MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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CDR-LEVEL STRUCTURAL MODELLING AND OPTIMIZATION OF THE MERCURY SODIUM ATMOSPHERE SPECTRAL IMAGER (MSASI)

Abstract

This paper presents an overview of the Critical Design Review (CDR)-level structural analysis of the Mercury Sodium Atmospheric Spectral Imager (MSASI), to be carried by the BepiColombo mission. This mission consists of two coupled spacecrafts that will orbit planet Mercury in polar orbit. Launch is predicted to take place in 2014, while orbital insertion is predicted for 2020. This missions aims to improve the overall Mercury-related knowledge, namely detailed cartography, exosphere composition, core composition, general relativity, solar system formation, and ice deposits in the shadowed craters.

MSASI intends to address a number of scientific questions regarding Mercury's exosphere. It is a high-dispersion visible spectrometer for the sodium D2 emission (589 nm). It includes a single high-resolution Fabry-Perot etalon, and a one degree of freedom scanning system.

MSASI is a highly complex optoelectronic instrument, with a stringent set of requirements. Two major environments define design efforts for MSASI survivability and optimal performance. MSASI must survive launch and interplanetary mechanical environmental conditions in order to reach Mercury fully operational. Additionally, it must be ensured that the thermal environment around Mercury will not compromise requirements regarding optical axis alignment of the instrument.

The present design is the culmination of a nearly four year-long process of optimization. The overall design refinement level has iteratively increased in order to meet all optical performance requirements, while complying with mass budget and structural requirements.