ESA Workshop on

# Avionics Data Control Software Systems

# Welcome to ADCSS 2016


| | |
|---|---|
| Kjeld Hjortnaes | Head of Software Systems Div. |
| Philippe Armbruster | Head of Data Systems Div. |
| Alain Benoit | Head of Control Systems Div. |


18-20/10/2016

# ADCSS-2016

## SAVOIR (Tuesday)

**The objective is to update the avionics stakeholders on the progress done over the last year and to discuss the next steps.**

1. SAVOIR Status and Ongoing activities

### Avionics Related Technology Sessions

1. Results of the ESA Technology Harmonisation Meetings
2. Exhibitors Flash Presentations
3. Model Based Avionics

## Avionics Related Technology Sessions - (Wednesday/Thursday)

**Mega-constellations, compact spacecraft avionics and mixed criticality systems**

1. Avionics in mega constellations satellites
2. Compact on-board computer architectures
3. Mixed criticality systems issues in relation to spacecraft avionics

---

4. Avionics systems for exploration missions
5. Automated Code Generation for AOCS

# Avionics Data Control Software Systems – workshop 2007-2016


Workshop Focus

- SAVOIR initiative
  - Reporting on the results from the SAVOIR initiative
    - System architecture definition
    - Reference functional / Interface spec definition.
    - the SAVOIR working groups
- Addressing various avionics related technology issues
  - state of art vs state of practice.
- Strong link between the technology dossier and the Savoir initiative in particular
  - The Avionics Embedded Systems dossier.
  - The Data Handling dossiers (TD-1)
  - The AOCS dossiers (TD-5)
  - The Software Dossiers (TD-2)

# Avionics Related Technology @ ADCSS

| | SDSS | ADCSS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2005 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| SAVOIR status reporting | | | | x | x | x | x | x | x | x | x |
| Avionics systems | x | x | x | | | | | | | | x |
| Reference architecture | x | x | x | | x | | | | | | |
| SW ref architectures / IMA | x | x | x | | | | | | x | | |
| platform/payload interface | | | | | | | | | x | | |
| Model Based Sw Engineering & Testing | | | x | | x | x | | x | x | | x |
| Auto-coding | x | | x | | | | | | x | | x |
| Formal Methods | | | | x | | | | | | | |
| FDIR | | | | | | x | | | | x | |
| next generation. µ-p's / micro contr | x | x | | x | x | x | | | | | x |
| RTU's | | | | | x | | | | | x | |
| Mass memory | x | | | | | | x | | x | | |
| Communication SOIS /CAN / ethernet | | | | | | | | x | | x | |
| AOCS sensors / AOCS control / GNC | | x | | | x | | x | x | | | |

# **SAVOIR** means ***S**pace **A**vionics **O**pen **I**nterface a**R**chitecture*

- Avionics Embedded Systems technology Dossier – 2006 had focus on avionics architecture, re-use, cost reduction
- The Technology Harmonisation Group (THAG) requested ESA to organize a workshop to harmonise the views and roles of Reference Architectures and product orientation.
    - This became ADCSS-2007 (which had focus on system architecture)
    - IT again led to the formation of the SAVOIR Advisory Group (SAG) with the objective to:
        - *streamline the development of the avionics system for space programmes,*
        - *increase efficiency and cost-effectiveness in the development process*
        - *taking into account the trend towards more functionality implemented by the onboard building blocks (product orientation)*

# **SAVOIR** ambitions


- The objective of the SAG is to review the current roadmaps, to guide the R&D activity plans and to monitor their execution in order to maximize the results towards the shared vision.

- In particular the objective for the SAG is to achieve the definition of reference architectures, based on open interface standards, for the purpose of specifying building blocks that can be developed, qualified and composed into compliant avionics systems with a minimum of re-engineering effort and providing a maximum of reliability and performance.

- Dissemination of results from the Joint undertaking and from related R&D shall be presented at annual ADCSS workshop.

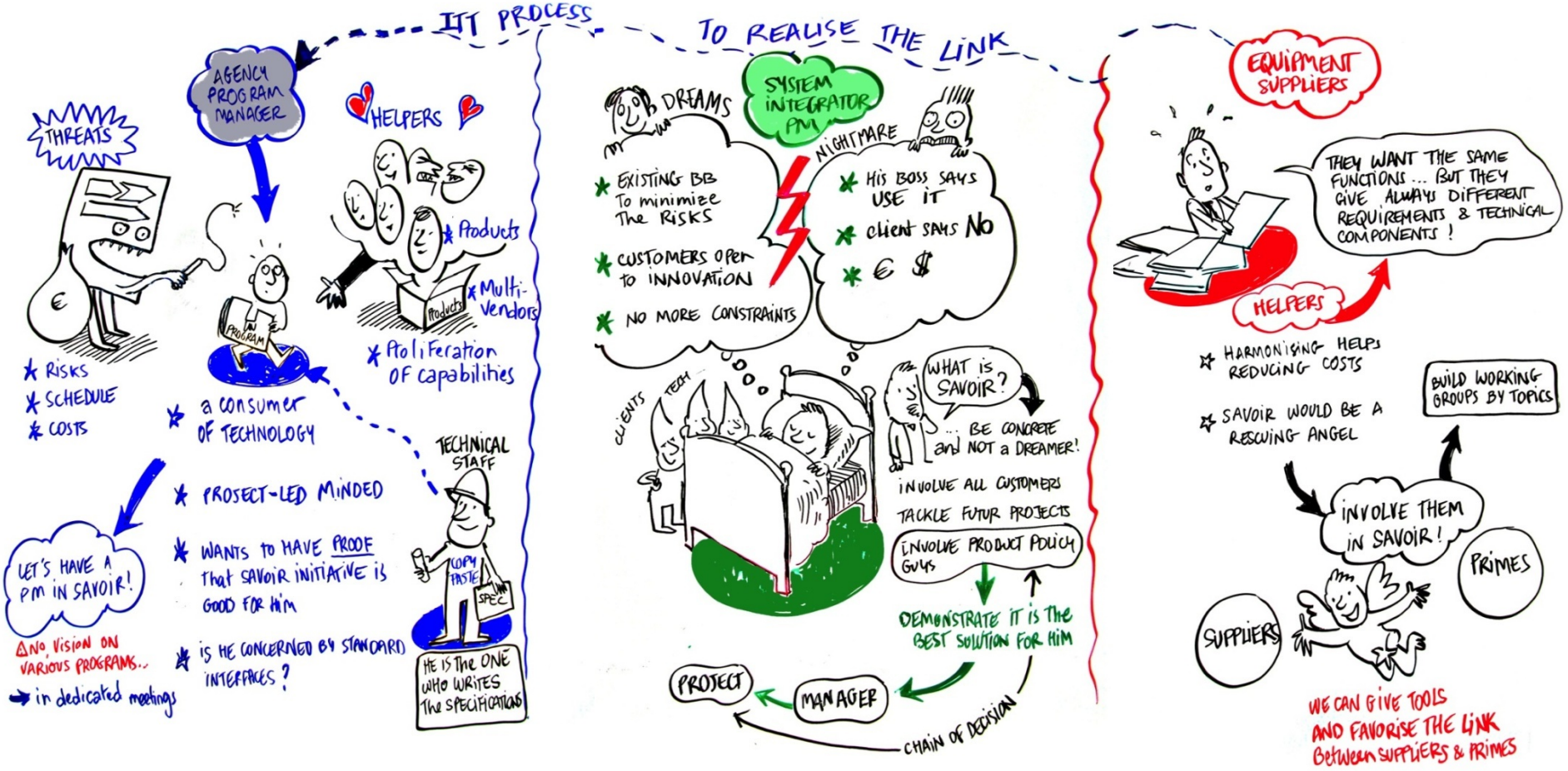
# **SAVOIR** – initiative assessment

- A reference architecture was established.
- A long list of building blocks (products) were proposed
    - Component level
    - Unit level.
    - Software /Software library level

- However it did not clarify
    - Ownership
    - Warranty
    - Funding
    - Maintenance
    - Acceptance by projects.

- Some rethinking was required

# Deep thinking (Jan-2011)



# Refinement of the SAVOIR objective

- Focus remain on re-use potential & cost effectiveness

- SAVOIR to focus on
  - Avionics Reference architecture
  - Identify building blocks.
  - Interface specification
  - Reference functional spec
- R&D to supports the product maturity process (TRL steps <5(6))
- Industry undertakes
  - Final product definition & implementation,
  - Retains Intellectual property right
  - Governance,

Reference architecture, functional spec, interface spec are submitted for public review in collaboration with Eurospace, to achieve the highest possible acceptance within the European Space community.

# **Savoir** initiative impact.

Does the SAVOIR initiative address the over-arching objective?

- Supports the product orientation within the European Space programs, by using
  - reference architecture,
  - harmonizing interfaces definitions,
  - use reference functional requirements augmented with mission specific

Is the Savoir initiative - Trend setting or Trend following?

- It is rather unique to have European level harmonization of Avionics design across the European Space sector.

**Collaborate on standardization compete on implementation**

- Visible effect
  - Platforms are becoming a commodity that are tailored for a mission and rarely redeveloped from scratch – major cost & schedule reduction.
  - New programs kick-off the payload before placing the satellite contract.

# The **SAVOIR** initiative progress

How is it going?

- Consensus takes time
- Writing reference spec via working groups takes time
- Maturing of concepts via R&D programs takes time
- Public review of reference spec's takes time
- The Risk Avoidance mantra makes changes takes (long) time

despite all of that

- Reference architectures have been defined (HW & SW).
- A set of building block reference spec's have been released.
- Public reviews have been completed.
- Further documentation sets are in progress by the SAVOIR working groups

Is it used in the programs?

- It has been adopted in parts in projects as Euclid, JUICE, Flex and currently considered for the Plato mission.

Can we do better ?

- Always – and with your help!

We wish you all

a good and informative workshop

---

On behalf of the

Workshop Organising Committee