

SPACE SYSTEMS SYMPOSIUM (D1)
System Engineering - Methods, Processes and Tools (1) (3)

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BE AWARE OF THE SQUAD: LESSONS LEARNT FROM 50 CONCURRENT ENGINEERING
STUDIES FOR SPACE SYSTEMS**Abstract**

Early design studies, especially for advanced projects, are often considered as not-so-relevant and far from reality since the outcome is usually and “solely” a set of documents covering the overall system trades, presentations describing the related design evolution, Excel sheets providing the major system budgets and a set of 3D-drawings showing the preliminary configuration and accommodation of the spacecraft. Compared to critical procurement, integrating and testing activities, the pre-development phases – although doubtlessly very interesting for everyone - are not always sufficiently prestigious in the engineering world.

However, in the last years there is an increased effort destined to structuring and improving space development projects right from the beginning by applying various systems engineering methodologies. These also include Concurrent Engineering (CE), a collaborative, iterative and communicative approach in which all relevant disciplines, including the customer, work simultaneously together in a guided and typically co-located manner.

The principal engineering tasks within such an activity are clear, but the additional component of constant and intensive interaction amongst the domain representatives could create e.g. misunderstandings, irritations, friction and eventually a suboptimal design solution. Although the advantages of such CE studies, such as quality increase, time and cost decrease as well as mutual education of team members, far outweigh the risk carried by the elevated social component, one has to carefully be aware of the squad to guide the project in the right direction, particularly in such an early stage.

As of today, the Institute of Space Systems of the German Aerospace Center (DLR) has performed about 50 CE studies, mainly lasting one to three weeks, with many different internal and external teams for exploration and satellite missions as well as launch vehicle design. During these activities, the authors have identified several basic rules for successful studies, mainly related to reducing formality, providing transparency, facilitating honesty and engaging well-balanced data sharing.

The present paper describes our lessons learnt, focusing on the various communication means which are necessary within a comprehensive group of engineers and scientists, and points out the challenges and dangers when treating team members in front of others during plenary workshop sessions, or before and afterwards. It summarises a set of Dos and Don'ts which should be taken into account when conducting

such interdisciplinary and often multi-cultural events, in order to seriously improve the envisaged design and moreover, to elaborate on the reputation of early system studies.