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Author: Ms. Aline Decadi
HE Space Operations, France

EVOLUTION OF CREW SAFETY CRITERIA FOR FUTURE SPACE TRANSPORTATION SYSTEMS

Abstract

Crew safety is of paramount importance for future human exploratory spaceflight. In order to ensure optimum safety standards, the design criteria for this new generation of spacecraft must be defined; such as the level of crew safety required as well as establishing the methods for safety assessment. This should be done in cooperation with international partners, whilst considering expected project constraints such as cost and time. Through a hazard control process assessment, several risk mitigation strategies may be found suitable to achieve both an acceptable level of crew safety as well as mission success. Such an assessment thus requires both: elaboration of a regulated safety assessment process, that is shared and approved worldwide, and definition of safety criteria that are required to fulfil the mission objectives, and need to be approved by a Certification Authority.

This paper defines what reliability and safety standards are used for current low earth orbit human spaceflight operations through a failure conditions safety assessment, applying it to crew transportation systems and taking into account the mission aims. It will evaluate existing standardized safety and regulatory processes that are in place for civil aviation (ARP 4761, ARP 4754A, AC 25.1309), which are largely accepted as being a premier example of industry safety standards, and assess how it could be extrapolated and adapted to ensure similar safety standards in future human space exploration missions.

The civil aviation process presents commonalities in terms of methods for conducting a safety assessment, that are expandable to space exploration. This paper describes the related transfer function between civil aviation and space exploration (ISS, Moon and Mars) as a stepping stone to reach an international consensus to be targeted by the Space Agencies to ensure the crew a safe journey and return to Earth.