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OVERCOMING CHALLENGES: ACHIEVING FORMATION FLYING FOR SIGNIT WITH LIMITED SPACE SITUATIONAL AWARENESS AND PROPULSION SYSTEMS

Abstract

The use of small satellites for signal intelligence has become increasingly important in recent years. Small satellites offer unique advantages such as low cost, rapid development and deployment, and the ability to form constellations. The collected data is valuable for military and security applications, making small satellites an essential tool for these industries.

The focus of this paper is not on new technologies, but rather on the challenges posed by limited space situational awareness and propulsion systems. Despite these limitations, the paper presents a successful mission that demonstrates the feasibility of achieving formation flying with such constraints. This paper elaborates on the issues and lessons learned from a new space company perspective regarding formation flying using CubeSats (6U platforms) equipped with an electric propulsion system. This study offers insights from a new space company's perspective on the challenges encountered during the formation flying mission using CubeSats equipped with an electric propulsion system. The paper highlights the need for adaptation in the initial planning phase to achieve a successful formation. The main constraint faced during the mission was the lack of reliable GNSS data due to electromagnetic interferences with other subsystems. To overcome this limitation, we explored the viability of using Joint Space Operations Center (JSpOC) Two-Line Elements (TLEs) as an alternative to assess the evolution of the formation configuration. Additionally, the paper investigates the use of differential drag for formation maintenance and the impact of uncertainties in the attitude determination on the cluster configuration.

In sum, this study provides a comprehensive account of the steps taken and challenges encountered in achieving successful operational formation flying of small satellites using real-life data. Specifically, the study focuses on the ability to maintain along-track separation requirements in the tens of kilometers, enabling accurate geolocation of detected RF signals in multiple bands. The presented findings are of

great significance to the space sector, providing insights into alternative solutions for robust formation flying acquisition and operations with limited resources. Sharing these lessons with industry will enhance the value of small satellite constellations for signal intelligence and other applications.