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Insuring Quality and Safety in a Cost Constrained Environment: Which Trade-Off? (1)

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USING COST-OF-QUALITY INDICATORS FOR THE PROCUREMENT OF SPACE SYSTEMS

Abstract

Quality is of paramount importance for space missions given the high cost of failure, but given the financial and time constraints of any spacecraft development project, the question 'when is quality good enough?' must still be addressed. This paper reports the findings of a research project to investigate the extent to which space systems developments can learn from quality management practices designed for terrestrial (often high volume) manufacturing applications. In particular, we discuss the concept of 'Cost of Quality' (CQ) and its value for space technology.

This research described in this paper expands the body of knowledge of CQ techniques within the context of spacecraft systems engineering by (i) identifying and summarizing prior studies that investigate best practice in quality management (ii) reviewing lessons learnt from other space projects and (iii) proposing modifications to the generic CQ process that will increase its relevance to space technology developments.

Our research describes how CQ can be used to measure and compare success and failure among various projects, to provide cost/benefit justification and tracking for improvement initiatives, and to establish a basis for budgeting the quality management and assurance functions. However, there are challenges in applying extended CQ techniques in the procurement of space missions. The extended CQ deals with administration and control costs, like the cost of carrying out contract reviews, or the cost of performing regular progress control of external participants and continuously improving quality planning. To that end, management is necessary to collect, measure, and analyze quality. However, this is often complex and ineffective, because of the sheer number of activities and external participants involved in procurement. Moreover, space sub-contractors vary in size and technological capabilities, making it difficult to manage project-related information, particularly data regarding quality costs. In fact, many sub-contractors have no such system in place, or even fail to collect quality cost data.

We conclude by proposing a holistic 'systems engineering' approach for a tailored implementation of CQ for space, based on the key parameters that have perceived value to the system's stakeholders and incorporating the risk dimension (for example, the high cost of failure in space projects) and time dimension (for example, the potential for future reuse impacts the optimal level of investment in quality for a given technology). Opportunities for further research in this area are also described.