Paper ID: 22745
oral

25th IAA SYMPOSIUM ON SPACE ACTIVITY AND SOCIETY (E5)
Space Architecture: Designing Human Systems Interaction (3)

Author: Dr. Ondrej Doule
Florida Institute of Technology, United States

Prof. Guy Boy
Florida Institute of Technology, United States
Ms. Lucie Poulet
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany
Mr. Don Platt
United States

ADAPTIVE SPACESHIP COCKPIT ARCHITECTURE – ORGANIZATION AND MANAGEMENT OF SPACESHIP COCKPITS DESIGN PRACTICES IN THE PAST AND IN THE FUTURE BASED ON PUBLISHED DATA AND FEEDBACK FROM ASTRONAUTS WINSTON SCOTT, JOHN MCBRIDE AND ROBERT SPRINGER

Abstract

There are many reasons for absence of comprehensive spaceship cockpit guide. Some of them are linked to industrial secrets some are related to specificity of the ship operations and lots of them are based on the fact that the history of human spaceflight is full of newly developed prototypes without significant spaceship family development history as we are used to it in automotive or aircraft industries. The longest operating vehicles such as Space shuttle and Soyuz recall numerous updates but those could hardly be considered significant evolution in spaceship and spaceship cockpit design.

Spaceship cockpits bare some specific features that are related to the very extreme environment that spaceship is dealing with such as: high G-load, high exterior temperatures, high vibration levels, exposure to vacuum, exposure to ionizing radiation, exposure to micrometeoroids and thus has to provide to its crews heavily shielded confined environment. All these factors are precluding the crew of the spaceship due to these extremes that are difficult to cope with physically and mentally. Extreme conditions inside the cockpit often do not allow the crew to interact at all with spaceship operations as human reaction and haptic feedback may be significantly disturbed by the environment. The crew is thus suggested to be minimally involved in the spaceship control requiring high level of automation and/or high level of ground control in the past. Function allocation priorities in the spaceship cockpit were very different from aviation cockpit in the past. Interestingly though the aviation industry, at a present time, is considering similar strategies as in the space industry (related to high level of airplane systems autonomy and function allocation). This is mainly due to advancement of technologies, exponential increase of computational power and significant integration. Finally, the main driver for the spaceship cockpit design should be crew and passenger safety.

This paper presents strategic views on organization and management of the spaceship cockpits design in the past and present within the project goals of ASCA (Adaptive Spaceship Cockpit Architecture) research project at Florida Institute of Technology and provides suggestions for design strategies and concrete design drivers for the future also based on experts feedback from astronauts Scott, McBride and Springer who were interviewed for purposes of discovering the needs of humans inside the spaceship cockpit in the future.