IAF SPACE PROPULSION SYMPOSIUM (C4)
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THE EMIRATES MISSION TO THE ASTEROID BELT: CHEMICAL PROPULSION SYSTEM ARCHITECTURE AND USAGE IN EMA

Abstract

The United Arab Emirates Space Agency (UAESA) and the Laboratory of Atmospheric and Space Physics (LASP) at the University of Colorado Boulder are collaboratively leading the Emirates Mission to the Asteroid Belt (EMA) launched in 2028. EMA is an exploration mission that will orbit six asteroids and land on the seventh. The primary science goal of EMA is to understand the origins and evolution of water-rich asteroids. To accomplish the mission, the spacecraft will be powered by both a chemical propulsion system and a solar electric propulsion system. This paper focuses on the architecture of the chemical propulsion system used in EMA and its application throughout the mission's phases. It provides a brief overview of the mission and its objectives, mission timeline, and key milestones. The system architecture and design will be explored in depth, including the layout of the chemical propulsion system, key components and their role, design considerations, and the interaction with other spacecraft subsystems, such as avionics, guidance and navigation, thermal and others to ensure seamless function throughout the mission. The paper also discusses the propellant selection and the considerations behind the selection, including performance, storage, and safety. Additionally, the propulsion system is essential throughout the mission in supplementing the electric propulsion capabilities through all mission phases, including trajectory corrections, safe mode attitude control, and momentum management. The advantages of the system, including reliability and high performance, are also covered. In order to develop chemical propulsion systems for deep space missions in the future, the study also discusses the challenges and lessons learned in propulsion design. Finally, this paper aims to provide insights into the future advancement and application of the chemical propulsion system and its impact on future space research missions, including those that will investigate asteroids and beyond.