Space Situational Awareness in the Joint Space Operations Center

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CONFERENCE PAPER

Flight safety of orbiting resident space objects is critical to our national interest and defense. United States Strategic Command has assigned the responsibility for Space Situational Awareness (SSA) to its Joint Functional Component Command – Space (JFCC SPACE) at Vandenberg Air Force Base. This paper will describe current SSA imperatives, new developments in SSA tools and developments in Defensive Operations. Current SSA processes are being examined to capture, and possibly improve, tasking of SSN sensors and "new" space-based sensors, "common" conjunction assessment methodology, and SSA sharing due to the growth seen over the last two years. The stand-up of a Defensive Ops Branch will highlight the need for advanced analysis and collaboration across space, weather, intelligence, and cyber specialties. New developments in SSA tools will be a description of computing hardware/software upgrades planned as well as the use of User-Defined Operating Pictures and visualization applications.

1. SPACE SITUATIONAL AWARENESS IMPERATIVES

Deputy Secretary of Defense, Honorable William J. Lynn stated [1] the current space domain is a contested, congested and complex environment. As such, the Department of Defense requires near real-time awareness and assessment of the space environment, forces, and threats. Current SSA capabilities are insufficient to maintain pace with an increasingly difficult and challenging environment – one metric for measuring performance of the space surveillance network manifests itself in the number of objects considered “lost” or, in other words, not tracked for a period greater than 30 days. The Joint Space Operations Center (JSpOC) requires highly responsive SSA capabilities that rapidly detect, track and characterize objects in space. As such, new developments in SSA tools and data sources, streamlined processes, and a new way of thinking to provide the Commander, JFCC SPACE the capability to assess and respond to events in space are imperatives for the future.

2. NEW DEVELOPMENTS IN SSA TOOLS

Existing SSA processing and analysis are performed on the Space Defense Operations Center (SPADOC) and Correlation, Analysis, and Verification of Ephemerides Network (CAVENet) systems. These 614 AOC legacy systems accomplishing catalog maintenance and conjunction assessment have exceeded design limits forcing JSpOC operators to experience degraded system performance due to resource conflicts and task time delays [2]. As such, continuing improvements in both hardware components and software algorithms are necessary to sustain existing processes until follow-on systems are available. The JSpOC recently completed a hardware migration and software update for the Astrodynamic Support Workstation (ASW) Maintenance Action Project (AMAP) to migrate to sustainable LINUX Operating System servers and correct deficiencies in software tools. Additionally, several new SSA tools are in development to refine orbit prediction accuracy and to reduce the JSpOC analyst workload.

3. PROCESS ANALYSIS

Since the Iridium 33 collision with Cosmos 2251 in February 2009, the JSpOC fundamentally changed its position and process for screening and notification of active payloads conjuncting with secondary space objects. Prior to the collision, the JSpOC reported potential conjunctions for active DoD payloads only. Since that time, US Strategic Command (USSTRATCOM) has completed SSA Sharing agreements with 27 owner/operators and requests for SSA Sharing support has increased since January 2011 from 2 requests per month to now over 20 per month. USSTRATCOM has issued at least 7 modifications to its space operations OPORD in the last year specifically related to SSA Sharing. Additionally, 24 new civilian positions were created at the JSpOC to assist with the increased workload of screening now over 1000 active space objects against the 22,000+ space object catalog.

While existing processes are currently able to match the demand, JFCC SPACE has undertaken a value-stream map analysis process of existing SSA Sharing processes and will soon expand the process analysis to the entire JSpOC SSA enterprise with the goal of documenting existing SSA processes and procedures to identify areas for improvements and efficiencies. Sensors are tasked and active satellites are screened for collisions every 24 hours. Screenings are done by according to defined orbit regimes by a combination of military, civil service and contract personnel. The conjunction assessment process has evolved over time and, in some cases, been adjusted to compensate for system limitations. The objective of the value stream analysis is to identify those areas in the SSA Enterprise that can be modified and streamlined, from a process perspective, to allow JSpOC operators to focus on higher-end analysis of the SSA data.

4. DEFENSIVE SPACE CONTROL DEVELOPMENT

Our ability to detect, characterize, monitor, attribute and prevent/mitigate threats to US space systems, in other words, achieve space superiority is not a new challenge but one that is becoming increasingly important. Advanced knowledge of spacecraft owner/operator actions cannot be assumed in a contested environment. Therefore, it is incumbent upon the DoD to construct a cohesive defensive space control strategy or framework to anticipate and manage the risk. The current JSpOC structure does not include a dedicated defensive space control (DSC) team nor does it have the tools necessary to maintain the necessary awareness of the environment. In order to develop and promote a DSC culture throughout JFCC SPACE, a small team was formed in June to establish and integrate DSC processes, produce sample courses of action, define requirements and identify capabilities. The team's objective is to identify, fuse and assess pertinent traditional and non-traditional data to protect US space systems. The team is aligned using a links and nodes (space and ground) approach and is designed with collaborative partnerships with the space protection and intelligence community. The JSpOC has achieved several "low hanging fruit" successes since the inception of the team with many more advances expected over the coming year.

5. PREVIEW OF SSA IN A NET-CENTRIC ENVIRONMENT

The most significant development in revolutionizing mission systems since the inception of the JSpOC came with the delivery of Capabilities Pack Zero (CP-0) of the JSpOC Mission System (JMS). While JMS has far-reaching goals to provide services and applications across the entire JFCC SPACE portfolio, it's potential impact to SSA is notable. With JMS, the JSpOC is on the verge of entering the net-centric age to promote data discovery, encourage the use of non-traditional sensors, eliminate air-gapped data transfers, and provide user-defined operational pictures that engage the human sensory system beyond flat files of text-based information. Not only will JMS automate and accelerate processing of critical SSA data, but it will also encourage an operator's creativity in finding new ways to accomplish traditional mission sets or innovative ways to advance the art of the possible. There is already evidence of the process improvements associated with CP-0 with many more successes yet to come.

6. REFERENCES

6.1 References

1. Lynn, William J., Deputy Secretary of Defense, 2010 Space Symposium Remarks on Space Policy, Omaha, Nebraska, 3 Nov 2010.
2. Armantrout, John L., 14 AF/A5 Director, Plans and Requirements, Memorandum for HQ AFSPC/A5C, "614 AOC Legacy System Sustainment," 24 Mar 10.