Paper ID: 17709
poster

46th SYMPOSIUM ON SAFETY AND QUALITY IN SPACE ACTIVITIES (D5)
Poster Session (P)

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STUDY OF SAFE RELIABILITY ASSURANCE MODE FOR MANNED SPACE ENGINEERING

Abstract

With the rapid development of manned space technology, the safety and reliability has become even more important with the development of the manned space program. Many space agencies have their own successful experiences. NASA focuses on Safety and Mission Assurance (SMA) whose core idea is "Mission Success Start with Safety". ESA proposes "product assurance (PA)", and for this purpose to establish perfect product assurance standard architecture. China's space engineering mainly draws lessons from ESA's PA mode, and has obtained rapid development and great achievements. After nearly 20 years of development, a distinct space system development mode called Safe Reliability Assurance (SRA) mode have been formed gradually. SRA can be defined as a general name of all kinds of safety and reliability technical and administrative activities during the design, production and operation phases through the whole space product development which takes the safety as its core and the mission success as its target. The reliability is on the premise that the system is absolutely safe, while the safety targets the high reliability and availability of space system. The SRA mode whose key elements can be abbreviated to R-ADV-M is proposed which can be described as exact Requirement decomposition, rigor Analysis, robust Design, high-effective Verification, and perfect Management. This mode complies with system engineering idea. The first R include comprehending user's requirement, translating into design requirement and exact decomposing design requirement which is a repeatedly balance and iteration process. The ADV means a series of applications of safety and reliability technology in development process which are reduced to more than 17 important working items, such as FMEA, SCA, material and part choosing, EMC, safety centered maintenance analysis, and so on. The M include the process control and technology management in development process whose cores are abbreviated to 3A, that is TRL (technology readiness level) Assessment, human rating Assessment, and mission risk Assessment. The SRA mode is a systematic summary of successful practical experience of China's manned space engineering, and will propose a good reference and system engineering method of safety and reliability assurance for future manned space system development.