SAVOIR Electronic Data Sheet Definition: Overview and Status

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October 2020

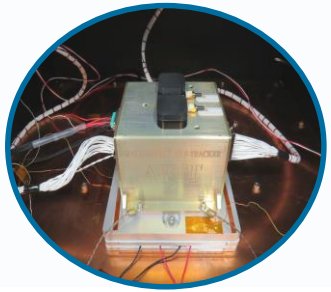
EDS Overview – Key areas

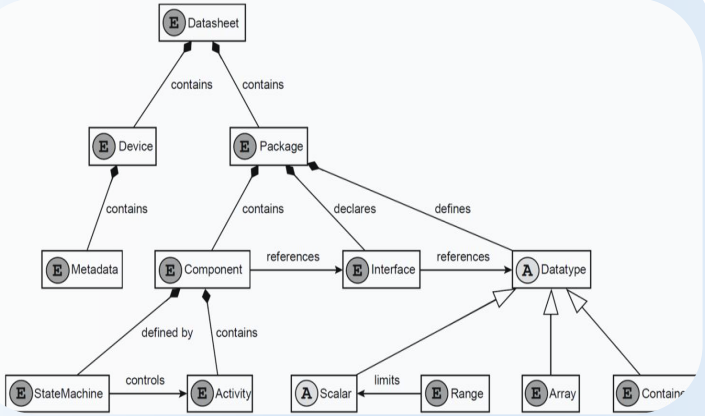
1. What is Electronic Datasheet (in brief)
2. ESA's SAVOIR EDS Definition of activity
3. SAVOIR EDS domain model definition and outcomes
4. CCSDS EDS Working Group & Applications
    - Lunar Gateway
    - SOIS-EDES-Compiler (SEDS-C)

What is Electronic Data Sheets (EDS)

Unambiguous machine readable interface specification for spacecraft avionics

- Sensors, actuators
- Other units (PCDU, RTU, Memories)
- Instruments

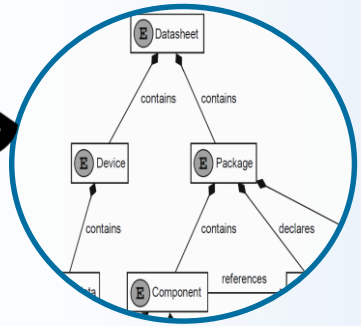




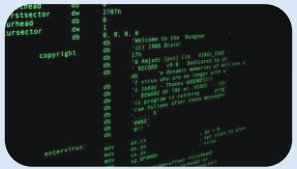
What is Electronic Data Sheets (EDS)

- **Objective:**
  - Replacing paper ICDs with standardized electronic format
  - Automatic generation of artifacts

One source multiple outputs



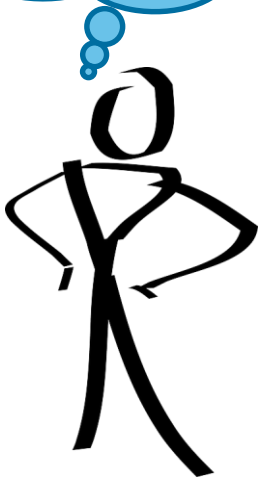
ICDs



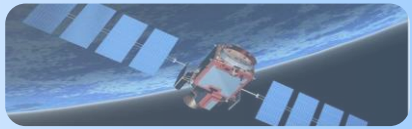
code

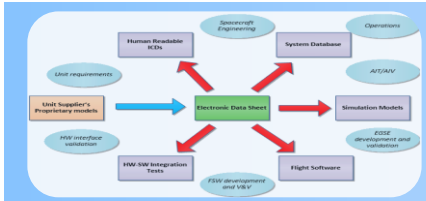
What is Electronic Data Sheets (EDS)

Don't call it just "**S.EDS**"



Initially only for communication/data handling (i.e. TM/TC ICD)
SOIS EDS
(CCSDS WG)

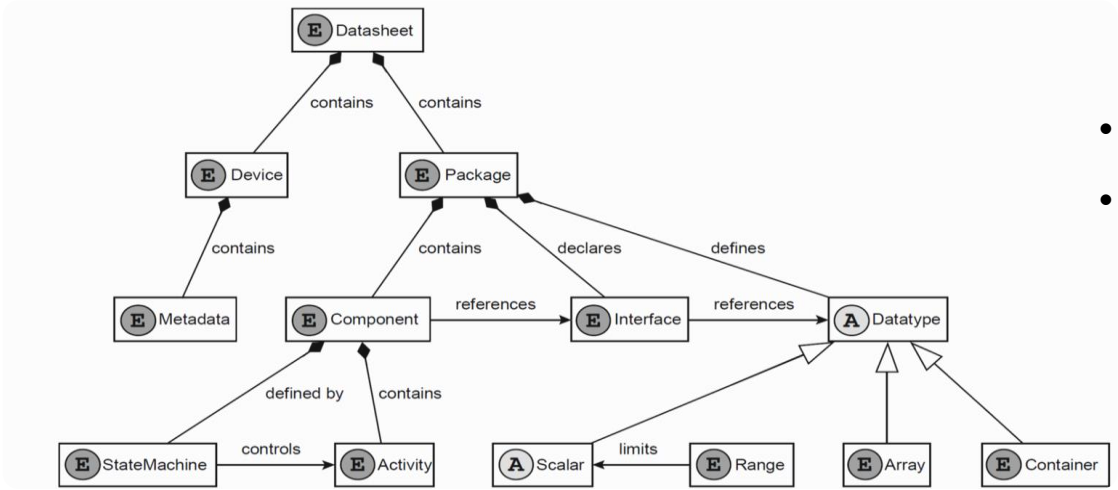




EDS definition aimed to cover multiple domains of knowledge (electrical, thermal, mechanical) **SAVOIR EDS**

CCSDS-SOIS Electronic Datasheet

Electronic standard used by space missions to describe **communication** and **data handling** of an on-board device accessed over a spacecraft subnetwork



Focused on Data Interfaces

- Models stored as XML files
- XSD defined according to CCSDS standard**:**

Blue book 876.0

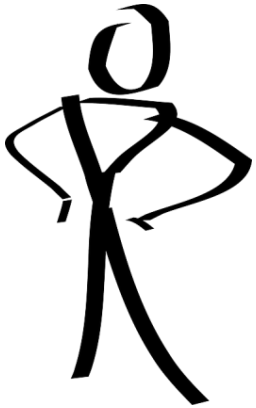
- defines WHAT+HOW

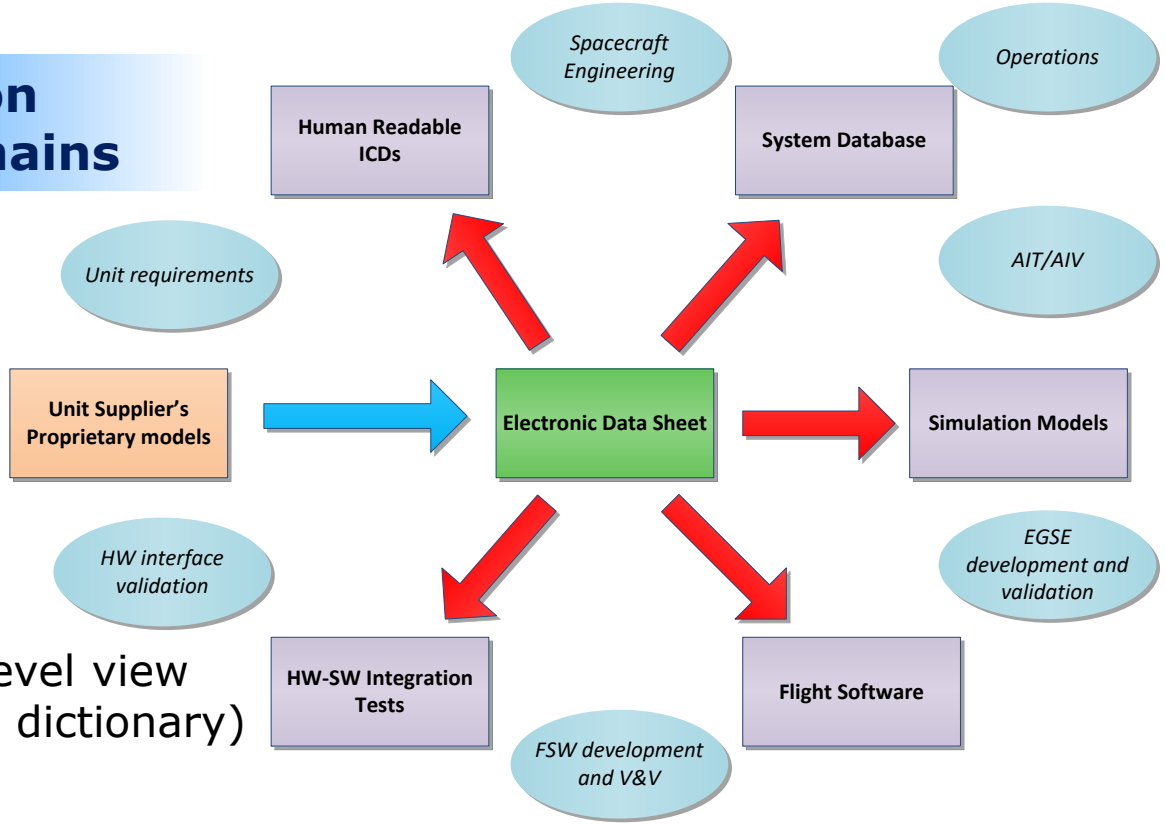
Blue book 876.1

- supports ontology definition (Dictionary of Terms)

SAVOIR Electronic Data Sheets

Focused on Multiple Domains

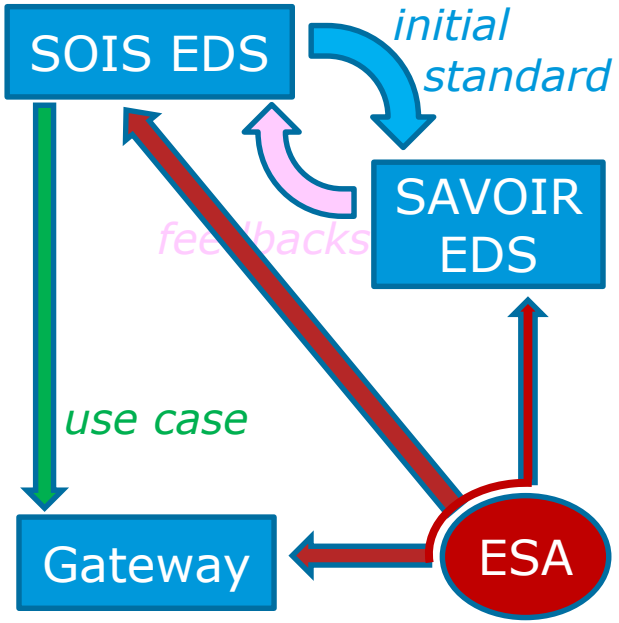




Broader system-level view (beyond just data dictionary)

All areas are interconnected

- ESA's participation in CCSDS (SOIS EDS)
- SAVOIR EDS provides feedbacks to CCSDS WG *(collected in the Pink Book)*
- Gateway's use cases in CCSDS
- ESA's participation in Gateway (I-HAB, ESPRIT)



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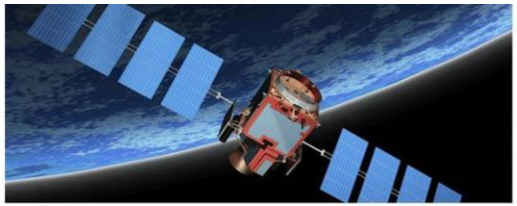
SAVOIR Electronic Data Sheet Definition

- **ESA GSTP activity**
- **Kicked off June 2018**
- **Consortium:**
  - SCISYS (now CGI): Prime
  - Airbus DS (Toulouse)
  - OHB System (Bremen)
  - Thales Alenia Space (Cannes)



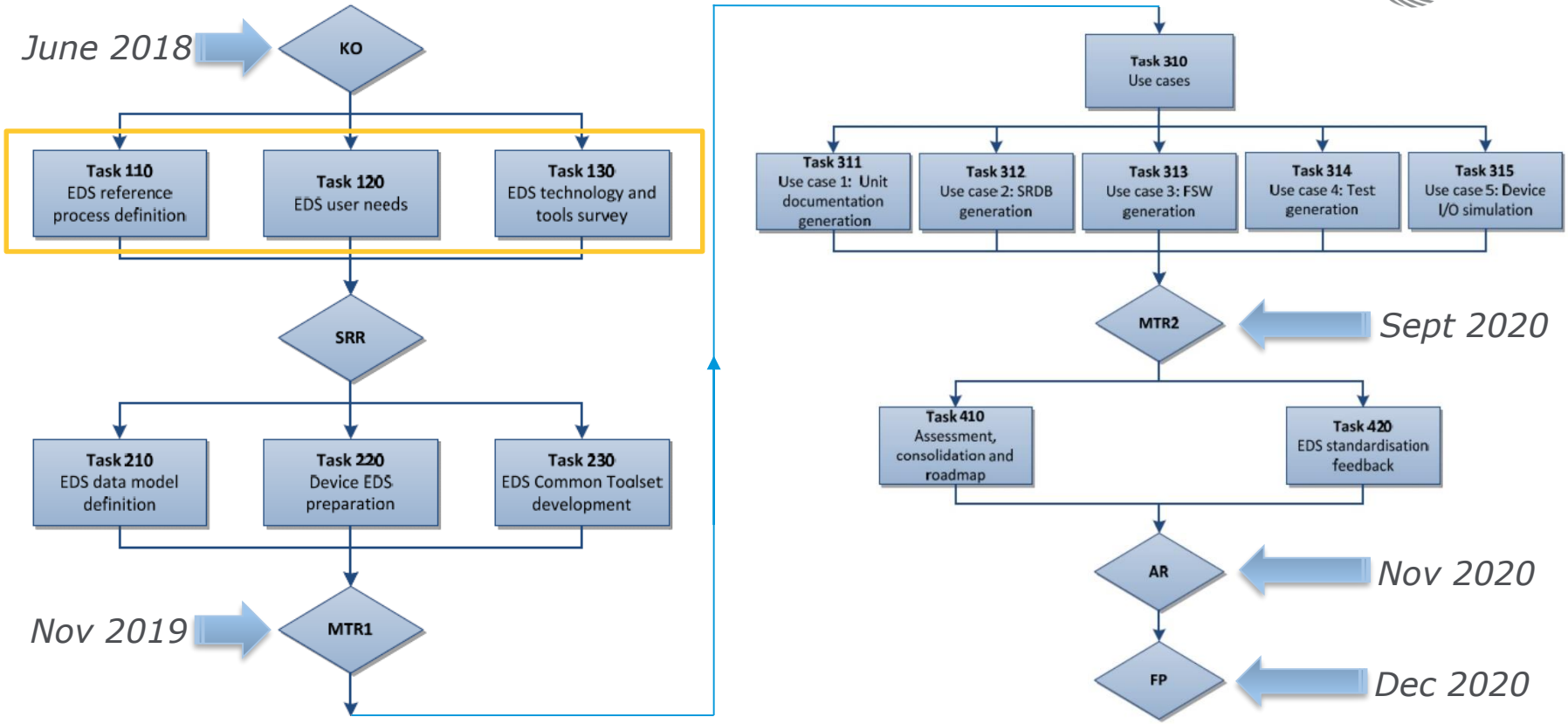


- **Duration: 18 months (planned)**

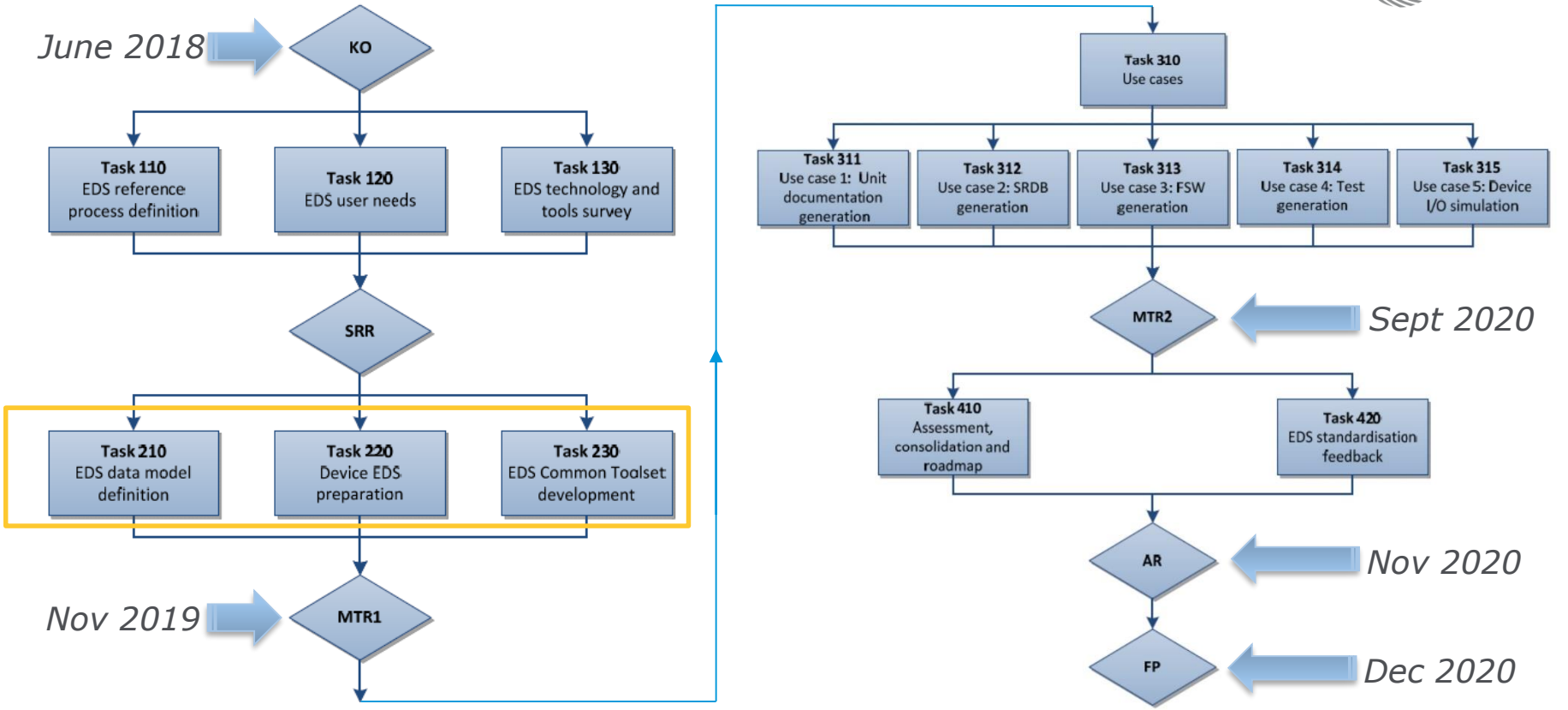
SAVOIR EDS Definition: *Objectives & Key-points*

1. Specify user requirements covering current avionics development process and data exchange between primes and unit suppliers
   - ⇒ different usage of EDS
   - ⇒ Various types of units (sensors/actuators, PCDU, SSMM, RTU, etc.)
2. Define the SAVOIR EDS data model
   - ⇒ Feedback to standardization (CCSDS, SAVOIR, ECSS ?)
3. Assess the existing XML based exchange format developed in CCSDS:
4. Development of SAVOIR EDS Common Toolset (SECT)
5. Development of multiple proof of concept prototypes reflecting various use cases
6. Propose a roadmap towards EDS adoption by European industry
   - ⇒ Steps to be taken by primes, unit suppliers, agencies

SAVOIR EDS Definition: Work logic & Plan



SAVOIR EDS Definition: Work logic & Plan



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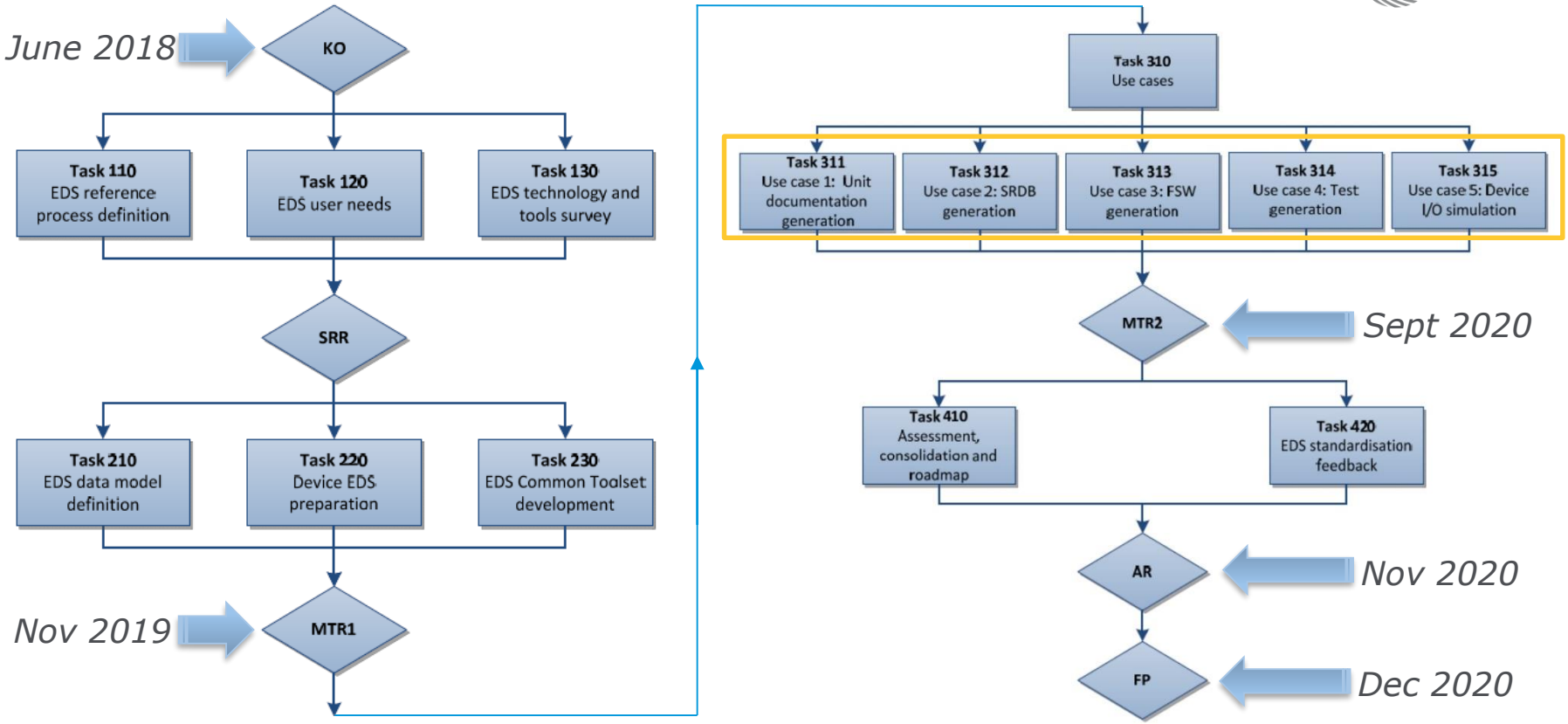

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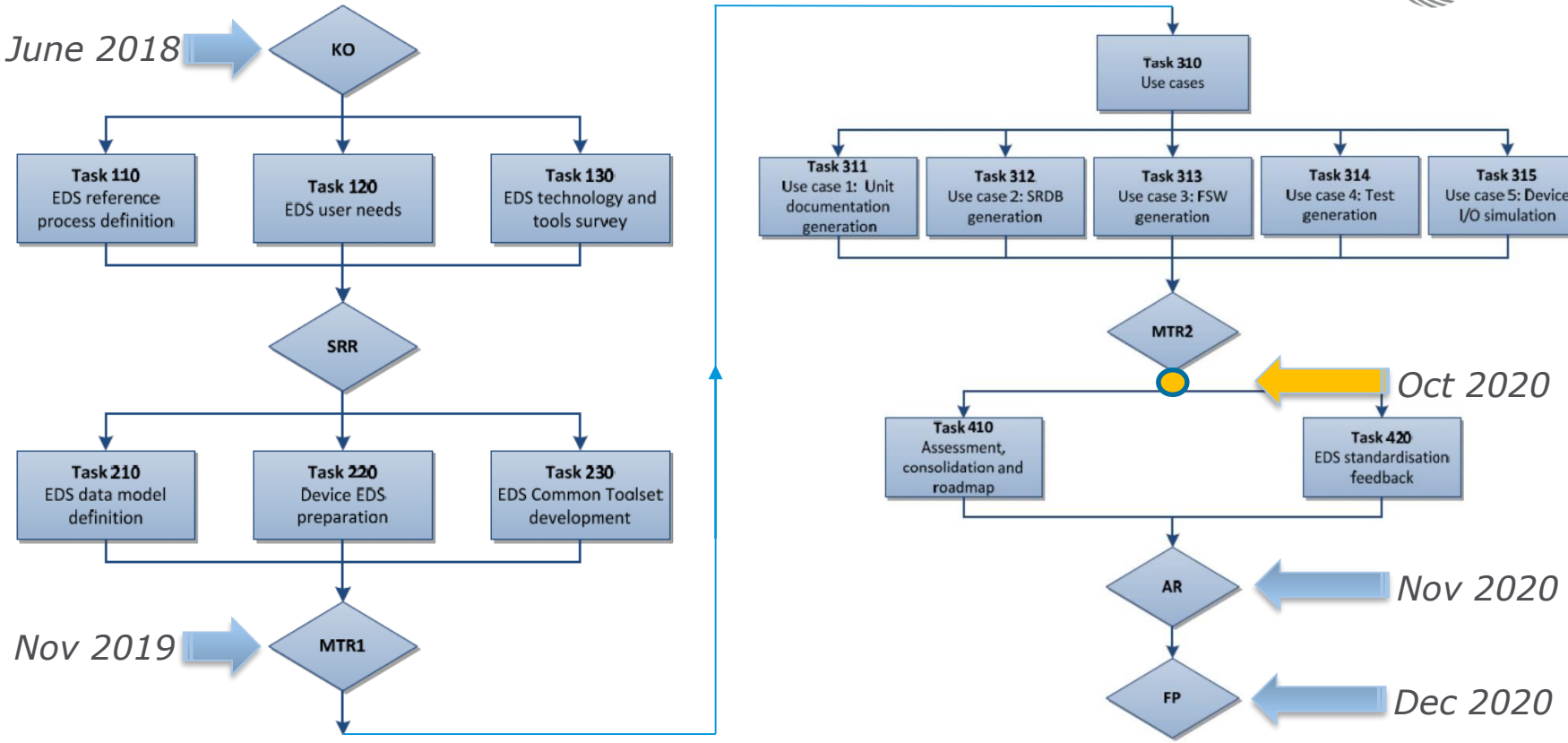

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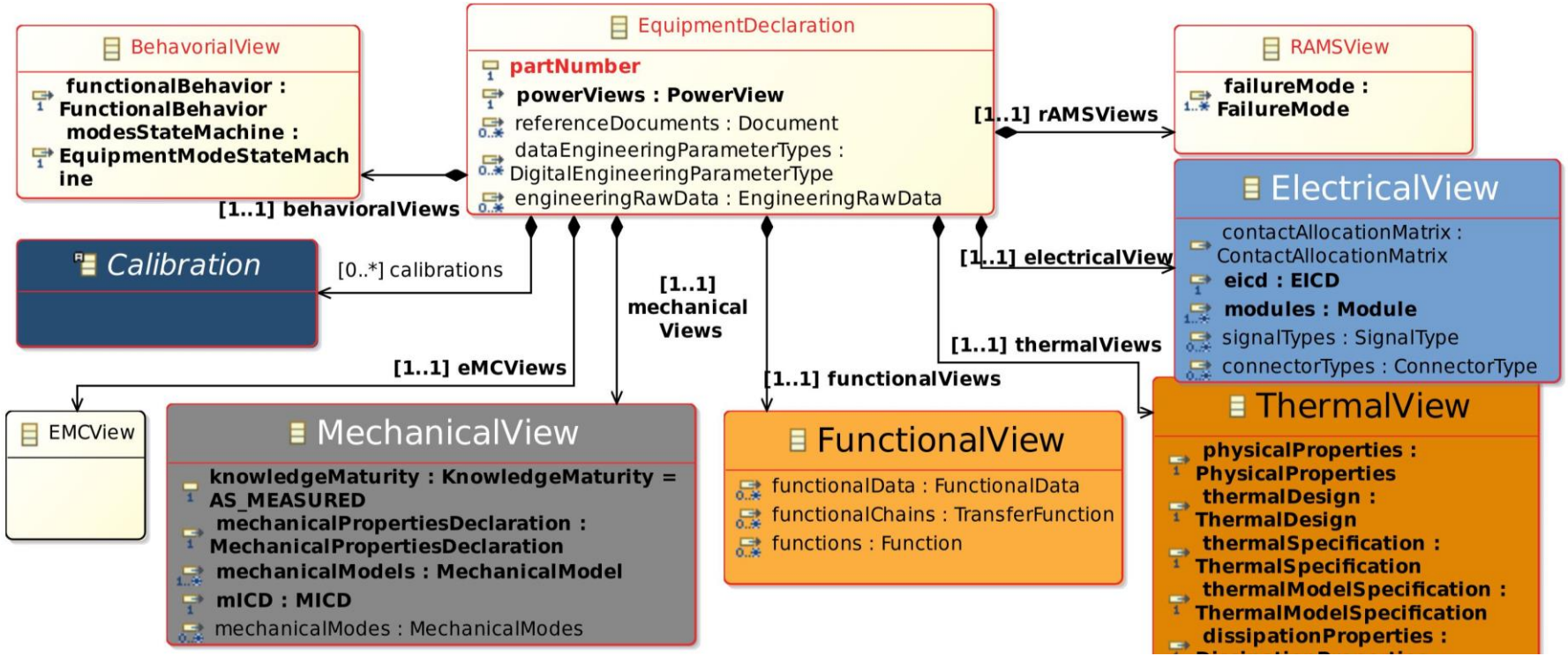
What is inside the (SAVOIR EDS) domain model



Current Status

1. The general intention of capturing communications/electrical/thermal/mechanical info in a tool-readable form is generally agreed

2. Open points regarding the exchange format (XML/XMI is still under discussion)

3. XML Spec Pink Sheets takes input from SAVOIR EDS and SEDS-C activities

4. Activities involving EDS in the roadmap for *Flight SW Harmonisation Dossier* include:
   - SAVOIR EDS Standardisation
   - SAVOIR EDS Common Toolchain Extension
   - Modelling Operational Interfaces for File-Based Operations
   - Test Automation Using SAVOIR EDS
   - Assessment of Electronic Data Sheets Use in the Avionics Equipment Engineering Process

Future Work for SAVOIR EDS studies

1) SAVOIR EDS Domain Model improvement:

- Clean up and strengthen the domain model
- documentation of the domain model
- additional engineering aspects (FDIR, RAMS analysis, support for simulation)

2) Exchange format consolidation:

- incorporating the SAVOIR EDS Domain Model into the CCSDS EDS XML format improve Dictionary of Terms and associated ontology

3) Consequent update of tooling and Proof of Concepts to reflect above changes

CCSDS EDS: Current Status

- **XML Specification for Electronic Data Sheets Blue Book (876.0)**
  - Published early 2019
  - ESA & NASA main contributors (also for interoperability testing)
  - Focused on communication aspects (TM/TC ICD)
  - Applicable in Lunar Gateway (see next slide)
- **Plan for 2020:**
  - **Publish "Electronic Data Sheets and Common Dictionary of Terms - Overview and Rationale" Green Book (870.1)**

    Key book providing rationale to EDS
  - **Publish "Specification for Dictionary of Terms for Electronic Data Sheets for Onboard Components" (876.1)**

    Provides means to define and use agreed semantical information in EDS
  - **Publish "Pink Sheets" to XML Specification for Electronic Data Sheets Blue Book (876.0)**

    I.e. errata with some minor corrections
- **Technical exchanges with SAVOIR EDS & Gateway**

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Lunar Gateway: Use of EDS

- **CCSDS EDS is applicable**
  - XML Specification for Electronic Data Sheets (CCSDS 876.0-R-2)
  - Dictionary of Terms for Electronic Data Sheets (CCSDS 876.1-R-2 draft)
- **Gateway Data Model and data dictionary**
  - EDS describes data model linked to data associated with the activities running on Gateway modules
  - Application interfaces, data, devices
- **Gateway specific extension of both the XML Spec and EDS DoT schemas**
  - Also data traffic description
  - The key motivation is interoperability (as opposed to SAVOIR EDS faster engineering process & MBSE & digital engineering, although clearly there are many common points)
  - Development of tools & reuse of existing ones: E.g. TTEPlan + XTCE + EDS + DoT

EDS for Simulation and validation – SEDS-C

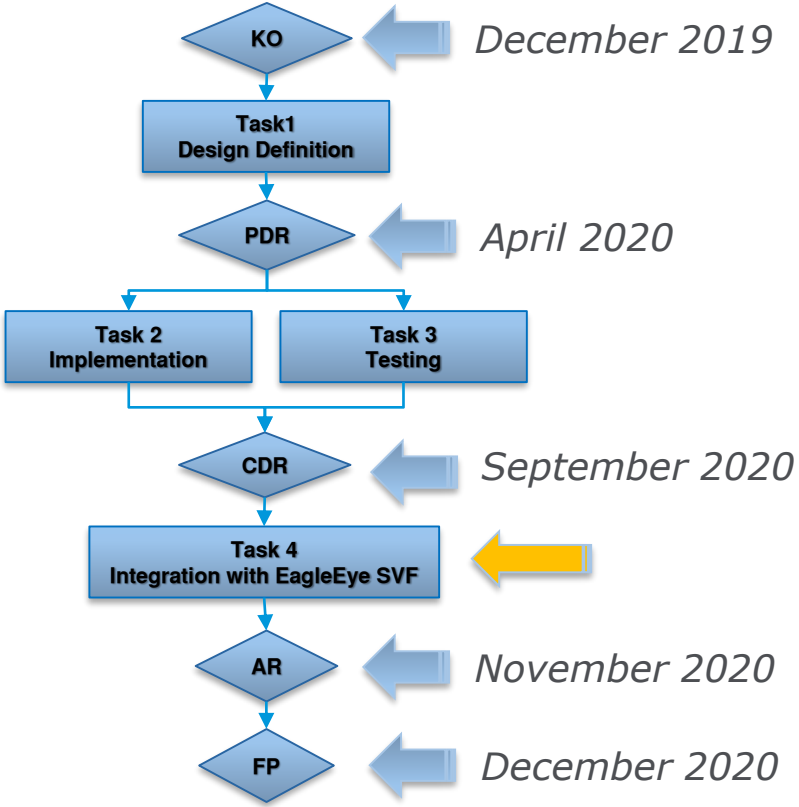
- **GSTP activity** **Tech. Officer:** Mr Jorge Lopez Trescastro ESA/ESTEC
- **Objective: compile SOIS EDS into simulation models running in TEMU**
  - Developing tool: EDS compiler translating EDS XML sheet into a simulation model for the EMUBT simulator
  - SEDS compiler will be implemented using MLIR and LLVM
  - Use case will implement a number of EagleEye SVF sensor/actuator models in EDS XML
  - Demonstrate both EDS compiler and ontology mapping definitions with environmental simulation subsystem
- **EMUBT – SEDS** KO in December 2019, 10 months duration

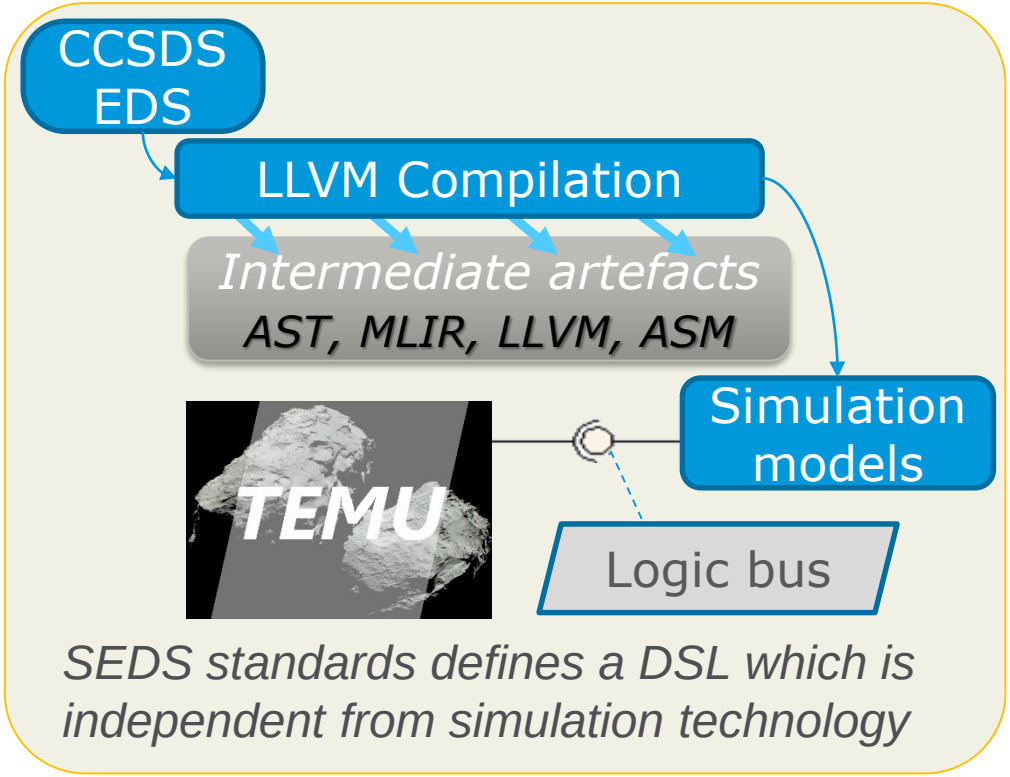
TERMA

Point of contact in Terma for this activity is
Mattias Holm <maho@terma.com>

MLIR: Multi-Level Intermediate Representation

Status of the activity





THANK YOU

Questions?

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