

## EUCASS 2013

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**Topic:** System Integration - Concurrent Engineering

### **Title: Challenges for Concurrent Engineering on Launcher Design**

Since June 2011, Astrium Space Transportation (Astrium-ST) is implementing concurrent engineering (CE) processes, methods and tools to perform advanced project studies in the different branches of its core activities (launchers, missiles, orbital and exploration vehicles).

The interest for adopting CE lies in reducing the inherent risk of the early stages of the system life cycle (phase 0, A and B up to SRR) by rapid but complete assessments of the solution alternatives involving all the relevant disciplines from the onset of the project on.

The SPACE CODE project (SPAcE Cost Efficiency & COncurrent DEsign) endeavours a company wide, transnational, multi-site deployment of a CE environment and embraces the perspective of an enhanced productivity and an encouraged innovation of the multidisciplinary teams that will use it.

This paper describes the deployment of the SPACE CODE environment for the ARIANE 6 phase A and phase B.1 launcher design activities. The architectural design iterations entail system analyses and decision sequences that require the agility to explore the various alternative options. These successive trade-offs require a flexible environment to capture those analyses, decisions and rationales.

The endogenous interactions between the system elements of a launcher (control, navigation, guidance, propulsion, ...) are stronger than on spacecraft because of the exogenous constraints from the laws of physics and the harsh environment the launcher is subject to. The system's measures of performance (mass, thrust, ...) are indeed strongly interlinked in a multivariable optimisation problem. The time dependency of the operational conditions calls for tight multidisciplinary simulations involving the different specialty engineering domains. The required computational effort represents a challenge for the concurrent engineering approach. Another challenge resides in implementing the contingency and margin policy on the relevant parameter exchanges.

A collaborative platform (PForge), based on Atlassian's solutions, is operated to record the proceedings of the advanced project studies during the different phases of the CE campaign (initialisation, preparation, operation and post-processing), capturing the corresponding knowledge.

The Concurrent Design Platform (CDP), commercialised by JAQAR Concurrent Design Services (J-CDS), is run to build the systems engineering data model, dealing with the launcher specificities such as the large number of options (propellant types, number of stages, number of boosters, ...) and the time dependency of the parameters.

The Functional Digital Mock-Up (FDMU), based on Dassault Systèmes' (3DS) solutions, is implemented to serve as the hub of the specialty engineering data repository, hovering around the geometric definition and progressing through the various specialty engineering workflows to assess the multi disciplinary launcher characteristics.

As a conclusion, this paper shares Astrium-ST's experience on the concurrent engineering processes applied for the launcher design problem in the frame of the ARIANE 6 programme (phase A and phase B.1).