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INTERNATIONAL SPACE REFERENCE ARCHITECTURE (ISRA)

Abstract

The increasing pace of space systems design, development, and deployment in the public and private sectors, both domestic and international, is applying significant stress to "the commons" of the space domain. At the same time, the classic "tragedy of the commons" is unfolding in space with both rapidly increasing debris and Near-Earth Objects (NEOs). While traditional Space Situational Awareness (SSA) and emerging Space Traffic Management (STM) efforts promise to address critical issues in the space commons, the agreements required for effective cooperation to achieve these goals are substantial and can benefit from a structured architectural approach. The agreements required for SSA and STM range from launch coordination, to operations in space, to re-entry, and cross both operational domains and sovereign national boundaries. All agreements must use technical, operational, and policy language which is understood and agreed across stakeholders, such that agreements are unambiguous and enforceable. However, there is no central intermediary organization for which all nations could agree will mandate such language and other standards. The alternative is to use multi-lateral cooperation to establish needed language and standards, however even this approach requires a framework to inform and structure such multi-lateral activities. This paper proposes an International Space Reference Architecture (ISRA), as the foundation for shared agreements which support and enable SSA, STM, and related space activities. ISRA is intended to be an internationally governed effort, and sets the foundation for multi-lateral technical, operational, and policy standards and recommendations. ISRA is comprised of four pillars. The first pillar is comprised of existing standards, best practices, behavioral norms, and tactics techniques and procedures (TTPs) in space operations that are common to all stakeholders. The second pillar is a shared vocabulary upon which to base emerging architectures and policy. The third pillar is a surface to space concept of atmospheric flight and space objects and transition to and from and supporting situational awareness and operating methods. The fourth pillar is the use of a decentralized and blockchain-enabled means of information sharing which enables maximal participation among diverse stakeholders. ISRA is intended to be an internationally governed effort, informed by ongoing MITRE-led, Multi-FFRDC (e.g. Aerospace, Rand), and international community; each contributing topics in space and blockchain concepts, prototypes, and architectures in support of government sponsor interests.