

## **Made for work in space. Evaluation of Human Factors in Cupola – a module of the International Space Station**

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*T. Dukic<sup>1</sup>, J. Frid<sup>1</sup>, M. Törner<sup>1,2</sup>, C. Wartenberg<sup>1</sup>*

*<sup>1</sup>Lindholmen Development, Göteborg*

*<sup>2</sup>Department of Human Factors Engineering,  
Chalmers University of Technology,  
Göteborg, Sweden*

### **Abstract**

Lindholmen Development, as sub-contractor to ALENIA AEROSPAZIO in Turin, received the commission from the European Space Agency (ESA) to perform the Human Factors Engineering evaluation (HFE) of the Cupola, an observation and control module of the International Space Station (ISS) whose on-orbit assembly has already started in 1998. The Cupola programme was a result of a bilateral agreement between ESA and the National Aeronautics and Space Administration (NASA). The goal is to create a long term orbiting science institute in space where man will be able to work and live for several months. The purpose of the human factors analysis was to verify the compliance of the design to a set of HFE requirements. Analysis was carried out in three major steps: task analysis, computer manikin simulations and tests with naive subjects as well as with astronauts in a full-scale mock-up. The presentation of the HFE work and its methodology exemplifies how human factors can be integrated early in a design activity encompassing the processing of a large amount of data, co-operation with professionals with different competence and from different geographical areas. The project followed a strict process protocol necessitated by these very conditions as well as by the strict safety concerns of manned space flights. It will serve also as an example of a participatory approach to ergonomics.

### **Introduction**

The on orbit assembly of the International Space Station (ISS) started in November 1998 and a total of 44 launches will be required to complete the facility in 2004. 16 nations take part in the project. The station will provide living and working facilities for seven astronauts and scientists. The goal is to create a long term orbiting science institute in space suitable for performance of long duration experiments in materials and life sciences in a nearly gravity-free environment. As a consequence, man will be staying in space for longer periods. Designing a space station environment implies a huge engineering process taking into account mechanical, electrical and physical parameters. Nowadays, technical achievements regarding e.g. communication and materials have reached a high level, which