Reconciling with the past, embracing the future

Lessons learned on implementing MBSE in Thales

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Thales today

a > 80k employees, > 56 countries company, developing systems for:

Multi-cultural, multi-industry, multi-background, ...
How to make evolve the engineering practices in a large organization?
It is not the most intellectual of the species that survives; it is not the strongest that survives; but the species that survives is the one that is able best to adapt and adjust to the changing environment in which it finds itself.
Reconcile yourself with your past

Embrace the future
Reconciling with the past: Models & Textual Requirements
Textual requirements are at the heart of the current engineering practices.

Needs & Context model
helps formalize and consolidate stakeholders and system requirements.

Solution model
helps validate feasibility, elicit/justify new requirements for the system/subsystems.
Models add rigor to needs expression / solution description

Models can be processed to ensure completeness and consistency

... Why not considering that models ARE requirements?
Requirements can either be textual “shall” statements, either model elements: textual and model requirements actually complete each other.
Some of the Arcadia concepts can be considered as **Functional** and **Interfaces** requirements, eventually with related **Performance** requirements.

Some expectations (**Environmental, Regulations, etc.**) are easier to express with textual descriptions with traceability links to model elements.
N-Level: Tablet is a constituent of a drone-based system.

N+1 Level: Tablet is the (sub)system of interest.

Models + Textual requirements bring clarity and rigor to “contracts” between engineering levels.
Models + Textual requirements enable a better coordination and planning of IVV activities.
Embracing the future: Models and Agility
Models add rigor to needs expression / solution description
Agility on systems engineering is required to cope with customers’ expectations

... Why not implementing Model-Based Agility?
Model-based practices are effective enablers of systems engineering agility

Build the solution in an incremental way based on value creation, using system-level Capabilities and end-to-end Functional Chains and Scenarios
Between 2 Gates, teams go through phases that can be iterated: increments at the team level.

**Warm-up** - collaborative definition of the detailed scope, goals and schedule of the increment and of the necessary resources.

**Run** - iterative effort punctuated by iteration reviews.

**Evaluate** - assess how the engineering was performed, that the expected outcomes are there and that conditions for pursuing are met.
Visualize data in live during flight
Display acquired HD video in live
Display multi-spectral image in live
Display thermal image in live
Visualize all collected mission data
Visualize substance level in live

Definition of increments with expected Functional Chains

System architectural design
Vertical slices of architectural design across need and solution models

Subsystems, software, etc.

System-level V&V procedures
Functional Chains are sets of functions working together to perform a service at a given context. Functions are allocated to components work together through interfaces.

Functional Chains represent different contexts of usage of a given capability of the system. Examples: real-time visualization, visualization from recorded data, ... Capabilities are high-level services for which the customer is paying for.
Functional Chains describing transverse, end-to-end system-level capabilities at physical architecture level
Model elements such as Capabilities and Functional Chains provide meaning to what SW developers are doing.
The road to Digital Engineering is in front of us
Thank you

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