HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)
How Can We Best Apply Our Experience to Future Human Missions? (2)

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DEVELOPMENT OF THE ORBITAL INFRASTRUCTURE

Abstract

As astronautics becomes matured, the in-orbit infrastructure functions are expended and complicated. Along with transition from research to exploration and from exploration to LEO leveraging, the orbital infrastructure configuration will be changed.

The most significant infrastructure elements currently are ISS, uninterruptedly operated by 6 crew crewmembers, manned and cargo vehicles.

Thanks to expended ISS research capabilities the dozens of experiments are simultaneously implemented for many science and engineering subject-trends. In upcoming years it's planned to pay more attention to ISS-based validation of advanced space technologies, required for outer space exploration as top priority. Despite of ISS benefits as multifunctional orbital laboratory, the technical and organizational constrains prevent from full research spectrum aboard ISS. For example, the limited number of the attitude modes is authorized for ISS, impact of a wide load range (vibration and etc.), the stringent EMC requirements, etc.

Due to this, the concept of future on-orbit infrastructure is under development: it will contain multipurpose base-station, "cloud" of specialized autonomously maintained modules and a number of cargo and crew vehicles to provide transportation support. Based on the predicted set of tasks it's possible to conclude that along with multipurpose base, 4 specialized free flying maintained modules are needed:

- a module for astrophysics research;
- a module for geophysics and Earth remote sensing;
- a module for the material and bioproduct manufacturing;
- a module to validate the advanced space technologies.

The medical and biological studies and experiments, involving large volume of resources and versatile set of hardware, will be conducted aboard base-station. As a rule, crew involvement is needed in the preparatory-final operations and in the experiment performance to validate the methods and equipment for experiment.

As for autonomous modules, the specialized researches and production type of operations are foreseen to be performed, during which the crew attendance is non desirable. In the course of the experiments the tighter requirements in terms of microgravity, attitude and etc. are imposed.

Such infrastructure is rather stable within the wide range of potential task sets. This is achieved by optimal working mode of infrastructure depending on the task specifics. For instance, during operation the base-station crew strength can be varied, as well as habitation mode (from long-term unmanned mission and the seldom visiting to the constant crew staying), tempo of the module maintenance, launch rate of vehicle to provide the transportation support.