

APPLICATION OF DIGITAL EXCHANGES BETWEEN PROJECT PARTNERS IN THE FRAME OF ENVISION PROJECT

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THE STUDY, THE PROBLEM TO SOLVE

/// Transitioning from a document based engineering and review to data and models is an important step toward digital engineering.

- ! To reinforce the co-engineering between two parties (customer – TAS or TAS – partners)
- ! In order to streamline the exchange process
- ! In order to implement digital continuity

/// As demonstrated by earlier studies with CNES :

- ! Many activities are already model based but model exchange is still very limited
- ! Documentation production from these models is time consuming, error prone
- ! Frequent interactions with project team and review based on documents is difficult and largely inefficient

/// In the frame of Envision phase A study (M5 mission to Venus), additional budget to deploy operationally model based approaches

/// With technical officer, we decide to address two problems :

- ! Exchanges of system budgets (incl. raw data, history, data visualisation, ...)
- ! Digitalisation of performance report (incl. requirement compliance justification, exchange of scenarios, ...)

Delivery to customer

Review web site

- Static (simple IT, no server, long time storage, ...)
- Cross domain
- User friendly (data viz, interactions, search, ...)
- Online collaboration services



Delivery to customer

Review web site

Raw data

- Enable data exploitation customer side
- Machine readable format
- Structured by an agreed ontology

Delivery to customer

Review web site

Raw data

Simulation data

- Deliver scenarios
- Deliver simulation timelines
- With advanced data visualisation

Data aggregation

Knowledge graph

- Graph structure : thousands of vertexes and edges
- Structured by an ontology
- Optimised for complex trans-domains queries at ontology level
- Configuration management (versions, branches, ...) with changelog
- Static design + simulation results



Delivery to customer

Review web site

Raw data

Simulation data



Source data

Engineering environnement data

- No structured data, no knowledge
- Source data directly from authoring tools (DOORS, Capella, IDM-CIC, ...)
- Do the mapping between tool data model and ontology
- Link and aggregate concepts that are similar into different tools

Data aggregation

Knowledge graph

Delivery to customer

Review web site

Raw data

Simulation data

LINK WITH OSMOSE

/// Obviously the objective is to structure the graph with the Osmose ontology

- / Extended with Thales Alenia Space specific concerns
- / Taking directly ORM definition as input
- / Simplify ingestion and export of extended enterprise data that will be based on Osmose

/// We support system budgets (mass, power, propulsion) domains of discourses

- / Inspired by the IDM-CIC data model (our authoring tool), used operationnaly to maintain these budgets for years...
- / May be a good input for opening new DoD for OSMOSE

/// Will be extended to 3D accomodation

LINK WITH DOCUMENTS

/// CNES study show that about 50% of the data-package may not be digitalised

! Very narrative documents (like design description, design justifications, analysis reports, ...) even if they include « views » coming from models

! We have to bridge digital and document based approach to provide seamless review navigating both ways

/// The links are part of knowledge graph and inferred automatically using AI and NLP

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3.1.2 TARGETED OBSERVATIONS

Requirement Id	Derived From	Derives To
G-MIS-PER-002a	G-MIS-020	

Standard 30m resolution SAR observations
The Envision mission should enable SAR standard (30m resolution) observations on a set of selected target areas totaling 27% of the Venus surface.

Requirement Id	Derived From	Derives To
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EXAGOS Envision Search...

Req G-MIS-PER-0022
Performance requirement from Envision MRD

Standard 30m resolution SAR observations The Envision mission should enable SAR standard (30m resolution) observations on a set of selected target areas totaling 27% of the Venus surface.
Performance requirement

REFERENCES IN DOCS

- ESA-ENVIS-EST-MIS-RS-001_EnvisionMissionRequirementsDocument_iss2.3-2020-12-18_signed.pdf 1 reference(s)
- TN A1-1 ENVISION Requirements review report_Issue 02.pdf 1 reference(s)
- TN A2-1D ENVISION Mission Performance Analysis Report_Issue 02.pdf 1 reference(s)

SOME SCREENSHOTS

Changes between PM7 and MSR

Raw data documents

EXACO Envision Search... Version MSR compare to PM7

Mass budget

Type	Name	Mass (kg)	Updated
▼	PF	~11.5 kg	
>	Subsystem STR		
>	Subsystem AOCs		
>	Subsystem MECH	~4.3 kg	
>	Subsystem EPS		
>	Subsystem HARNESS		
>	Subsystem COM		
>	Subsystem THERMAL		
>	Subsystem DH		

Identification of changes

With changelog

HISTORY COMMENTS DATA DOCS

mass of Subsystem MECH

Value history

Value history

File Path: 1.0	MSR	11.76 kg
File Path: 1.0	PM5, PM6, PM7	11.76 kg
File Path: 1.0	MCR	11.76 kg

History panel (here mechanical subsystem mass)

SOME SCREENSHOTS

EXAG Envision
Version MSR
compare to PM7

Power consumption per mode

Power consumption in LAUNCH

Component	Percentage
others	1.48%
RTU	2.57%
TCSPS	16.9%
Heaters	32.7%
ORC	24.6%
PF	22.7%

Power budget

name	LAUNCH	MSR	PM7	PM5	PM6	PM5, PM6
PF	22.7%	22.7%	22.7%	22.7%	22.7%	22.7%

Power consumption of LAUNCH

Value history

Value history

- For Page 12: MSR (24.6%)
- For Page 12: PM7 (22.7%)
- For Page 12: PM5, PM6 (22.7%)



WAY FORWARD

/// Knowledge graph is a key asset for digital engineering :

- / Break « model silos »
- / Isolate data and their exploitation from authoring tools (diverse and may change)
- / Support engineering team in day to day activities
 - KPI, dashboarding
 - Queries
 - Checks, consistencies, ...
- / Support digital reviews as demonstrated here
- / Support IA and data analytics :
 - Used in OSIP study on Natural language processing / IA for engineering



/// Digital review :

- / Demonstrate that we can deliver this solution to ESA for each PM (each month) without disturbing the project
- / We will extend the perimeter (IVV, physical view, ...) and extends the projects adopting it

/// Osmose : important for interoperability, new domains of discourse to start

THANKS FOR YOUR ATTENTION
ANY QUESTIONS ?

