first decision. The teams were also given their primary objectives for actions taken during the TTX. At the end of the deliberation period, each team provided their rapporteur with one or more actions that were made. The organizers adjudicated the actions taken by all teams, according to the capabilities established by the scenario, and decided which outcomes would be seen by which teams.

Simultaneously, each rapporteur worked with their team to document the decision-making process. At the end of Move 1, the organizers provided each rapporteur with the results of their action(s), and those taken by other teams. This provided the starting status for Move 2. The process was repeated for Move 2, and Move 3. The scenario ended when all teams submitted their third set of action(s), and the rapporteurs documented the third decision-making process.

2.2 Scenario 1

2.2.1 A Quick Overview of Scenario 1

Orange, Blue, and Red had a long-standing dispute over an island chain that may contain natural resources. The island chain is within 1,000 nautical miles of all three countries. Yellow has attempted to act as a mediator to reduce tensions and avoid outright conflict in the region. The crisis begins with the Standard Oil Company, a firm owned by the Orange government,

with substantial financial investment from Yellow companies, moving into the island chain to begin oil drilling operations (without prior consultation with its ally, Yellow). Blue and Red publicly denounce the action, and move naval and air forces into the island chain. Orange moves its own naval forces into the region to protect the commercial operations, and establishes a military base on Skull Island to provide additional support. The military base on Skull Island includes a military-grade position, navigation, and timing (PNT) downlink jammer, which disrupts civil PNT signals in a 200-km radius around the island (but not the military PNT signals). During the crisis, a Blue helicopter is struck by a unmanned aerial vehicle (UAV). The UAV was owned by Red, and the PNT downlink jamming disrupted its ability to navigate (although only the Red Team knows this at the beginning of the scenario).

2.2.2 Post-Scenario 1 Discussion

In the post-scenario discussion, the Red team stated that their goal was to return the situation to the status quo ante, but felt that they were being ignored by the other teams, and thus debated how early to launch the cyber attack. The Red team also stated that they fundamentally saw this as a territorial dispute, while both Yellow and Orange wanted to keep it an economic dispute.

The Blue team stated that they wanted to find a way to get Orange off of Skull Island, without provoking a military response from Yellow. That drove Blue to look for ways to control escalation while still being coercive. As part of this, the Blue team felt that Standard Oil could be treated as an independent actor from the Orange government. The Blue team stated that they were hesitant to go directly to attacks on space capabilities, because they felt that once the conflict moved to space it would be hard to stop it from ratcheting up.

The Orange team stated that they resorted to lawfare, disinformation, and diplomacy to offset their weak military position. Thus, the Orange team focused on being conciliatory, and offering economic incentives to Red and Blue, such as sharing in the commercial profits. The Orange team said that they were surprised by Blue's decision to escalate to armed attack at the end, and felt that up until then Orange was winning with diplomacy.

The Yellow team felt that Orange's decision to land forces in the island chain without prior consultation undermined their alliance, and thus were not incentivized to strongly back Orange. Yellow's overall strategy was to de-escalate, communicate, find credible stakeholders, frame the scenario, and take initiative in the international fora. As part of this, the Yellow team stated that they tried to use their space capabilities to

increase transparency, and hopefully peel Red away from Blue while deterring armed attacks. The Yellow team stated that if there had been a Move 4, they probably would have responded to Blue's jamming and dazzling in kind, but probably also with a communication to Blue to try and resolve the situation. The Yellow team also said that they probably would have considered the jamming and dazzling to be equivalent to a permanent attack, because it could come at any time and they thus could not rely on those space capabilities.

2.3 Scenario 2

2.3.1 A Quick Overview of Scenario 2

The scenario begins with a terror attack on Orange that was supported by a rogue element in Blue's intelligence services. Media speculation and leaks of possible involvement by Blue intelligence services leads to growing public anger in Orange, prompting an attempt at a covert raid of Blue by Orange and Yellow. However, the aircraft involved in the raid are shot down, leading both sides to mobilize forces along the border and prepare for possible conflict.

As part of the preparations, Blue secretly dispatches three small inspection satellites to drift towards Yellow national security space assets in GEO. As one of them arrives near a Yellow satellite that provides missile warning for both Yellow and Orange, both the Yellow missile warning satellite and the Blue inspector satellite experience interference with their command and control channels (although each is only aware of the interference with their own satellite). Yellow is reliant on a ground telescope located in Red for direct observation of the situation.

Yellow observes Blue mobilizing its mobile direct-ascent anti-satellite (ASAT) launchers and airborne satellite dazzler platforms near the border with Orange. Blue observes a high level of Yellow war planning, including possible preparations for pre-emptive strikes on critical command-and-control nodes, and re-tasking of space-based intelligence, surveillance, and reconnaissance (ISR) assets to increase collection of Blue military targets.

2.3.2 Post-Scenario 2 Discussion

In the post-scenario discussion, the Red team stated that their primary internal debate this round revolved around whether or not to posture a direct ascent ASAT as saber-rattling to cause Blue and Orange to back down. Yellow stated they were confused during the scenario as to why Red was making such a threat.

The Blue team stated that they backed away the inspection satellites in the first move, because they were concerned about their ability to avoid a collision that would escalate the situation, driven largely by the link between those satellites and Yellow's nuclear warning

system. The Blue team stated that they launched the multiple cyber attacks on Yellow, and jammed PNT over their own territory, in order to degrade Yellow's ability to conduct over-the-horizon precision attacks, and as a proportional response to Yellow cyber attacks. Once Blue realized that the main objective was not to be attacked, they were fine with letting people know it was a rogue entity behind the initial terror attacks. They also explained that while in this scenario having inspection assets near strategic assets mattered more than being next to "tactical" assets, the team members admitted that they were not sure that line would be as clear in the real world, and that it is very hard to tell where that threshold is. They also commented that when an adversary is nuclear-armed, that changes all calculations.

Yellow noted that it did not retaliate or escalate after the Blue cyber attacks on homeland, because it felt the objectives given to Yellow for that scenario were met and the attacks were in line with what they had done the round prior. They also noted that all of their objectives were met in the first move, so they did not need to execute any more kinetic options.

The Orange team did not respond to Blue's overtures because it did not include Yellow. They could not agree to anything that excluded Yellow, but did not want to get caught up in big power war. They also wanted Red to get involved, then felt they had succeeded in getting Yellow and Red involved in deterring Blue. At the end of the scenario, Orange attacked Blue's SSA ground stations to remove Blue's offensive co-orbital space capabilities.

2.4 Scenario 3

2.4.1 A Quick Overview of Scenario 3

The scenario focuses on the tensions created by a proxy war in Red, with Blue actively supporting the new government, and Orange and Yellow covertly supporting an insurgency consisting of remnants from the ousted government. Blue has covertly supplied Red with a military-grade commercial satellite jammer, which is being used to interfere with commercial broadcasts from an Orange satellite that are critical of the new Red government. A major solar storm damages several commercial and civil satellites, with significant impact to Blue's ISR coverage over Red. Blue military advisors are killed in a battle with insurgents, which drew upon Yellow space-based ISR and stealthy UAVs for intelligence and support. Yellow intelligence suggests that the Red SATCOM jamming played a role in the incident. In retaliation, Blue attempts to dazzle two of Yellow's imagery satellites with an airborne laser over Blue territory, which ends up blinding the satellites, but otherwise leaving them operational.

2.4.2 Post-Scenario 3 Discussion

In the post scenario discussion, the Red team explained that after the Orange push on the capital, Red made the ASAT threat in an attempt to escalate to de-escalate without using nuclear weapons. They also recognize that it backfired, and likely provided a political opening for Yellow to launch the kinetic attacks against Blue satellites. The Yellow team confirmed that once Red made a public threat about using ASATs, Yellow thought it was a chance to use dead assets to attack Blue in a way that might not have been attributable. Yellow also noted that they felt the long-term increased risk of space debris was seen as a useful trade for taking out valuable Blue ISR assets, although admitted they did not have a full appreciation or discussion of the possible long-term impacts. Blue believed that Yellow's kinetic attack gave Blue the diplomatic high ground, and was ultimately detrimental to Yellow's ability to achieve its objectives.

The Yellow team also explained that they went after Blue ground stations instead of satellites because they did not want to let Blue know the laser strikes were effective. Yellow also felt that if the Red cyber attack on Yellow military protected SATCOM was successful, they would have considered it a threat to its strategic deterrent and placed its nuclear weapons on high alert. Yellow stated they probably would have done the same thing if the attack had been on non-protected SATCOM because the same capability could have threatened the protected SATCOM.

The Blue team recognized that its attacks on Yellow were aggressive, but insisted that they were reversible and therefore perceived by the team to be less escalatory. The Blue jamming and dazzling attacks were designed to try to coerce Yellow, and by extension, Orange, although it did not work. The Blue team also stated that they did not respond to the kinetic attacks on its dazzler airbase because it felt the conflict in Red was resolving in its favor, and it did not want to escalate again. They also focused their attacks in Red to avoid risking bringing Yellow into the conflict directly.

The Orange team noted that the only thing they could do, given limited space capability, was to attack Red ASAT ground stations. Orange originally misread Blue's intentions, and felt that Blue was preparing for a major invasion of Orange.

2.5 Takeaways

While brief, both the organizers and participants felt there were some key takeaways from the TTX, although everyone recognized that it would be difficult to generalize the findings too much. Generally speaking, though, there was a real reluctance to use kinetic force against satellites. All of the teams were much more willing to use cyber attacks, radiofrequency interference (RFI), and even kinetic attacks against ground command and control facilities than kinetic attacks on satellites.

Most of the participants found offensive cyber capabilities to be consistently more useful than space control capabilities, because the cyber capabilities were perceived as usable, while the space control capabilities largely were not. However, the reluctance to attack satellites with kinetic weapons may be because many of the participants were space experts and well-versed on the negative repercussions to the space environment from the destruction of a satellite; perhaps if this scenario were to be ran again with general security experts and not space specialists, this reluctance would not be as strong.

A second key takeaway was that often the loss of a dedicated military space capability could be at least partially compensated for in other ways. In scenario 3, at the end of Move 2, Yellow attempted to maneuver its two blinded ISR satellites so as to intentionally collide with two Blue ISR satellites at a point where they were out of sight of Blue ground-based SSA sensors. Both attempts succeeded, and the collisions created several thousand pieces of orbital debris. However, Blue simply increased its airborne ISR patrols over Red to compensate for its lost satellite ISR, and continued its attempts to jam and dazzle Yellow satellite communications, PNT, and ISR over Red territory.

The TTX also showed that so-called "temporary and reversible means" of interfering with satellites were judged as threatening as permanent means. In discussing scenario 3, the Yellow Team stated that they probably would have considered the jamming and dazzling to be equivalent to a permanent attack, because it could come at any time and they thus could not rely on those space capabilities being there when they were wanted. Thus, they had to treat temporary jamming or dazzling with almost the same degree of concern as physical destruction of the satellite, from the standpoint of loss of capabilities.

In at least one example (the Red team in scenario 3), kinetic ASATs were considered so escalatory that they felt that the threat of them would allow them to deter the use of nuclear weapons by their foes.

The teams showed concern about threats to strategic space assets potentially causing unwanted escalation, but it was not universal. In scenario 2, Blue backed away their inspection satellites from Yellow's strategic warning satellites in the first move because they wanted to avoid a collision that would escalate the situation. However, at the same time, teams acknowledged it was not a hard-and-fast rule. While having inspection assets near strategic assets mattered more than being next to "tactical" assets, the team members admitted that they were not sure that line would be as clear in the real world, and that it is very hard to tell where that threshold between strategic and tactical assets is. This was also seen in scenario 3, when Red attempted a cyber attack on Yellow's military-protected SATCOM.

The TTX also showed that an in-kind response to an attack on a space asset is not always necessary. In scenario 2, Blue's SSA ground stations were attacked by Orange as a way of countering Blue's potentially offensive co-orbital space capabilities, which also served well as a response to public demands for action.

The TTX also showed that space capabilities could play a significant role in shaping the crisis and attempts to avoid escalation. Teams released satellite imagery to improve situational awareness, counter claims about capabilities in the region, assess damages, and so forth. They also were used as a sort of soft power outreach by sharing ISR, other satellite imagery data, and communications.

There was one mention of a hypothetical code of conduct (in this case, for electromagnetic interference), but otherwise, the concept of norms or responsible behavior was not really brought up. Teams instead focused on bilateral relationships.

3. India TTX

3.1 Standard Operating Procedures

Like the TTX organized in the US, the simulation exercise (SIMEX) undertaken by Observer Research Foundation in India had a couple of key objectives, including the exploration of escalation dynamics in a conflict that involved military and commercial space assets, role of deterrence and coercion, and that of traditional geopolitical rivalry among four nations, played by fictional states in the Exercise. The entire exercise involved one scenario with three moves.

The SIMEX was played by four teams, representing four fictional states, and a neutral team. The Control Cell at the beginning of the exercise provided a background briefing identifying key national objectives for the teams, team-specific intelligence, inventory and overall capabilities, as well as each state's broad foreign and security relationships. 25 participants took part in this exercise and the expertise was spread across the teams, allowing each team of five players to have representatives from diverse backgrounds – space security, national security, diplomacy, commercial, and civil space.

The entire exercise involved one scenario with three moves.

The Control Cell had three individuals from ORF, two military observers, and two civilian experts. In addition, three Control Cell rapporteurs were tasked with relaying messages between the teams and the Control Cell, as well as between the teams. The Control Cell remained responsible for adjudicating actions taken by teams, for instance, the effectiveness of moves by teams when relevant. Each team had a rapporteur who was provided with Decision Recording Forms, which recorded the steps taken by the team at each move, the logic for a particular decision, and whether the decision

was unanimous or if there was a split within the team. Understanding the logic provided for a more nuanced understanding of how a decision was arrived at and how different stakeholders in a country approach a conflict scenario.

3.2 A Quick Overview of the Scenario

The broadcast of a live speech by the Red prime minister which was expected to announce a set of internal security measures against pro-Blue activists is disrupted. Red and Yellow media publish stories within six hours of the event suggesting that this was the work of an extremist pro-Blue group that managed to jam the signal. Matters are also complicated by the fact that the satellite which was tampered with is owned and operated by Orange.

Yellow receives confirmed intelligence that Blue will broadcast a speech addressed to Red minorities to rise against the Red government while, simultaneously, moving Blue forces into Red. Yellow realises that the Yellow-Red treaty mutual-security alliance would then require it to aid Red. As a way to prevent a Yellow-Blue war, Yellow president orders his military to shoot down an Orange satellite Blue is likely to use for the broadcast.

A technical targeting error causes the direct-ascent Yellow ASAT weapon to destroy an Orange military communications satellite instead. Yellow apologizes to Orange but Orange's state-run media calls this an act of war.

3.3 Post-scenario Discussion and Takeaways

Two observations about the game play should be made right at the onset. One, there was a significant concern expressed by all four teams about the risk of escalation. This prompted one participant – a former military officer – to remark at the after-game debrief that all teams were playing the game perhaps too rationally. Two, given that the first move saw significant escalation from the in-brief that started the game, all teams extensively engaged in the use of private communications channels in the second and third move as a way to contribute towards de-escalation.

Inside Blue, there was a difference of opinion about the possibility of a Yellow-Orange confrontation. While there was agreement on the need to cooperate with Orange economically, military-to-military space cooperation was seen as a bad idea given the ongoing crisis.

The thinking within Orange was that a raise in military alert status would contribute to de-escalation – an interesting line of thinking given that Orange's adversaries could interpret such a raise as a signal of escalation. The decision to dazzle a Yellow satellite was seen as a way to increase pressure on Yellow. While Orange decided to call upon on Hague Court of

Arbitration to seek economic compensation for the loss of satellite by Yellow, it did not respond to private offers of bilateral discussions.

Yellow's focus was on preventing Orange from attacking it as a retaliation for their destruction of an Orange military satellite (the first Yellow national objective). Yellow jammed Blue's military PNT signal, localized to the border region, and moved co-orbital ASATs near protected communications satellite(s) in geostationary orbit against Blue. Yellow also carried out a cyber-attack on Blue's ISR satellites.

Red and Orange signed a bilateral technology exchange agreement. Red offered Orange high technology ISR and neutrality in Hague arbitration in exchange for influencing Blue to de-escalate. In an effort to further reduce tension and avoid potential damaging impact on outer space, Red stated, "Space is a global common. We invite multilateral cooperative efforts towards mitigation and removal of space debris." Red proposed four-party multilateral talks, which eventually were agreed to by all involved.

4. Conclusions

During the crisis simulations, teams were generally loath to physically threaten each other's satellites; however, interfering with the satellite's functions, whether that be through electromagnetic interference or some sort of cyber attack, was perceived as being perfectly acceptable. Looking at how space is used in the real world, this appears to be borne out. While there have been a few cases of reported hostile co-orbital inspection satellites, and some states are testing capabilities that could provide them with an ASAT capacity, generally speaking, counterspace efforts have been constrained mostly to non-kinetic options. While this is encouraging in that it is not creating large amounts of debris in orbits that could potentially be there for decades, it also is a little unsettling, as there is no generally agreed-upon law of armed conflict in space. McGill University is heading up a Manual on International Law Applicable to Military Uses of Space (MILAMOS) effort[3], but that is still in its initial stages, promises to be a huge undertaking that most likely will take several years, and even then, will take a while to proliferate and become the accepted norm of responsible space actors, if it reaches that point.

State actors and major users of space, which includes the commercial sector, need to start thinking

and having a public debate now about how they view the stability of their space assets and how they might respond to interference with that stability. While this consideration can and should be done at the national level, it would be helpful to think about what international discussions could also incorporate these issues. In particular, having agreed-upon norms of behavior by sector – scientific satellites, commercial satellites, cubesats, mega-constellations, etc. – would go far to help guide debates over what appropriate responses to instability and crisis situations could look like. The space domain is going to only become more complicated as potentially thousands of new satellites are launched over the coming years; we do not have the flexibility to wait for the norms to emerge over decades or centuries, as they have in other domains like maritime or air.

References

[1] More information about this event, including all of the background materials, scenarios, and summary of events, can be found in the Summary Report, available at

https://swfound.org/media/205726/ttx_report_7feb2017.pdf.

As well, on March 22, 2017, Brian Weeden and Victoria Samson spoke as part of a panel discussion at a conference organized by CSIS and the [Prague Security Studies Institute](#) (PSSI) about the results of the SWF-CSIS TTX. They were joined on the panel by Mr. Todd Harrison and Dr. Zack Cooper from CSIS. The panel discussion focused on the rationale for why space crisis dynamics are an important issue to study, the goals and structure of the TTX, major findings, and initial implications of the results of the TTX. A video recording of the discussion (with the TTX portion starting at 1:20:44) can be found at <https://youtu.be/lftY2-NKX0E>.

[2] This SIMEX was part of the lead-up to the 3rd ORF Kalpana Chawla Annual Space Policy Dialogue, held Feb. 16-18, 2017, in New Delhi, India. For more information about the Dialogue, please see <http://www.orfonline.org/kcspacedialogue/>.

[3] Brian Weeden is a technical advisor to the MILAMOS effort; for more information on its work, please see <http://www.mcgill.ca/milamos/home>.