

WE LOOK AFTER THE EARTH BEAT



SAVOIR industrial perspectives Thales Alenia Space View

23rd of october 2012

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- SAVOIR immediate benefits

- SAVOIR major actions
 - Interfaces harmonization
 - Building Blocks
 - Working Groups

- SAVOIR implementation
 - SAVOIR with respect to programs
 - SAVOIR implementation in TAS

- Avionics cost reduction

- Conclusion

SAVOIR immediate benefits

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- Allowed quickly a clear identification of Avionics functions and agreement of overall functional architecture
- Avionics opened forum discussion
 - Allows avionics matters discussion also within ESA (SW and HW together...)
 - Allows discussion with competitors and customers and suppliers
- Knowledge sharing on what is on-going (Avionics R&D) and who is doing what, so much better view of the landscape
- Better understanding and some more influence on ESA Avionics related road-maps
 - Although influence is at the end rather limited, which may be OK (better long term view at technological level in ESA because of existing funding for prospective actions, obligation to open competition for BB that may already exist, etc)

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Avionics interfaces harmonization: a good step with ASRA

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- ✈ SAG and associated WG are mandatory to discuss what to do, but concrete results need some funding and ASRA has allowed to go one step further (as well as CORDET studies for the SW architecture)
 - ✈ A generic OBC spec has reached a consensus
 - ✈ The Ground-Board I/F spec has allowed to open a wider discussion between Industry and ESOC (and CNES through ISIS) and should result in a better standardisation of OIRD
 - ✈ The RTU spec is more difficult because subject to more variability but at least has reached a consensus within the industrial partners
 - ✈ The P/F-P/L interface spec gives a good status of the existing possibilities but does not restrict the range of potential I/F:
 - Lack of P/L representative for the discussion

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- ✈ BB list, definition and priority classification has been subject to a long debate within SAVOIR and has allowed to build the Avionics related road-maps, which was a significant step, but:
 - ✈ This is a cumbersome activity that resulted in a list of BB for which we have not been able yet to define the governance principles
 - ✈ The variability from components up to units or even P/F coupled with the problems of IPR does not help to put right priorities
 - ✈ The definition for SW BB is even worse (only one today)
 - With the added difficulty that a SW BB is most often coupled with dedicated tools, and the selection of tools is often subject to Company constraints

- ✈ So BB is a key concept for re-use, but under the conditions that BB interfaces are harmonized
 - ✈ May be this should be taken into account at the next upgrade of the BB list, when Avionics road-maps will need to be re-issued

SAVOIR Working Groups

- A number of WG has been put in place to allow experts discussion and definition of activities for greater harmonization
 - This is the only way to make concrete progress in several areas
 - But there can be efficient results only if some funded studies are supporting each WG, like:
 - Cordet for SAVOIR FAIRE
 - SISTORA and IMA for Space for IMA WG
 - These WG shall be managed at industry level in addition to already existing WG (like PUS WG, EGSCC WG, etc)
 - There should be some funding available to make small RFQ's and then quick progress in areas of main interest for SAVOIR

- ✈ ESA (D-TEC) concern: how SAVOIR outputs could be endorsed by the ESA programs?
 - ✈ NB: concern is much less for industry, we do invest in close relationship with programs (under CTO supervision)
 - ✈ We believe in the bottom-up approach, i.e programs do not care about which architecture or BB you are using, as far as risks, costs and schedule are minimized
 - SAVOIR results will be de facto used by Industry for their proposals
 - ✈ However there must be some progress at program management level
 - Most urgent one: recognize the Avionics as a consistent part of the P/F and Prime responsibility, and stop with CDMS, AOCS, SW separated subsystems!!! → WBS to be reworked
 - Input SAVOIR specifications or guidelines should be taken into account by the programs, in addition to standards
 - Interesting work performed with ESOC for OIRD
 - Must be pursued on other areas of satellite SRD's

SAVOIR implementation in TAS (1)

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- ✈ TAS has been very pro-active in SAVOIR architecture implementation especially on SW side:
 - ✈ Bus SW already on-board S3
 - ✈ SW segregation on Iridium Next

- ✈ TAS is pushing to have progress made on all type of interfaces in order to « contain » avionics schedule and cost drift
 - ✈ How to fill in the SDB from HW and SW in a more efficient way?
 - ✈ How to cope with HW IDS in a more efficient way?

- ✈ TAS is willing to apply SAVOIR outputs, guidelines, recommendations and standards, as far as:
 - ✈ There is some compatibility with THALES Group strategy (e.g on SW tools)
 - ✈ We see a real positive impact on Avionics cost containment
 - ✈ There is no divergence with respect to other required standards (e.g ISIS from CNES)

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SAVOIR implementation in TAS (2): application for Spacebus

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✈ 1 - Main goal is to formalize BB and their interface with an objective to improve avionics non recurrent and recurrent costs

- ✈ BB allows to propose different avionics configurations with low impact on the development schedule, on OBSW and system operations
- ✈ BB allows to improve the avionics competitiveness as far BB are shared by several users . BB standardization may open the door to BB shared by several product lines (ex: RW, gyro, STR)

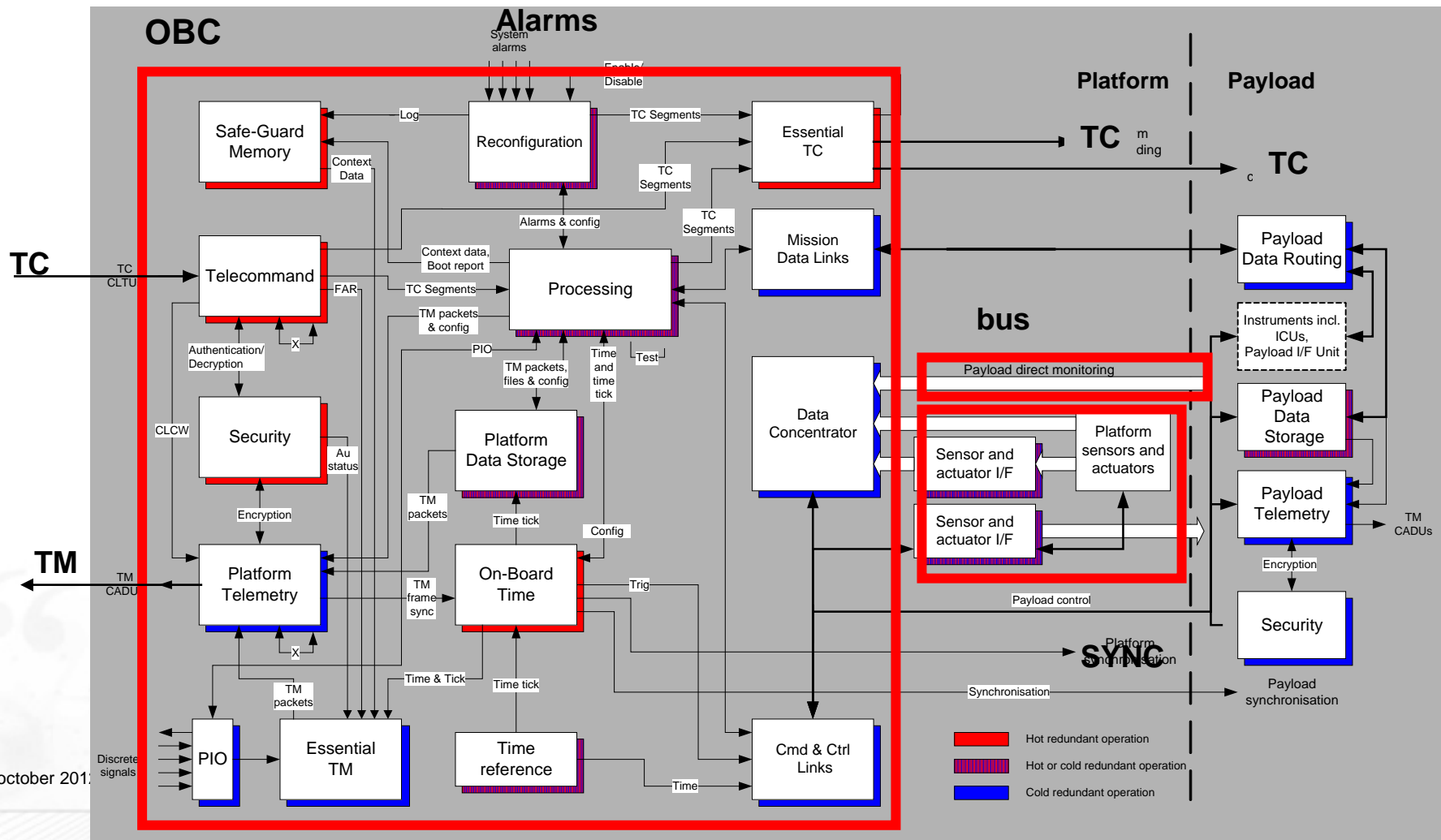
✈ 2 – Second objective is to optimize the development of the OBSW and avionics modeling in the Satellite Data Base.

- ✈ BB allows for a large OBSW reuse and reduced SW modification in case of BB modification
- ✈ support model-based design and automated code & test generation

✈ 3 – Third objective is to optimize development of satellite simulators and operation procedures

SAVOIR implementation in TAS (2): application for Spacebus

Spacebus Avionics Architecture is consistent with avionics functional break-down defined by the SAVOIR WG



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SAVOIR implementation in TAS (2): application for Spacebus

✈ What is the way forward for the next avionics generation ?

✈ Objective is to reduce recurring costs but also to limit development costs and development risks using as far as possible standardized BB:

- Electrical interfaces, communication busses, SW interface layer
- Electronic Units Interface Data Sheet for Sat Data base and OBSW customization
- BB models for satellite simulators
- Communication protocols
- Operational concepts :
 - generic TM/TC plan associated to a BB
 - Operational procedures for AIT and satellite operations

✈ Open points :

- PF I/O in the computer
- PUS services for Mission Operations
- Partitioning (security and components)
- Standardization (SOIS and EDS)
- Use of OBCP for Operations plus automation on ground

- ✈ Avionics cost reduction targets depend of the application:
 - ✈ For commercial (series), recurring cost is the driver, although low ROI has to be demonstrated
 - Targets: miniaturization, concatenation of functions, SW easy adaptation to missions, P/L I/F standardization
 - ✈ For Science/Observation/Exploration (one shot), non recurring cost is the driver
 - Targets: process optimization, I/F standardization, re-use
 - ✈ For the time being we do not achieve significant NR costs reduction because:
 - ✈ Systems are more complex than before with much more data to be handled and enhanced autonomy required: this is allowed because of the availability of larger processing resources
 - ✈ Re-use is limited (GEO return) and interfaces are not well standardized
- ⇒ Challenging target is to stay in « usual » costs (and schedule)...

Conclusion: how SAVOIR can help further to concretely decrease Avionics costs?

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- Harmonization of programs SRD's is a very efficient way
 - Variability in some major areas (like FDIR or tests) has to be analyzed and limited
 - Re-use of most of the Execution P/F from program to program should be also very efficient
 - But today is too much computer and I/O dependant
 - Data model and EDS is an area where significant improvements shall be achieved
- ⇒ These are examples where SAVOIR can play a leading role, and industry implementation will follow as this will help to improve competitiveness

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