2018 SSA DATA OPERATORS WORKSHOP

Meeting Notes

2018 SSA Data Operators Workshop

EXECUTIVE SUMMARY

The Maui Economic Development Board (MEDB) and the Aerospace Corporation led a workshop on Space Situational Awareness (SSA) Data Strategy from the perspective of SSA data operators. This was the third invitation-only International SSA Data Operator Exchange workshop held in conjunction with the Advanced Maui Optical and Space Surveillance Technologies (AMOS) Conference, on the Hawaiian island of Maui. This year's workshop took place on 12 September 2018 and included government, industry and non-governmental organization (NGO) representatives from Australia, Canada, France, Germany, Italy, Japan, New Zealand, Poland, Republic of Korea, Thailand, the United Kingdom, and the United States of America.

The enduring goal of the International SSA Data Operator Exchange workshop is to provide an opportunity to develop and advance insights and relationships among key international SSA data stakeholders including military, academic, civil, and commercial entities. To accomplish this, the workshop chooses timely topics relevant to the global SSA community and allows each participant time to present their views. This year's session was cohosted by the UK Defence Science and Technology Laboratory (DSTL) and the Deutsches Zentrum für Luft- und Raumfahrt (DLR) and the Centre National d'Etudes Spatiales (CNES).

The 2018 SSA Data Operator Exchange workshop was focused on development of unified SSA data strategy objectives for consideration at a policy level. A key aim was to help guide the international community in the development of a modern data strategy benefiting all members and ultimately improving global SSA.

The workshop was organized into a main session followed by three small breakout groups and allowed for "not for attribution" discussion. The main session included a keynote address, country perspectives, and an open question and answer session on Data Strategy use and development. The keynote address was given by Maj Gen Kimberly Crider, the Mobilization Augmentee to the Commander of Air Force Space Command (AFSPC) and former acting USAF Chief Data Officer on behalf of the current USAF Chief Data Officer. The three breakout sessions provided the participants with an opportunity to brainstorm data strategy objectives in a smaller group setting. The results of the breakout sessions were presented back to the larger group for discussion.

The main takeaways from the workshop were that a unified data strategy is necessary to transform the international SSA data sharing architecture. A strategy guides the evolution of disparate architectures towards common international objectives and goals in support of commercial and government activities spanning satellite operations, orbital safety and space security. Because there are so many sources of data, a strategy should be focused on an enterprise-centric or system-of-systems model to maximize data collection and sharing. Metrics to gauge the success or failure of each objective in the data strategy should be established upfront. For goals and objectives, data should be mission-oriented, be fit for purpose, include a thorough provenance and be as transparent as allowable to all SSA consumers. Trustworthiness is a key objective building on provenance, security and access control. Because data is a living creature, a unified data strategy must not cater too specifically to current needs or missions for three specific reasons. Foremost, in today's dynamic information environment, the rate of change is alarming. Second, when collaboration involves international aspects, not all missions (e.g., those supporting one's national security) are able to be fully exposed which can lead to unclear goals and/or expectations. And finally, analyses are quite often focused on unique applications of the data which can result in the creation of unachievable governance requirements. The data strategy must focus on the data itself which can be indeterminate at the outset and is quite different from a "mission" or "analysis" strategy,

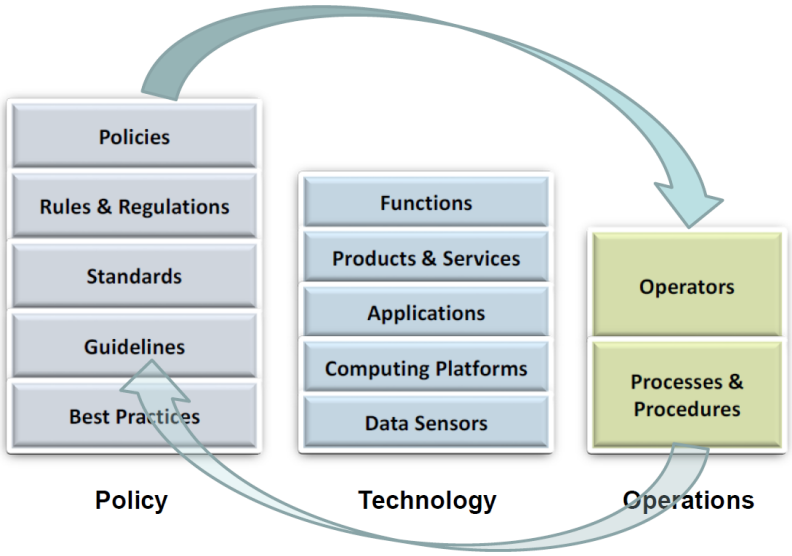
where we must know beforehand which data is "good" or "useful." Collaboration with multiple data sources help solve multiple hypothesis that explain the same data. Acknowledging not all data is useful, but to truly treat data as an asset, we must not bias our repository but rather allow for acceptance of the "unknown unknowns." There is value in comparative SSA, offsetting the need for one "watch" (gold standard data repository) across the community. To get started we must dissect the data down to its fundamental components (an ontology) uniformly accepted across all analyses and mission types (i.e., metadata, data type, etc.) and provide a means to catalog all data in a way so that it can be accessed at any time for any analysis or mission. Data standards are a luxury but publishing formats to access data is absolutely necessary.

OVERVIEW

Following this high-level summary will be a chronological summary of previous workshops in order to show how the conversation has evolved. Details from this year's exchange will be included as part of that. Highlighted are key concerns regarding data exposure, use, and cataloging, all with an eye toward a collaborative data strategy for improving global SSA.

BACKGROUND

Since 2016, Aerospace and MEDB have together led a series of International SSA workshops, one during the Space Symposium with a focus on international policymakers involved in SSA and the other during the AMOS conference with a focus on SSA Operators. These topic areas have been chosen to encourage SSA collaboration across the policy, technology, and operations communities. The graphic below depicts the areas of concentration within each community across which collaboration can occur.



While the workshops are not entirely dependent on each other for content, the intent is for ideas and topics from one workshop to help shape the next ensuring robust and diverse discussions across the communities.

WORKSHOP RECAP

2016

SSA Data Operator Exchange - AMOS

In September 2016, the inaugural International SSA Data Operator Exchange workshop at the AMOS conference was led by the MEDB and Analytical Graphics Inc. and cohosted by the UK Defence Science and Technology Laboratory (DSTL) and the Deutsches Zentrum für Luft- und Raumfahrt (DLR). The main topic that year was key challenges in SSA. The following table captures the key challenges, proposed resolution and recommended action.

Key Challenge	**Proposed resolution**	**Action**
Need forum to exchange key challenges and work to a common solution	Host International SSA provider exchanges at key conferences such as AMOS	MEDB to explore options
Need organizing body to help facilitate these exchanges	Maui Economic Development Board Other non-profit	
Different terminology with similar meanings leads to communications issues during international exchanges	Develop a dictionary of common terms Develop a common taxonomy	Each international SSA provider to draft a list of common SSA-related terms to share with other providers
Less experienced providers are having to learn basic practices that more experience providers have mastered	Develop and share best practices Hold SSA short courses at AMOS Hold multi-national SSA data exchange exercises Exchange officers Multi-national cells (e.g., Germany)	MEDB to explore short additional courses for next AMOS conference
International SSA data providers are confused with organizational structure of allied partners	Each government should develop and share a diagrammatic representation of their organization	Each international SSA provider to draft and share a diagrammatic representation of their organization
SSA data is used incorrectly (e.g., using TLEs with special perturbations propagator)	Develop guidelines and recommendations on how to use data products	
Data access	No resolution discussed	

2017

International SSA Policy Exchange - Space Symposium

In April 2017, the International SSA Policy Exchange workshop entitled Space Situational Awareness in an Evolving World was held during the Space Symposium at the Broadmoor in Colorado Springs. The event included 40 participants from 8 nations (Australia, Canada, France, Germany, Japan, New Zealand, UK and US) and included dialog on the issues, challenges and potential solutions in the areas of Orbital Safety and Mega-Constellations. The workshop included 2 panels, one on orbital safety and the second on impacts of mega-constellations. Key points from each panel are listed below:

- Orbital Safety

- Orbital safety implies providing information to operators on other hazards, such as RFI and space weather
- The orbital safety challenges of LEO are becoming particularly acute due to orbital debris and mega-constellations --we need to do more to preserve the LEO environment for commerce
- Nations should consider sharing threat information with commercial operators to help them avoid foreseeable problems
- Nations need viable regulations and universal rules-of-the-road for space activities
- Continue to encourage data sharing starting among nations
- Incorporate new technology into orbital safety, leveraging innovation from industry

- Mega-Constellations
  - We are likely to dramatically increase the pace of "real-time" space planning and operations as these new constellations evolve - should aim to automate space situational awareness and orbital safety services to the maximum extent possible
  - Given current filings there could be up to 10,000 new satellites in LEO and MEO
  - The 18th Space Control Squadron provides COLA, launch support, early orbit, on-orbit, end-of-life disposal, deorbit, and reentry support
  - We need better fidelity of tracking to reduce the number of conjunction warnings as more objects are added to the population of orbiting objects
  - Owners should be encouraged to register their satellites when they are put in orbit or soon thereafter
  - New constellation should ideally have best practice guidelines to follow for satellite operations and disposal
  - Should there be the equivalent of orbital slots for LEO operators? Could this work?
  - Should there be higher reliability requirements for satellites in large constellations?
  - Best practice should be captured and published/guidelines developed for satellite operations and constellation maintenance
  - A significant increase in data will result from the new tracking capabilities and as constellations come on line. There needs to be more consideration of the implications of this in advance.
  - There were options for data management - a single shared picture that includes source data, or multiple sets of shared data
  - Satellite operators should be encouraged to talk with each other as part of development of best practice
  - Is it sustainable/credible to 'hide' satellites that are classified when everyone knows where they are? Commercial tracking entities will put position info on classified satellites in the public domain-enthusiast already do. The classified aspects might be what the satellites do, not where they are.
  - Development of a master catalog/data set/operational picture will revolutionize space situational awareness

SSA Data Operator Exchange - AMOS

In September 2017, the International SSA Data Operator Exchange workshop at the AMOS conference was led by the MEDB and Aerospace Corporation and cohosted by the UK Defence Science and Technology Laboratory (DSTL) and the Deutsches Zentrum für Luft- und Raumfahrt (DLR). The main topic was Space Traffic Management (STM) and Mr. Jeff DeTroye, from the United States (US) Federal Aviation Administration (FAA), provided the keynote address with the following summary points:

- Although the US Congress needs to give authority and as such, the timeline is unclear, the US is moving to a Civil Space Traffic Management approach.

- The FAA has been given the action to work with US Department of Defense and is creating a joint pilot program due to begin soon and run for 1 - 1.5 years.
- The pilot program seeks to maximize use of commercial capabilities, create a "learning" organization to minimize onboarding time, and utilize observations from multiple sources as international partners are very important.
- The business model is still in discussion and innovative analysis techniques are being examined. In the interim, the US DoD via the 18th Space Control Squadron (18SPCS) at Vandenberg Air Force Base (VAFB) will continue to provide this function.

Leveraging the international nature of the workshop, the perspectives of the host countries are highlighted below:

Germany

- German SSA Centre is in a build-up phase - full operations planned for 2020 - 2021.
- All nations are facing similar problems – e.g., expecting mega constellations in the future. We all need to work together, but someone has to drive this with rules and regulations. The US FAA initiative has lots of good ideas.
- Ensure 3 phases are covered to be successful
    - Launch phase
    - Life cycle phase (operations in space)
    - Re-entry phase (end of life activities)
- LEO Ring of "death:
    - Non-maneuverable objects that decay slowly
    - Maneuverable to very low orbit to decay

United Kingdom (UK)

- Looking to increase presence in space
    - UK spaceport
    - Space tourism
- We must understand how to keep space safe during all phases: launch, on orbit, end of life
- We all must work with our partners - international and industry
    - We operate in FVEY (US, UK, Canada, Australia, New Zealand) and EUSST (European Union Space Surveillance Tracking) communities to share and exchange data
    - Looking to UK industry for solutions, new capabilities
- Desire to develop a closer relationship with the UK Space Agency (UKSA) and academia. Looking to enhance the new National Space Operations Center (SpOC) in High Wycombe to feed the STM piece.

United States (US)

- Popular misconception that the 18SPCS does NOT do STM – they do provide services needed by the public, but “management” implies a level of control which they do not have. They strive for the best quality of data to empower space operators.
- Working towards more collaborative environment to influence responsible actions
    - How do we best advance that collaboration with a national security mandate?
    - Need to be more transparent and have open communication and a willingness to work with other partners
    - These types of forums are good for establishing these relationships - even as simple as sharing contact information

Following a lively question and answer session, the workshop wrapped with the following outcomes:

- Consider leveraging the FAA initiative as a pathfinder for a global solution
- Solicit commercial solutions for data acquisition, automation and fusion
- Develop command standards and datasets
- A global solution is necessary to solving this problem; a prototype will facilitate identifying challenges and applying potential solutions
- Many policy and regulatory frameworks need to be developed which is challenging due to the many new space actors

2018

International SSA Policy Exchange - Space Symposium

In April 2018, the International SSA Policymaker Exchange workshop was held during the Space Symposium at the Broadmoor in Colorado Springs. The title of the workshop was Policy and Regulation Impacts on Space Traffic Management. There were four speakers: 1) Prof. Dr. Kai-Uwe Schrogl, Chief Strategy Officer, European Space Agency; 2) Dr. Bhavya Lal, Institute for Defense Analyses Science and Technology Policy Institute; 3) Richard H. Buenneke, Senior Advisor, National Security Space Policy, Office of Emerging Security Challenges, Bureau of Arms Control, Verification and Compliance, U.S. Department of State; 4) Wolfgang Duerr, Senior Vice President, Director Space, Airbus Defense and Space, Inc.; Chairman of the Working Group on Military Space Applications of the German Aerospace Association (BDLI); BDLI representative to the Space Situational Awareness (SSA) Users Representatives Group of the European Space Agency (ESA). Key points from the presentations included:

- Space Traffic Management (STM) defined as "the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space and return from outer space to Earth free from physical or radio-frequency interference."

- A number of initiatives and research have been underway since 2006. The 2018 study is going to deliver: a multidisciplinary approach, global participation through contributors and advisers, update of space activities 2030, detailed set-out of potential traffic rules, structure for a STM regime outlining legal instruments down to the level of articles, and a concrete roadmap for implementation with timeline.

- The national security of the US is central to everything. We need to rethink our policies. International action has not worked to ensure peace. We need to lead the initiatives not follow them. If we secure space, everyone in the world benefits.

- There are 4 pillars to the US strategy:
    - Transform into resilient Space architectures
    - Strengthen deterrence and warfighting
    - Improve foundational capabilities
    - Foster conducive domestic and international regulations and rules

- Industry is transforming in highly disruptive ways. How does the US react to the fact that they don't control the data? We need an ITU role in Space. Time is of the essence.

2018
SSA Data Operator Exchange - AMOS
Main Session

To kick off this year's workshop, Mr. Shawn Sloan, a data scientist with Aerospace Corporation, presented an introduction to data strategies and how the new space data strategy can be successfully developed across the enterprise. Discussion during and following Mr. Sloan's talk uncovered that an area ripe for growth is the mission assurance behind the SSA operational construct. To help pave the way toward utility, it is vital to keep in mind that information relating to the data being mined (pedigree, traceability, format, authority, etc.) must be returned, along with status on any impact preventing successful prosecution of the mission. As the data strategy matures, curation of the mission will occur to help ferret out the most critical bits of data, identify secondary and tertiary ways to satisfy queries, streamline the information backplane, add trustworthiness, and ensure interoperability. Development of governance and standards are key to overall system quality and integrity and ensuring a robust and measurable information exchange, but should not limit creativity and collaboration.

Following Mr. Sloan, Maj Gen Kimberly Crider provided the keynote address on behalf of the USAF Chief Data Officer entitled "Harnessing the Power of Data." Maj Gen Crider came to the topic with a wealth of experience as the former Air Force Chief Data Officer and the current mobilization assistant and Chief Data Officer (CDO) to the Commander, AFSPC. A quote by Honorable Secretary Heather Wilson, United States Air Force cited at the outset of Maj Gen Crider's presentation well sums up the points made: "The advantage in today's competition will go not to those who create the best technologies, but to the ones who can integrate and adapt faster than the adversary." Data is a strategic asset, an item of value, a source of competitive advantage and thus we need to understand why we need it and realize that it gets better the more it is used. When data and services are judiciously added to traditional assets such as people and capabilities, mission performance can be brought to the next level. Maj Gen Crider highlighted key concepts from her work as the acting CDO for the US Air Force and discussed how these principles can and will be applied to space and most specifically, the SSA mission area. She noted that because space is the key to successfully executing command and control across all domains, we must stay ahead of our adversary by purposely collecting, making sense of, and properly sharing relevant data and consistently leveraging it to be fully cognizant of their OODA (Observe, Orient, Decide, Act) loop and where they are within it at all times.

Dr. Moriba Jah from the University of Texas at Austin followed Maj Gen Crider. Dr. Jah's presentation was entitled "Managing Risks in SSA Data" and covered the notion of "group think" which can result from data fusion. Assertions should be examined and vetted to prevent an unwarranted bias and toward this end, pulling from diverse sources can prove fruitful. He illustrated this point through the concept of a really busy day, which on the surface seems productive, but when examined, turns out not to be, i.e., lots of data does not necessarily equal quality "information." Ensuring the right information is in the right place at the right time is an art. In the SSA mission area, we are working to provide decision makers with actionable information, thus the data we collect, process, correlate, store, forward, leverage, share, and disseminate must be in alignment with that principle. Toward this end, a key sentiment from Dr. Jah is that you "Can't Manage What You Don't Know; [and you] Don't Know What You Don't Measure. To Know it, you MUST Measure it; to Understand it, you MUST Predict it!" Additionally, he made the point that the "truth" behind a piece of data or dataset is a key element in ensuring that the "data pool" is not inadvertently (or intentionally) polluted. One must "know thy data [and what you] can assume and what [you] can't." Multiple datasets can help us ensure we have the right answer to the hard question, just as having several watches helps us be sure we know what time it is. In addition, Dr. Jah presented a mind map (below) on Space Traffic Management that was created as part of an workshop held earlier in the year in Edinburgh Scotland.

<u>Breakout Groups</u>

Following the main session, the group was separated into three parts to explore the breakout topic - brainstorming on International SSA Data Sharing Objectives. The contributions from each group are shown below:

Group One

- Strategy for who?
  - The US
  - Satellite operators
  - Our children
  - Each nation
  - The vault
- Characteristics
  - Accessible
  - Timely
  - Comprehensive
  - Accurate
  - Assured
  - Protected
- Goals
  - Safety
  - Mission success/surety
  - Responsible behaviors/norms
  - Attribution

    - Transparency (or the appearance of such)
- Sharing
    - Needs to provide value
    - Should enhance participants/alliances

Group Two

- Goal: Max transparency of data (depends on mission)
    - Objectives:
        - Improve knowledge of environment
        - Protect RSOs/achieve effects
        - Protect environment
        - Develop/improve technology
        - Decision quality info (vs. advisory tip)

Group Three

- Increased resiliency
- Transparency/confidence
- Traceability
- Integrity
- Pedigree through increased diverse collaboration/shared cost
- Emphasize community

As each breakout group relayed their findings to the larger audience, a common theme became apparent: transparency is a big issue. If we can get this right and follow the chain of custody correctly, then the world will become much smaller, we can all share the cost, and the overall effect will be to exponentially improve the pedigree and usefulness of the data. To best do this, we need to look beyond our traditional sensor sources and respect the views of each contributing user. Our goals for use of the information may differ, but if handled with care, collectively we will all be better for the expanded collaboration.

CONCLUSIONS AND NEXT STEPS

Overall, the group attending the International SSA Data Operators Exchange workshop at AMOS hailed the exchange as a positive one. The industry perspectives were noted as interesting and adding value and there was a keen desire to promulgate the key discussion points to senior decision makers. To ensure preservation of the momentum coming from this and previous sessions, several attendees asked the workshop leadership to define attainable goals with measures for success. These can then be tracked from session to session and worked on in between. With an enthusiastic nod to the next International SSA Policymaker Exchange workshop at the April 2019 Space Symposium, where additional discussion on data sharing mechanisms and awareness of successes and pitfalls.