IAF SPACE SYSTEMS SYMPOSIUM (D1)

Space Systems Engineering - Methods, Processes and Tools (1) (4A)

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TOOL FOR EVALUATION OF FUTURE EO SPACE SYSTEMS DURING PHASE 0/A

Abstract

In order to support the definition and evaluation of future Earth Observation (EO) missions in phase 0/A studies, ESA has been developing EOMAST, the Earth Observation Mission Analysis and Sizing Tool. Starting from a preliminary definition of the payload and of the orbit, EOMAST is used to perform an initial sizing of the required platform in terms of mass, power, data handling and communications, attitude and orbit control and related parameters. Information being limited early in the development of space missions, one of the main tasks is the translation of mission requirements and preliminary instrument specifications to a suitable satellite design. Based on first estimates of the payload mass, power, volume and data rate, as well as the preliminary orbit definition, EOMAST uses an iterative process, employing analytical, parametrical and numerical methods as well as reference data to generate an estimate of the required platform main parameters.

Analytical formulae are used to compute values such as the required solar array size or the link budget and translate them to mass and power values. Based on existing satellite platforms, a relation between platform dry mass and platform volume has been parametrically established. Numerical methods are used to determine the propellant budget, as well as the variation of solar beta angle throughout the year. Where it is not possible to use the previous mentioned methods the data from a reference satellite is used, ranging from CubeSats to Sentinel class satellites. Verification with an existing EO mission proved that EOMAST provides mass and power estimates within 10The tool is developed in Microsoft Excel with VBA macros for its simple programming and graphical user interface environment to foster its use and further developments within the ESA EO Future Missions and Instruments team. For advanced functionalities, the tool has an interface to Python which allows to propagate the orbit and perform specific analysis such as ground station visibility or on-board data evolution.

The tool has been used in the evaluation process of the Earth Explorer-9 mission proposals, and will be used in the same way for Earth Explorer-10, providing input for the technical evaluation and identifying potential areas of concerns.

In summary with EOMAST tool it is possible to perform an initial sizing of future Earth Observation misions and to further develop the mission analysis and sizing capabilities in ESA EO Future Missions and Instruments team.