SAVOIR
space avionics open interface architecture

ASTRIUM View

ADCSS 2012

Earth Observation, Navigation & Science

R.Roques

ESTEC, Noordwijk

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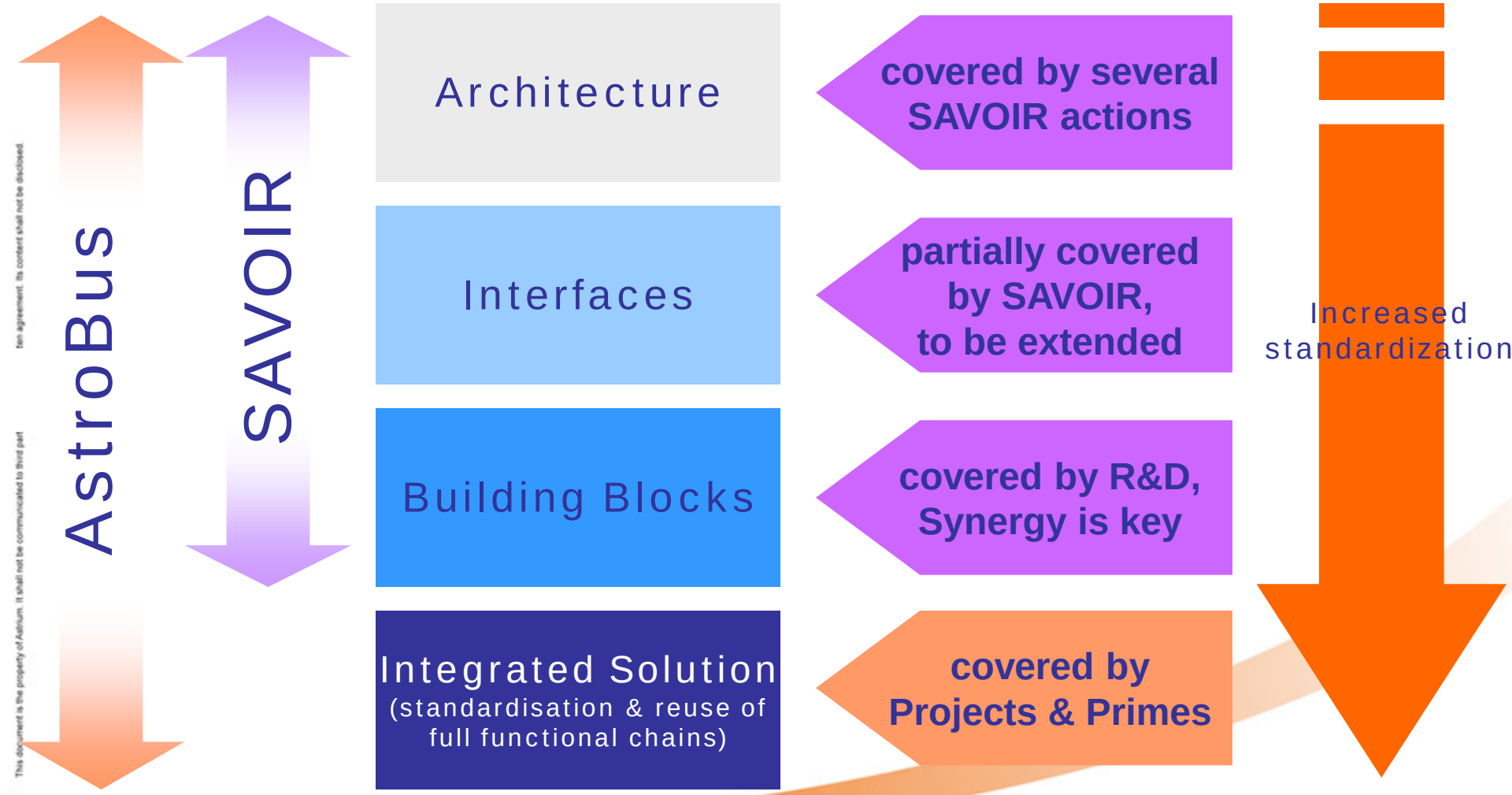
Benefits of avionics rationalization

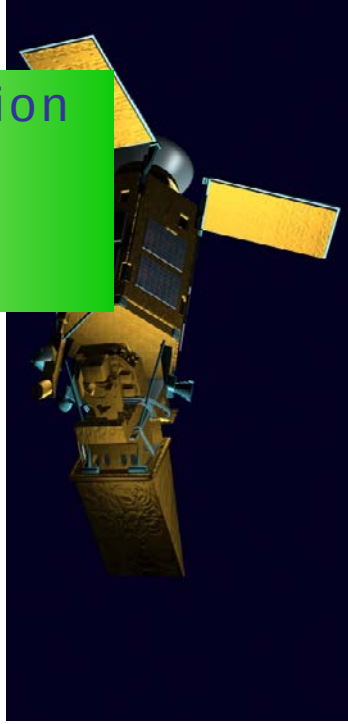


AstroBus follows SAVOIR ASRA principles

- **AstroBus platforms successfully deployed, e.g. on Sentinel-5P, SEOSAT, Sentinel-2 & EarthCare for ESA**
- **AstroBus avionics architecture and building blocks also applied beyond LEO mission range, e.g. Solar Orbiter**
- **ASRA compliance :**
  - Centralised platfom data management and core software
  - TC/TM handling, OBC reconfiguration
  - Flexible input/output units sizeable to mission needs
  - Payload interface via SpaceWire or MIL-Bus
  - ECSS compatibility

ASRA : « [SAVOIR] Avionics System Reference Architecture »

Sentinel-5 Precursor



Standardization level wrt AstroBus Standard

Architecture

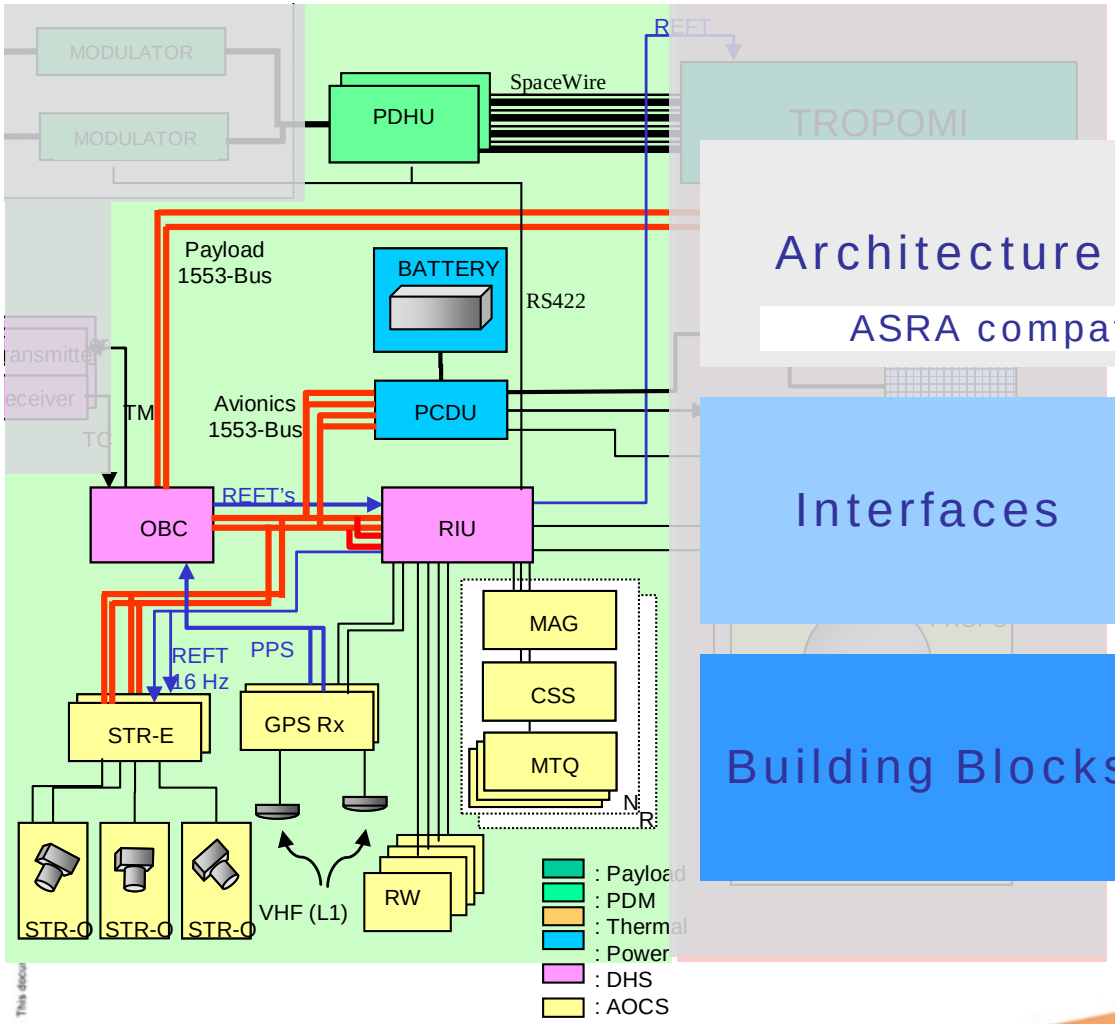
ASRA compatible

Interfaces

Building Blocks

Full adherence to reference interfaces

Introduction of new compatible units (TRSP, PDHU)



Industrial efficiency also means ...

- **Frozen inter-unit and HW/SW interfaces**
  - Smooth introduction of new units better tailored to the Mission and/or with improved performance
  - Flexible equipment sourcing
  - Substitution of obsolescent items
- **Pre-Existing key "building blocks" (HW, SW) having reached adequate TRL at project start**

For an efficient injection into BCD programmes SAVOIR induced evolutions should be compatible/adaptable to existing industrial solutions (or evolution roadmaps)

- **Standardised engineering and validation processes**
- **Validated operations and AIT procedures**
- **Standardised test infrastructures**
- **Technical data management system to cope with generic and specific parts of the Project documentation**

Review of SAVOIR initiatives (hardware)

SAVOIR Initiative	Comments
Architecture	
ASRA Reference architecture (WP2)	Useful Astrium AstroBus is compatible ➔**Process for introduction in programmes to be worked out.** ➔ **R&D to increase TRL of identified evolutions (e.g. SpW network, CAN bus)**
ASRA PF/PL interface	
ASRA S/C monitoring & control	
Interfaces	
SAIF sensors/actuators i/f	needs more detailed standardisation actions ➔**Push for use of digital interfaces**
EDS electronic data sheets	➔**Give priority to System and harness data base interfaces**
Building Blocks	
ASRA OBC spec	Astrium AstroBus is compatible RTU : technical contents OK, some doc improvement req'd
ASRA RTU spec	
RTU 2015	➔**Highly modular I/O unit. Emphasis to be put also on cost efficiency**

➔ **Recommended Action**

Review of SAVOIR initiatives (software)

	SAVOIR Initiatives	Comments
Architecture		
	SAVOIR-FAIRE	
	Reference SW Architecture	Useful outputs ➔ **Assess / re-align SOIS ?**
	Component-based eng. (Cordet 2)	Useful component model
	IMA (TSSP)	➔ **Prioritize use cases and focus on those for which no alternative to TSP exists (mid/long term)**
Interfaces		
	SAFI (Sensor/Actuator Funct. I/Fs)	Technical feasibililty with existing equipment ?
	[SOIS Protocols?]	➔ **Investigate protocol standardisation above data link layer, in priority for existing equipment (1553, SpW, 422)**
Building Blocks		
	[TSP hypervisor ?]	➔ **Needs development of key BB for the future (hypervisor qualification)**

[Future Initiative ?)

➔ **Recommended Action**

Additional considerations on Building Blocks

- **Building Block development is key to enable injection of SAVOIR outcomes into programmes**
- **« Enabling technology » building blocks**
  - Address in priority technologies required to support the identified evolutions of the reference architecture

  ➔e.g. on-board SpW network, TSP solution, CAN Tx/Rx
- **Product-oriented building blocks**
  - Implement close loop with potential users (LSI) to keep track on
    - Compatibility of the new product with existing equipment/architectures (or flexibility to be adapted to)
    - Cost efficiency of the ultimate flight item

    to speed up introduction into programmes

  ➔ e.g. RTU 2015

Additional considerations on System Requirement Documents

- **On each ESA project, the SSRD is the formal parent document of the architecture definition**
- **A harmonised SSRD structure and reference contents would increase project efficiency, esp. for verification consolidation**
- **ASRA documents includes proposals for SSRD contents harmonization**
  - OBC spec, section 9 and appendix A
  - Doc. « General recommendations for platform/payload interface »
  - Doc. « General recommendations for spacecraft monitoring/control »
- **It is suggested to share ASRA outcomes with Agency projects, review other initiatives (ISIS) and define the way forward**

Conclusion

- **SAVOIR has demonstrated its efficiency to foster avionics standardization and gather LSIs, equipment suppliers and Agencies around common goals**
- **SAVOIR Building Block developments are so far limited. Compatibility with existing architectures (and their interfaces) and cost efficiency of their design are to be carefully monitored with LSI involvement to ensure their embarkability on future programs**
- **Software activities to be extended to cover protocol interfaces between Central software and other units (ICUs, sensors, actuators)**
- **SAVOIR to sponsor the availability of digital interfaces for sensors & actuators (when it is not done yet)**
- **The work started by ASRA on SSRD requirement harmonization needs to be shared with Projects**