



Space Weather

MEETING REPORT

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Key Points:

- Both commercial and government have interest in curated and shared satellite anomaly information
- International efforts through agencies such as the Coordination Group for Meteorological Satellites (CGMS) are underway to routinely collect satellite anomaly information

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Summary of Stakeholder Inputs on Development of a Satellite Anomaly Database From the European Space Weather Week

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Abstract Stakeholders met at the recent European Space Weather Week to discuss the development of a satellite anomaly database. This summary reviews the presentations and suggestions given at the discussion session. Presenters reviewed ongoing international efforts to collect and distribute satellite anomaly information. Well-defined suggestions were given for different possible frameworks. Group discussion after suggested that a way forward would be to first demonstrate the utility of an anomaly database with available public anomaly information. More discussion is needed to define the exact framework for future implementation.

1. Meeting Summary

At the most recent European Space Weather Week held at the end of November 2017, stakeholders gathered to discuss the value and development of a satellite anomaly database. The concept is not new but has gained attention recently as both government and commercial institutions have expressed interest in such a resource because it can help with analyzing, understanding, and mitigating anomalies. Existing databases, while of value, are not all actively updated and maintained (such as that held at the National Oceanic and Atmospheric Administration's National Centers for Environmental Information (NOAA NCEI), <https://ngdc.noaa.gov/stp/satellite/anomaly/satelliteanomaly.html>), are often not publicly available, lack critical engineering data, and exact location and times needed to determine the likely cause of anomaly, or may be difficult to access and navigate.

Several presentations were given at the discussion to provide background information and review recent progress both in the government and commercial sectors. These presentations covered various governmental activities within different nations as well as coordinated international projects. Within the United States, the National Space Weather Action Plan, Section 4.2.8 states that the “Department of Commerce and the Department of Defense will create and support a satellite anomaly database to enable secure collection and analysis of satellite anomaly data related to space weather” (National Science and Technology Council, 2015). It was reported that the work is ongoing, and details on the scope and progress of this action are not yet available. On the international arena, the World Meteorological Organization 4-year plan states that the group will collaborate with the Coordination Group for Meteorological Satellites (CGMS) to review the procedure for recording spacecraft anomalies attributed to space environment, including the archiving and utilization of this data. The CGMS has requested that member agencies deliver reports on satellite anomalies at Plenary Sessions and has given these agencies a template for anomaly information to be tracked. The template is derived from an Aerospace report (O'Brien et al., 2011) and includes information such as the universal time, spacecraft location, and initial guess of the type of anomaly. (Some agency reports of anomalies such as CGMS-44-EUMETSAT-WP-19.pdf, CGMS-44-NOAA-WP-01.pdf, and GMS-44-KMA-WP-01.pdf are available by downloading Working Paper Reports at <https://www.cgms-info.org/agendas/Downloads.aspx>). The importance of collecting a complete set of anomalies and not just suspected space weather related ones through the CGMS and any future database collection effort was highlighted by the stakeholders. Some unexplained anomalies may in fact be attributed to space weather after more thorough analysis. A complete set would also be beneficial to those developing attribution tools to differentiate between anomaly types and would quantify the overall relevance of space weather impacts. The CGMS Space Weather Task Team has also distributed a space weather anomaly survey to its members. Responses are currently being reviewed. This exciting initiative provides proof that coordinated collection of anomaly information is possible and is an example that should be followed by other stakeholders and organizations in the future.

Additional presentations from commercial stakeholders described some challenges to consider including (1) anomaly information may reveal an operational weakness that may be detrimental to business in a

competitive market, (2) issues of liability from attribution, and (3) sensitivity on the part of satellite service customers. It was suggested that a robust legal framework would need to be established to protect the interests of both those handling the anomaly data collection as well as those providing data and subscribing to receive products based on pooled information. Two possible frameworks were presented: a curated pool and a standardized share. In the more favorable curated pool framework, subscribers would voluntarily submit specific anomaly information to a “trusted agent,” which would include actual satellite position, time, and suspected cause. The information would be covered in a nondisclosure agreement that would prohibit direct sharing with others. The trusted agent would apply an agreed upon algorithm to obfuscate the information such that individual spacecraft could not be implicated. The trusted agent would provide specific space weather anomaly forecasts and analysis to data providers based on comparisons of their information against the pool of data. They would also provide general service products to all subscribers using only the obfuscated data. The less favorable standardized share framework would allow data providers to obfuscate their own data before providing it to the anomaly database. This framework is less likely to provide relevant and valid data because subscribers would not benefit from analysis by the trusted agent and nonstandard obfuscation could make the data unreliable.

Lastly, it was suggested that commercial satellite operators benefit from collecting anomaly information because they have an interest in better understanding any on-orbit performance issues. Satellite operators often rely on satellite manufacturers for on-orbit anomaly analysis. However, one major operator described anomaly analysis by satellite manufacturers as highly variable in their approach. As a result, the operator was tracking and performing their own anomaly analysis. Beyond just creating a database, it was recommended that a forum be created for operators, manufacturers, and others to openly discuss anomalies and procedures for analyzing events. The forum may begin with a workshop on “Environmental Anomaly Analysis” that would discuss typical space environment anomalies, timelines, data sources, and available and needed tools.

Group discussion after the presentations suggested that a way forward would be to first demonstrate the utility of an anomaly database. A successful demonstration could be used to encourage international institutions already involved to begin developing a more formal framework such as the “curated pool” and putting in place any needed legal or intergovernmental agreements. The demonstration could be done with publicly available anomaly information such as the reports from the CGMS and would need to show the benefit of the database as well as test viable obfuscation methods. A possible structure was suggested where data providers would contribute anomaly information to a trusted agent within their country or region such as EUMETSAT or NOAA. From there, the information would be provided to an overarching organization such as the World Meteorological Organization to create an international collaboration. Further discussions at future space weather forums are needed to continue defining a workable implementation.

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