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FUNCTIONAL MODEL OF A SPACECRAFT.

Abstract

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Planning missions and forming spacecraft groups involves building and applying special models. The choice of a particular model and its details depend on the level of abstraction required. But when it comes to testing the possibility of assembling a spacecraft or a constellation suited to a particular mission and subsequently conducting a simulation experiment, there are several categories:

1. A model responsible for the vehicle's ability to change orbits. It describes the movement relative to a center of mass and determines the spacecraft location.
2. An energy model responsible for charging solar panels, storing and using the energy that powers the spacecraft.
3. A model of equipment wear and possible failures during the operation of some parts of the onboard hardware.
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5. A model of the target equipment and its operation, along with a set of instructions for performing the tasks of that equipment.
6. A model responsible for processing, storing, and transmitting target and telemetry data.
7. A model of the satellite's thermal balance, which controls the distribution of the spacecraft's thermal energy.

The simulation experiment involves modeling the spacecraft's movement, orientation, telemetry, control commands, and its own control algorithms. Depending on the tasks assigned, either all of the spacecraft systems or select ones can be simulated.

Each of the spacecraft functional systems can consist of several parts with different functions. For example, the model responsible for the vehicle's possible movement contains the models of the propulsion, orientation, and stabilization systems, as well the mass and size characteristics of the spacecraft. In the context of the movement capabilities of the spacecraft, it is also necessary to consider models that describe the sufficient amount of energy and characteristic speed reserve. Moreover, describing the entire

system requirements fragmentary submodel descriptions, since they are particularly important for getting a unified picture.

We can therefore conclude that in order to describe a functional model of a spacecraft that includes numerous submodels, it is necessary to form a basis from the functions involved in the model and use it to expand the list of spacecraft properties and features. This makes it possible to obtain a full picture of the mission and formulate the requirements for its completion. The present paper exemplifies such a stepwise progression toward creating a functional spacecraft model.