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MEC – MAGNETOSPHERE MONITORING BY HETEROGENEOUS CONSTELLATION DESIGN

Abstract

The effects that high-intensity solar events, such as coronal mass ejections and solar energetic particle events, have on Earth's magnetosphere are not yet well understood. However, those events significantly affect the space weather in the vicinity of our planet and most of the space assets there located. For this reason, a mission to study the interaction of the solar wind with the Earth's magnetosphere would be definitely beneficial.

The paper reports about the Magnetosphere Explorer Constellation (MEC) mission preliminary design, run within 3 months at Politecnico di Milano: MEC assessed the feasibility of a space weather mission to study the dynamic response of the magnetosphere and upper atmosphere to solar events. To this end, a collection of simultaneous multipoint measurements in the most relevant plasma regions of the Earth's magnetosphere is mandatorily required: the magnetopause, the polar cusps and the magnetotail, with particular attention given to the magnetic reconnection points.

The multipoint synchronous measurements for a randomic event represented the most challenging scientific requirement which drove a complex mission analysis and design. The proposed solution necessarily

leans on several space assets distributed in space nearby the critical magnetosphere regions so that to co-ordinately orbit, with limited station keeping, over a long lifetime mission. In particular, a flower constellation with a total of 52 satellites, subdivided into three classes to properly operate at the different regions of interest, has been preferred. A dedicated launch strategy to be operational while keeping launching the complete constellation has been identified. The paper will go through the full constellation trajectory design rationale together with an overview of the space assets implementation, selected to be in the microsatellite class.