

Reducing Costs through Collaborative Engineering accross all Phases of the Mission

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Purpose

Properly applied system engineering methodologies have in most industries been proven to have a significant quality and cost impact. In particular in low-cost missions such methods could be paramount in reducing the overall mission costs.

The purpose of this paper is to investigate the impact of architectural methods and system engineering methodologies within space organizations, draw the lessons learned and recommend a way forward.

Main points

The goals of applying architectural and system engineering methods varies from organization to organization but can typically be summarized by: heighten the quality of the system specification and at the same time reduce the end-to-end engineering costs, through a structured engineering process throughout the lifetime of the mission.

Different architectural and engineering techniques have over the last decade been applied in the space domain to reach some or all of these goals: enterprise level frameworks such as DODAF/MODAF, methods such as Model Driven Architecture (MDA) and Model Based System Engineering (MBSE) in their many flavors, to specific languages such as UML, SysML and IDEF0.

In most organizations there is a clear difference in focus between three user groups of the methodologies

1. The system engineering team. Focused on ensuring the organization's engineering standards and architecture are maintained horizontally across all phases and all missions;
2. The mission system team. Focused on the specification and implementation of a given mission; and
3. The mission operational team. Focused on the operations of the mission.

The methodologies to be used are typically selected by the system engineering team. This has shown to pose a number of critical problems. The skills and focus of the engineering team is very different compared to the skills and focus of the mission teams. They as engineering experts tend to focus on formalism and structure. Mission teams focus firmly on usability and collaboration.

This conflict frequently leads the mission team to reject the applied methodologies. The paper critically asks the questions: Did the selected methods in the end add real value to the mission teams?

Method

The authors based on analysis as well as through direct experience evaluate the impact system engineering methods have had on the mission teams. Most of these programmes have been initiated by system engineering teams, with the intent to support of the mission teams.

Conclusions

The core conclusions of this paper are

1. Not surprisingly considerable effort reductions can be gained by collaboration across all phases and teams of the project;
2. The needs of the mission teams are surprisingly simple and entirely focused on structured collaboration. Formalism, structure and engineering methods form the core, but must be completely hidden and automated by the methodology;
3. In order to succeed any solution must first and foremost consider the skills of the intended end user, then the engineering methodology to be applied; and
4. To succeed the methodologies need to make a subtle change of focus from the model based system engineering to collaboration platforms enabled through model based system engineering.