



## Human Factors Studies for Human Space Exploration

**SEA was awarded a contract by the European Space Agency (ESA) to help European astronauts to cope with trips to the Moon and Mars. Such missions are planned in the next 20 years as the culmination of the Aurora Exploration Programme.**

Human space exploration is a test of human abilities, extending our knowledge and understanding of human capabilities and limitations. In this study of Psychological Support Tools and Techniques, SEA will bring to bear its background in Human Factors Engineering and knowledge of operational requirements in areas such as submarine environments.

The undertaking is exciting but is also challenging even for most the mentally prepared and trained astronauts and cosmonauts. Hence, this challenge extends to scientists and industry to devise techniques and technologies that can provide psychological support to the crew on exploration missions. Human space exploration is a test of human abilities, particularly, extending our knowledge and understanding of human capabilities and limitations; and is also a test of technology and how it can provide efficient support throughout the duration of a long mission.

The crew on exploratory missions to Mars and Moon will be faced with interchanging periods of high and low workload, a multitude of stressors and the monotonous passage of travel time. The success of the mission will largely depend on the psychological and physiological well being of the crew, which will be difficult to support merely through external resources, such as communication with the mission control on Earth. The crew will have to be dependent on each other for the entire duration of the mission, which can last 190 days during a Moon mission and up to 1000 days return trip to Mars. The evacuation of the crew in case of an emergency is not possible during a mission to Mars, but can be done from the Moon surface. The communication during a mission to Mars has delays of up to 40 minutes. Under these conditions, where external immediate support is unavailable, the crew will have to problem solve and deal with events themselves.

For detail information on missions to Mars and Moon please refer to:

1. ESA Human report;
2. Hoffman & Kaplan (1997) Human Exploration of Mars: The Reference Mission of the NASA Mars Exploration Study Team <http://exploration.jsc.nasa.gov/marsref/contents.html>

### **Complex tools for spaceflight**

Space crews will no longer be able to depend on the ground crew to support them in real time in controlling and monitoring complex spacecraft systems. They will be required to operate the spacecraft autonomously, while travelling through the hostile environment of space, independently resolving emerging safety-critical situations of varied urgency, some may not even be foreseen. Hence, there is need for defining an expert tool to support crew autonomous operation in a complex human spacecraft.

The objective of this ESA study is tasks SEA to define an expert tool to support crew autonomous operations in complex human spacecraft, assessing potential advantages and risks.