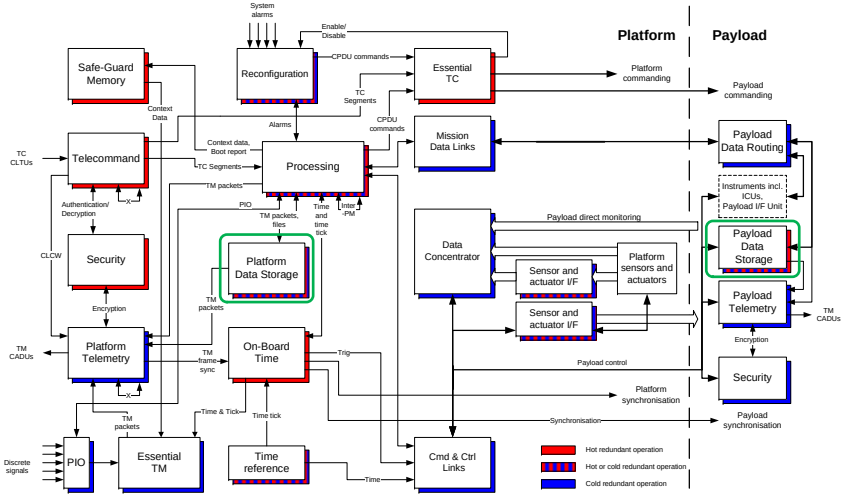
SAVOIR UNION
space avionics open interface architecture

SAVOIR UNION status
ADCSS 2017

ESA UNCLASSIFIED – For Official Use

Savoir-UNION Tasks

- UNION stands for User Needs In Onboard Network
- The SAVOIR-UNION Working Group shall have as a main goal the review of the functional, performance, operational and interface requirements of the functional links and their management defined within the OSRA-Net activity.



- The scope is currently:
  - limited to the identification and characterization of the needs of users in term of communication,
  - does not address the communication physical standards,
  - does not address the communication protocols.

ESA UNCLASSIFIED – For Official Use

SAVOIR-Union Members

Firstname	Lastname	Entity
Mathieu	ALBINET	CNES
François	BONNET	CNES
Michael	BRAHM	OHB-System
Frank	DANNEMANN	DLR
Brice	DELLANDREA	TAS
Marie-Hélène	DEREDEMPT	Airbus-DS
Julien	GALIZZI	CNES
Wahida	GASTI	ESA
Christophe	HONVAULT	ESA
Laurent	MARY	CNES
Marco	PANUNZIO	TAS
Marek	PROCHAZKA	ESA
Marco	ROVATTI	ESA
Jacques	SERONIE-VIVIEN	Airbus-DS
Dirk	THURNES	ESA

ESA UNCLASSIFIED – For Official Use

SAVOIR-Union Planning

16/09/2015	Presentation of ToR to SAG ESTEC and distribution to SAG members
30/09/2015	End of review of the ToR and nomination of members by SAG
14/10/2015	Distribution of the update ToR to SAG and participants
20/10/2015	Presentation of the Working Group at ADCSS
~~01/11/2015~~ 15/12/2015	Start of TRP activity
~~26/04/2016~~ End 09/2016	Webex #1: Review of the OSRA-Net Analyses
18/10/2016	Presentation to ADCSS 2016
12/2016	Review of the “OSRA communication network Specification”
~~06-08/2017~~ 11-12/2017	Translation into a SAVOIR document
01-02/2018	Review by SAG/SAVOIR-UNION
04-05/2018	Public review
…	

ESA UNCLASSIFIED – For Official Use

Communication network specification

- Communication system capabilities
  - Generic capabilities: transactions, timing, resources
  - Quality of Service: At least once, at most once, exactly once
  - Class of communication: Seven classes defining based on frequency, QoS, throughput, jitter, latency
- Communication infrastructure requirements: redundancy
- Error handling and FDIR requirements
- System-level communication requirements: communication manager

ESA UNCLASSIFIED – For Official Use

USE CASE

	Equipment	Data type	Max Cargo size (bits)	Frequency (Hz)	Period (ms)	bit rate	AOCS sensitivity	Jitter requirement		Latency (ms)		Other requirements	QoS level	Time stamp (8 octets)	Proposed Class of Comm
								Value (ms)	ROM	Value (ms)	ROM				
	Traffic description														
Sensors	Magnetometers	AOCS	12	8	125	100 bits/s	> 1 cycle	1000	1 cycle	1000	1 cycle	order of msg		No	2
	Coarse Sun Sensors	AOCS	96	8	125,00	770 bits/s	Low	10	1 cycle	10	1 cycle	order of msg		No	2
	Gyro (Coarse/safe mode)	AOCS	576	8	125,00	4,6 kbits/s	1 cycle	2	1 cycle	2	1 cycle	order of msg		No	
	Gyro (fine-grained)	AOCS	576	32	31,25	18 kbits/s	1 cycle	2	< 1 Cycle	2	< 1 Cycle			Yes	8
	Gyro (future)	AOCS	576	32	31,25	18 kbits/s	1 cycle	2	< 1 Cycle	1	< 1 Cycle			TBD	8
	Star-Tracker (Smart)	AOCS	8194 - 32777	8	125,00	65 to 262 kbits/s	1 cycle	1	< 1 Cycle	10	1 cycle			Yes	2
	Star-Tracker (Smart)	AOCS - Geo	8194 - 32777	8	125,00	65 to 262 kbits/s	> 1 cycle	2	1 cycle	10	> 1 cycle			TBD	2
	Star-Tracker	AOCS - Agility	8194 - 32777	30	33,33	245 to 983 kbits/s	<< 1 Cycle	0	<< 1 Cycle	1	<< 1 Cycle			Yes	5
	Camera - High Res.	AOCS - Rendez-vous	41943040	8	125,00	335 Mbits/s	1 cycle	10	< 1 Cycle	100	1 cycle			Yes	6
	Camera	AOCS - Nav. Cam	10485760	8	125,00	84 Mbits/s	> 1 cycle	100	> 1 cycle	100	> 1 cycle			Yes	4
	Camera	AOCS - Multi stage (1kHz)	1000000	1000	1,00	1000 Mbits/s	> 1 cycle	100		100				Yes	6
	IR Spectrum Camera	AOCS	2457600	1	1000,00	2,5 Mbits/s	> 1 cycle	100		100				Yes	6
	Payload sensors	Various - closed loop	Mission dependant	100	10,00	Mission dependant	<< 1 Cycle	Mission dependant	<< 1 Cycle	Mission dependant	<< 1 Cycle			TBD	5
	Tachometer	AOCS	30720	8	125,00	245 kbits/s	> 1 cycle	10	> 1 cycle	100	> 1 cycle			No	3
	Tachometer	AOCS - Agility Multi stage	Time stamp could be greater than actual value	100	10,00	TBD	1 cycle	1	< 1 Cycle		< 1 Cycle		1	Yes	5
	GNSS	AOCS	10000	1	1000,00	10 kbits/s	1 cycle	10	1 Cycle	10	1 Cycle			Yes	1
		AOCS	14	1	1000,00	10 kbits/s	1 cycle	0,001	<< 1 Cycle	0,001	<< 1 Cycle			Yes	1
Actuators	Magneto-Torquer Bars	AOCS	12	0,125	8000,00	neglectable	1 cycle	500	< 1 Cycle	8000	1 cycle		1 or 2	No	1
	Thrusters (x28)	ACOS	2800	8	125,00	22 kbits/s	<1 cycle	Mission dependant		Mission dependant			1 or 2	No	3
	Thrusters - chemical	ACOS	2800	256	3,91	720 kbits/s	< 1 cycle	0,1	<1 Cycle	0,1	<1 Cycle	no loss	2	TBD	5
	Thrusters -electrical	ACOS	No hard constraints due to propulsion cycles: several minutes and the imapct on trajectory is not immediate										1 or 2	TBD	1
	Reaction Wheels	AOCS	30720	8	125,00	250 kbits/s	1 cycle	10,00	< 1 Cycle	10,00	1 cycle		1 or 2	Yes for some	2
	Reaction Wheels (high speed)	AOCS -Agility	30720	100	10,00	3 Mbits/s	1 cycle	0,50	< 1 Cycle	1,00	< 1 Cycle	No Loss of msg End of process in same cycle	2	TBD	5
Payload	Spectrometer	Science	2,00E+08	10	100,00	2000 Mbits/s	N/A	N/A	N/A	N/A	N/A		0 or 1	No	4
	Ultra HD Camera (4K)	Science	9,95E+07	10	100,00	1000 Mbits/s	N/A	N/A	N/A	N/A	N/A		0 or 1	No	4
	X Ray detector	Science	1,80E+10	0,0303	33003,30	545 Mbits/s	N/A	N/A	N/A	N/A	N/A		0 or 1	No	4

ESA UNCLASSIFIED – For Official Use

Avionics Embedded System Dossier

- One activity has been placed in the roadmap as a follow-on of the current OSRA-Net activity.
- It addresses
  - the development of tools that support the modelling and analyses required to perform the trade-offs of communication networks, buses and links;
  - the demonstration of the tools through two different Use Cases.
    - The first Use Case shall consist in the modelling and the analysis of the architecture of an existing spacecraft for what concern communications.
    - The second Use Case shall consist in the modelling of an optimized communication architecture and the generation of the related sets of requirements.

ESA UNCLASSIFIED – For Official Use

SAVOIR-UNION ToR extension

- An extension of the ToR of the SAVOIR-UNION Working Group is proposed in order to prepare the future activity.
- Before the preparation of the Statement of Work:
  - Identify the set of communication links and protocols to be considered (1553, CAN, SpW, SpFi, …)
  - Identify their characteristics w.r.t. SAVOIR-UNION requirements.
- During the execution of the study:
  - Review the results of the study and provide recommendations

SAVOIR-UNION WORKING GROUP

TERMS OF REFERENCE

Version issue 1.2 dated 09/06/2017

1. PURPOSE

At the SAVOIR WG meeting #29 (16/09/2015) the SAVOIR Advisory Group has decided to setup a new working group for addressing the interconnection of SAVOIR functions.

2. BACKGROUND

2.1. Functional avionics

The next figure recalls the SAVOIR avionic architecture detailed in (RD1).

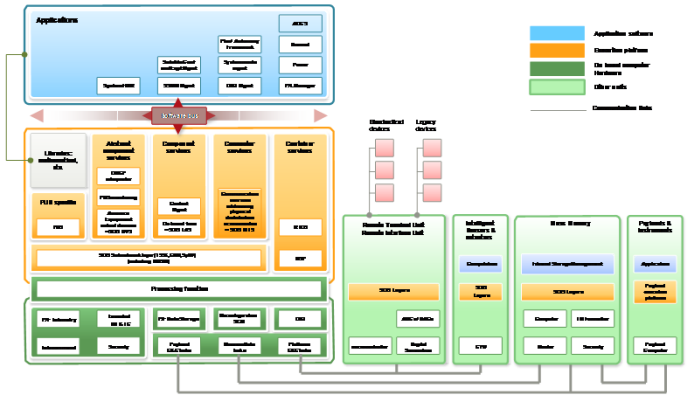


Figure 1-1 Overall consolidated avionic architecture

ESA UNCLASSIFIED – For Official Use