

HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Utilization & Exploitation of Human Spaceflight Systems (3)

Author: Dr. Igor V. Sorokin

S.P. Korolev Rocket and Space Corporation Energia, Russian Federation, igor.v.sorokin@gmail.com

Mr. Alexander Markov

S.P. Korolev Rocket and Space Corporation Energia, Russian Federation, Alexander.V.Markov@rsce.ru

Mr. Igor Khamits

S.P. Korolev Rocket and Space Corporation Energia, Russian Federation, igor.khamits@rsce.ru

A FREE-FLYING RESEARCH AND MANUFACTURING MODULE FOR THE INTERNATIONAL
SPACE STATION

Abstract

In order to improve utilization effectiveness of Russian segment of the International Space Station (ISS) at S.P. Korolev Rocket and Space Corporation Energia has been launched development of a robotic OKA-T spacecraft. The spacecraft will interchange cycles of autonomous operations in orbits close to the ISS orbit with cycles of approaching and docking to the ISS in order to implement maintenance of a payload complex that will be installed aboard the vehicle. The spacecraft is capable to perform operations both on forming the working orbit and on returning repeatedly to the ISS for docking and maintenance. This allows creating and maintaining aboard the vehicle such environment that would be impossible or difficult to create aboard the ISS. First of all, it is continuous (up to 20 days) capability to preserve orientation of a remanent microacceleration vector with a longitudinal component about 10^{-6} g, and a transverse component down to 10^{-8} g. Also, it is capability to provide a vacuumization level down to 10-14 mm Hg in a zone of installation of the molecular-beam epitaxy facility to be slid out to the outer space. The spacecraft purpose is: carrying out experiments to obtain semiconductors monocrystals under minimum levels of microaccelerations, as well as to obtain heteroepitaxial structures in conditions of ultrahigh vacuum that cannot be provided on the ISS and aboard of other robotic spacecraft. The payload complex should be maintained with a help of the ISS crew; the material samples return to the Earth is also required. Implementation of the free-flying OKA-T module project will allow proving in space methods of its exploitation as a component of the ISS infrastructure, and also its maintenance with the exchangeable payloads concept use; estimating prospects of human space complexes development on the basis of similar research and manufacturing free-flying modules. Also, medical and biological experiments on higher orbits (up to 1000 km) is planned to carry out aboard OKA-T, as well as a number of astrophysical and geophysical investigations in more friendly, in comparison with the ISS, physical environment. Implementation of experiments with use of a lock-chamber to slide scientific instruments to outer space will be also provided for. This paper explores the spacecraft mission design, its composition and utilization scenario with focus on conditions and methods to provide better environment for experiments; analyses prospects of free-flying modules use in the capacity of components of human orbiting complexes.