

## HUMAN EXPLORATION OF THE MOON AND MARS SYMPOSIUM (A5)

Joint Session on the Role of Humans, Machines and Intelligent systems in the Future of Space Endeavours  
(2.-B3.6)

Author: Mr. Alexander Kalery

S.P. Korolev Rocket and Space Corporation Energia, Russian Federation

Dr. Igor V. Sorokin

S.P. Korolev Rocket and Space Corporation Energia, Russian Federation

Mr. Mikhail Tyurin

S.P. Korolev Rocket and Space Corporation Energia, Russian Federation

# HUMAN SPACE EXPLORATION BEYOND THE ISS: ROLE RELATIONS OF HUMAN, MACHINE, AND THE EARTH

## Abstract

Over the last 11 years all human spaceflights were directly related only to the International Space Station (ISS). Infrequent special-purpose Space Shuttle flights can be treated rather exceptions than the rule. The process of the station deployment and utilization definitely became as routine as daily coming to office or working on the production line. All participants of this process became used to standard procedures for scientific program development, crew training, safety data package reviews, and cargo manifesting. Continuous growth of ground support personnel as well as subdividing of their functions into smaller pieces goes in line with increase of bureaucracy at all levels of control and producing of huge amount of documentation for different purposes. Focusing of the existing bureaucratic system on secondary details related to crew and station safety leads to the gradual loss of initial basic guidelines in human flights which first of all include crew ability to act autonomously, to be initiative, to be logically and technically appropriate during a spaceflight, which is critical for the journeys beyond the low Earth orbit. Once young and trained space muscles of the humankind start aging in spite of high level modern technology (compared to the usage of cars instead of walking, running, and cycling). As a consequence the global public attention to space exploration naturally goes down, or even ceases, and crews actually acquire the role of taxi drivers or lab workers. At the same time the governments of the ISS member-nations drastically require reports on spending of a considerable amount of money from their agencies. At the same time specialists responsible for ISS utilization are feverishly looking for more and more convincing excuses for existence the space station; otherwise there would be no need of any – if having a different perception of “space reality”. Did we need to have such excuses in 1960s? However, space exploration is not only, and much more than the ISS. It is important that the guidelines and approaches legalized and currently dominating in the ISS Program are not kind of “sticking”. That would only mean regress, a degradation of humankind inspiration for space, a degradation of human explorative and pioneering abilities associated with risk and necessity to make vital real-time decisions. The common confidence that spaceflight to the Moon will appreciably change the situation is disputable. How to prevent regress? The answer to this question lies in the definition of the goal of space exploration. If the goal is to explore the Solar system, then neither machine, whatever perfect it could be, nor “collective mind” of the “Earth” – mission control center – would be able to replace human being in space. It is only possible (and necessary) to combine human, machine, and the “Earth” as a basic element of the control loop and decision making process. As for any complex system, it is necessary to look for optimal combinations of relative “weights” of the elements inside the system, which ensure its maximal efficiency. Only an effective system has potential for evolution. The article tries to find optimal combinations for human spaceflights beyond the ISS, but ISS-based.