MODEL-BASED SYSTEMS ENGINEERING MUST BECOME A TEAM SPORT!!

Context

Airbus Safran Launchers was created by Airbus Group and Safran as a 50/50 joint company. Airbus Safran Launchers unites all the assets and skills of the two parent groups in launch vehicles and strategic missiles.

Airbus Safran Launchers, together with its subsidiaries and partners, designs, develops and sells to global market an unrivaled range of launchers, associated services and derivative products for both civil and military applications.

The design of a launcher, missile is a multidisciplinary activity that requires the contribution of numerous experts in specific and various domains (mechanics, thermic, software, avionics, telecommunications, power, propulsion, safety, costing, etc.).

Our systems are more and more complex and new challenges appeared such as optimization fields, cost and delay reduction. To succeed, this requires the implementation of an efficient Systems Engineering approach and effective communication between the domains and subcontractors throughout the project's life cycle: from the definition of the needs to the maintenance, including the design, development, integration, verification, validation, manufacturing and operations phases.

Airbus Safran Launchers main targets and expected gains are related to:

- improvement of the efficiency,
- reduction in engineering waste: rework, over-processing, over-production,
- reduction in lead time, for projects more and more constrained by time-to-market, or by budget,
- reduction of costs: mainly development, but also production and operations,
- improvement of the value for the customer(s).

Model-Based Systems Engineering (MBSE) technics were successfully used inside Airbus Safran Launchers, but with the following limitations:

- lack of automatic links and consistency between models,
- lack of end-to-end approaches,
- no transversal standardized approaches.

Airbus Safran Launchers decided to investigate a new approach. The main objective was to favor the commitment of stakeholders: customer, domain experts, sub/co- contractors, system engineers... by providing them with a better integrated and collaborative solution, in coherence with Airbus Safran Launchers methodology.

Solution

Airbus Safran Launchers started an experimentation of Arcadia and Capella on a launcher pilot case project.

Several key success factors were identified:

- to ensure the consistency of the model within a project,
- to support function managers to elaborate their specification, facilitating exchanges among stakeholders (program, domain experts, function managers, customer..),
- to allow production of common material for deliverables.

Airbus Safran Launchers started by tuning Arcadia method and Capella tool to projects needs and structure, and by adapting the process to stakeholders.

For this pilot case, Team for Capella has been used to collaboratively create an architecture model in a common repository. Elaborated in close cooperation of the modelers with system engineers and function managers, this model encompasses a glossary (definition of terms) for the projects. It contains description of life phases, system functions, functions definition and interactions, logical and physical architectures.

In order to achieve these targets, a dedicated and precise method was applied to design each function in the same way, regardless of the end to end functional chains functionality, thus limiting the risks of inconsistency at design level or interfaces.

Some exports have been generated, to be used as material for creating deliverables documents and to support reviews.

Results

The use of Arcadia method is new for Airbus Safran Launchers but completely compatible with ISO 15288. The model-based engineering tool implementing this method, Capella, has been evaluated by experts, and considered beneficial for our development, as a complement to SysML/Rhapsody (already used for software activities).

This complementary use associated to requirements management done with Doors reinforces the link between system analysis, requirement, functional architecture and implemented design.

This implemented approach provides the following advantages:

- to map functions on products in a coherent way,
- to identify and decline the technical requirements associated to each functional chain (end to end representation from function to components),
- to design the hardware and the software in a coherent way,
- to design the related software with a clear system design definition.

This pilot case has been considered as very helpful for the project development; it will reduce number of iterations, and thus save time.

Next Steps

The practical use and experience in new projects are expected to provide valuable input to future developments in all areas that could enhance the whole MBSE process.

Based on positive feedbacks of this first utilisation, Airbus Safran Launchers will continue to adapt its systems engineering practices to increase the benefits of such usage.

MBSE is considered as a key enabler of Airbus Safran Launchers systems engineering vision, but the current implementation of this process based on Arcadia / Capella shall be reinforced:

- Facilitate the creation of models across all engineering disciplines
- Enlarge model integration to other domains (requirements, PLM, BPMN, ...)
- Reinforce model integration between layers and between domains.
- Add new capabilities (reuse, variability, data security, link with simulation and testing).

This is a must, as we need to drive innovation of future Capella versions while managing cost and lead time as well...

Therefore MBSE is an area where Airbus Safran Launchers will continue with regular exchanges with Capella ecosystem. Of course this is also an excellent area where Airbus Safran Launchers is open and could request collaboration with partners.

Alain HUET

Alain Huet is head of System Engineering Solutions at Airbus Safran Launchers, managing the adoption of MBSE.

Working in the Airbus group for more than 35 years, he has been participating in the development of numerous defense and space programs such as satellites, launchers, space vehicles, air traffic management. On these systems he has used and implemented processes, methods and tools to manage requirements, validation & verification, real time and hardware in the loop simulations.

> *“This new MBSE approach based on Arcadia method and Capella tool is promising, this initiative shall be reinforced”*