SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES (D5)
Safety of Vehicules and Ground Segment for Aerospace Missions (1)

Author: Prof. HARUKI TAKEGAHARA
Tokyo Metropolitan University, Japan, hal@astak3.tmit.ac.jp

Dr. Junichiro Aoyagi
Tokyo Metropolitan University, Japan, j-aoyagi@astak3.sd.tmu.ac.jp
Mr. Yuki Kubota
Tokyo Metropolitan University, Japan, ykubota@astak3.tmit.ac.jp
Prof. K. Kuriki
Japan Aerospace Exploration Agency (JAXA), Japan, kuriki@usef.or.jp

A NEW CHRONOLOGICAL METHOD FOR RELIABILITY IMPROVEMENT / RISK ASSESSMENT

Abstract

High reliability/safety are indispensable for the space systems because of its large-scale structure, long-term operation, maintenance-free condition and extraordinary environment. In the conventional reliability analyses, Failure Mode Effect and Criticality Analysis (FMECA), Fault Tree Analysis (FTA), Event Tree Analysis (ETA) and other miscellaneous methods have been adopted. In these methods, the relationships between the failures including malfunctions, anomalies, hazards and catastrophe, and its causes are evaluated in detail at each development phase. However, these methods cannot identify the mechanism of failures along time and the background of failures it. It is necessary to evaluate the reliability throughout the project (conceptual design, detailed design, manufacturing including procurement, test, assembly, launch and practical operation on orbit). Objectives of this study are to propose a new method for the reliability improvement and the risk assessment where temporal updates of space system reliability/risk are taken into account, focusing on the following two points. (1) Taking time-wise variation into account We first clarify the chronology of failures. And moreover, a new risk assessment method that make possible to detect anomalies early in advance, mitigate detrimental failures and prevent serious accidents in advance. (2) Making information common and sharing information Teams working in a large-scale project sometimes lack communication among them. With systematized documents and tools, all concerned could share information. In this paper, a new chronological method for the reliability improvement / risk assessmentTime-tagged Risk/Reliability Assessment Program (hereinafter referred to "T-TRAP") is described. In this program, time-evolutionally evaluation process is included and this process makes possible time-tagged analysis. We expand risk/reliability assessment for all phases of the development, including conceptual design, detailed design, manufacturing, test and practical operation. T-TRAP program has not only the usual spacial axis including the system/subsystem/component/part interfaces, but also the temporal axis including the development phases of each items. In T-TRAP, by connecting the information (operational function, performance, design, anomaly in test, procurement, assembly, and another histories) of each document with its special spacial axis and temporal axis, using configuration/information control processes, the systematized documents will be common for all managers and engineers, and the technical information and its communication will become better in the project, in every development phase, in any interface between system/subsystem/component level. Its sample of the T-TRAP applied to the propulsion subsystem will be presented.