

This talk will describe the impact of the Space Domain Knowledge Modeling project [1], an effort with origins in 2011, to create conceptual models and provide knowledge representation, organization, management and reasoning for space data, applications and operations. It has been expressed in collaborative and singular activities, such as ESA call for proposals, NASA activities and technical reports [2], and webinars. The talk will briefly summarize concepts of knowledge management and representation, conceptual data modeling, knowledge graphs and ontology, giving the audience an introductory understanding of key concepts. The work will then be introduced, demonstrating relevance to a number of the workshop topics—from knowledge graphs and ontology to natural language to MBSE. This includes the following: a practical example application of a space ontology [3] will be shown in the form of an interactive 3D visualization [2]; introduction to some ontologies [1] (such as the Spacecraft Ontology, the Space Situational Awareness Ontology [3], Space Mission ontology, the Orbit Ontology, etc.); relevant works (to ESA [5][6][7][8] and beyond); relevance to national or international standards efforts for space [10]; the importance of multi-lingual aspects in terminology [9] [4]; relevance to contemporary trends of open data (e.g., methods of FAIR); the flexible methodology for ontology development. Future work will demonstrate use-cases and benefits such as interoperability, data integration of disparate sources, and continued development of the given models. The talk will be open to attendees constructive input on how to support the work, advancing it for improving global space safety, sustainability, and security.

[1] Space Domain Knowledge Models, <https://purl.org/space-ontology>

[2] An Ontology-based Virtual Orrery, NASA Technical memorandum  
<https://ntrs.nasa.gov/citations/2021000030>

[3] “Preliminaries of a Space Situational Awareness Ontology”, Rovetto, Kelso, 2018.

[4] “Research & development in Astronautical Terminology - A project summary and call for support”, IAC 2022 <https://iafastro.directory/iac/paper/id/70941/summary/>

[5] “Model-based Astronautical Systems Development: A project and call for support”,  
<https://atpi.eventsair.com/QuickEventWebsitePortal/esaw-2021/website/Agenda/AgendaItemDetail?id=1e4811b9-1143-478a-bec6-e262958df952>

[6] “Space Situational Awareness (SSA) Ontology and Knowledge Graphs for ESA's SSA Program”, ESA IDEAS Knowledge to Boost Space Activities, grant proposal. (Top-5 Finalist)  
<https://ideas.esa.int/servlet/hype/IMT?documentTableId=45087150951842400&userAction=Browse&searchTerm=cm92ZXRObw&templateName=&documentId=c82b75da554ff6b58dab9f088dd89e8d&searchContextId=cf0b62e8960e063eba8da635303a2581>

[7] ESA Space Debris Conference <https://conference.sdo.esoc.esa.int/proceedings/sdc7/paper/1046>

[8] "Creating Semantic Reference Models for Spaceflight – An Ontology and Knowledge Graph Suite to support Astronautics", <https://op.europa.eu/en/publication-detail/-/publication/41b06a9b-e388-11eb-895a-01aa75ed71a1/language-en/format-PDF/source-281648236>

[9] "Space Traffic Management Terminology",  
<https://www.sciencedirect.com/science/article/abs/pii/S2468896722001069#!>

[10] "Human Spaceflight: Spacecraft Architecture and Systems Engineering Ontology (ANSI/AIAA S-153-2021)"