

# SAVOIR Industrial Consultation : SAVOIR RTU Generic Spec/Functional and Operability Spec

Giorgio MAGISTRATI TEC-EDD

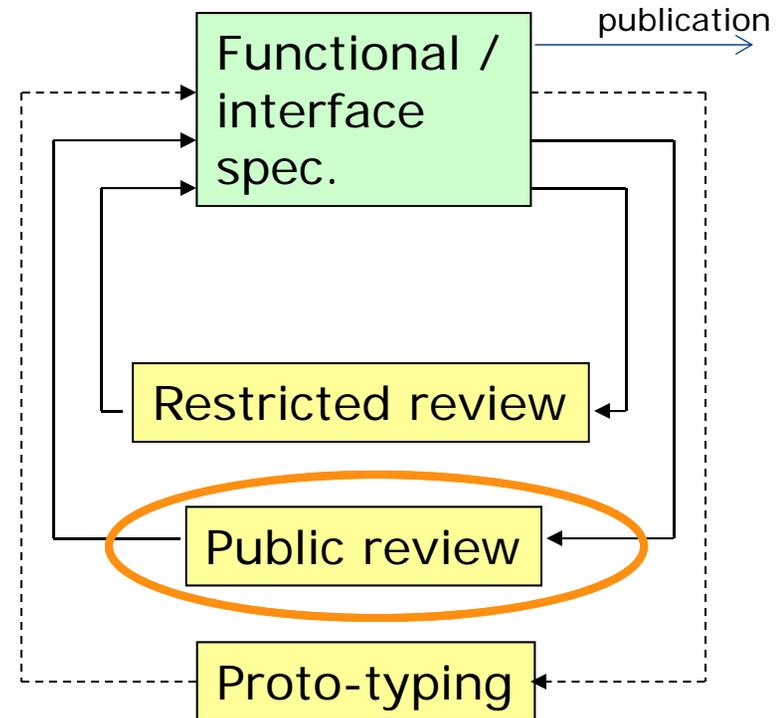


# Specification production scheme



Under SAG agreement;

1. A draft version is produced;
  - By a SAG working group
  - Output of an R&D activity
  - Proposed by Industry
  - **ESA internal** (inspired by Operability and Modularity concepts of future RTUs/RIUs day-3 of ADCSS2015)
2. Submitted for **restricted review** and updated as needed
  - Check compliance to SAVOIR architecture and principle
  - Completeness / consistency / etc
3. Submitted for **public review** and updated (same objective as 2)
4. Verified by **prototyping** – to demonstrate maturity of the spec., consistency with the ref architecture (as far as possible on a case by case basis)
5. **Publication**



# Consultation process, tool and O.N.



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**DOCUMENT**

SAVOIR Document Review Organisation Note



space avionics open interface architecture

Prepared by: Jean-Loup Terrailon  
Reference: TEC-SW/13-647/JLT  
Issue: 2  
Revision: 8  
Date of Issue: 02/03/2015  
Status: Document Type: Distribution:

European Space Agency  
Agence spatiale européenne

For SAVOIR-GS-001, 002 and TN-001

For SAVOIR-GS-003...

<b>Originator of DRR:</b>	OHB System AG	<b>Draft in Review:</b>	SAVOIR-GS-003 i1r0
<b>e-mail originator:</b>	dirk.felbach@ohb.de	<b>Start of Public Review:</b>	03 July 2017
<b>Date:</b>	04/09/2017	<b>End of Public Review:</b>	04 September 2017
<b>Instructions:</b>		Compiled DRRs distributed to WG:	
1. One comment per row			
2. Grey shaded cells are reserved for SAG secretariat			
		<i>To be entered by SAG secretariat</i>	<i>To be entered by SAG secretariat</i>
<b>DRR number (to be entered by SAG Secretariat)</b>	<b>Clause number</b>	<b>Page number</b>	<b>Review deficiency and justification</b>
OHB-1	§6	14	The Special User Interface are generally project specific and might be connected to either one or both...  Justification: The note doesn't make clear that the Special User Interfaces have to be redundant and only RTU-internal cross-strapping is not implemented.
		<b>Proposed change (preferred approach: change "From - To")</b>	<b>Disposition of DRR by SAG</b>
		The Special User Interface are generally redundant but project specific and might be connected to either with or without cross-strapping to the nominal and redundant RTU core.	agreed, to be modified as per DRR proposed change
			<b>DRR implementation by SAG</b>

# Consultation focal points, Objectives



- Focal Points reviewers selected in industry with support of EuroSpace



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SSF	Finland	BOS	Victor	<a href="mailto:victor.bos@ssf.fi">victor.bos@ssf.fi</a>
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Syderal	Switzerland	LOMBARDI	Pasquale	<a href="mailto:pasquale.lombardi@syderal.ch">pasquale.lombardi@syderal.ch</a>
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Space Applications Services	Belgium	MUNOZ	Miguel	<a href="mailto:miguel.munoz@spaceapplications.com">miguel.munoz@spaceapplications.com</a>
LogicaCMG (CGI)	UK	NORRIS	Pat	<a href="mailto:pat.norris@cgi.com">pat.norris@cgi.com</a>
RUAG	Multi	OLSON	Bjorn	<a href="mailto:bjoern.olsson@ruag.com">bjoern.olsson@ruag.com</a>
SpaceBel	Belgium	PARISIS	Paul	<a href="mailto:paul.parisis@spacebel.be">paul.parisis@spacebel.be</a>
4-Links	UK	WALKER	Paul	<a href="mailto:paul@4links.co.uk">paul@4links.co.uk</a>
NLR	The Netherlands	WIEGMINK	Klaas	<a href="mailto:klaas.wiegmink@nlr.nl">klaas.wiegmink@nlr.nl</a>
SCISYS	UK	WAUMSLEY	Kevin	<a href="mailto:Kevin.Waumsley@scisys.co.uk">Kevin.Waumsley@scisys.co.uk</a>
SELEX	Multi	BOLDRINI	Franco	<a href="mailto:franco.boldrini@selexgalileo.com">franco.boldrini@selexgalileo.com</a>
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- Objectives of the consultation:
  - Verify *reusability*
  - Verify *domain of reuse*
  - Verify *completeness*
  - Verify *industrial aspects (w.r.t. product lines)*
  - Verify *dissemination aspects*



# Schedule



- Restricted review (SAG) September 2016 – January 2017,
- May 2017: consolidation of list of companies and focal points,
- **27 June 2017: kick-off of the review**, SAVOIR-GS-003 issue 1 rev0
- 25 August 2017: Reminder,
- **4 September 2017: DRR cut-off date**,
- DRR disposition process on going, SAG experts (ESA, TAS, ADS, RUAG) webex/meetings on 13/10, 23/10, 24/10 (TBC),
- **DRR originators will receive a file with all the dispositions end of Oct /mid Nov 2017**,
- **SAVOIR-GS-003 issue 1 rev1 Dec 2017** on <https://essr.esa.int/>
- SAVOIR-GS-003 issue 1 rev2 in 2018 (what is that ?)

European Space Software Repository Project  USER GUIDE

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### LATEST PROJECTS

**→ ASN1SCC - ASN.1 SPACE CERTIFIABLE COMPILER**

ASN1SCC is an ASN.1 compiler that was developed for ESA to cover all data modelling needs of space applications. The compiler is targeting safe systems and genera...

[READ MORE](#) Updated on: 29/04/2015 Created on: 29/04/2015

**Version Control System:** git  
**Owner:** Neuropublic  
**Links:**  
1. [Source code : ASN1SCC Source code repository](#)  
2. [Blog article : Article introducing ASN1SCC](#)

# Statistics

- 145 RIDs
- the DRR originators/reviewers will receive a file containing all the DRRs with the proposed disposition, we will be available for any further comment or request for clarification you may have
- The Review has been quite a success... 145DRRs on 48pages > 3.02DRRs/page we have 122 reqs so 1.18DRR/req
- For the SAVOIR OBC Generic Spec SAVOIR-GS-001 we collected 242 RIDs on 94 pages > 2.57 RIDs/page We have 407 reqs so 0.59 RID/req
- You as reviewers are improving ...



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## DOCUMENT

SAVOIR RTU Functional and Operability Requirements



Prepared by	SAVOIR
Reference	SAVOIR-GS-003
Issue	1
Revision	0
Date of Issue	27/06/2017
Status	Under review
Document Type	Spec
Distribution	<input type="checkbox"/>



# SAVOIR : one of our scope is to "entertain" the Space community...



## SHOOT THE BEAR!

IT'S LEGAL... IT'S FUN!

**SHOOT THE BEAR** is a brand-new, completely legal game employing the famous Seeburg *RAY-O-LITE* rifle range. It's a game of skill—it's a game of fun—everybody will want to play.

To the operator, **SHOOT THE BEAR** presents a fine opportunity for additional earnings. See it, shoot it at your first opportunity. See your Seeburg distributor for full details.

**MARKSMAN**  
**SHARPSHOOTER**  
**EXPERT**

**SKILL.** Each game consists of 20 shots at the target. The top panel keeps the score. The lower panel tells the player—at the game's end—whether he is a "Marksman," "Sharpshooter" or "Expert." The marksman's score is at least 12 hits, sharpshooter at least 16 hits and expert 19 or 20 hits.

**ANIMATION.** There are three targets—one on each side and a third in the chest of the bear. When hit, the bear stands on his haunches, utters a realistic electronically developed growl and displays his anger by red lighting effects in his mouth. Skillful shooting will keep the bear turning from side to side in reverse directions.

**HUMOR.** The bear is the target, but the hilarious antics of the dog get the laughs. When the bear is on the run, the dog is as bold as brass—but watch him turn tail and "kite it" when the bear turns.

See **SHOOT THE BEAR** at your first opportunity—you'll quickly appreciate the business opportunity it presents to you.

**STURDY, TUBULAR STEEL LEGS.** Chromium plated. Provide

**THE TARGET.** The **SHOOT THE BEAR** target is colorful, well lighted. Skillfully designed scenery gives fine illusion of depth. Sturdy wood cabinet attractively decorated. Cabinet size: 36 1/2" high x 42" wide x 19 1/2" front to back. Overall height, including stand, 75 1/2".

**THE GUN STAND.** Compact modern styling. Measures only 34" high x 15 1/2" wide x 18" front to back, including stand. Overall height, floor to top of gun stock, 49". Mounted on sturdy chromium finished tubular steel legs. Two push-type coin chutes.

**THE GUN.** Realistic in appearance... light in weight. Accurate sight gives everybody chance to improve shooting skill. Standard length cord is 50 feet.



# Major DDRs : Power-On Self-Test and Commanded Self-Test



- Requirement Number : SAVOIR.RTU.STATE.13  
*Power-on Self-Test The RTU shall provide a self-test capability that is started automatically at power-on.*
- Requirement Number : SAVOIR.RTU.STATE.15  
*Commanded Self-test The RTU shall provide a self test that can be started by command and shall allow a full test of the entire RTU, also including the tests run during Power-on Self-test.*

**Self-Tests are now optional**, having taken into consideration the complexity of their implementation in RTUs w/o a MCU or intelligent controller, however new requirements will be added and one will be modified:

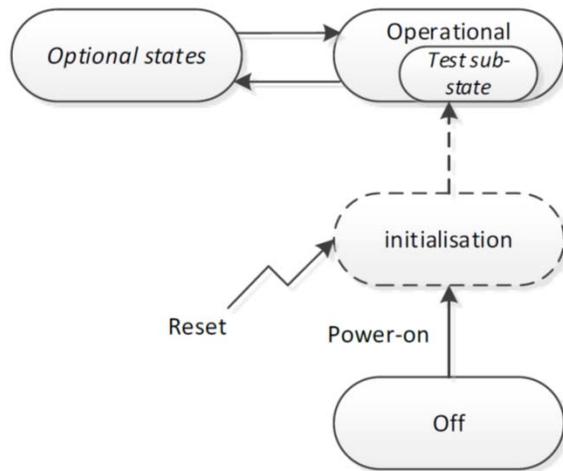
- *"The RTU shall provide sufficient telemetries to detect and isolate any operational malfunction as identified in the FMECA" mandatory*
- *"Power-On Self Test shall not block the transition to Operational State"*  
OptionInfo : Option Power-On Self-Test=Yes
- *"Self test shall have no effects on Standard and Specific User Interfaces ( input and output) and no disturbance of the nominal operation of RTU"*  
OptionInfo : Option Power-On Self-Test=Yes



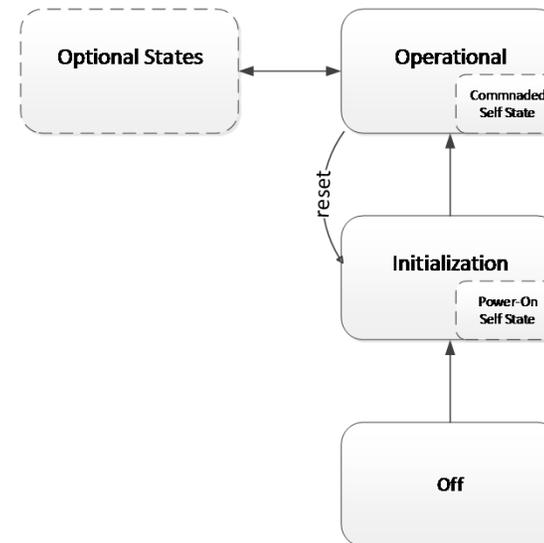
# Major DDRs: RTU states



From :



To :



- Self Test and Commanded Self Test are now optional (dotted lines)
- Initialization includes Self Test and it is a (temporary) state.
- Optional States are possible ( e.g. SW update & patch )



# Major DDRs : comment from ESA-EOP



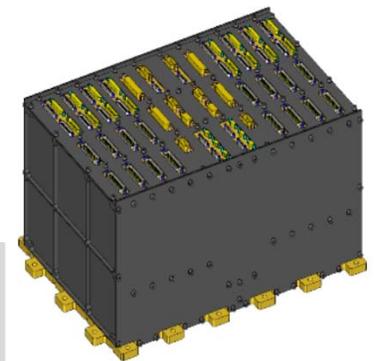
- ***“the current requirements represent a “standard” set of limited usefulness for the most recent EOP approved missions (i.e. Biomass, FLEX). It would be useful if ESA and industry discuss and agree on a set of requirements useful for RTUs to be used in the future platform concepts”***
- *“...therefore, it would be useful to define requirements taking into account current and future technology developments for scenarios envisaging an RTU with:*
  - ***miniaturisation of S/C avionics: implying smaller RTU, reduced overall harness together with more digital communications, reduced electronics around the sensors, etc.***
  - ***additional functionalities / performance***, giving more intelligence and autonomy (e.g. with microcontrollers or FPGA) for :
    - *ability to close loop, output calibrated/Engineering measures*
    - ***FDIR functionalities***
    - *More accurate **time stamp and synchronization** (e.g. of acquired telemetries)*
- *increased and spread intelligence to eventually push the limit towards a **micro RTU directly embedded in the sensor/equipment”***



# Major DDRs : comment from ESA-EOP, how to answer to them ?



- It has been decided at the SAG experts (of RTUs) mtg of 13/10/2017 that a revision 1 of SAVOIR-GS-003-i1 will implement DDRs on the current set of requirements
- While a revision 2 of SAVOIR-GS-003-i1 (spring 2018) will implement requirements of a future RTU (most probably in separate section(s))
- Modifications in TN-001 as well to describe the expected new evolution trends as **miniaturization, I/F digitalization, harness reduction (see ADCSS2017 section on Harness Reduction of tomorrow), FDIR (implementing directive and suggestion from SAVOIR-FDIR)** , etc etc however these trends are not limited to RTUs ! New revision of the SAVOIR-GS-001 is expected as well !
- **Verification by prototyping the Spec** is considered a necessary step especially for new concepts or new functions – this is considered extremely important for the RTU of the future – we are working on this
- A **“pre-prototype”** is the Modular RTU developed  
By ADS-CRISA under GSTP - TEC-ED/SW FPD May 2017



# Major DDRs : OBC-RTU interfaces



- Requirement Number : SAVOIR.RTU.CIF.2

RTU Remote Control Interface; Types

*The RTU Remote Control Interface shall provide at least one of the following interfaces:*

- *Mil-Std-1553B (see paragraph 7.6.3.1)*
- *CAN (see paragraph 7.6.3.2)*
- *Spacewire (see paragraph 7.6.3.3)*

This requirement has been written considering availability of technologies (in a current/short/medium term scenario that is 0-7 years), reduction of number of I/F types and conceivable data bandwidth for an OBC to RTU communication channels.

Few DRRs are asking to include other interfaces as RS422, Ethernet or SpFI –  
Discussion on going inside the SAG



## Major DDRs : others



- Check of required figures and parameters value – e.g. Requirement Number : SAVOIR.RTU.STATE.20

Start-up time - *The RTU shall change from entry of Initialisation State (power-on/reset command) to Operational State within <InitTime> seconds.* Requirement Rationale : ...Typical <InitTime> value is 10 – 100ms

**Typical Init time increased to 100msec–1s** (memory check in self-test can have a longer duration, ...)

- Improvement of Requirements – e.g. Requirement Number : SAVOIR.RTU.STATE.6

Operational state - Performance - *When the RTU is in the Operational state it shall be able to perform all its tasks simultaneously*

**Vague and unverifiable requirement** – it will be replaced by requirements in Telemetry Acquisition and Commanding & Actuation sections stating that “acquisition of telemetry can occur simultaneously to execution of commands”



- Thanks to all the reviewers for the quality of their comments and the time spent in this review.
- Thanks to the SAG experts for the effort put in supporting the discussions originated by the DDRs.
- A kind request to Prime and Equipment suppliers: after all this effort please use the SAVOIR RTU Functional and Operability Requirements when available !