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Space Technology and System Management Practices and Tools (3)

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## TOWARDS MULTI-DOMAIN TRAFFIC MANAGEMENT

**Abstract**

Space vehicle launch is gradually on the rise. As this activity increases, the demand for a unified system to curb the emerging operational challenges and highlight opportunities brought in by the integration of conventional Air Traffic Management (ATM) and Space Traffic Management (STM) is becoming important. The need to consolidate these management frameworks into a Multi-Domain Traffic Management (MDTM) structure essentially provides the flexibility of operations and centralizes different solutions for different schemes in air and space domains.

Recent trends in sub-orbital flights and human-rated spacecraft have increased the usage of the airspace which is contrary to International Civil Aviation Organization (ICAO) and Committee on Peaceful Uses of Outer Space (COPUOS) regulations. The traffic data generated are put together in a centralized framework which helps manage the incoming traffic in both air and space domains. The coexistence of manned and unmanned vehicles requires a suitable traffic management system for a higher degree of automation. However, human understanding of the automated decision-making processes is important to build trust, enhance teaming and support post-mission analysis. This is important for coordination and management of both air and space systems. To date, no explainable artificial intelligence (AI) techniques have been developed for air, UAS and space applications.

This paper proposes a new AL/ machine learning (ML) technique for MDTM architecture with standard operating procedure across air and space domains. The proposed MDTM is a centralized management solution with many differing aerospace vehicle systems for large-scale distributed environments. The architecture is tested against the current ICAO and COPUOS regulatory frameworks and noncontrolled airspace (aerospace) above 20 km airspace and below Karman line (100 Km). For many diverse systems, centralized traffic management gives administrators the flexibility to manage traffic and formulate policies with a balanced enterprise-wide requirement. Results are provided with details of the proposed architecture.