2023 AMOS Dialogue: Moving from Industry Best Practices to Space Traffic Management "Rules"

About Secure World Foundation

The Secure World Foundation strives to be a trusted and objective source of leadership and information on space security, sustainability, and the use of space for the benefit of Earth. We use a global and pragmatic lens to study and evaluate proposed solutions to improve the governance of outer space. While recognizing the complexities of the international political environment, SWF works to encourage and build relationships with all willing stakeholders in space activities, including government, commercial, military, civil society, and academic actors. Central to this approach is increasing knowledge about the space environment and the need to maintain its stability, promoting international cooperation and dialogue, and helping all space actors realize the benefits that space technologies and capabilities can provide.

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Since 2013, Secure World Foundation (SWF) has partnered with the Maui Economic Development Board (MEDB) to hold an invite-only workshop that promotes collaboration and cooperation on space situational awareness (SSA). This year's Dialogue was held on September 21, 2023, as part of the 2023 Advanced Maui Optical and Space Surveillance Technologies (AMOS) Conference.

The goal of the AMOS Dialogue series is to facilitate discussion among key stakeholders in space situational awareness (SSA), thereby promoting greater collaboration and cooperation to enhance SSA for safe and responsible space activities. To accomplish this, the Dialogue brings together representatives from current and future SSA programs and initiatives around the world with a variety of end users and stakeholders so that they may exchange information and views in a not-for-attribution setting.

This year's Dialogue looked at the growing number of industry best practices with the goal of possibly identifying how they can eventually evolve into space traffic management (STM) standards or rules. Overall, many participants felt that these best practices should be aspirational and not just rubber-stamping what is already being done and that they needed to be fairly easy to implement in order to ensure compliance amongst all actors (not just the more mature space powers).

The discussion started with an overview of a few industry groups and what they had identified as starting points for best practices. The first was an overview of the Space Safety Coalition's (SSC) **Best Practices for the Sustainability of Space Operations**. Their best practices are built on existing standards (such as the IADC space debris mitigation guidelines) and then expanded upon them. The SSC best practices are aspirational in nature, as the goal was to go beyond what could be done by consensus internationally. It is a live document, so once companies endorse an existing document, they can still contribute to the next set of revisions. SSC was the first organization to come up with the five-year end-of-life rule for satellites (as opposed to the 25-year rule) for post-mission disposal (PMD). It also has promoted the end of intentional fragmentation of satellites. The SSC's data-sharing policies are not just limited to sharing ephemeris or maneuver plans; they also include things like establishing points of contact.

Next, the group discussed the **Satellite Orbital Safety Best Practices Guide** that was jointly developed by the American Institute for Aeronautics and Astronautics (AIAA), SpaceX, Iridium, and OneWeb. These best practices were also aspirational, as they include practices that aren't done today. This allows the operators to go beyond what is actually being currently done, as opposed to the unfortunately frequent situation where such documents provide only the lowest common denominator and do not push the discussion forward.

This group found that the highest risks to their satellites are uncataloged recently-deployed objects. Thus, they believed it would be helpful for every operator to generate ephemeris in order to help match early tracks after launch and to provide maneuver ephemeris. There should be zero decay time on orbit: satellites should be intentionally deorbited at end of life, instead of slowly decaying over years or decades.

This group also found that If a satellite operator expects to have a lot of close approaches with another operator in its neighborhood, it is helpful to get non-disclosure agreements (NDAs) in place before it becomes a problem. For that to work, though, trust between the operators needs to exist. Operators should also optimize ground contact to meet their CA/COLA goals; burning later requires more delta/v, but it also means you might not need to maneuver at all. Operators should also share all conjunction data messages (CDMs).

It was pointed out that while progress has been made on these best practices, it has been largely a coalition of the willing and largely composed of U.S. and Western actors. The community needs to make sure this is an inclusive discussion that includes the rest of the world, not just the U.S./West, particularly since, over the past 20 years, there has been an increase in rocket body masses abandoned in low Earth orbit (LEO). Nearly 60% of the rocket body mass left in LEO over the last 20 years is from Russia and China, for example. In any case, a lot of the proposals come from the United States or other like-minded countries. They are often very detailed and good but sometimes flounder internationally because the other countries don't have the experience to understand why they're obvious or the capacity to carry them out. Sharing observations does not necessarily have to be about creating something new but rather clarifying existing rules and how they apply to new parts of the space sector.

The next part of the AMOS Dialogue shifted to developing "rules" for space traffic management (STM) and how best to get to a common set that can be implemented by all countries. Participants were asked to examine whether the focus should be on more common space activities where there is a lot of agreement or if there should be a focus on newer activities that don't have a lot of standards as of yet. Finally, the group was asked how much governments should be involved in this conversation: Should it let industry work it out itself, or should governments play a strong role in guiding and shaping the process?

One example given in response to these questions was the example of U.S. railroad interoperability back in the 1860s. It was pointed out that we need to look at design and building, not just operations, because many of the standards and practices flow from design choices.

The question was raised: what do we mean by rules? If we mean rules in terms of national regulation, then nation-states need to take the initiative and start making regulations at the national level. If we are talking about legally-binding rules, then it is pretty clear that states are going to be enforcers of the rules, but we also need to recognize that these international laws will take years—possibly even decades—to finalize, and then there is the free rider problem (why should countries put in place restrictive rules when others might not follow them?). But even then, it is not clear how or which actors will be involved in the conversations or even what sort of framework the rules may take; for example, the Open-ended Working Group on Space Threats discussed in Geneva what is responsible and irresponsible behavior in space,

but it did not promote not a legally-binding framework and not all space actors were involved in the conversations. There has been a different set of actors involved in discussions at the UN Committee on Peaceful Uses of Outer Space (COPUOS), which again is focused on non-legally binding norms.

Participants also pointed out that there is a proliferation of various efforts trying to address this problem. For example, the Net Zero Space initiative run by the Paris Peace Forum and the European Space Agency's Zero Debris Charter have some similarities. Participants discussed the need for a forum to hash out a harmonization of all these different sets of best practices, but the proliferation of such fora suggests there's no one place that all can agree on yet.

Many current initiatives also assume that we will have a federated approach, in that it will be a system of systems where we will have to work to find out how they can be interoperable, and we will have to have some sort of agreement about what rules to follow. One example to look at are the space debris mitigation guidelines, which started off as domestic standards, became elevated (and thus more general) to international guidelines, and then flowed back down to the national level in terms of how they were implemented.

It was noted that space powers are going to want to shape the international best practices to fit what they're already doing. If so, domestic agreement will be needed in order to bring opinions and goals to the international discussions. Within the U.S. government, who will be the convening power to start this conversation? Would it be DOD/NASA as existing experts and operators? DOC as the industry oversight? Or another agency entirely? How will that work in every other country?

The point was made that whoever writes the training writes the rules and that this is true at the national and international level.

In regard to how to get consensus at the international level, there was general agreement that one forum or resolution at one point in time is unlikely to resolve the problem. It is valuable to have discussions of longer-term issues for STM; the process does not have to be serial but rather can be a series of parallel conversations. The system must be flexible, as no one rule will govern everyone.

It is important to let owners/operators know what they need to do to put the best practices in place while concurrently, ways are needed to verify compliance with the rules. The point was made that if we want buy-in, the rules (and compliance with them) need to be simple; of course, the danger is that you have to be careful of going too far in the other direction and oversimplifying the rules, which can cause harm as well.

With the current focus on STM rules for active satellites, we should not lose sight of the fact that the majority of objects in space are not trackable and pose a huge challenge. We also need to think about best practices for shielding satellites, which starts with more data on debris-caused anomalies and how the community can start to report on those statistics.

One participant noted that official U.S. policy is to base regulations on industry practices, which is a different approach from how many other countries do it, and the U.S. policy is to try to get a base position on industry standards that support the industry while not favoring any particular industry organization. At the moment, the large constellation operators are leading on many of the best practices for CA/COLA, so should we allocate more authority to them to set the practices, and reserve the things they might not care about for the government to do so?

However, the industry cannot police bad actors, so the question is how to deal with irrational/risky/malicious actors. Looking at other domains suggests that the best way to do it is via an international organization and convention. While it will be challenging to do this and preserve

states' sovereignty, if we don't and there is a catastrophic event, states will end up losing their sovereignty that way. Perhaps a treaty process could be led by other countries than U.S./Russia/China in order to sidestep the current geopolitical impasse.

It was noted that most people want to do the right thing, so any effective system would make it easy for them to do so. However, it is hard to design a system that's easy to comply with. People can come up with different decisions from the same data; they can have the same data with different risk profiles; or they can have the same risk profiles with different data. Operators may also have limited/different opportunities to take action. The larger question is, how do we create a system that helps new entrants make good decisions, especially when they're trying to do new things? Finally, it was emphasized that what we're doing now is space traffic coordination; we might eventually move to STM, but that's a more advanced thing that will need to bring governments into the conversation.

A few participants noted that there are no venture capitalists (VCs) or other investors directly involved in current discussions on implementing best practices. There was a discussion about how such best practices might be used by future investors to help incent the adoption of space sustainability practices among new actors. Many of the signatory companies are VC-backed, so perhaps if VCs could use best practices as a tool in evaluating where to invest their money, they could help drive the proliferation of best practices amongst new actors.

At the end of the discussion, there was an effort to try and identify a few areas that should be prioritized for codifying STM "rules" first instead of trying to tackle everything at once. The group identified these areas as good places to start:

- Human spaceflight should have right of way over all other active satellites,

- Non-maneuverable satellites should have a transponder to help identify their location and owner more accurately (but no one currently has the authority to require this), and

- Owner/operators should share ephemeris data that also includes maneuvers, at least with other operators in their neighborhood, and ideally publicly.