49th IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES (D5)
Prediction, Measurement and Effects of space environment on space missions (3)

Author: Mr. Alessandro Grasso
OHB System AG-Bremen, Germany, alessandro.grasso@ohb.de

Mr. Marc Scheper
OHB System AG-Bremen, Germany, marc.scheper@ohb.de
Mrs. Yulia Bogdanova
Rutherford Appleton Laboratory, United Kingdom, yulia.bogdanova@stfc.ac.uk
Dr. Jackie Davies
United Kingdom, jackie.davies@stfc.ac.uk
Dr. Richard Harrison
United Kingdom, richard.harrison@stfc.ac.uk
Dr. Mario Bisi
United Kingdom, mario.bisi@stfc.ac.uk
Dr. Mike Hapgood
United Kingdom, mike.hapgood@stfc.ac.uk
Dr. Aurelie Heritier
Deimos Space UK Ltd, United Kingdom, relieheritier@gmail.com
Mr. Oliver Turnbull
United Kingdom, oliver.turnbull@deimos-space.com
Dr. David Riley
Deimos Space UK Ltd, United Kingdom, david.riley@deimos-space.com
Mr. Reuben Wright
Deimos Space UK Ltd, United Kingdom, reuben.wright@deimos-space.com
Dr. Mark Gibbs
United Kingdom, mark.gibbs@metoffice.gov.uk
Dr. David Jackson
United Kingdom, david.jackson@metoffice.gov.uk
Mr. Stefan Kraft
ESOC - European Space Agency, Germany, stefan.kraft@esa.int

MISSION ARCHITECTURES FOR SPACE WEATHER MONITORING FROM THE SUN-EARTH LAGRANGE POINTS L1 AND L5

Abstract

As part of the Space Situational Awareness (SSA) Programme, ESA has initiated a study to define a system to monitor, predict and disseminate Space Weather information and to generate alerts to a wide community in sectors like space-based communications, broadcasting, weather services, navigation and terrestrial communications and infrastructure. The effects of Space Weather are observed for example in the degradation of spacecraft performance and risks to human health in manned space missions. Space weather also affects ground systems by damaging aircraft electronics, disrupting power distribution networks and pipelines and degrading radio communications.

The Sun-Earth Lagrangian L1 and L5 orbits provide an unobstructed view of the Sun and hence are an optimal observation point for space weather payloads. Necessary space weather observations like monitoring of solar wind and the interplanetary magnetic field (IMF) are only possible from space with a spacecraft outside the Earth's magnetosphere. Spacecraft missions currently enabling monitoring of solar events and IMF from the Lagrange point L1 are ACE and SOHO. Both missions are well beyond their original design life time and need replacement to ensure continuity of the measurements. Continuous observations from L5 have not been implemented so far and would significantly enhance the space weather forecasting capabilities by observing the state of the Sun's upcoming surface regions, and by the (through the side-viewing) very much improved Coronal Mass Ejection tracking and propagation prediction capabilities.

The L1 mission baseline architecture as derived in this study takes heritage from the LISA Pathfinder mission concept. The spacecraft will be injected into low Earth orbit by the future European VEGA-C launcher, and will perform a transfer injection manoeuvre with the help of a transfer stage. For the L5 mission architecture, the satellite will be directly injected to the final trajectory using the future ESA Ariane 6-2 launcher.

Both missions will carry imagers and in-situ instruments allowing to measure interplanetary medium and Sun conditions. In addition the definition study investigates the possibility of carrying a Near Earth Object imager to detect Near Earth objects posing a threat to Earth.

Concluding, this paper will describe the space architectures and preliminary mission definitions enabling the continuation of space weather monitoring outside the Earth's magnetosphere. We will show the current outline of the satellite and ground station system definition, which is based on European heritage, and which can then be used in a next step for the feasibility studies.