



# The « Functional Verification Manager »

to support end to end the satellite verification process.

DEFENCE AND SPACE

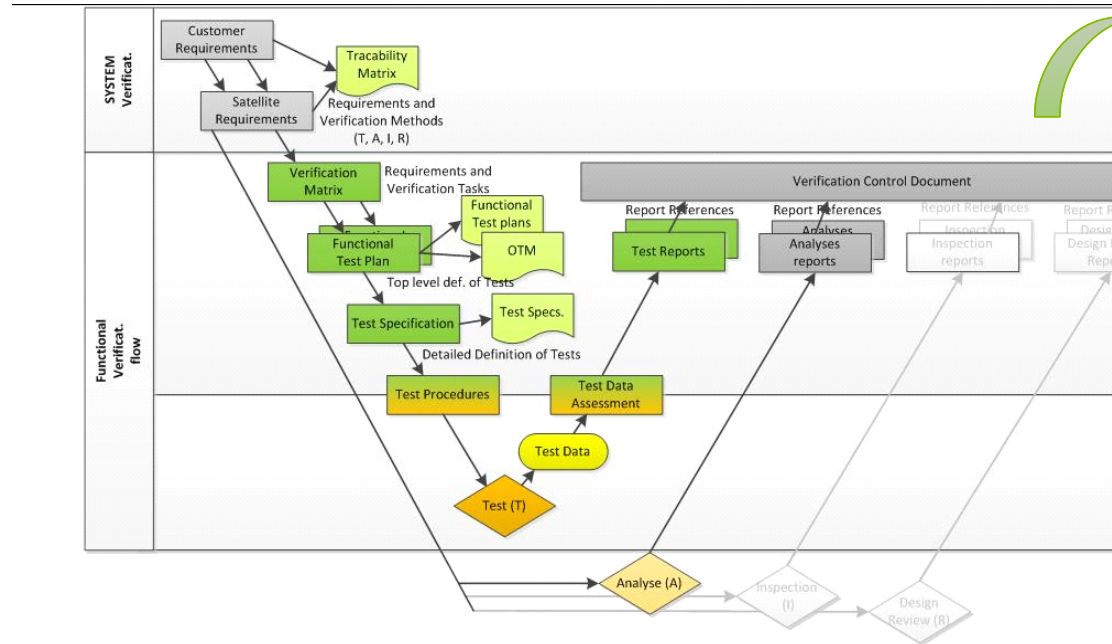
Jean-Francois Vasse, M. Scheuble, S. Von Der Nuell, Colin Borrett, M. Khalfallah  
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**AIRBUS**

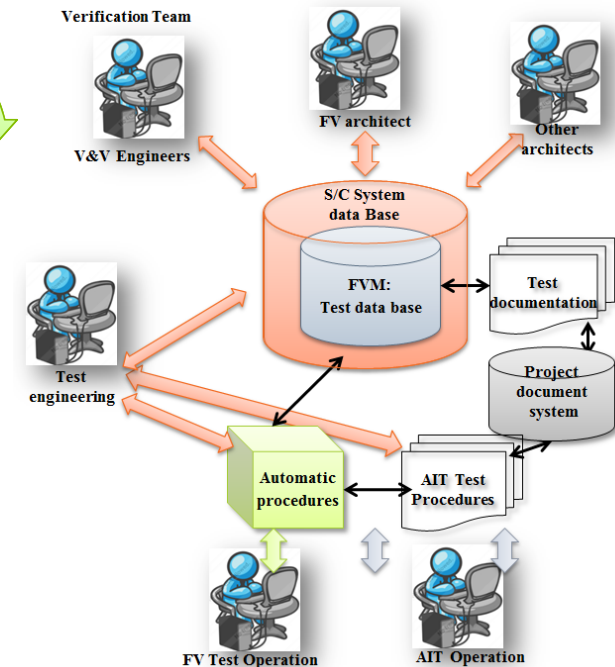
# SUMMARY

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- THE RIGHT VALIDATION TOOL AT THE RIGHT PLACE
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# THE FUNCTIONAL VERIFICATION MANAGER: OVERALL



Traditional space system verification work flow, based on test documents



New "Test driven" work flow, thanks to the FVM Tool.

➤ The **traditional** Verification and Validation work flow of the space systems is **"document driven"**.

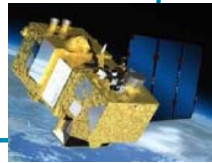
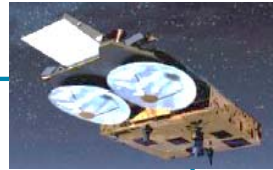
➤ **The innovation** brought by FVM is to change this verification work flow into a **"test driven" work flow**. Meaning that the main element is now centered on the test itself, and not any more on the test document.



## BACKGROUND AND FVM HISTORY - 1

### 2004-2014 – FTM: The precursor tool: The Functional Test Manager

- An initial experience started in Airbus DS Germany on the Cryosat satellite, A precursor data base FV tool – **“Functional Test Manager”** (FTM) based on Microsoft ACCESS.
- Then the tool has been improved on successive ESA programs Swarm, Grace-Follow, and Sentinel-2 & EarthCare.



### 2014 – Emergence of FVM

- The FTM tool was proposed for evaluation to the Airbus DS community on functional validation.  
-> showed a great interest, but also an insufficient level of industrialization.
- Decision has been taken in 2014 to develop a new industrialized “FVM” tool, based on “Range DB” and relying on transnational FV needs definition.



### 2015 - FVM Great principles selected

- Full digitalization, Maximized automation, Centring on the test  
One data One source, Interconnecting to other verification tools



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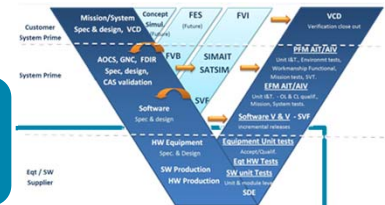
## BACKGROUND AND FVM HISTORY - 2

### 2015-2016 – FVM development and ramp-up.

- Finally it appeared that the tool can support not only the Functional Verification, but also the **full Verification & Validation** process, and this, whatever the models, for qualification or recurrent. The scope is enlarged to full V&V.
- Today a first version has been developed, validated and successfully implemented on a pilot program in Germany: **AS400**.

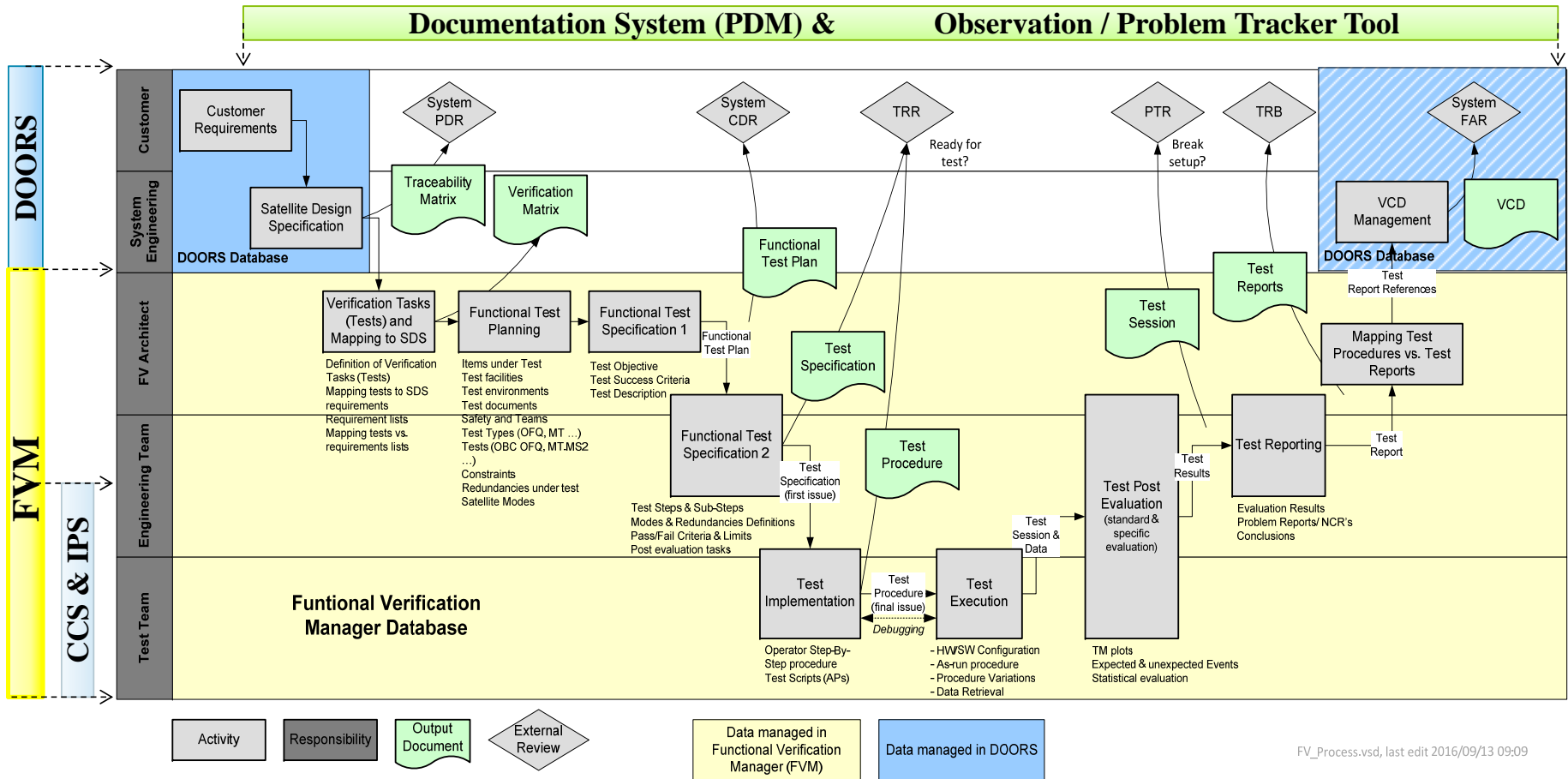
### 2016-2017 – FVM in the core of a fully digitalized spacecraft factory 4.0

- Today the development continues in the frame of digitalized engineering factory for spacecrafts from Telecom, Sciences and Earth observation domains.
- FVM is now expected for all the future Airbus DS validation campaigns like METOP-SG, JUICE, NEOSAT, and all the future Telecom products.



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# THE RIGHT VALIDATION TOOL AT THE RIGHT PLACE



## FUNCTIONALITIES PROVIDED BY FVM:

### ***Test engineering tasks:***

- Test verification needs according to VCD inputs,
- Test plans,
- Test specifications and test configurations,
- Test procedures.

### ***HW / SW Configuration Manager***

- HW/SW test configurations,
- Equipment modes and states for the tests,
- Redundancy configurations.

### ***Test results engineering:***

- Automatic cockpit for supervising of test progress
- Test sessions storage and direct access to test results,
- Test assessments,
- Test results sign-off for AIT and for Engineering,
- Test execution reports,
- Test engineering reports,
- VCD closure.

### ***Product line test engineering:***

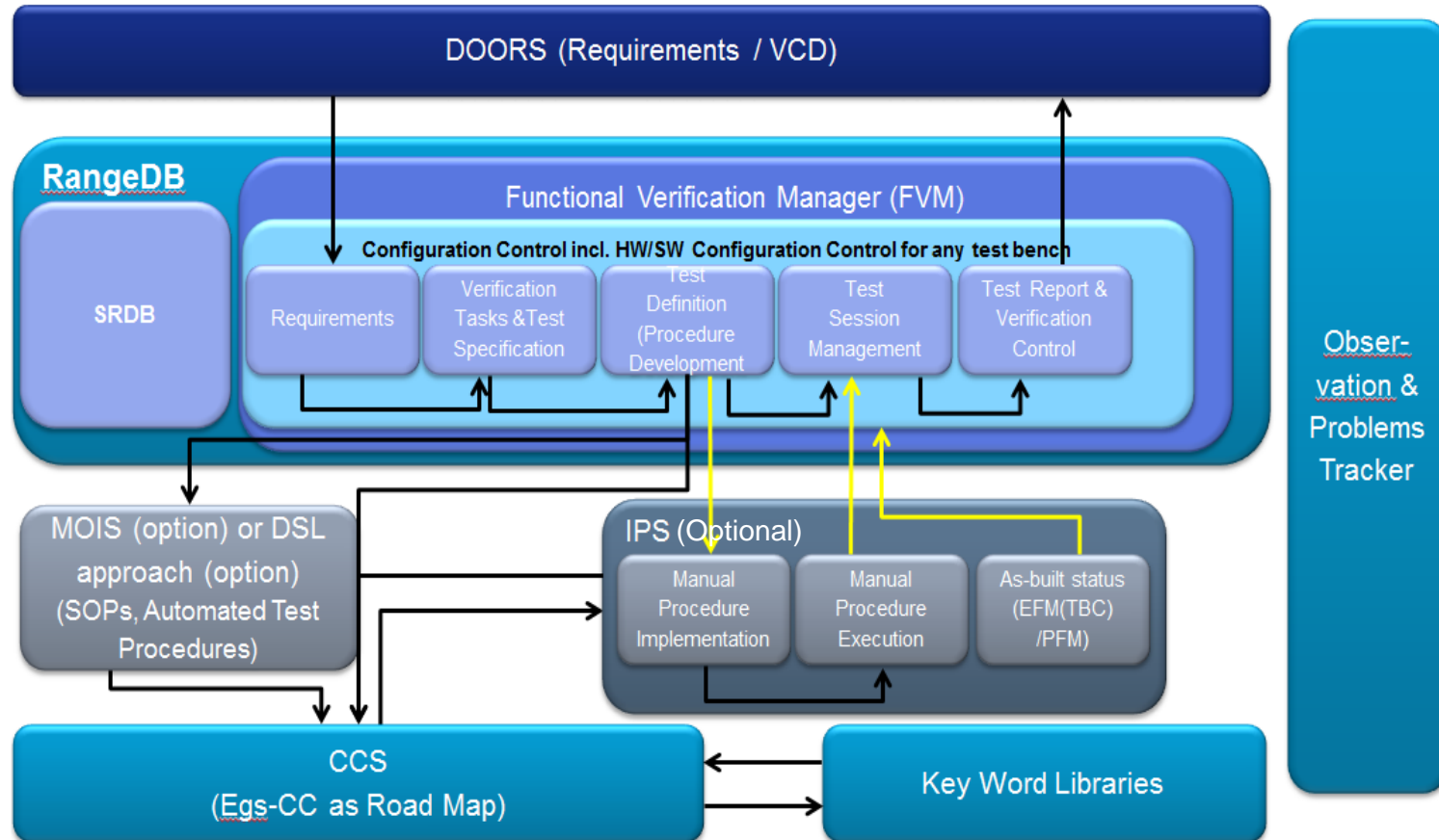
- Overall test matrixes with regard to the AIT Phases,
- Generic product test matrixes and applicability matrixes for specific instances.
- Test configuration per functional chain.

Display actual Satellite HW / SW configuration acc. to test session

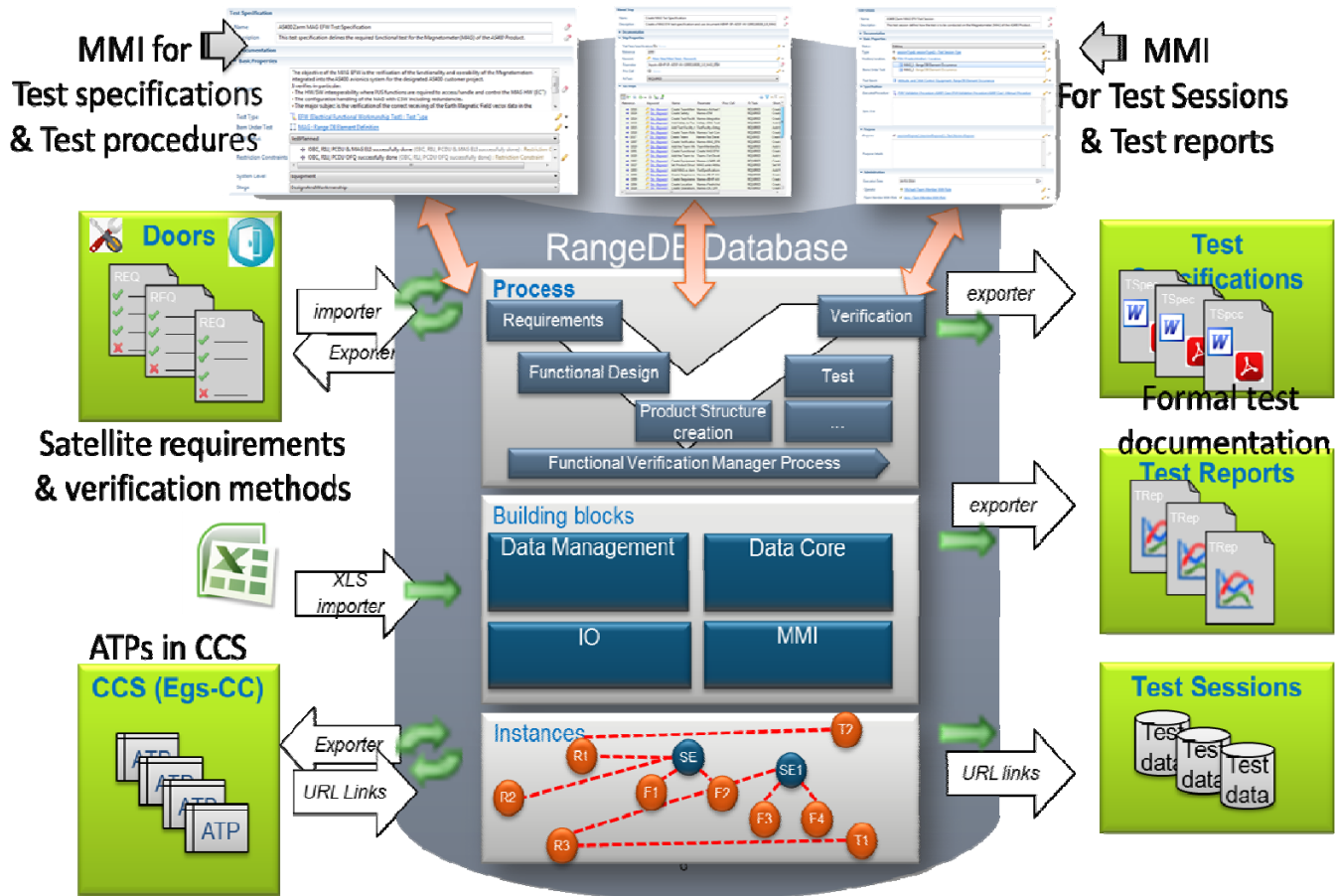




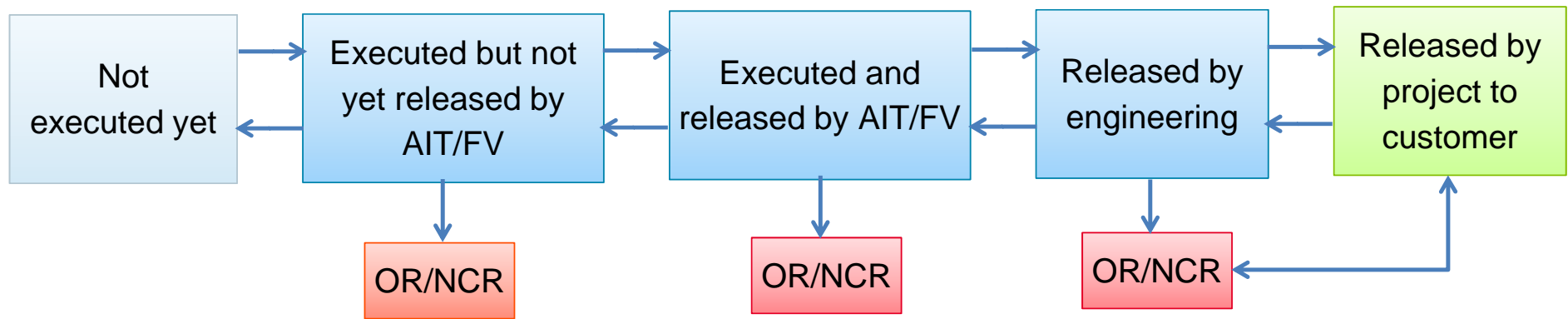
# FUNCTIONAL DECOMPOSITION OF THE TEST TOOLS



# CONCEPTUAL ARCHITECTURE SOLUTION OF FVM

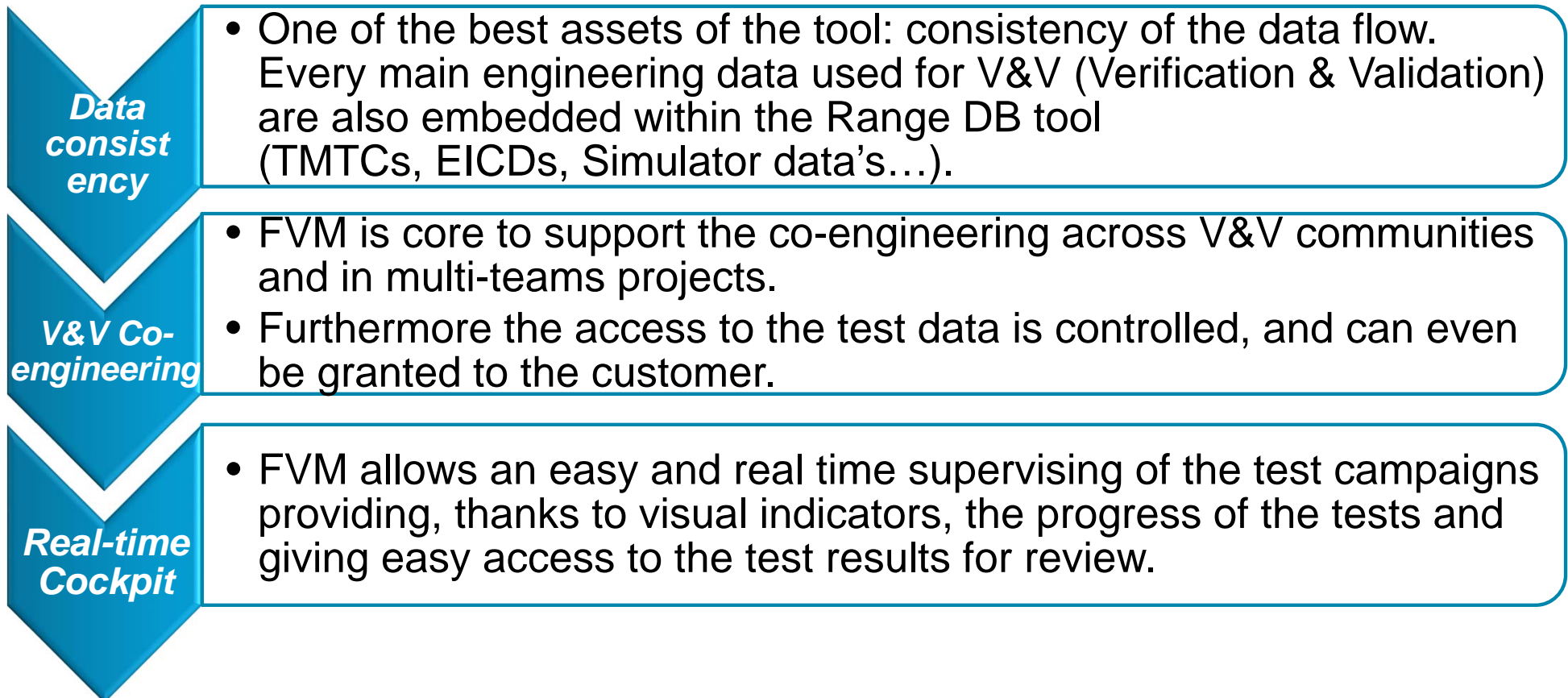


## TEST RESULT PROGRESS THANKS TO FVM



- A powerful sign-off/release process of the test datas
- Supports the test assessment by the different stakeholders from AIT/FV up to the customer.
- Connection to the Problem tracking / Non-conformance report tool.
- Efficient support to the post test reviews (PTR).

## FVM ASSETS - 1



## FVM ASSETS - 2



*Harmonization Re-use*

- Harmonization of V&V best practices between the V&V actors, implementing common templates of V&V documents.
- Re-enforces the re-use between projects and sites.



*Data Base application*

- Benefits of the all the features of the Range DB Tool:
  - Enhanced Man-Machine I/F,
  - Configuration management at test data level,
  - Evolution tracking's,
  - Statistic processing,
  - Search & Comparison from projects to other.

## FVM CHALLENGES AND DIFFICULTIES - 1

### *Buy-in of the V&V actors*

- Radical change of the V&V working method, Moving from a usual word/Excel written documents to a data base application.
- Needs training and support!

### *Harmonized process*

- FVM enforces harmonization of the V&V process & tools.
- It is an asset only if there is also the overall buy-in of the actors.
- Not only a new tool but also a new standardized V process!

### *Man- Machine Interface*

- The Man Machine Interfaces (MMI) has to be enough “user friendly”.
- Otherwise the V&V actors will be tempted to write test documentation in traditional Word/Excel mode.
- A recognized user-friendly MMI I/F is one of the main challenges.

## FVM CHALLENGES AND DIFFICULTIES - 2

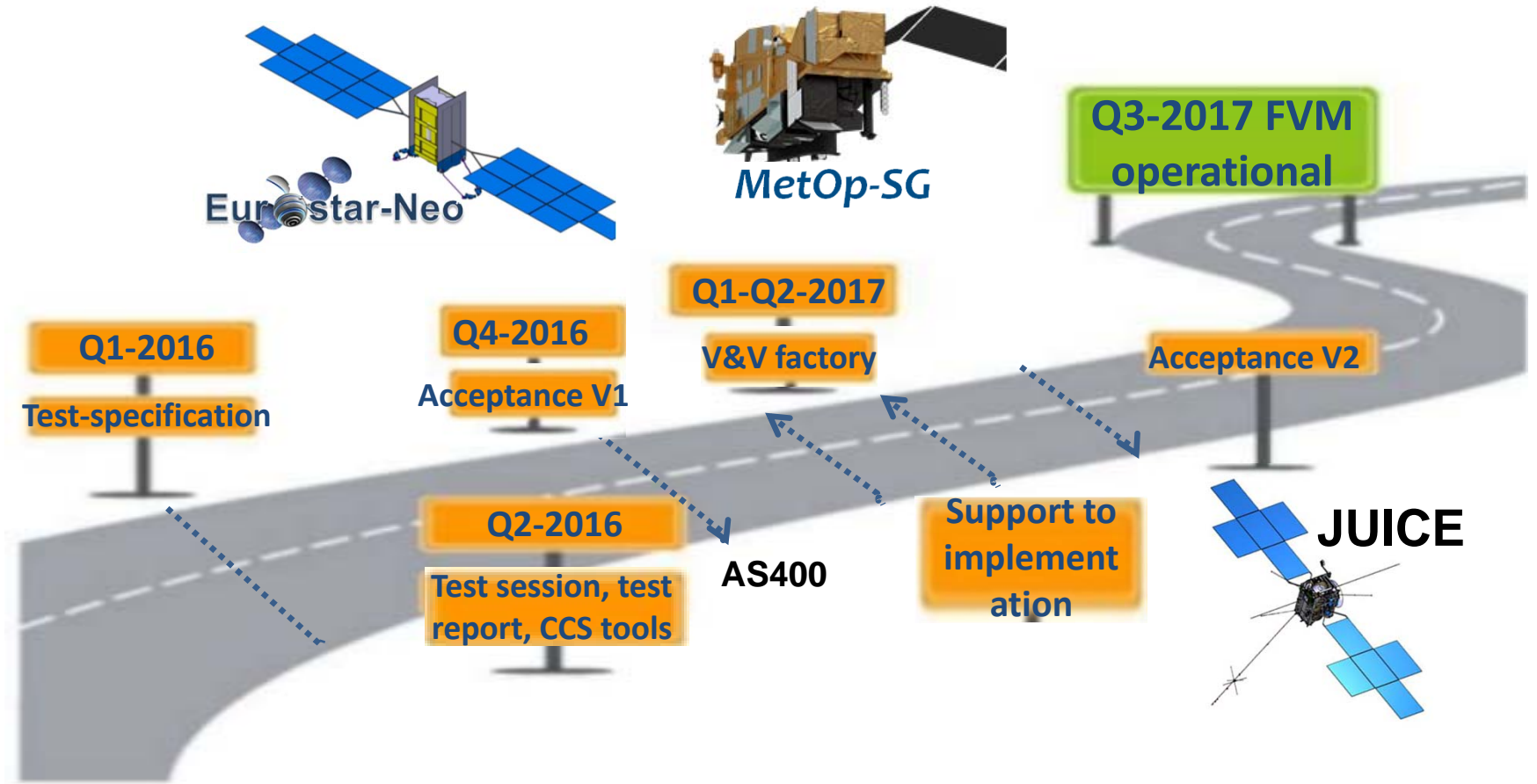
*Use of a  
data base  
application*

- FVM is based on the Range DB tool,
- Must be permanently accessible and available all over the satellite project test campaigns.

*other  
validation  
tools*

- Connecting a data base tool to other industrial validation tools is not evident
- It has been well foreseen from the beginning.
- A difficulty is added if these ones are different from projects to another, like the CCS (CCS5, OC, or Egs-CC....).

# FVM WAY FORWARD





## CONCLUSION

An advantage for the future validations of space systems.

- Passing the validation process from a “document driven” to a “Test data driven” process is considered as a real advantage for the future validation programs.
- It will streamline the development and the validation of our space products.

But also a significant change to be carefully supported

- In order to master the transition phase, and to get the expected buy-in of the V&V actors.
- A lot of intermediate workshops has been required to collect the feed-backs. We are now proceeding carefully in this way.

## CONCLUSION

In future, FVM opens the door to different interesting enhanced possibilities

- Enlarge the validation tool to other test domains (possibly Mechanical, Thermal...),
- Possible extension of the scope to the flight operations,
- Automatic test definition, according the selected on-board configuration,
- Support to Data base validation...
- Automatic test report,
- Multi-project statistical test analysis,
- Trend analysis on specific technical parameters...

A step towards a fully digitalized factory for satellite engineering

- FVM is one of our more challenging steps towards a fully digitalized factory for satellite engineering, production and validation.

Thanks for your attention

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