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Author: Mr. Kathiravan Thangavel
Royal Melbourne Institute of Technology (RMIT), Australia

Mr. Andoh Michael Afful
Royal Melbourne Institute of Technology (RMIT) University, Australia
Prof. Roberto Sabatini
Khalifa University of Science and Technology (KUST), United Arab Emirates
Dr. Alex Gardi
RMIT University, Australia
Mr. Samuel Hilton
RMIT University, Australia

# DISTRIBUTED SATELLITE SYSTEM FOR SPACE TRAFFIC MANAGEMENT

**Abstract**

Over the years, constant efforts are being made to replace monolithic satellite systems with distributed ones. This is envisaged to increase the value of the mission and its payload capabilities owing to the increase in active satellites in Earth's orbit. The impending launch of New Space (Space 2.0) system mostly large constellations of Low Earth Orbit (LEO) is anticipated to bring about changes in the space environment by way of augmenting current processes for space flight safety. Commercial companies have proposed launching constellations of small to medium-sized satellites over a new 20,000 satellites in space in the immediate future. This presents a new challenge faced by satellite operators hence it is critical that methods are developed to minimise collisional risks which could adversely affect long-term use and exploitation of outer space.

Distributed Satellite Systems (DSS) mission architecture is gradually on the rise. The significance of DSS architecture is observed to improve flexibility, responsiveness, and adaptability to structural and functional changes. Depending on the goal, different concepts for such systems can be thought of. These concepts are mostly characterised by the distance between the satellites and their control accuracy helping improve their performance.

This paper proposes novel methods using artificial intelligence (AI)/ machine learning techniques to mitigate collisions in a DSS framework with other active satellites and resident space objects (RSO) with a view to contribute towards the space situational awareness (SSA) problem. The proposed methods with the aid of on-board sensors are envisaged to guarantee separation assurance and collisional avoidance manoeuvres bringing about trusted autonomous operations in space. In addition, the paper presents details of an analysis tool/technique which provides access to a successful manoeuvre plan for the DSS system. The proposed solution is verified and validated with the current Space Traffic Management (STM) regulation. Results for the simulated network are provided along with a standard optimised procedure and framework for the DSS and for future distributed missions.