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Feb 26th, 2:00 PM

ASTRIA Ontology: Open, Standards-based, Data-aggregated Representation of Space Objects

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Wolfgang, Jennie; Krysher, Kathleen; Slovenski, Michael; Karadkar, Unmil P.; Iyer, Shiva; and Jah, Moriba K., "ASTRIA Ontology: Open, Standards-based, Data-aggregated Representation of Space Objects" (2019). *Space Traffic Management Conference. 2*. <https://commons.erau.edu/stm/2019/presentations/2>

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ASTRIA Ontology: Open, Standards-based, Data-aggregated Representation of Space Objects

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Abstract

The necessity for standards-based ontologies for long-term sustainability of space operations and safety of increasing space flights has been well-established [6, 7]. Current ontologies, such as DARPA's OrbitOutlook [5], are not publicly available, complicating efforts for their broad adoption. Most sensor data is siloed in proprietary databases [2] and provided only to authorized users, further complicating efforts to create a holistic view of resident space objects (RSOs) in order to enhance space situational awareness (SSA).

The ASTRIA project is developing an open data model with the goal of aggregating data about RSOs, parts, space weather, and governing policies in order to provide a comprehensive awareness of space objects and events. The first step in this direction involves modeling RSOs. Our standards-based, graph data model adopts design and documentation best practices as well. The model expresses data using well-known general-purpose data modeling schemas (such as Dublin Core [1] and OAI-ORE [4]), and orbit representations (such as Keplerian elements and position-values), and controlled vocabularies (e.g. DISCOS classifications of space debris, orbital regimes, and fragmentation events [3]) expressed as Resource Description Framework (RDF) triples. Recognizing uncertainties in tracking as well as associating RSOs with known objects, our model supports name or track-based initiation, incremental specification, and uncertainty in association.

De-siloing data is the first step toward enabling discovery regarding impact of the space environment and human based activity on space object behavior. We intend the ASTRIA ontology to support data-driven decision-making processes in order to make the space domain safe, secure, and sustainable.

References

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[4] Open Archives Initiative. 2008. ORE Specification – Abstract Data Model (Retrieved in Nov. 2018, <https://www.openarchives.org/ore/>)

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