

FROM SAFETY TO SECURITY
REDUCING THE THREAT ENVIRONMENT THROUGH
THE RESPONSIBLE USE OF OUTER SPACE

SURVEY REPORT

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FROM SAFETY TO SECURITY: EXTENDING OUTER SPACE NORMS

SURVEY REPORT SUMMARY

ABOUT

As part of a wider research project that is mapping the normative landscape in outer space with the aim of informing the further development of norms related to space-based military capabilities and activities, we invited global space experts to participate in a survey that was open from May 15 to June 10.

This research is being undertaken by Dr. Jessica West, a Senior Researcher at Project Ploughshares, and Mr. Gilles Doucet, President of Spectrum Space Security, Inc.

HIGHLIGHTS

In all, 102 individuals from 15 countries completed the survey. Responses point to a chasm between current and developing military and security practice, on the one side, and established safety and sustainability norms of activity in space, on the other. Fortunately, responses also provide some clues on how to span it.

Specifically, respondents highlight the following issues with respect to norms of behaviour in outer space:

- Safety and sustainability norms have a positive impact on the outer-space environment.
- While these norms have not been fully adopted by military actors, they are directly relevant to military and security actors and activities:
 - » security in space is not possible in the absence of safety and sustainability measures;
 - » at the same time, participants repeatedly claimed that military activities in space were a threat to both safety and sustainability.
- Seventy-seven per cent of survey respondents indicate that they think that there are norms or practices specific to security that influence military or defence activities in space. These norms provide value, by reducing the number of mishaps and misperceptions, as well as the risk of conflict escalation.
- However, responses convey the sense that the values and practices that influence military security in outer space are shifting and in some cases new capabilities are challenging historical perspectives . Specific examples include:
 - » non-consensual rendezvous and proximity operations (RPO),
 - » ASAT testing,
 - » potential weaponization/use of force,
 - » potential tensions arising from competition during lunar activities and resource extraction.

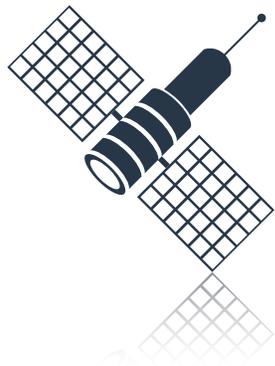
- Participants identify the emergence of a striking range of military activities of concern, linked to a broadening range of action seen to be permissible.

NEXT STEPS

Feedback from survey participants indicates that a present opportunity exists to extend norms of best practices rooted in safety and sustainability into the domain of security. Several specific measures stand out:

- debris prevention and mitigation in the context of weapons tests or the use of force;
- enhanced sharing of Space Situational Awareness data;
- rules to enhance the safety of non-cooperative rendezvous and proximity operations;
- expanded notification for a wide range of activities, including launch, orbital manoeuvres, weapons tests, and potential radiofrequency interference;
- better identification of strategically sensitive satellite systems such as those linked to nuclear command and control or verification of arms control agreements;
- efforts to better coordinate and protect the radiofrequency spectrum.

Many paths can be taken to reach these new behavioural norms; no doubt, many must be taken simultaneously. But a key message is that states must make a major contribution to improving the collective safety and sustainability, as well as security, of the space environment. Some state or group of states must be prepared to lead, in partnership with commercial and civil-society stakeholders.



ABOUT THE PROJECT

RESEARCHING NORMS IN SPACE

Specialists in space security are constantly calling for more robust norms¹ of behaviour in outer space.² Diplomats are particularly concerned about the lack of progress in addressing increasing geopolitical tensions and competition in space.³

As the number of users and uses of space grows, the calls get louder and more urgent. Canada's national defence policy, "Strong, Secure, Engaged," for example, aims to "provide leadership in shaping international norms for responsible behaviour in space."⁴ Many states have similar objectives.

Our project, funded by a grant from the Mobilizing Insights in Defence and Security (MINDS) program of the Canadian Department of National Defence, supports this objective by generating information and insight into how existing and emerging norms of safety and sustainability in outer space—developed mostly in the civil and commercial sectors—can inform norms related to space-based military capabilities and activities, enhancing security in the space environment. One element of this project involves surveying global space experts, both to test and verify the outcomes of our initial round of research, and to further probe the collective conceptualization of norms by the space community.

A SURVEY OF GLOBAL SPACE EXPERTS

Our team's initial round of research involved identifying, recording, and mapping expected behaviour or standards of behaviour established by law or policy. But this documentary evidence does not clearly indicate practice.

To facilitate consultation with a broad representation of the global space community, we designed a detailed survey of roughly 30 quantitative and qualitative questions. Participants were asked to identify existing sources of norms, to outline content that related to safety and sustainability, and to reflect on the nature of the impact of these norms on space activities. The survey then probed the relevance of these safety and sustainability norms to military and security activities in outer space. Participants were also asked to reflect on military-specific norms in outer space, and to consider the extent to which expectations of responsible behaviour in civil and commercial activities can be applied to a military context. Finally, participants were asked to identify the opportunities that exist to further develop a normative framework for security governance in outer space, as well as the obstacles to such developments.

To encourage participation and candid responses, survey participants were not identified; however,

¹ In keeping with prevailing academic and political interpretations, we define norms as social rules rooted in shared ideas and expectations of appropriate behaviour.

² B. Weeden, V. Samson, "Op-ed | India's ASAT test is wake-up call for norms of behavior in space," SpaceNews, April 8, 2019, <https://spacenews.com/op-ed-indias-asat-test-is-wake-up-call-for-norms-of-behavior-in-space>; Phillip Swarts, "'Standards and norms' needed in space, Pentagon experts say," SpaceNews, November 18, 2016, <https://spacenews.com/standards-and-norms-needed-in-space-pentagon-experts-say>; Bruce McClintock, "Space safety coordination: A norm for all nations," The RAND Blog, April 16, 2019, <https://www.rand.org/blog/2019/04/space-safety-coordination-a-norm-for-all-nations.html>; World Economic Forum, "Why we need a new global code of conduct for outer space," September 11, 2019, <https://www.weforum.org/agenda/2019/09/why-we-need-a-global-code-of-conduct-for-outer-space>.

³ C.A. Ford, Assistant Secretary, Bureau of International Security and Proliferation and Nonproliferation, Whither Arms Control in Outer Space? Space Threats, Space Hypocrisy, and the Hope of Space Norms, CSIS Webinar on "Threats, Challenges and Opportunities in Space," April 6, 2020, <https://www.state.gov/whither-arms-control-in-outer-space-space-threats-space-hypocrisy-and-the-hope-of-space-norms>; Committee on the Peaceful Uses of Outer Space, Operating in space: towards developing protocols and norms of behaviour, A/AC.105/2019/CRP.12, June 13, 2019, https://www.unoosa.org/res/oosadoc/data/documents/2019/aac_1052019crp/aac_1052019crp_12_0_html/AC105_2019_CRP12E.pdf.

⁴ Government of Canada, Strong, Secure, Engaged: Canada's Defence Policy, June 7, 2017, (New Initiative 84), <https://www.canada.ca/en/department-national-defence/corporate/policies-standards/canada-defence-policy.html>.

a series of demographic questions tracked the quality of engagement with the expert community. Invitations to participate in the survey were sent to more than 150 experts from 20 different states. To extend participation beyond our immediate network, these people were asked to share the survey with appropriate colleagues. Additionally, information about the survey and an invitation to participate were also published in SpaceWatch Global, and shared on social media. Online responses to the survey were collected from May 15 to June 10, 2020.

A complete list of the survey questions is available in the Annex to this report.

A SNAPSHOT OF SURVEY PARTICIPANTS

The survey received 102 responses from 15, mainly Western, countries. (Efforts to solicit more diverse perspectives will be pursued in the next phase of focused workshops.) Of those who entered a response to the open-ended questions on gender, 43% identified as female and 57% as male.

The professional makeup of participants is as follows:

FIGURE 1: Level of experience among participants (in years)

Not all participants answered this question.

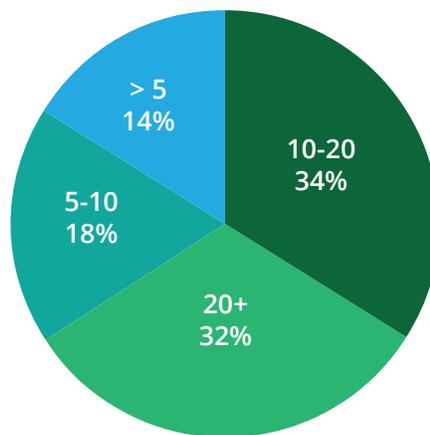
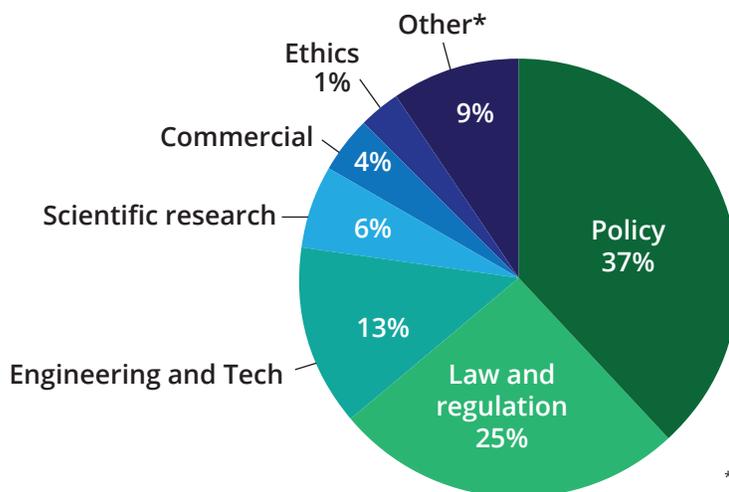
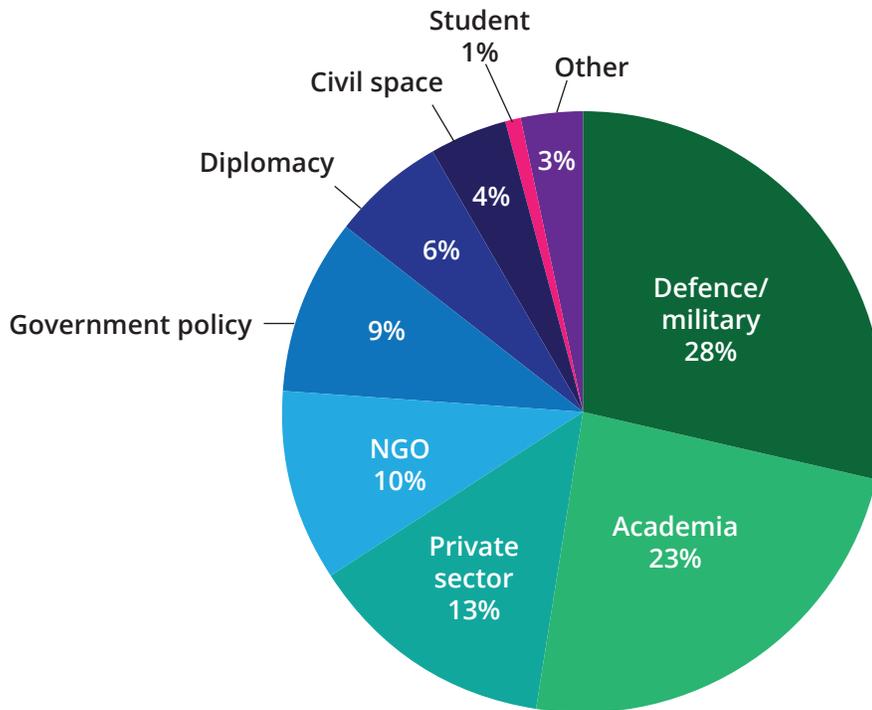


FIGURE 2: Participants' fields of expertise



* Self-identified as "peace," "military," and "space tracking."

FIGURE 3: Participants' sector of employment



Although the survey is not fully representative of the global space community, persistent patterns in answers suggest that norms are valued by the community because they have a positive influence on both sustainability and safety, and they are also relevant to military and security activities. However, the survey also flagged a significant contradiction between the perceived value and applicability of normative behaviour in outer space to military and security activities and actors, and their adoption and implementation in practice.

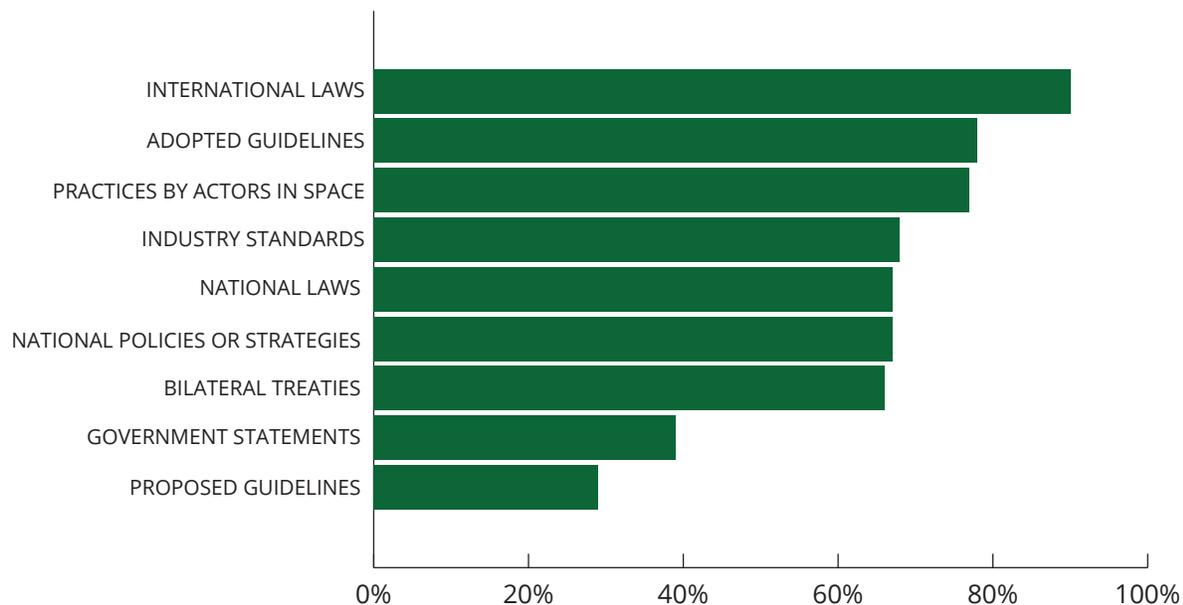
ANALYSIS OF RESPONSES

IDENTIFYING NORMS

A key goal of the survey was to verify the approach and findings of our existing research on outer-space norms, including key sources and indicators of norms.

While participants identify international laws, adopted agreements and guidelines, bilateral treaties, national policy, industry standards, and national laws as the source of norms, almost all of them also identify practices. Practices are more difficult to document; additional survey responses and comments significantly help in identifying some of those key practices of normative behaviour.

Figure 4: “How can we identify norms in space?”



FOCUSING ON SAFETY AND SUSTAINABILITY NORMS

While the survey probes safety and sustainability norms separately, respondents clearly indicate intimate linkages between the two, which can be viewed in terms of macro and micro—or collective and individual—benefits and obligations.

Participants most commonly cite debris mitigation guidelines and the UN Long-Term Sustainability Guidelines developed by the Committee on the Peaceful Uses of Outer Space (COPUOS) as sources for normative behaviour. These guidelines are clearly linked to practices most often identified as norms by survey participants, including those related to debris mitigation: a variety of practices associated with end-of-life procedures, such as deorbiting, passivation, and the use of graveyard orbits;

- practices associated with collision avoidance, including
 - » Space Situational Awareness (SSA) data sharing,
 - » sharing conjunction notifications or warnings,
 - » sharing individual orbital information or being trackable.

Other identified sustainability norms also focus on the interaction between individual and collective responsibilities:

- launch practices, including notifications, fuel safety and hazards;
- re-entry of large objects;
- spectrum management and coordination.

Norms associated specifically with collective safety emphasize transparency and collective responsibility, particularly in sharing information on everything from orbital parameters to threats posed by common hazards such as near Earth objects (NEOs) and space weather. Norms more specific to individual safety practices are broadly related to hardware design, with objectives that include debris prevention, resiliency and redundancy, and trackability.

THE VALUE OF NORMS FOR SAFETY AND SUSTAINABILITY

Survey responses indicate that norms have a positive effect on both safety and sustainability in outer space.

FIGURE 5: “How would you rate the impact of norms on behaviour related to the sustainability of outer space?”

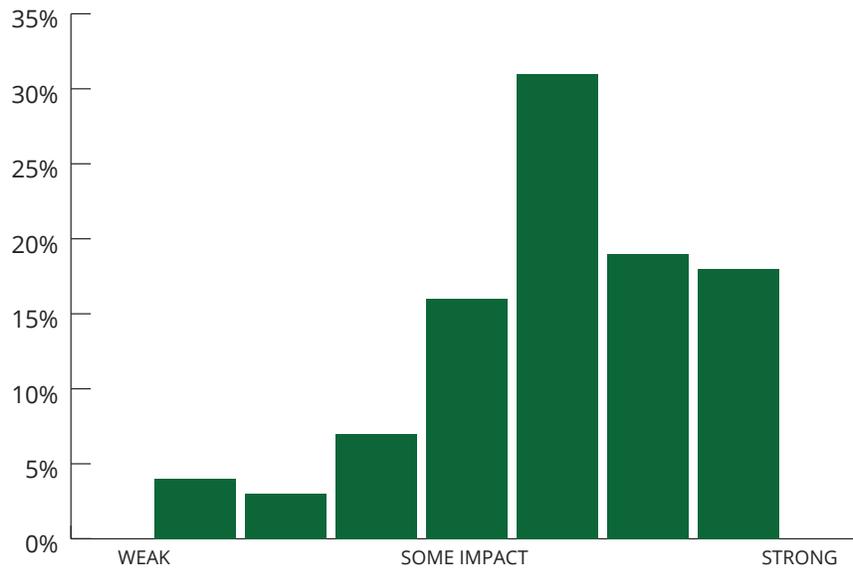


FIGURE 6: “In your opinion, is the normative influence on sustainability positive or negative?”

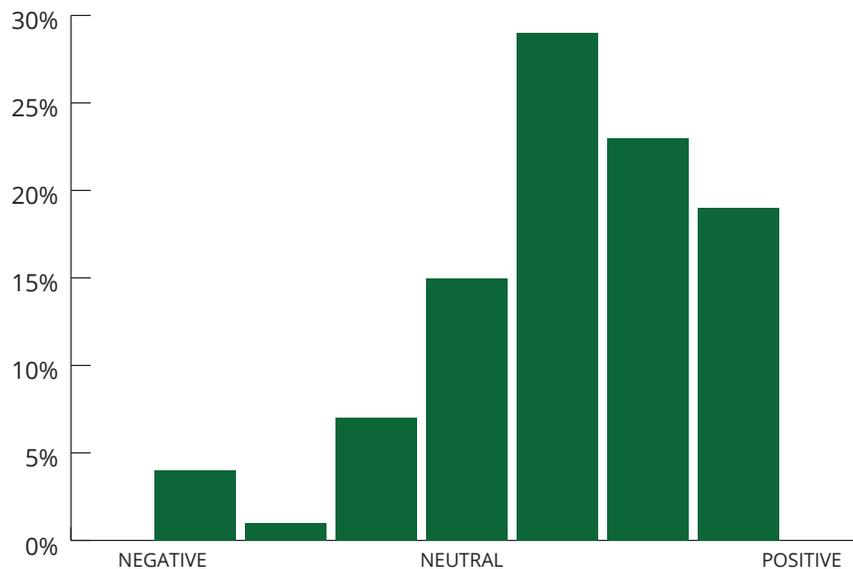


FIGURE 7: “How would you rate the impact of norms on behaviour linked to safety in outer space?”

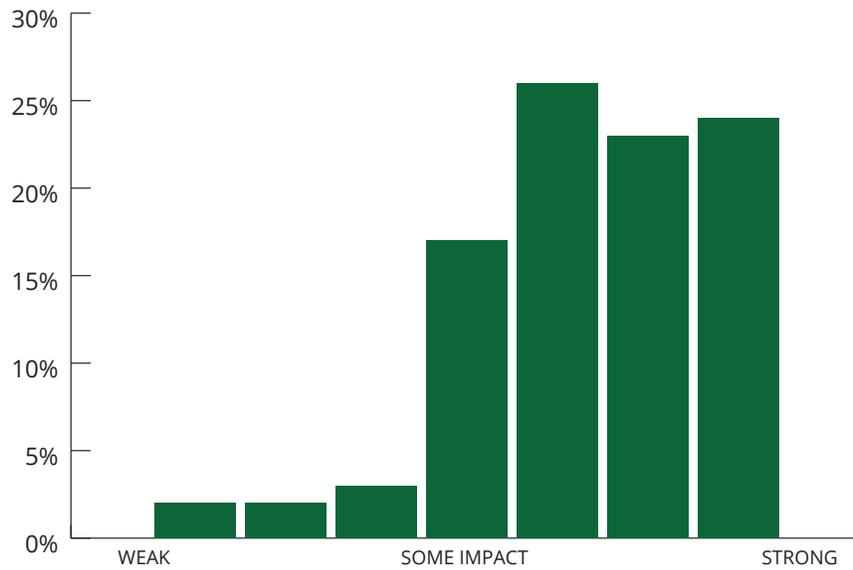
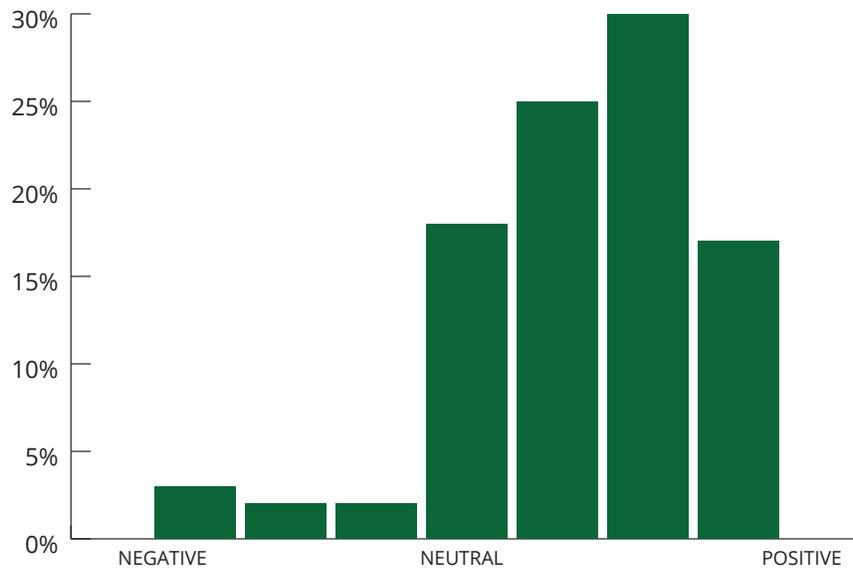


FIGURE 8: “In your opinion, is the normative influence on safety positive or negative?”



Comments indicate that in a shared environment, norms are valued because they provide mutual benefits and promote common interests. For operators in space, norms provide a greater level of predictability and transparency of activities. They also provide a way to publicly identify and censure bad behaviour.

THE DOWNSIDE OF NORMS

Norms are not inherently positive. Some survey responses raise concerns about negative norms that could legitimize bad behaviours or make “good enough” behaviour acceptable. ASAT testing and debris-mitigation practices stand out as examples. Clearly, norms alone are not an adequate mode of governance, but rather a reflection of the overall quality of governance.

Indeed, some participants question the impact of norms on activities and behaviours. Although reflecting social expectations and standards, norms retain a level of subjective interpretation and voluntary action. For this reason, implementation and compliance can be inconsistent and haphazard.

Responses also suggest that current norms related to safety and sustainability are weak, and that the existing normative framework cannot meet the growing challenges faced in outer space. This feedback is linked to a perception of flux and instability in the current space environment—one with few agreed-upon rules—in which the rapid increase in new and emerging uses and users is spurring uncontrolled competition.

Still, responses indicate that, without norms, the current space environment would be even more unstable. With additional norms of appropriate behaviour emerging, responsible behaviour can become a productive path to enhanced safety and sustainability in outer space.

THE CURRENT STATE OF MILITARY AND SECURITY NORMS: LINKAGES WITH SAFETY AND SUSTAINABILITY

Responses and comments linked to existing military norms reflect a growing chasm between aspiration and practice.

On the one hand, there is strong agreement that safety and sustainability norms are relevant for military and security actors. An overwhelming number of responses state that military and security actors should be obligated to assume the same responsibilities for safety and sustainability in outer space as all other actors, because of the direct impact of their activities on the shared outer space environment. As well, assuming such an obligation not only preserves outer space for the use of all, but benefits the individual actors, who cannot be secure if their environment is unsafe and unsustainable. This perspective promotes the virtuous circle of comprehensive security of the space environment.

FIGURE 9: “Do you think that norms related to sustainability are relevant to the conduct of military or security activities in space?”

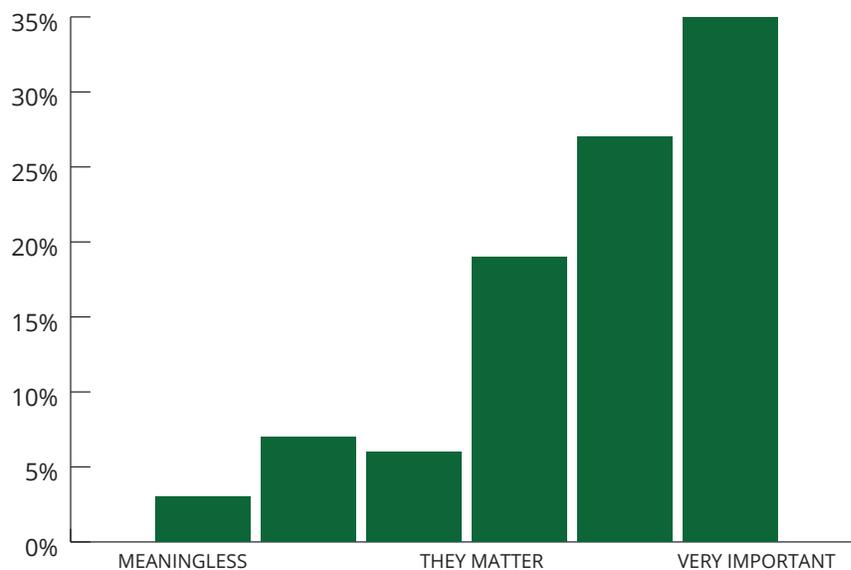
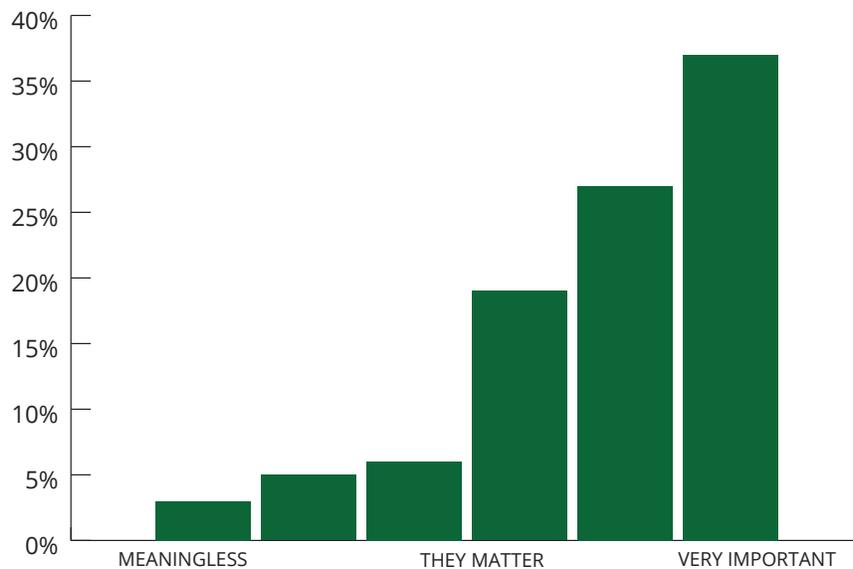


FIGURE 10: “Do you think that norms related to safety are relevant to the conduct of military or security activities in space?”



Participants also note that norms provide military-specific value, by

- reducing the number of mishaps, misperceptions, and risk of conflict escalation;
- helping to identify potentially harmful activities;
- facilitating early detection of possible hostile action;
- Indicating threshold triggers for rules of engagement.

The absence of norms in this context is seen to be destabilizing. Thus, enhancing the normative framework is seen as a tool of security governance, particularly in the absence of formal agreements to restrict or regulate military activities in space.

But participants indicate that there is a distinct gap between the norms that military and security actors should be observing and actual practice. These actors have a different playbook.

Participants repeatedly claim that military activities in space are a threat to both safety and sustainability. The promotion of armed conflict or warfare in space, in particular, is seen to be in conflict with these goals. For example, the use of weapons in space would increase the amount of space debris.

Additionally, there are strong concerns that the norms linked to the testing of anti-satellite weapons and other activities linked to warfighting do not unequivocally promote safety and sustainability, with previous normative restraints being eroded. Responses convey the sense that the values and practices that influence military security in outer space are shifting.

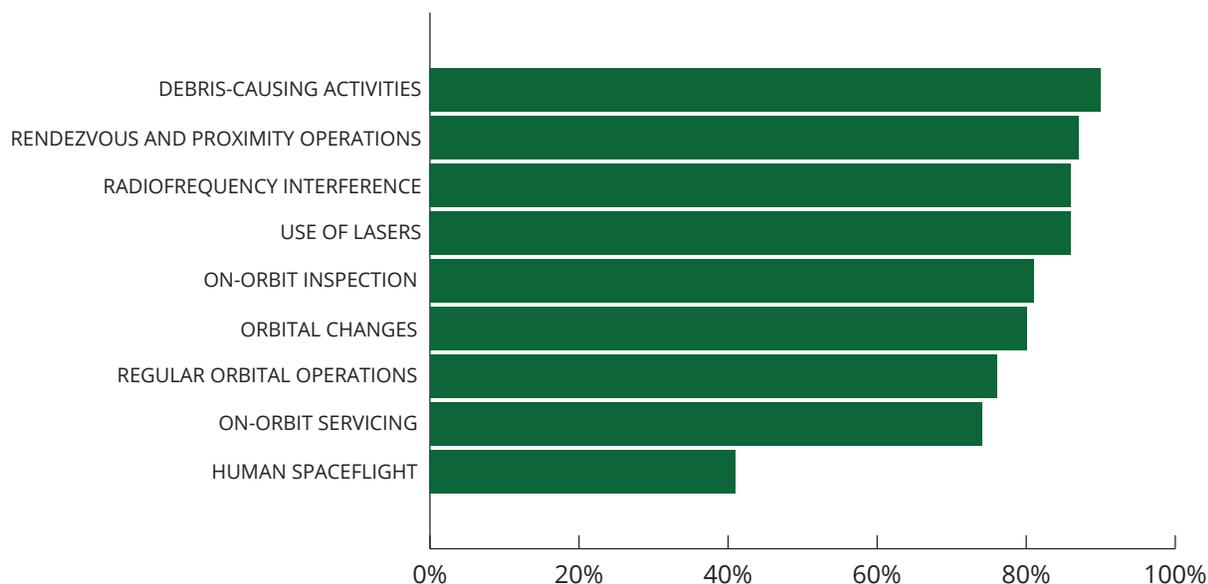
This chasm between current and developing military/security practice and established norms of activity in space are at the heart of our research. Participant responses provide some clues on how to span it.

Seventy-seven per cent of survey respondents indicate that they think that there are norms or practices specific to security that influence military or defence activities in space. The effects are not

always positive.

The following figure indicates the extent to which types of norms identified in our initial round of research are applicable to military and security activities in outer space.

FIGURE 11: “Following are activities for which we have identified evidence of a norm of responsible behaviour. Select any that you think are applicable to military and defence activities.”



Asked to identify existing normative behaviours of military and security actors in outer space, participants offer responses that significantly overlap with those on safety and sustainability. Areas of notable overlap include:

- debris mitigation,
- manoeuvre notifications and collision avoidance,
- Registration of space assets,
- Spectrum coordination.

Again, the comments strongly suggest that the normative landscape and practices that influence military security activities in outer space are shifting.

WHAT ARE NORMS FOR MILITARY ACTIVITIES?

The Outer Space Treaty (OST) is persistently identified as the most important influence on military/security behaviour. Applicable principles include peaceful use; free overflight; no harmful interference; banning weapons of mass destruction (WMD); the right to self-defence via the reiteration of the applicability of the UN Charter in Outer Space; and the ban on military activities on, or the appropriation of, celestial bodies. Again, participants note a gap between policy and practice, particularly in relation to electronic interference (jamming) of satellite systems.

Other types of positive military-specific norms and restraint identified by survey participants include:

- ◆ debris mitigation, which is thought to influence behaviours such as ASAT testing and the use

of force in outer space;

- maintaining one's own security with cybersecurity technologies, encryption, and command and control of satellite systems;
- surveillance and tracking of objects in space;
- transparency practices such as pre-launch notifications, publishing of some orbital data, public military doctrines, registration (not always well observed), and manoeuvre notifications;
- no irreversible damage to satellites, or a threshold against physical harm;
- non-interference with such strategic satellites as national technical means of verification (NTM) and early warning;
- calling out bad behaviour.

A careful reading of the comments points to a sense of flux in military activities as well as shifting normative influences. Specifically, participants point to both a growing focus on safety, as well as a broadening range of permissible military activities.

The focus on safety is seen in the applicability of the LTS guidelines; and operational concerns with collision avoidance, debris mitigation, and deorbiting; as well as increased SSA data sharing and the provision of more precise conjunction data by the U.S. military.

Participants identify the emergence of a striking range of military activities of concern, including:

- ASAT testing;
- a growing focus on weapons and warfare in outer space, including space forces, military doctrines, and self-defence or armed satellites;
- new capabilities such as lasers and concepts linked to blinding or dazzling of satellite sensors;
- growing cyber-interference threat to satellite systems;
- the proliferation of surveillance and inspection satellites;
- new activities associated with satellite servicing, active debris removal, constellations, and the use of space-based resources.

SHIFTING AND EMERGING MILITARY NORMS

The identification of shifting behaviours and activities in outer space highlights the gap between practice and rules/concepts of appropriate behaviour. Also frequently observed are the erosion of military restraint in outer space and the growth of strategic competition.

Survey comments point to several military activities that indicate shifting or emerging norms. The following stand out:

1. Non-consensual rendezvous and proximity operations (RPO)

This type of activity, which is associated with the growing use of inspection satellites to collect information about (or from) foreign satellites, is the most strongly cited example of an emerging norm. As an activity, it overlaps with some associated with safety and sustainability, such as on-orbit servicing and diagnostics, as well as active debris removal. Operating in closer proximity to other satellites is linked to growing use of and congestion within heavily used orbits, particularly the geostationary orbit.

Many survey responses indicate that norms to enhance safety are emerging for RPO activities. For example, the industry-led Consortium for Execution of Rendezvous and Servicing Operations

(CONFERS) process has identified a set of best practices. However, the CONFERS recommendations address RPO with a cooperative or authorized object. It does not address unauthorized RPOs of the type that is normal for national security missions. A basic question seems to remain unanswered: how close is too close?

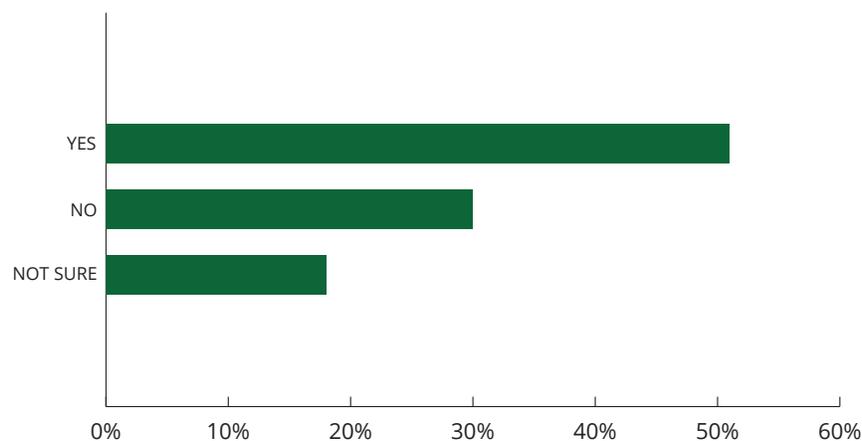
Survey comments indicate that, in practice, operators seem to observe a minimum distance between satellites, according to the specific orbit. There are some indications that military operators and inspection satellites also observe a norm linked to safe distance. Some participants see the norm as one that allows a satellite to get as close to another as its operator chooses, as long as no physical harm is inflicted; others indicate that a definition of “too closeness” is emerging, determined by an operator’s feeling that an asset is under threat. A specific close approach by a Russian satellite to a U.S. satellite in 2019 stands out as an example of exactly this.⁵ Thus, it is possible that the idea of a keep-out zone is emerging, but must still be clearly defined.

2. ASAT testing

Many survey participants describe a norm against testing ASATs as a case of military restraint in outer space. However, it is also the case that participants most frequently cite the conducting of anti-satellite tests when explaining the need to strengthen security norms in outer space.

The testing of ASATs is an example of a military-related norm that appears to be in flux and becoming more permissive. A series of tests in recent years suggests that they are becoming accepted, as long as they produce little or no debris, stay a safe distance away from other objects, and do not involve a physical intercept. However India’s test in 2019 raises questions about what counts as low, or short-lived, debris.⁶ A relaxation in the conducting of weapons tests in space concerns many participants, who see it as a sign that previous normative restraints are eroding.

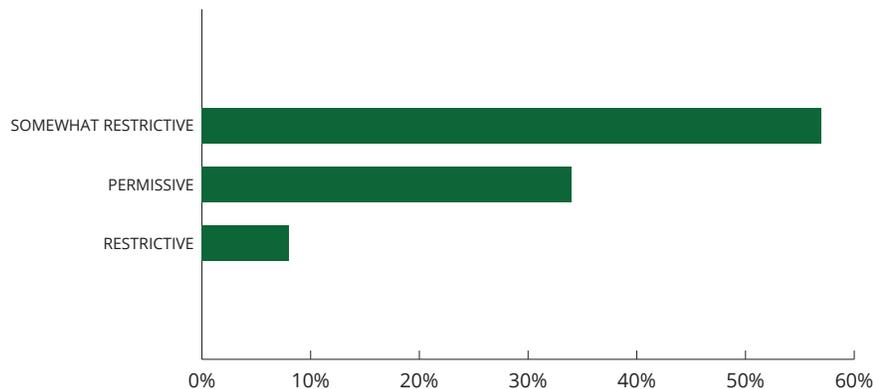
FIGURE 12: “Demonstration of anti-satellite (ASAT) capabilities is increasing. Would you say that there is evidence of an emerging norm related to this activity?”



⁵ W.J. Hennigan, “Exclusive: Strange Russian spacecraft shadowing U.S. spy satellite, general says,” Time, February 10, 2020, <https://time.com/5779315/russian-spacecraft-spy-satellite-space-force>.

⁶ Doris Elin Urrutia, “India says its anti-satellite weapon test created minimal space debris. Is that true?” Space.com, March 28, 2019, <https://www.space.com/india-anti-satellite-weapon-test-debris.html>; Sarah Lewin, “India’s anti-satellite test created dangerous debris, NASA chief says,” Space.com, April 1, 2019, <https://www.space.com/nasa-chief-condemns-india-anti-satellite-test.html>; Caleb Henry, “India ASAT debris spotted above 2,200 kilometers, will remain a year or more in orbit,” SpaceNews, April 9, 2019, <https://spacenews.com/india-asat-debris-spotted-above-2200-kilometers-will-last-a-year-or-more>.

FIGURE 13: “How would you describe this emerging norm?”



3. Non-weaponization/use of force

Many survey respondents point to a persistent norm against the weaponization of space or the use of force against adversaries in outer space. There is a belief that a physical attack against a foreign satellite continues to be a threshold that militaries are hesitant to cross. And although ASAT testing is increasing, some respondents point to the continuing, near-universal support for United Nations (UN) General Assembly resolutions linked to the prevention of an arms race in outer space (PAROS) as an indication that the use or placement of weapons in outer space is not seen to be appropriate. Since there are no formal restrictions on such activity—with the exception of weapons of mass destruction—such an analysis of normative behaviour by many survey respondents is significant.

Nonetheless, this norm lacks clear definition, as participant questions and comments indicate. For example, respondents note a growing number of potentially offensive weapons, ranging from kinetic destruction to laser and electromagnetic. Cyberattacks are often mentioned. All raise questions about what counts as a weapon, an attack, and a threat.

4. Lunar activities and resource extraction

Many survey participants mention lunar activities and the extraction and use of space-based mineral resources as activities in which they expect new norms of behaviour to begin to emerge. A few raise concerns about the potential expansion of military involvement in these activities.

ENHANCING SECURITY: LEVERAGING EXISTING NORMS

A deeper dive into the military relevance of specific categories of normative behaviour identified in our preliminary round of research offers an opportunity to influence new normative standards in ways that contribute to safety, sustainability, and stability. These categories include transparency, due regard for the safety of other operators, environmental due regard, and collaboration.

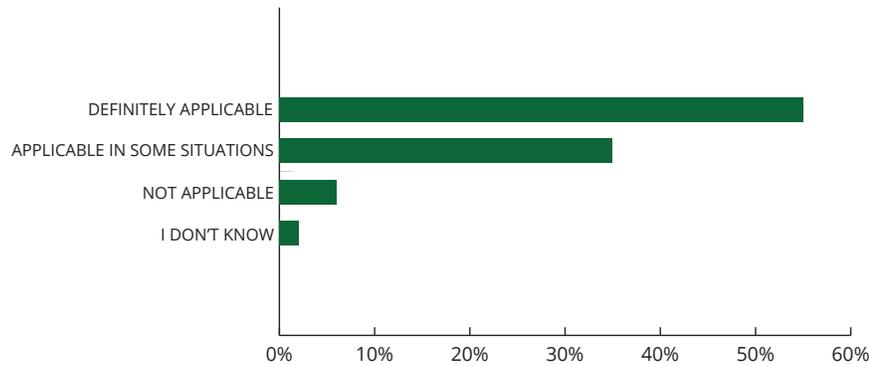
In responding to a number of questions, survey participants reflect on the extent to which broad categories of existing norms are relevant to military and security practices in outer space. Their answers indicate not only that existing normative themes are relevant in a security context, but provide numerous examples of practices that could be extended or better applied.

TRANSPARENCY

Most survey participants believe that practices linked to transparency of activities in outer space are

applicable to military activities. A few suggest that existing practices are insufficiently developed or not verifiable.

FIGURE 14: “How applicable do you think transparency is to military and security activities in outer space?”



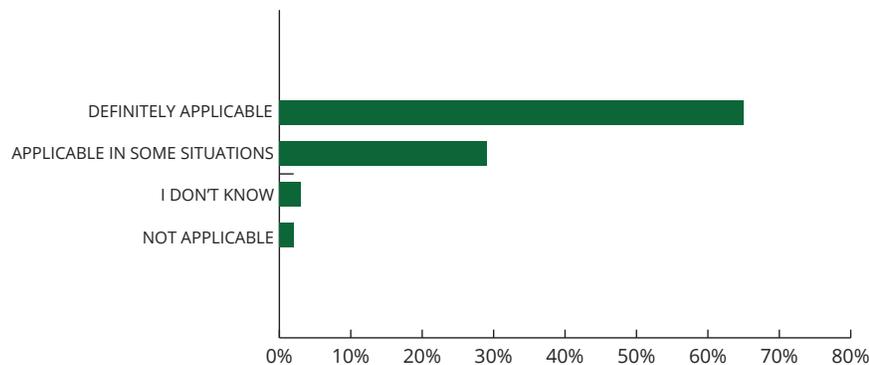
Participants link the following activities to transparency, or see them needing greater transparency:

- RPOs/inspection/servicing;
- planned manoeuvres or orbital changes;
- sharing orbital parameters;
- satellite registration;
- launch notifications;
- notification of weapons tests, including jamming, or the disclosure of technology testing goals;
- disclosure of capabilities related to nuclear command and control or arms control verification, which are linked to understandings of non-interference with strategically sensitive satellites.

DUE REGARD

While a few comments suggest that the concept of due regard is too vague to apply, many others indicate that it is applicable to military and security practices. There are some indications that practices linked to regard for others are much better than transparency measures in communicating a non-harmful intent.

FIGURE 15: “How applicable do you think due regard for others is to military and security activities in outer space?”



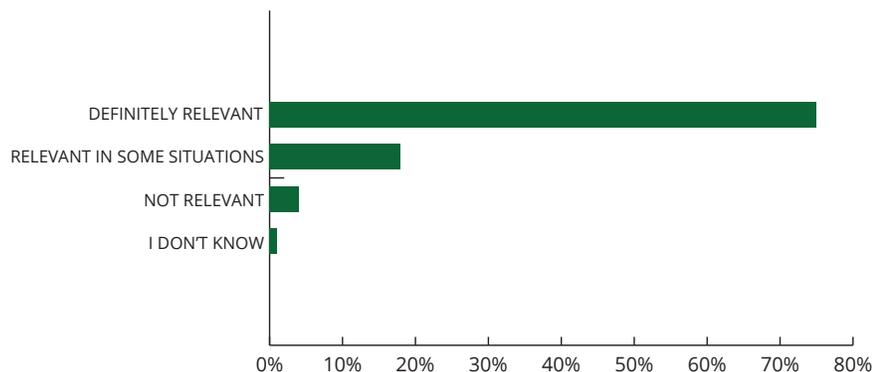
Identified activities that would benefit from enhanced “due regard” practices include:

- pre-coordination or notification of orbital changes and manoeuvres, including RPO/inspection/servicing;
- sharing orbital parameters;
- “due regard” practices linked to ASAT tests or other interference tests, including:
 - » notification of potential interference or jamming exercises,
 - » notification of interference with civil operators,
 - » reporting incidents of radiofrequency interference,
 - » notification of any possible interference with foreign military satellites;
- pre-launch notifications;
- conjunction notifications/SSA data sharing;
- information on orbital breakups.

CONTAMINATION

Survey participants strongly support the application of norms that restrict the contamination of the space environment. Most assert that this standard of behaviour should always be applied, except in the most extreme of circumstances.

FIGURE 16: “How relevant are efforts to reduce contamination of the space environment, such as debris mitigation measures, for military activities in space?”



Activities to which norms related to non-contamination of the space environment could be extended or better applied include:

- debris mitigation;
- end-of-life activities (satellite disposal, deorbiting, passivation);
- tests of ASATs or other weapons;
- re-entry, particularly of large objects;
- launch practices;
- RPO or on-orbit servicing activities;
- active debris removal;
- activities linked to space traffic management (trackability, collision avoidance capability, notification/coordination of orbital changes);

- disclosure of dangerous cargo.

COLLABORATION

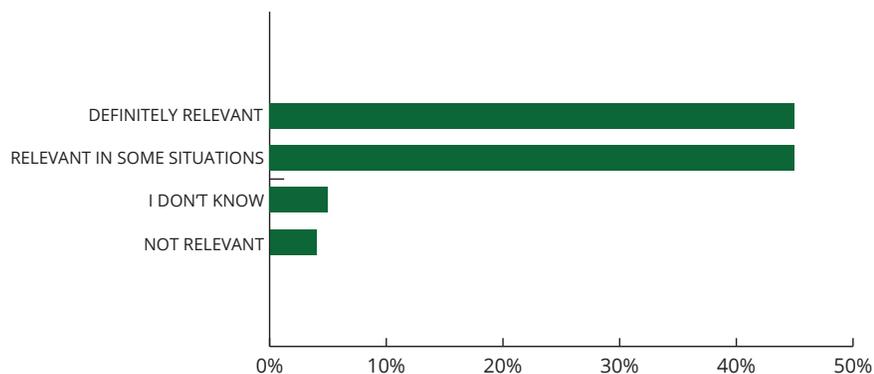
Most participants find the idea of norms of collaborative behaviour relevant for military and security practices, within certain limits. Many focus on activities with likeminded states or allies, including: enhanced interoperability/redundancy/resilience through mutual design interfaces,

- shared threat characterization and calling out bad behaviour,
- sharing SSA data,
- joint exercises.

The following collaborative activities were identified that involve perceived competitors or adversaries that could reduce tensions and enhance safety:

- space traffic management practices;
- exploration activities, such as the International Space Station;
- radiofrequency coordination to reduce interference;
- use of space capabilities for rescue or emergency response;
- active debris removal;
- friend or foe identification;
- signing reciprocal cooperation agreements.

FIGURE 17: “Are collaborative practices relevant for military and defence activities in outer space?”



MILITARY AND SECURITY NORMS: THE WAY FORWARD

Survey responses suggest that the road to enhanced security governance may be found by focusing on existing norms of behaviour in outer space and their applicability to military and security activities.

But how to engage the appropriate agencies? Many survey respondents believe that the United Nations provides an optimal forum for discussion and testing ideas, but do not expect concrete measures by UN bodies at this time. Indeed, some lament that the discussion of norms at the UN has become too politicized to be productive. Instead, most favour a mix of commercial and industry groups, civil society, and smaller groups of states to drive action on this topic. Still, as not all groups

will share the same interests, the need for a state champion is recognized.

Participants agree that all significant state actors must be involved in establishing military and security norms of responsible behaviour, but do not agree on their exact role. Uniform or unilateral behaviour by this influential group could create norms. However, as several of these states do not trust each other, this way forward seems unlikely. Escalating geopolitical competition is often cited as a barrier to progress. Other obstacles include the sense that militaries perceive benefit in unrestrained activities, as well as a growing focus by some major states on dominance and freedom of action.

Many participants feel that the necessary ingredients for progress—transparency, public engagement and interest, global cooperation, and an understanding of the space environment—are missing. Others note a possible misalignment of national interests as well as different interpretations of norms.

Further governance challenges include an overall waning of international governance and the rule of law, as well as growing hostility and aggressive behaviour in space.

PROCEEDING WITH THE PROJECT

The goal of the survey, to supplement the project's research on norms related to space security, has been reached.

The survey results reinforce the central themes that the project is developing: that safety and sustainability are essential for security in outer space, and that security and military operations in outer space have a significant impact on that environment's safety and sustainability. But the survey also highlights a significant conundrum: how to bridge the gap between the principles on which best practices are based and the reality of activities as practised. Added to all this is the perception that existing normative restraints on military activity are weakening, even as we watch.

The emergence of new capabilities and activities in outer space, combined with a growing focus on warfighting, are creating flux in the rules long associated with operating in outer space. But the value of maintaining normative constraints that promote good behaviours is still evident.

Feedback from survey participants indicates that, there is still a present opportunity to expand norms of best practices rooted in safety and sustainability into the domain of security. Several specific measures stand out:

- debris prevention and mitigation in the context of weapons tests or the use of force;
- enhanced sharing of Space Situational Awareness data;
- rules to enhance the safety of non-cooperative rendezvous and proximity operations;
- expanded notification for a wide range of activities, including launch, orbital manoeuvres, weapons tests, and potential radiofrequency interference;
- better identification of strategically sensitive satellite systems, such as those linked to nuclear command and control or verification of arms control agreements;
- efforts to better coordinate and protect the radiofrequency spectrum.

Many paths can be taken to reach these new behavioural norms; no doubt many must be taken simultaneously. But a key message is that states must make a major contribution to improving the collective safety and sustainability, as well as security, of the space environment. Some state or group of states must be prepared to lead, in partnership with commercial and civil-society stakeholders.

Ultimately, this project aims to produce a roadmap of the existing normative landscape of out-

er-space activities, with directions on how to expand it. The first stage of this work involved identifying and recording sources of norms and their content from the growing collection of public documents that span international law, bilateral agreements, industry standards, national laws and policies, voluntary guidelines, and proposed best practices. The survey helped to verify these findings and fill in gaps, particularly those related to actual normative behaviour.

In the final stage of our work we will refine this map and fill in those gaps. We will also look to examples from other domains, such as the high seas, for additional ideas and guidance on norms and governance. And we will put our work forward for criticism and burnishing once more when we gather in detailed consultation with smaller groups of experts from diverse countries and fields of expertise.

The project is expected to conclude in October 2020.



ANNEX: SURVEY QUESTIONS

The purpose of this project is to generate knowledge about how existing and emerging norms of responsible behaviour in outer space related to safety and sustainability - developed mostly in the civil and commercial sectors - can inform space-based military capabilities and activities to enhance security within the space environment.

This research is being conducted by researchers in Canada:

Jessica West, Project Ploughshares

Gilles Doucet, Spectrum Space Security

It is funded through a grant provided by the Mobilizing Insights in Defence and Security (MINDS) program of the Canadian Department of National Defence.

Responses to this survey are anonymous. Information collected will be used to expand and inform the next stage of our work. It will be accessed exclusively by the two project researchers.

A. DEMOGRAPHIC QUESTIONS

First, we are asking some demographic questions to keep track of our engagement. We are hoping to benefit from a diversity of views and experiences.

1. Do you work or study in a field related to outer space activities?

Yes
No

2. Gender?

3. How long have you been engaged in work related to outer space activities?

< 5 years
5-10 years

10-20 years
20+ years

4. What is your primary field of expertise?

Scientific research
Engineering and technology development
Law and regulation

Policy
Commercial/business
Ethics

5. What is the sector in which you primarily work or study?

Defence/military
Government policy
Diplomacy
Private sector

Civil space program
Academia
NGO
Student

6. In which country do you primarily live and/or work?

7. Part of our goal is to engage with members of the Canadian Armed Forces and Canadian De-

partment of National Defence. Do you work for either of these organizations?

- Yes
- No
- Prefer not to answer

B. QUESTIONS ABOUT NORMS IN SPACE

Now we're curious to know what you think about norms in outer space. We define norms broadly as standards of appropriate behaviour.

8. How can we identify norms in space? Select the options that you think inform or reflect normative understandings or behaviour.

International law
Bilateral treaties
National law
National policy or strategy
Adopted guidelines

Proposed guidelines
Industry standards
Practices by actors in space
Government statements

Sustainability norms

9. Let's think about norms related to sustainability.

- a. How would you rate the impact of norms on behaviour related to the sustainability of outer space?

0 1 2 3 4 5 6
weak *some impact* *strong*

- b. In your opinion, is the normative influence on sustainability positive or negative?

0 1 2 3 4 5 6
negative *neutral* *positive*

- c. Care to explain?

- d. What are some examples of norms or practices related to sustainability that come to mind?

Safety norms

10. Now let's think about safety.

- a. How would you rate the impact of norms on behaviour linked to safety in outer space?

0 1 2 3 4 5 6
weak *some impact* *strong*

In your opinion, is the normative influence on safety positive or negative?

0 1 2 3 4 5 6
weak *some impact* *strong*

- b. Care to explain?
- c. What are some examples of norms or practices related to safety that come to mind?

Security norms

11. Now on to questions about security.

- a. Do you think that norms related to sustainability are relevant to the conduct of military or security activities in space?

0 1 2 3 4 5
meaningless *they matter* *very important*

- b. Please explain.
- c. Do you think that norms related to safety are relevant to the conduct of military or security activities in space?

0 1 2 3 4 5
meaningless *they matter* *very important*

- d. Please explain.

12. Do you think that there are norms or practices specific to security that influence military or defence activities in space?

Yes
No
Not sure

- a. Please explain.
- b. Do you think that there are norms or practices specific to security that influence military or defence activities in space?
- c. Describe any existing security-related norms in space that you think are relevant to military and security activities.

13. Norms shift and evolve over time. List events or activities that you think point to new or emerging normative behaviour in space.

C. QUESTIONS RELATED TO OUR RESEARCH FINDINGS

Next we're going to ask questions related to our preliminary findings.

Our goal is to map existing norms in outer space and consider how they might inform military and security activities.

Through our norm mapping exercise, we classified the norms in our research using the following four categories:

- * The purpose or value
- * Activities involved
- * Responsible behaviours identified
- * Mechanisms and tools used

14. Following are activities for which we have identified evidence of a norm of responsible behaviour. Select any that you think are applicable to military and defence activities.

Regular orbital operations
Orbital changes
Rendezvous and proximity operations
On-orbit servicing
On-orbit inspection

Radiofrequency interference
Debris-causing activities
Use of lasers
Human spaceflight

15. List examples of other military- or security- related activities that you think would benefit from rules of behaviour.

The following is a preliminary list of categories of responsible behaviours that we have identified:

- * Transparency/disclosure related to activities and capabilities
- * Actions linked to the due regard for others
- * Actions linked to environmental regard
- * Activities that are restricted or restrained
- * Collaborative abilities

We would like you to consider their applicability to military and security activities in space.

Transparency

16. Transparency of activities and capabilities on-orbit, through actions such as disclosure, trackability, registration, and status updates, is a significant theme in the research.

a. How applicable do you think transparency is to military and security activities in outer space?

Not applicable
Applicable in some situations

Definitely applicable
I don't know

b. Why not? OR: Provide examples of security-related situations or activities to which existing transparency measures could be applied.

Due regard

17. Due regard for other operators is another common category of normative behaviour in outer

space.

Some examples of due regard that we have identified in the research include notification and communication, information exchange, coordination, and avoiding interference.

- a. How applicable do you think due regard for others is to military and security activities in outer space?

Not applicable

Applicable in some situations

Definitely applicable

I don't know

- b. Why not? OR: List examples of situations or activities to which practices of due regard for others could be applied.

Environmental due regard

18. What about due regard for the environment?

- a. How relevant are efforts to reduce contamination of the space environment, such as debris mitigation measures, for military activities in space?

Not relevant

Relevant in some situations

Definitely relevant

I don't know

- b. Why not? OR: List examples of situations or activities to which practices of environmental due regard could be extended.

Collaboration

19. Collaborative practices such as standardization and interoperability are becoming more common.

- a. Are collaborative practices relevant for military and defence activities in outer space?

Not relevant

Relevant in some situations

Definitely relevant

I don't know

- b. Why not? OR: List examples of situations or activities to which collaborative practices or capabilities could be extended to military operators or activities.

Restraints and restrictions

20. The final theme relates to restraints and restrictions, ranging from rationing the use of space resources to protections for strategic satellite capabilities, and is directly related to military and security activities.

- a. Indicate which of the following security-related activities you think are currently influenced by normative (not legal) restraints or restrictions.

Kinetic ASAT demonstrations
Cyber interference
Radiofrequency interference
Directed energy targeting an adversary

Proximity operations near a foreign satellite
Inspection of a foreign satellite
Placement of a weapon in orbit

- b. Demonstration of anti-satellite (ASAT) capabilities is increasing. Would you say that there is evidence of an emerging norm related to this activity?

Yes
No
Not Sure

- c. How would you describe this emerging norm?

Permissive
Restrictive
Somewhat restrictive

- d. Can you explain?

- e. List other examples of normative or voluntary restraints or restrictions that you think are influencing security-related activities in outer space.

- f. Any further comments on restrictions or restraints to military activities?

Tools of norms making

21. Our research has also identified a broad range of tools that are used to facilitate responsible behaviour in outer space.

- a. Which of the following tools and mechanisms do you feel are relevant to facilitating positive normative behaviour related to military and security activities in outer space?

Hardware design
Technical standards
Open data
Confidentiality
Dispute resolution mechanisms
Communication hotlines

Inspections
Diplomatic fora
Operational concepts
Activity automation
None

22. The emergence of norms or rules of behaviour can follow different pathways.

- a. Which paths do you see as the likeliest to develop additional security-related norms in space?

UN fora
Individual state practice/leadership
Multilateral agreement
Bilateral agreement

Civil society advocacy
Commercial advocacy
None of the above

- b. Care to comment?
- c. Identify obstacles that could prevent the further development of normative behaviour in security activities in outer space?

Questions

Now it's your turn to ask us questions.

- 23. If you have any questions or comments for the researchers, please submit them here.
- 24. If you would like to receive updates and outputs related to this work, please provide an e-mail address below.

End

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Project Ploughshares is a Canadian peace research institute with a focus on disarmament efforts and international security, specifically in the areas of the arms trade, emerging military and security technologies, nuclear weapons, and outer space security.