International SSA/STM Policy Exchange
Autonomous Collision Avoidance Systems:
Impacts on Policy, Safety and Space Traffic Management
April 4, 2022

EXECUTIVE SUMMARY

The rapid emergence of large Low Earth Orbit constellations (LLC) over the last few years and Automated Collision Avoidance (ACA) systems increases the urgency to update SSA/STM policy around the world. This is an issue critical to the global community and the long-term sustainability of space. Acknowledging this issue, an international policy exchange (the 4th such event) consisting of governmental, and non-governmental SSA/STM subject matter experts and ACA experts was held in April 2022 seeking to identify, categorize, prioritize, and institutionalize approaches for addressing new complex concerns raised by ACA collision avoidance systems. The workshop attendees focused their discussion on identifying policy and regulatory innovations needed to maximize benefit from autonomous collision avoidance systems.

The organizers stand ready to support the international community to progress on SSA data sharing, questions surrounding ACA systems. We will build upon these findings and engage with the wider space operator community at Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS), September 2022.

BACKGROUND

The Maui Economic Development Board (MEDB) and the Aerospace Corporation led the annual International SSA/STM Policy Exchange on 4 April 2022. This was the fourth invitation-only International SSA/STM Policy Exchange held in conjunction with the Space Symposium in Colorado Springs, Colorado, USA. This year's exchange was held in-person. The exchange included international representatives from Australia, EU, EU SST, France, Germany, Japan, Poland, and the United Kingdom. U.S. government representatives attended from the National Space Council, Department of Commerce (NOAA), Department of State the Federal Aviation Administration, and the Department of the Air Force (SAF/IA). Non-governmental organizations attended from Space ISAC, CONFERS, Space Safety Coalition, Astroscale, and SpaceX/Starlink.

GOAL

The enduring goal of the International SSA/STM Policy Exchange is to provide an opportunity to develop and advance relationships among key international SSA/STM policymakers and to share and explore relevant opportunities and challenges among domestic agencies/ministries and transnational entities. This year's exchange sought to identify, categorize, prioritize, and institutionalize approaches for addressing new complex concerns raised by ACA collision avoidance systems. To accomplish this, the exchange built upon the key findings from the 2021 SSA Data Operator Exchange workshop. This year's session was cohosted by the Centre National d'Etudes Spatiales (CNES), the Space Agency of the Deutsches Zentrum für Luft- und Raumfahrt (DLR) and the UK Ministry of Defense (UK MOD).

PURPOSE

The 2022 International SSA/STM Policy Exchange informs and shapes international SSA/STM policies.

DESIRED OUTCOMES

Desired outcomes included (1) begin the discussion to identify, categorize, prioritize, and institutionalize approaches for addressing new complex concerns raised by autonomous collision avoidance systems (defining the problem), (2) identify policy and regulatory innovations needed to maximize benefit from autonomous collision avoidance systems, (3) seek participant updates in legacy SSA/STM efforts in order to learn from successes and identify emerging policy gaps and roadblocks, (4) identify a path forward on policy that can enable a degree of coordination and transparency into how each autonomous collision avoidance systems works, (5) relationship building among international SSA policymakers, and (6) spark discussions about innovative, new governance ideas.

KEY FINDINGS

1. ACA systems are widely seen as necessary to keep up with growing congestion in space, the deployment of Large LEO constellations, and the ever-increasing amount of space debris. The ACA system discussed operates on a spectrum of autonomy, i.e., from completely autonomous operations for spacecraft v. debris scenarios to "person in the loop" with owner operator notifications and coordination (if possible) for incidences between maneuverable spacecraft.
    a. Inconsistency in Conjunction Data Messages (CDMs) and data indicate a need for human judgment to decide. Cannot be fully autonomous, all the time.
    b. Also, sensitive to procedural bugs/glitches (e.g., Aeolus incident Sep. 2019)

2. ACA systems should be scalable, and transparent internationally.
    a. Bilateral agreements to deconflict between the two mutually ACA-enabled spacecraft commercial owner/operators currently exist but will not be sufficient as more ACA owner/operators, commercial and governmental, deploy ACA-enabled systems. Policymakers should consider how to establish processes and mechanisms to allow multiple ACA-enabled owner/operators to deconflict, coordinate, and provide transparency to make ACA-systems compatible and interoperable.
        i. A pre-requisite is contact information for all owner/operators to reach all other owner/operators on a 24 hour a day, 7 days a week basis.
    b. Policymakers will need to resolve potential international liability issues, support common standards, ACA rules of the road, and prioritization schemes. For example, priority order might be establish based on mission criticality such as for human spaceflight, operational non-maneuverable satellites, operational maneuverable spacecraft, orbit raising, spacecraft End-of-Life operations.

   i. An agreed upon prioritization scheme might establish when a person-in-the-loop is needed, and how much testing and regulation is required, and other criteria.
c. Policymakers should balance mandatory, regulatory ACA and STM requirements on commercial owner/operators that provide a public service, against voluntary guidelines and incentives for compliance. Policymakers should anticipate different perspectives internationally on the best balance and be prepared to work together to overcome barriers.

3. Governments and other investors are investing heavily in commercial SSA industry. Setting standards takes on new urgency. ISO, CONFERS, and other entities offer paths forward.

4. Burden sharing. LLC's and ACA systems exasperate the global space congestion and sustainability problem set. Key international stakeholders should consider a reasonable division of labor to accelerate solutions.

5. China's lack of transparency and participation in dialogue is a looming problem as China prepares to deploy their LLC with ACA system.

WAY AHEAD

Persistence. Keep implementing. Keep working it. Foster investment and innovation, research and development. Policymakers prioritize norms/rules of the road; common standards (not bilateral standards). Develop people, skills, hardware, software, and best practices.

PROGRAM ON 4 APRIL 2022

Welcome Remarks

Leslie Wilkins, Maui Economic Development Board (MEDB)
Jamie Morin, The Aerospace Corporation, Center for Space Policy and Strategy (CSPS)

Keynote presentation

Air Commodore Mark Flewin, Head of Operations, Plans and Training, UK Space Command.
Topic: Space Situational Awareness challenges and opportunities.

Overview of 2021 AMOS International SSA/STM data operators workshop findings

Mick Gleason, Aerospace Corporation

Panel Discussion: Autonomous Collision Avoidance Systems, Impacts on Policy, Safety, and Space Traffic Management.

Moderated by Jamie Morin
Panelists:
NASA CARA: Lauri Newman
US Dept of Commerce: Mark Mulholland
EU SST: Pascal Faucher

Astroscale: Dr Clare Martin
SpaceX/Starlink: Erik Babcock

U.S. Department of Commerce DOC/NOAA/OSC: Open Architecture Data Repository OADR demo.
Dr Stephen Volz, NOAA Assoc Administrator. Scott Leonard, DOC/NOAA/OSC

Roundtable Discussion
Moderated by Mick Gleason and Jeff Ansted
Opportunities and challenges created by automated collision avoidance systems. Organizational updates provided by Australia, EU SST, EU (EEAS), France, Germany, Japan, Poland, United Kingdom, United States.

Synthesis, Summary, and Next Steps
Jeff Ansted, Aerospace Corporation

Closing Remarks
Leslie Wilkins, MEDB
Jamie Morin, CSPS