SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES (D5)
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COMPARISON OF HETEROGENEOUS SPACE PROJECTS THROUGH COMPLEXITY INDEXES, FOR TECHNICAL AND MANAGERIAL EVALUATIONS

Abstract

Data coming from successful and unsuccessful missions should be aggregated to highlight excellent and poor practices, basing on the comparison between actual results of several projects. The main purpose of this kind of knowledge-management approaches is to learn as much as possible from the past, leading to a continuous improvement of the design and verification approach. The first step to reach this objective is to collect relevant data and gather them in a structured information system, as the ESA Model and Test Effectiveness Database (MATD) experience learns. The second step is to analyze and compare the historical information to understsand better trends and effectiveness of design and verification philosophies, but space systems may be extremely different one from another, and the comparison requires a normalization method able to compare "apples and oranges", assigning to each system its complexity level, according to the objective of the single analysis that can be devoted to risk, cost and schedule evaluations. Rough methods have been used since now, using the spacecraft mass or the number of electronic parts as normalization factors, but they are not able to describe with good approximation the real complexity of the system and specialize it for the specific purpose. This problem has been driving the joint Thales Alenia Space – Politecnico di Torino Research Group for the last years. The objective is the transition in the ESA Model and Test Effectiveness Database (MATD) analysis from the number of Electronic Parts (EP) to complexity indexes, as variable to normalize the data from different spacecraft programs, including technical, industrial and operational dimensions of the complexity. The objective of this paper is to present the latest definition of the methodology for the calculation of complexity indexes for space, based on the functional analysis of a generic space project, validated preliminarily with scientific satellites and pressurized modules data, but conceived to be used also for exploration systems. The methodology is then applied to eleven heterogeneous spacecrafts whose data is contained in MATD (including earth observation satellites, planetary probes and manned pressurized modules) for the comparison of ground (AIT) and flight anomalies and of cost evaluation.