ESA's Digital Twin Spacecraft

JOTNE ISO/IoT/PLM Workshop

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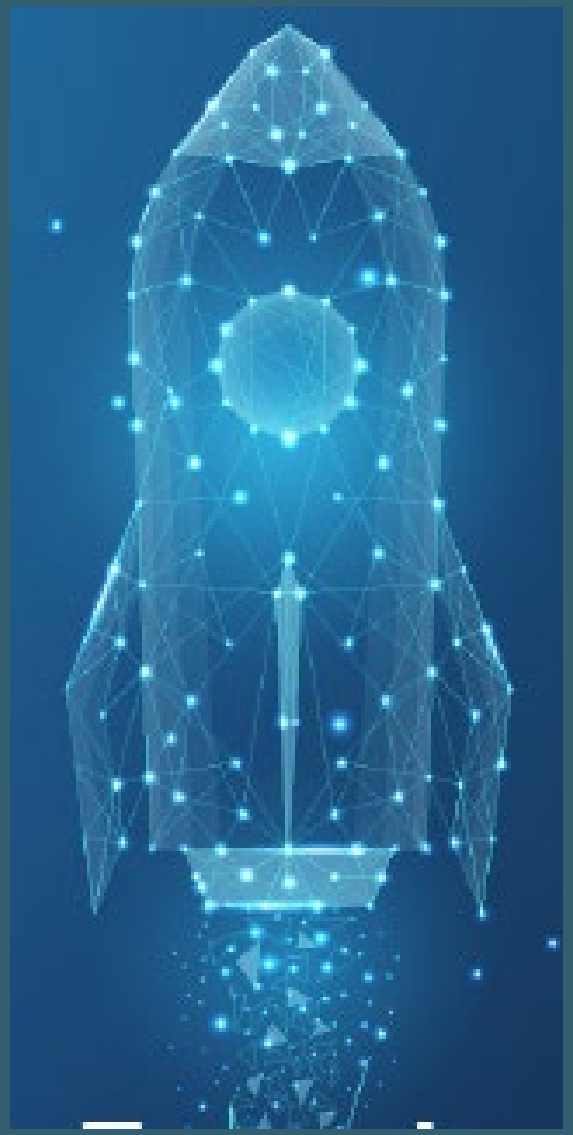
ESA AGENDA 2025*

- “Progress is needed to transform vast sets of climate data from space into digital twins that will allow, through ‘what if’ simulations, the testing of policy effectiveness, and support decision-making…. The creation of **digital twins of Earth** will advance the understanding of complex systems and problems like climate change, loss of biodiversity and questions in Earth science”

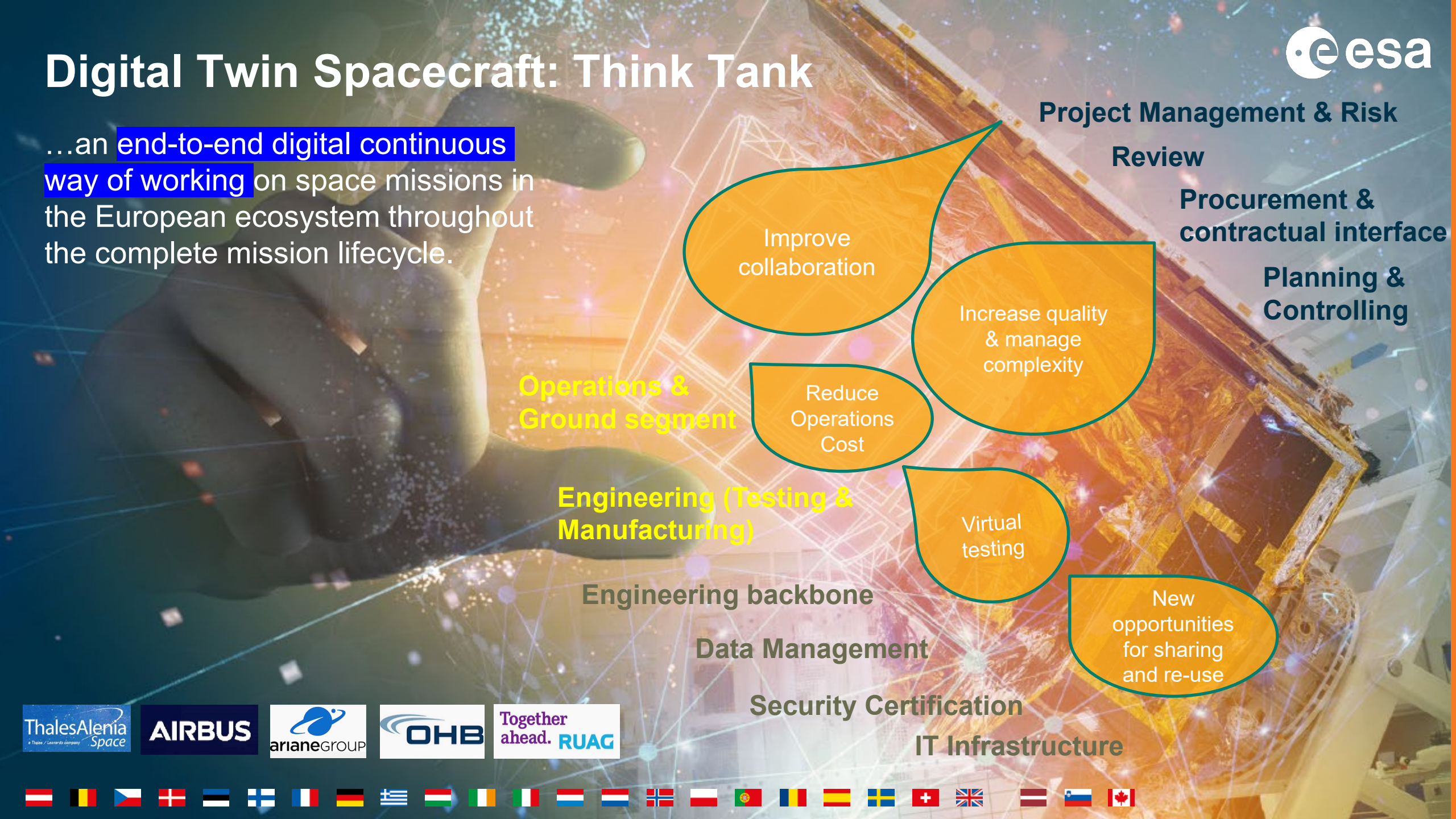
- “*In Europe, ESA has the unique ability to implement, together with industry, complex and ambitious space missions and programmes on an equal footing with other leading space agencies worldwide. We will ensure that this ESA strength and value is further reinforced. .. ESA will therefore digitalise its full project management, enabling the development of digital twins, both for engineering by using Model Based System Engineering, and for procurement and finance, achieving full digital continuity with industry.*”



* https://download.esa.int/docs/ESA_Agenda_2025_final.pdf

Digital Twin Spacecraft: Think Tank

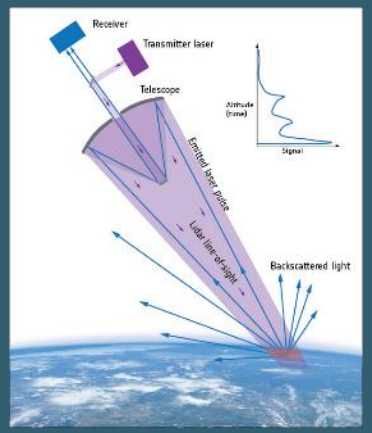
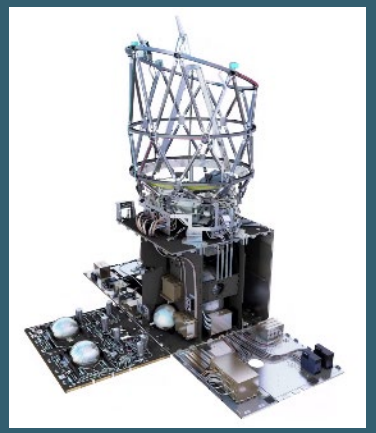
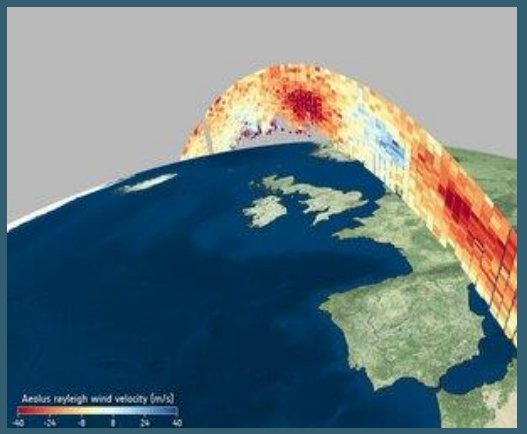
…an end-to-end digital continuous way of working on space missions in the European ecosystem throughout the complete mission lifecycle.



Digital Twin Spacecraft – Concept

1st Step:

Digital Continuity, within ESA, on a specific project

As Conceived	As Designed	As Built	As Operated
			

INFRASTRUCTURE(S)

Data / Models / Documents – Configuration Management

TECHNIQUE

MBSE *Simulations* *Manufacturing* *Test* *Operations*

MANAGEMENT

Cost / Schedule / Risk / Contract / Review

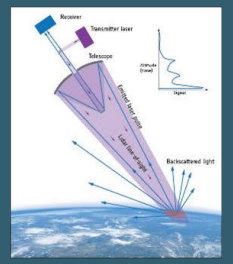
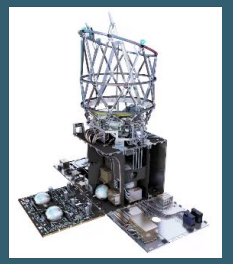
Digital Twin Spacecraft – Concept

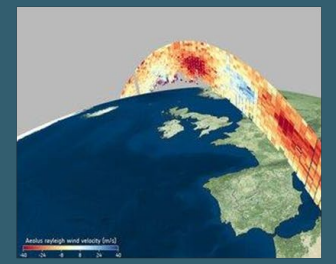
2nd Step:

DT project connections with Industrial DTs

ThalesAlenia Space
AIRBUS
ariane GROUP
OHB
Together ahead. RUAG
...

As Conceived | As Designed | As Built | As Operated



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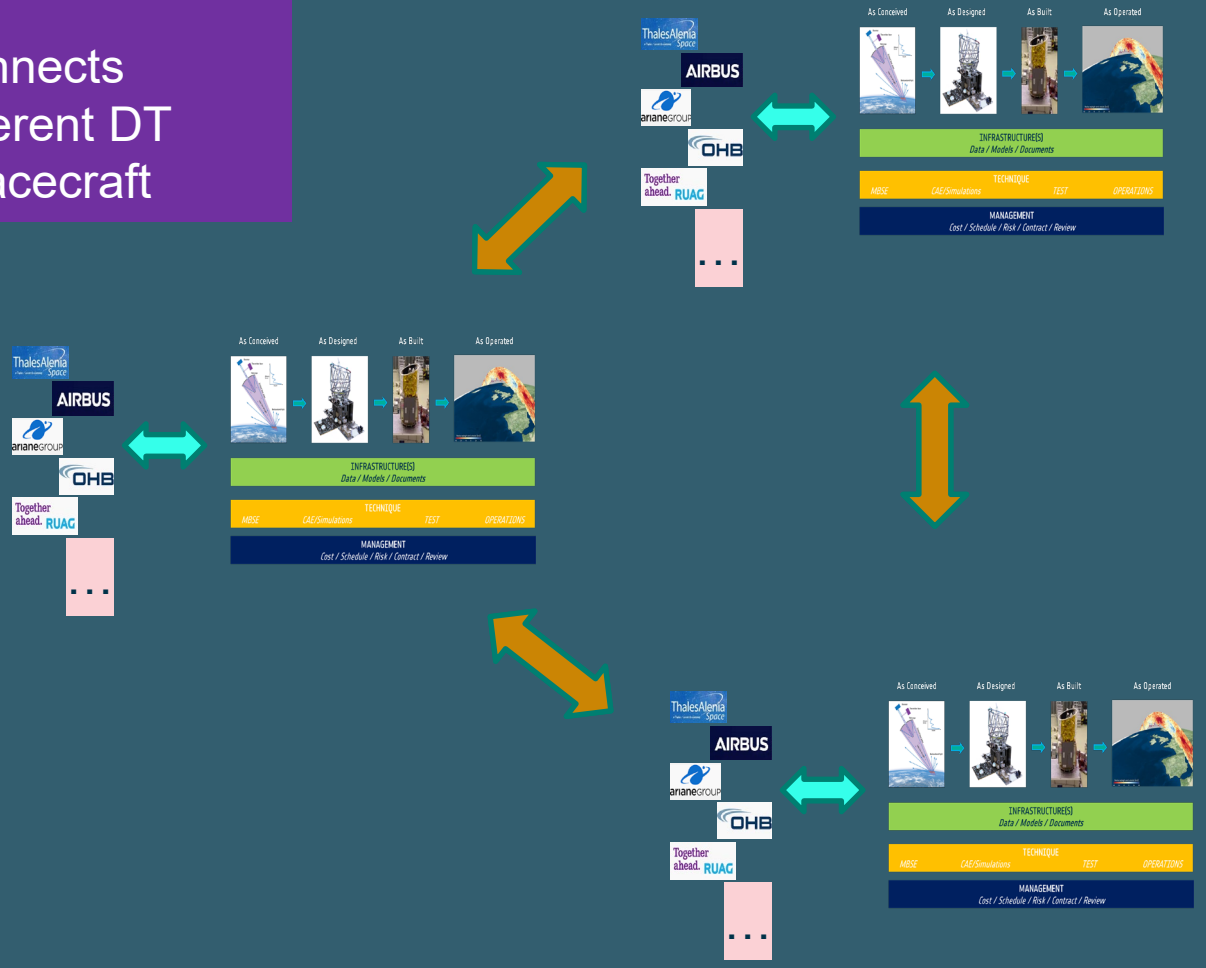
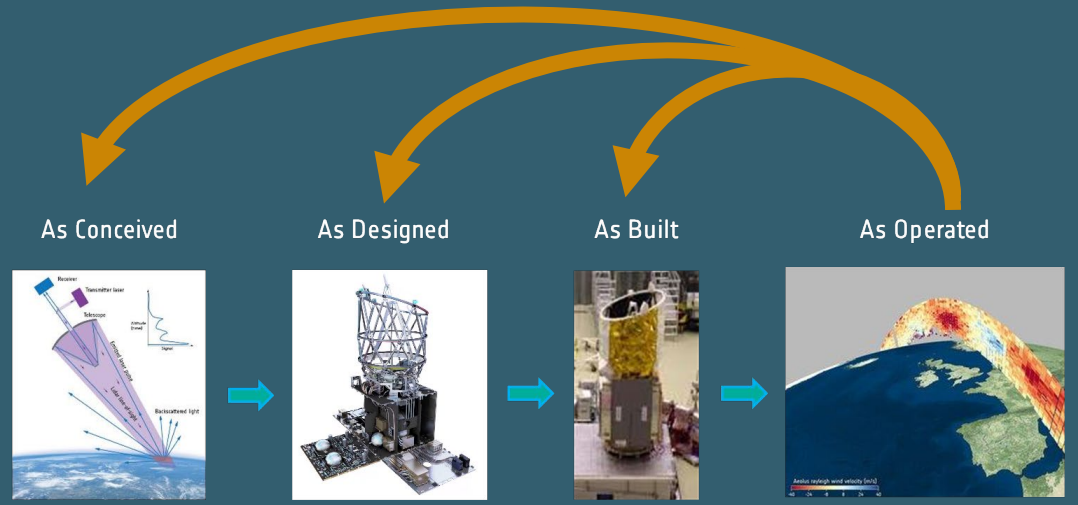
Digital Twin Spacecraft – Concept

3rd Step:

Connects different DT Spacecraft





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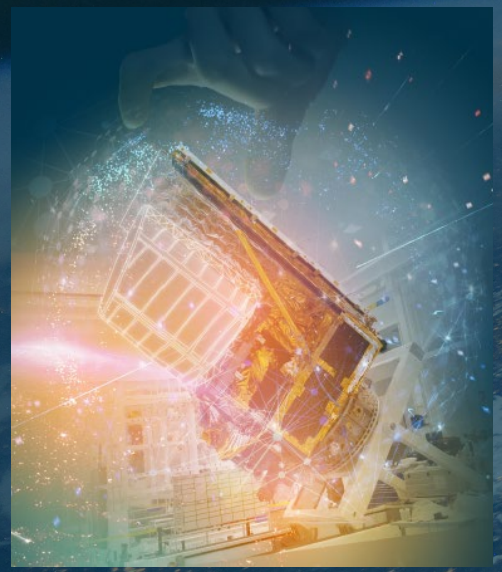
Vision for Digital Spacecraft



- Industry: Remove “waste” among stakeholders and foster creativity and innovation
- Programme dir.: Enhance oversight project with almost real-time data (technical, cost, schedule, risk)
- TEC: Enable rapid and effective support to the projects during the whole life-cycle
- OPS: Monitor actual status of the satellite and prevent possible anomaly/malfunction

DTSC Platform

Crucial foundation to proper capture, manage and exploit documentation, models and data about ESA projects.

Cost, Quality, Collaboration

Short-Term Goal

Provide end-to-end digital continuity for developing space projects across the complete mission lifecycle within the European ecosystem.

Medium-Term Goal

Provides great valuable insights from the massive amounts of data that was previously lost or locked in projects and functional silos to European stakeholders.

Digital Spacecraft is a journey

Specific pilots to test & learn about new way of working and/or new digital solution are vital before any deployment at scale. This selection should consider *interest, technical or management pre-requisite, readiness for deployments, alignment with project pain points*, …

This requires a change management,
therefore it is crucial to focus on people.

- Messages should be cleared
- Technology should be an enabler not a barrier
- Tools/processes should be simple, user-friendly and reliable