ADCSS 2013
"SW Factory" Session

On-Board Software Astrium Standpoint

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Together the pioneer of the full range of space solutions
for a better life on Earth

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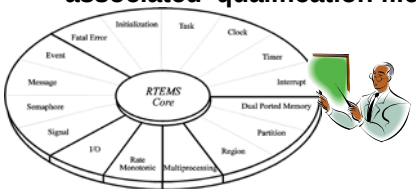
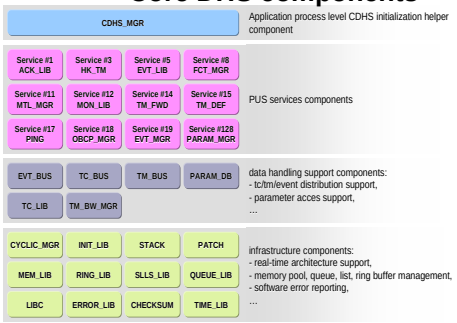
ASTRIUM Satellites OBSW Factory in practice
Developments & products

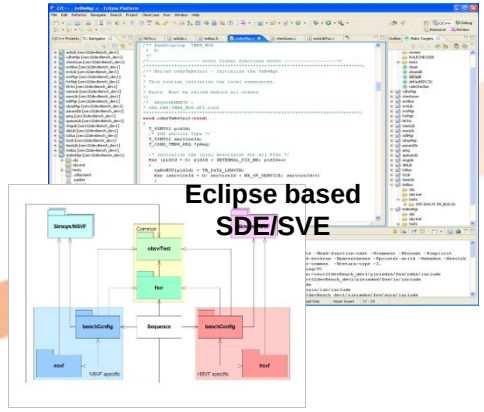
- Based on more than 30 years of experience in on-board software development and maintenance for all types of satellites, spacecraft and equipment: about 4 Millions of LOC - more than 50 satellites - around 500 years of cumulated in-orbit running software.
- Software development are based on software products and integrated standard development and validation environment (SDE/SVE) for improving productivity, mastering of schedule and quality:
  - Telecom & Earth Observation **SW product lines**
  - RTEMS Product **operating system**
  - Core DHS **service library for PUS based operations**
  - OBCP Interpreter **for smart and automated operations**
  - Eclipse **based** Software Development Environment **and** Software Validation Environment

RTEMS Product with associated qualification file



Core DHS components

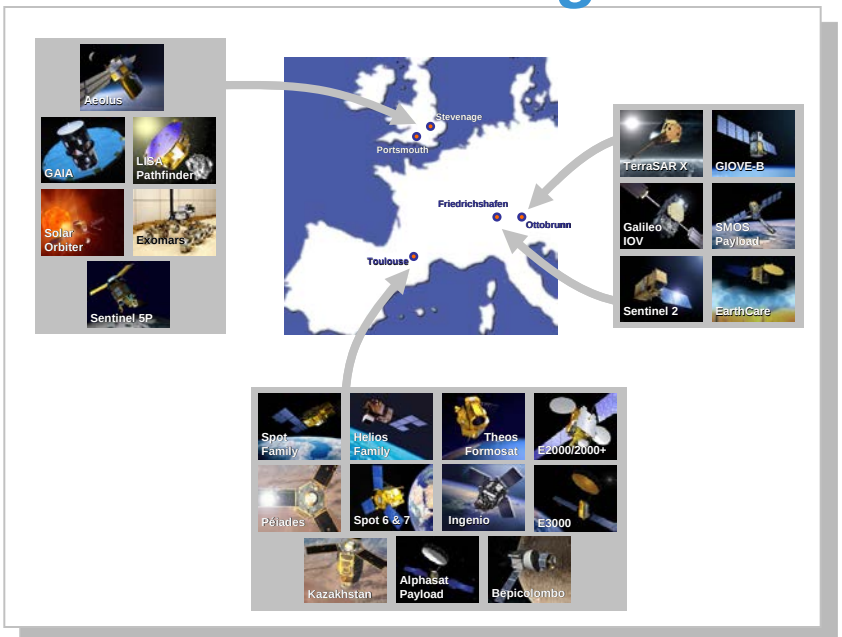


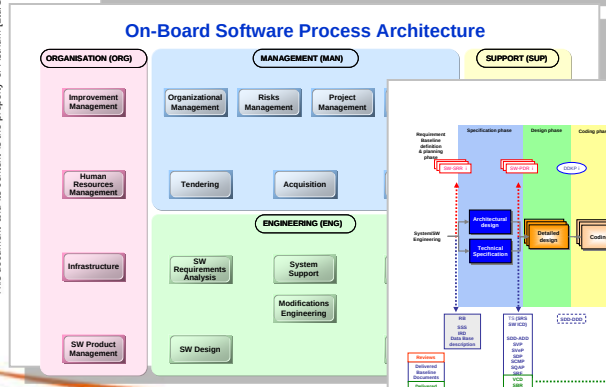


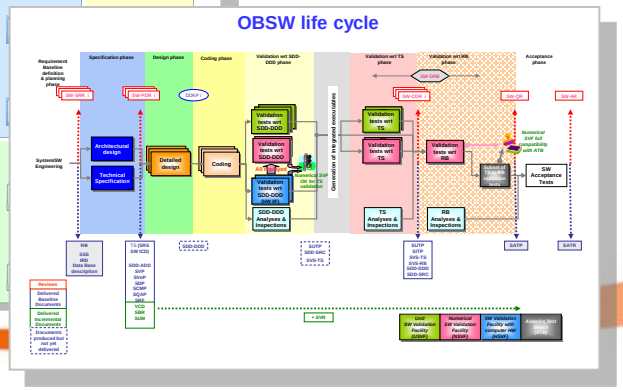
Eclipse based SDE/SVE

ASTRIUM Satellites OBSW Factory in practice

Skilled and Integrated Transnational Teams

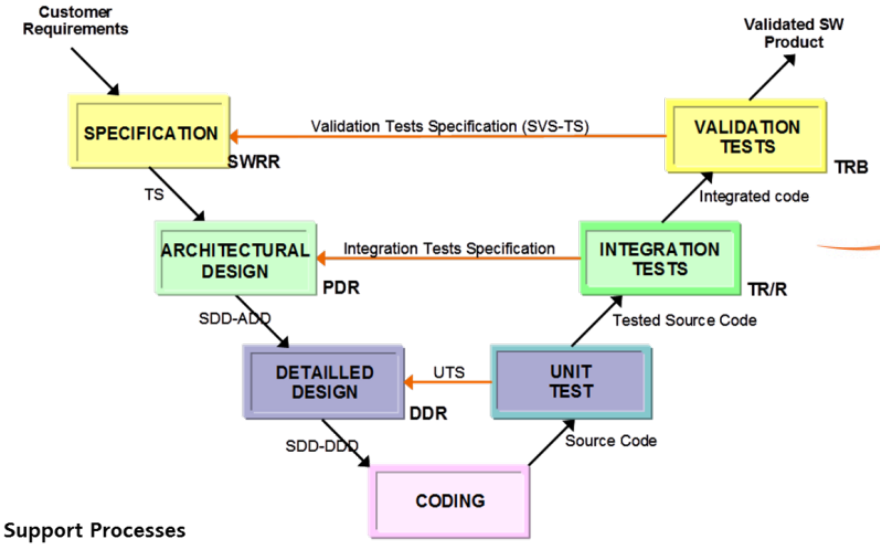


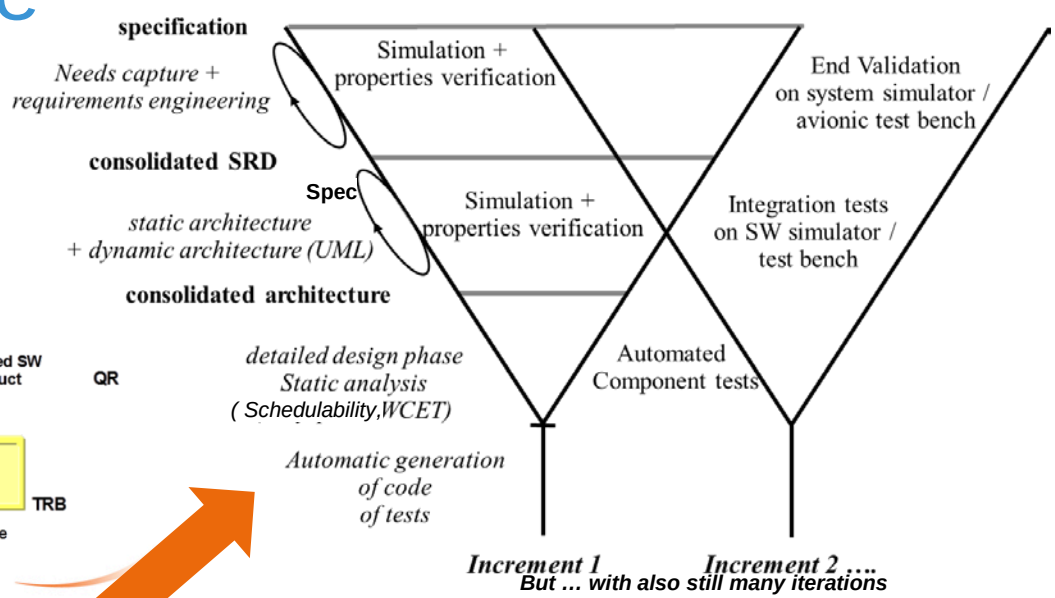




- Capability of On-board software development on 4 sites for all Astrium satellite projects
- Capability of development sharing on several sites, including subcontractors (Galileo IOV, GAIA, BEPI, SOLO, Rover, Sentinel 2, Sentinel 5P, …
- Working across sites is performed thanks to:
  - Common development life cycle and process reference (OPAL, assessed CMMI level 3)
  - Catalog of reusable software products and building blocks
  - Unified software development and validation environment and associated tools
  - Skills and dedicated training

From « V » Reference Life-Cycle to Enhanced Life-Cycle



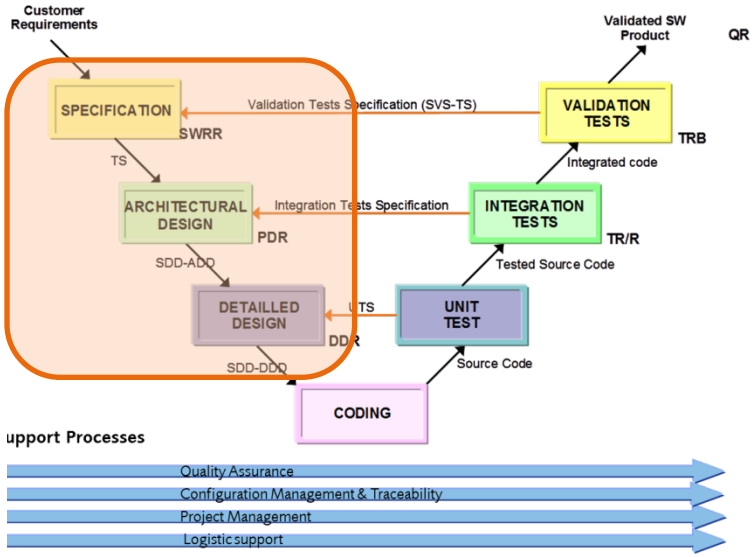


Support Processes

- Quality Assurance
- Configuration Management & Traceability
- Project Management
- Logistic support

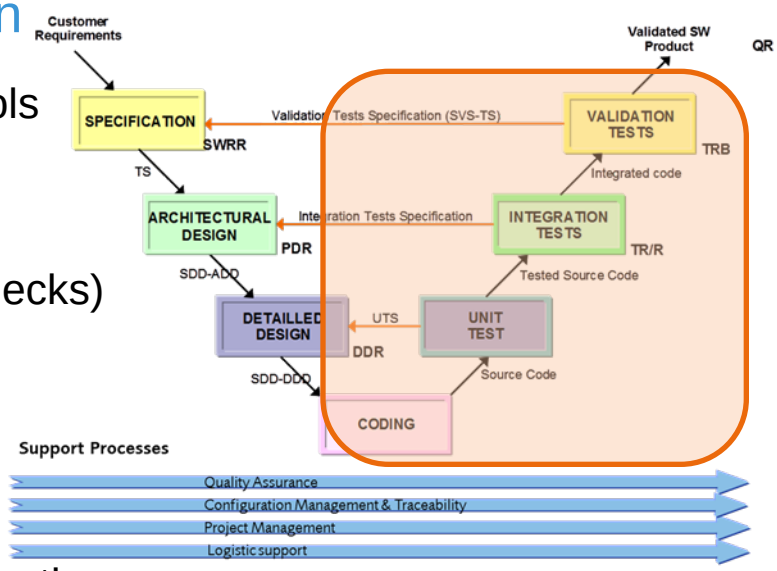
Requirements and design

- Better support of SW product lines development and building blocks reuse
  - Options and variants management all along life-cycle: requirements, models, code, tests, documentation
  - Robust and complete SW Data model full compatible with System Data Base and allowing efficient SW parameters integration in all SW assets (Doc, code, tests)
  - Product documentation with generic and mission specific
- Reinforce improvement through MBSE
  - System to SW engineering: from documents-based only to model-based (SysML, Mathworks) supporting both engineering, capitalisation, documentation production and requirements management with some compatibility and interface with DOOR ➔ need for models at system level (OPS, FDIR, Satellite, Avionics , HW) + better definition of modelling objectives (feasibility concept, requirement formalisation, properties verification)
  - Extend UML-based design with dynamic architecture and real-time concepts for more code generation and real-time / schedulability analysis
- Explore semi-formal textual techniques for requirements
  - Support of ontologies / boilerplates (with tool like RQA)



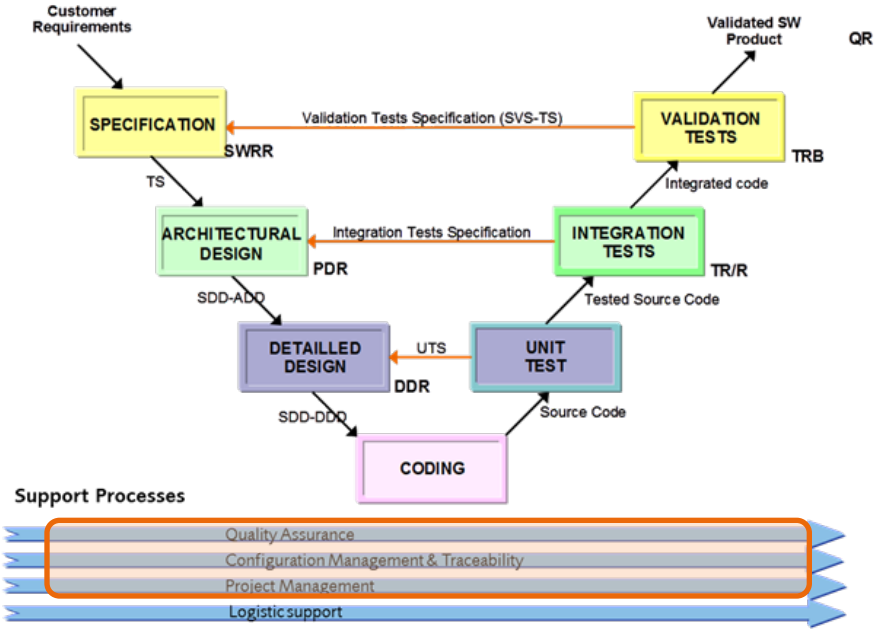
Code production and tests

- Automate all code production and verification
  - Move to continuous building and integration with tools like Hudson
  - Automate and integrate all code verification in the production process (code and quality rules, code checks)
- Optimise tests effort and duration
  - Reduce test engineering with a full Java-based test framework with generic libraries
  - Tests automation is well achieved, now reducing duration is at stake for non-regression and incremental validation (one week for full SW to few days)
  - Continue to promote Numerical Simulators for covering a large part of SW integration and validation, preparing key building-blocks like new microprocessors emulators
- Better integration of development and test environment



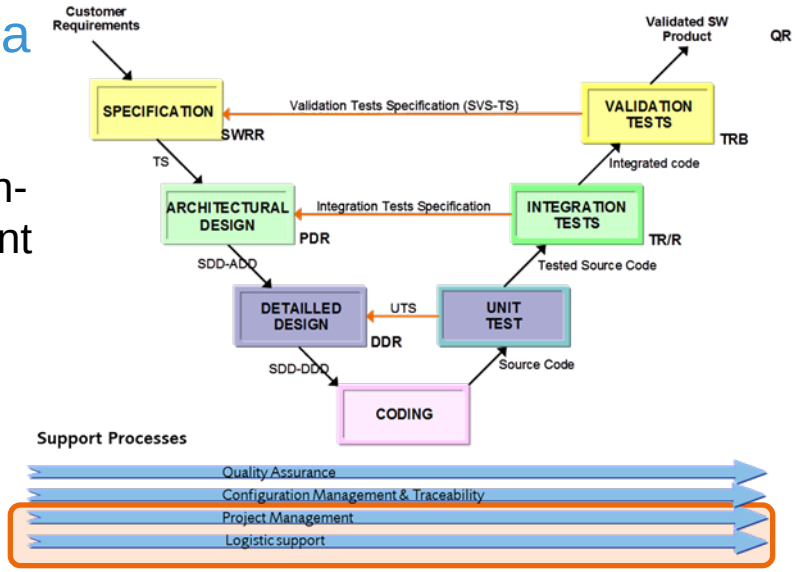
Configuration management and traceability

- Move from pure SW configuration and change management to work-flow and process oriented management
  - From “classical” configuration and change management tools to more flexible and open solutions like SVN & GIT.
  - Open-Source tools have still to be improved
- Integrate models in the configuration management and traceability process
  - Being able to trace some requirements in the models and to use models as “requirements”
  - To make easier models evolution by a collaborative team with efficient Check-in/check-out and Merge / Difference capacities



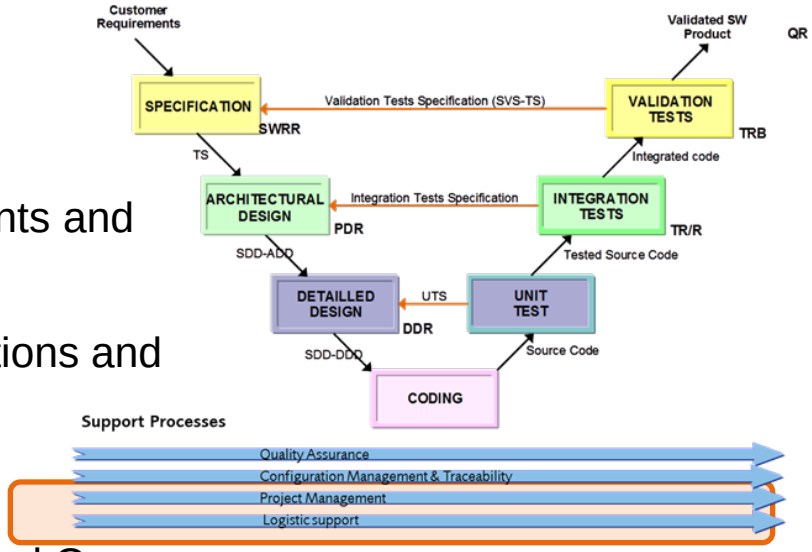
Infrastructure and Development Environment

- Continue to use ECLIPSE environment as a de facto Standard
  - Promote and integrate all tools (Commercial, open-source or in-house) in the same single environment
  - Enhance HMI tools interface with efficient views, limited options corresponding to processes and roles
- Prepare Extended Enterprise collaborative environment
  - Solve security and confidentiality issues on network for trans-national and trans-companies exchanges
  - Keep an efficient SW developer environment with all the engineering, management and communication tools accessible on the same workstation
  - Being able to deliver a OBSW SDE for OBSW Flight maintenance on some ESA projects



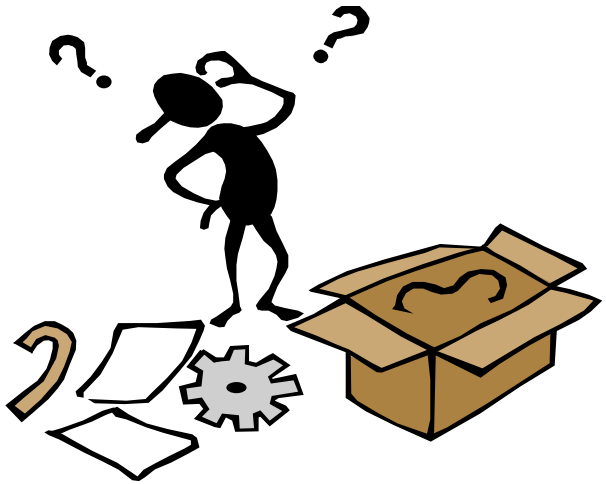
Tools business model

- Between COTS and In-house, open source could be a good comprise
  - Better support for long term maintenance
  - Enabler for openness and innovation (improvements and R&D) and skills (education and training)
  - Making easier tools integration and sharing evolutions and enhancements costs
- Organising the eco-system
  - POLARSYS is one mean to federate End-users and Open-Source tools Services providers in a single ECLIPSE-based organisation
  - Decide what is standard or common (like ECLIPSE, Component Model, SysML/UML editor,) and what is Domain / Company or Project specific (Tool customisation, Model instantiation, DSL, Rules verification)
  - Reinforce Open-Source tools usability (maturity assessment, legal aspects and licences checks)



Thank for your attention.

Any question ?



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