System Engineering Data Repository
Return of Experience and recommendations
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WE LOOK AFTER THE EARTH BEAT

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- Main characteristics of System Engineering Data Repository from various experiences : Earth Observation (MSG – PROTEUS, the sentinels, MTG), Science missions (Herschel/Planck), Telecommunications (Spacebus – Constellations)
  - Data Perimeter in System Engineering Data Repository
  - Data Volume in Satellite Reference Data Base
  - Data Exchange format
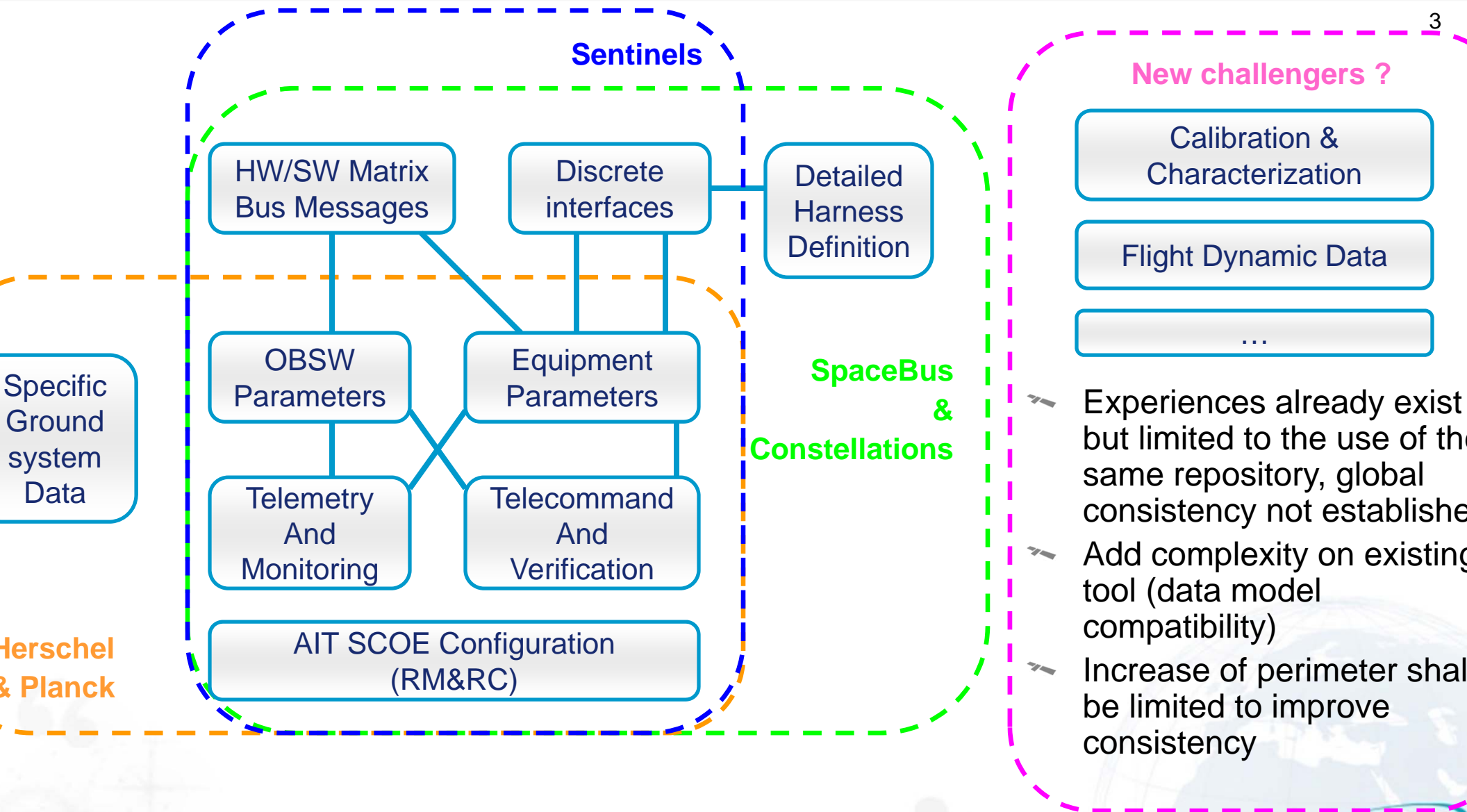 - Schedule aspect
- Recommendations for the future
  - To cover the main encountered difficulties
  - Perceived trends and recommendations

Main message

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Data Perimeter in Satellite Reference Data Repository

Sentinels

New challengers ?

HW/SW Matrix Bus Messages	Discrete interfaces	Detailed Harness Definition

Calibration & Characterization

Flight Dynamic Data

…

SpaceBus & Constellations

OBSW Parameters	Equipment Parameters

Telemetry And Monitoring	Telecommand And Verification

AIT SCOE Configuration (RM&RC)

Specific Ground system Data

Herschel & Planck

- Experiences already exist but limited to the use of the same repository, global consistency not established
- Add complexity on existing tool (data model compatibility)
- Increase of perimeter shall be limited to improve consistency

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Data Volume in Satellite Reference Data Repository

SPACEBUS

Increase of the data count through technologies evolution

4000B2-B3-C1-C4

3000B3

3000B2

TM = 50 000
SOFT = 70 000

x3

TM = 16 000

x10

TC = 5 500

x2

TM = 7 000

SOFT = 7000 ——— = ——— SOFT = 7000
TC = 2 000 ——— = ——— TC = 2 000
HRN = 7 000 ——— = ——— HRN = 9 000 ——— = ——— HRN = 10 000

x3
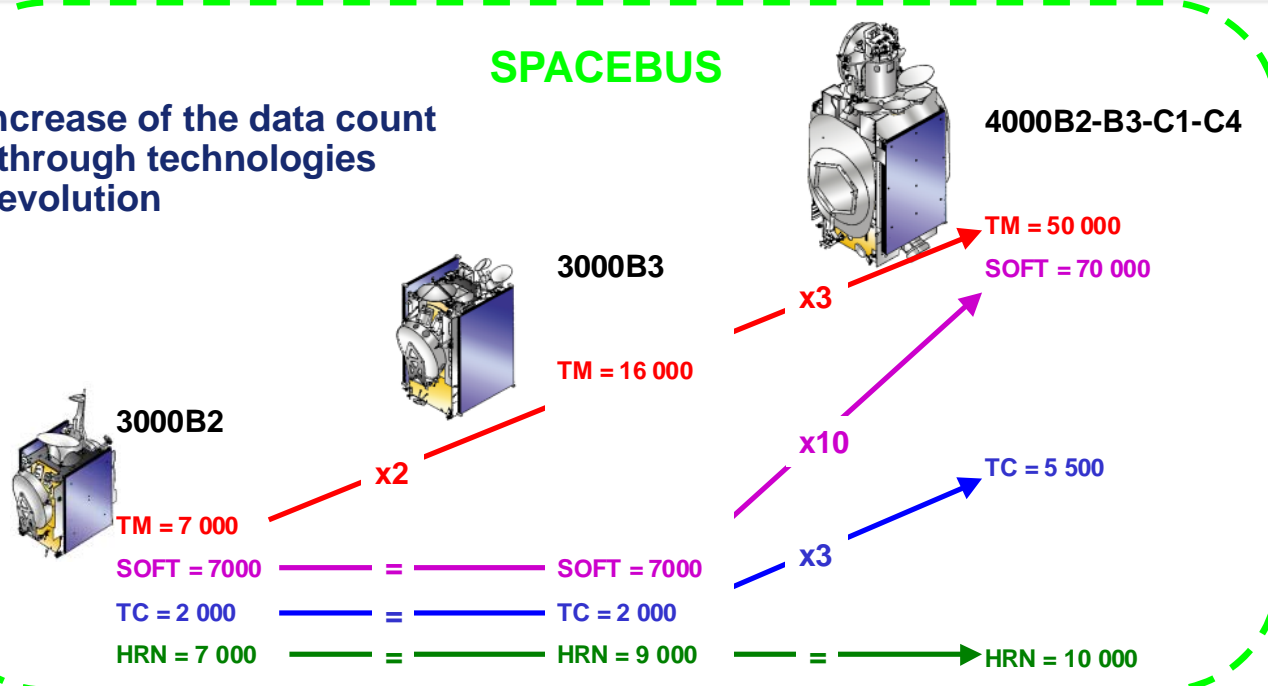
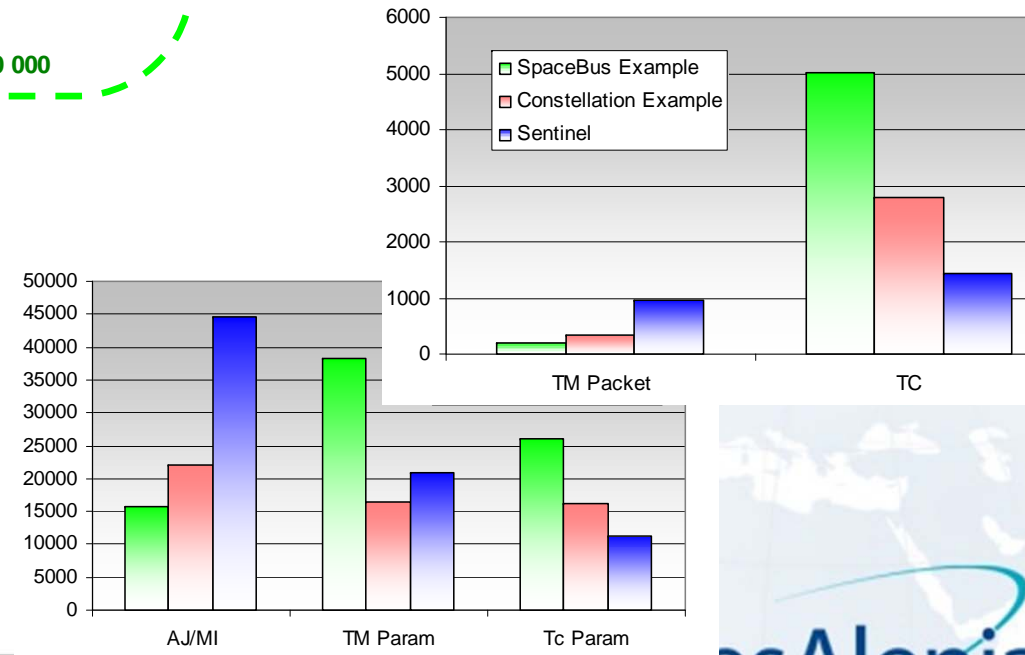- Increase of data volume with technologies evolution
- Clear growth of software parameter in particular in block oriented architecture to satisfy Satellite famil approach
- Clear growth of telemetry parameters to bring more precision and details to the ground about on board behavior.

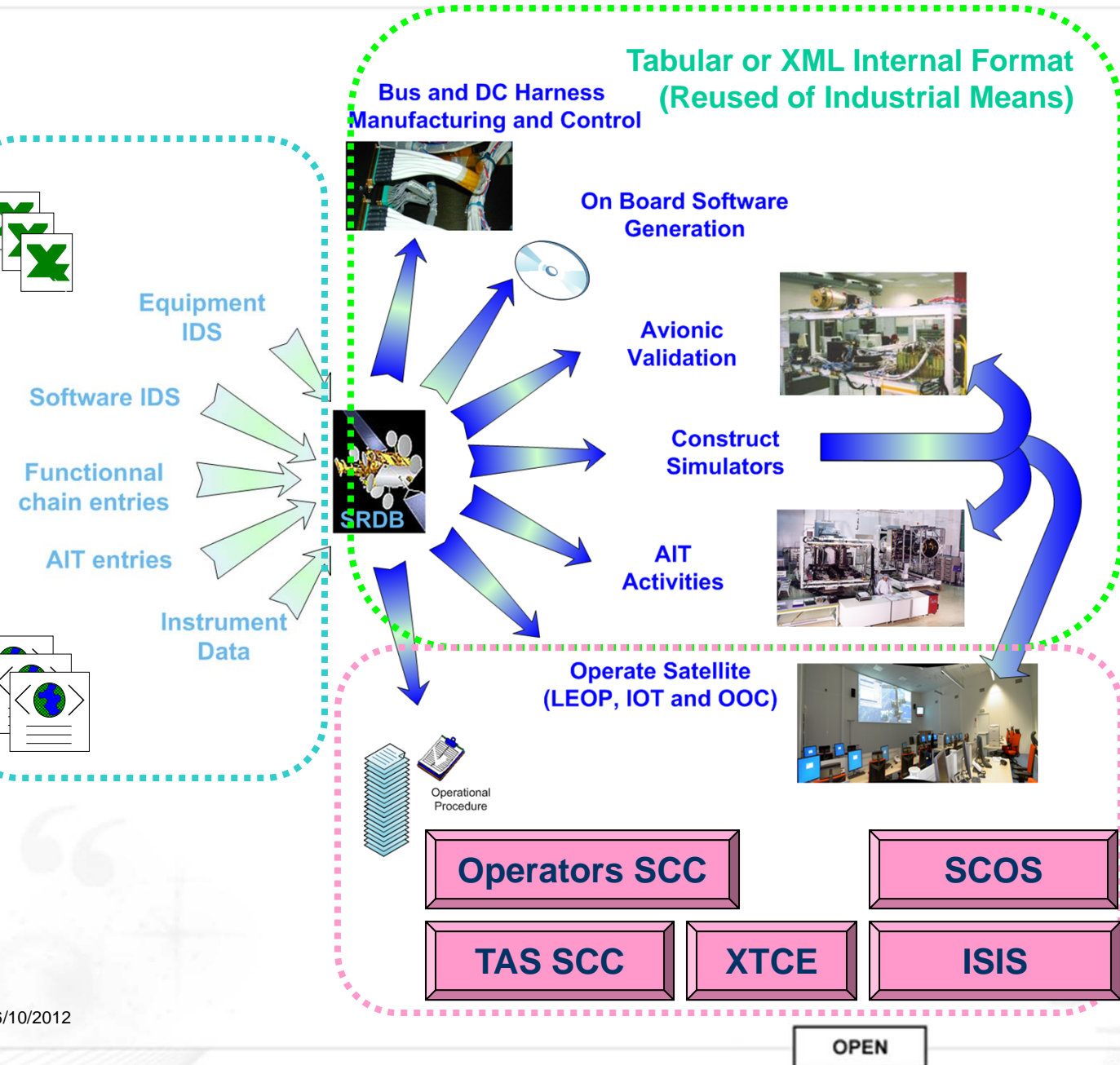Comparison for several programs : Ranking depends on data type

Many factors are at the origin of the growth of the data volume :

- Nb of equipments, I/O interfaces
- Architecture Technology and complexity
- Ground system concepts

Chart legend: SpaceBus Example, Constellation Example, Sentinel
Categories: TM Packet, TC

Categories: AJ/MI, TM Param, Tc Param

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Data Exchange in Satellite Reference Data Repository

Tabular or XML Internal Format
(Reused of Industrial Means)

Bus and DC Harness Manufacturing and Control

On Board Software Generation

Equipment IDS

Software IDS

Avionic Validation

Functionnal chain entries

Construct Simulators

AIT entries

SRDB

AIT Activities

Instrument Data

Operate Satellite (LEOP, IOT and OOC)

Operational Procedure

Operators SCC		SCOS
TAS SCC	XTCE	ISIS

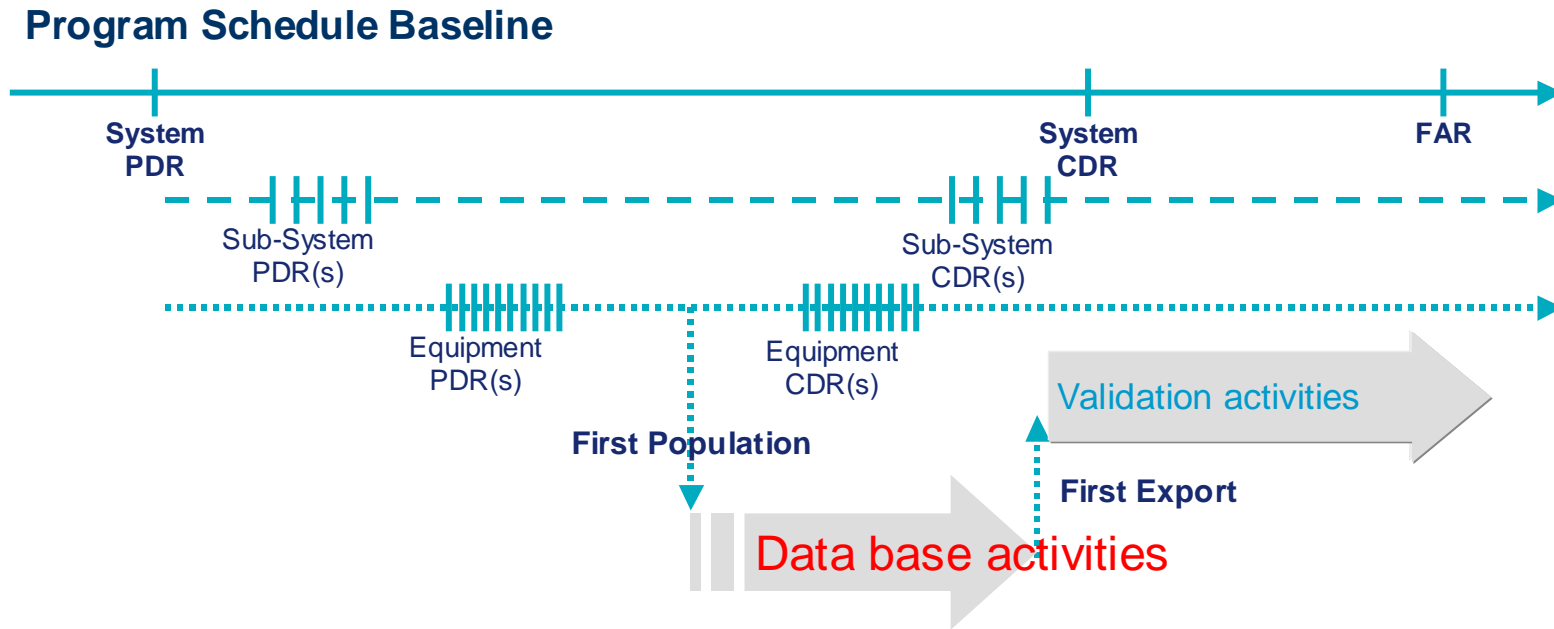Large and various format, seve[r]al concepts, several language[s]

- For Customer deliveries : on[e] standard per customer

- For Industrial Means, high level of reused and stability [to] maintain industrial investme[nt]

- Main entries in Excel or XML format (TAS proprietary) :
  - need lot of iterations with equipment/system suppliers
  - Induce additional cost at supplier level

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Schedule for data management

Program Schedule Baseline

- First data base definition is one of the last step for the fine definition of the product, that requires some particular attentions on any details of the data definition.

- This activity has is own incompressible workload, and the unavailability or delay of inputs can generate a bottleneck in the global schedule.

- Standardization of exchange format from equipment supplier should help them to provide data with higher level of maturity and earlier in the life cycle.

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Difficulties are mainly encountered in :

- The centralization, growth of the data perimeter and volume, increase of the number of persons in interface, require more and more qualified resources for data management.

- Existing proprietary formats have their own semantic and concepts that add useless complexity in data management and data model, and in some case limitations on the on board behavior. This lack of standard increases the cost and delay for the supplying of the data at any level of the organization (equipment, software, sub-system, instruments, …)

- Data Validation and verification becomes a boring and complex task due to the various exchange formats that handle different concept not always compatible.

- Existing tools were built to centralize the data management with a fix data model. They shall now evolve to answer to the new constraints :
  - Electronic Process to cover Data Workflow, Configuration and Change management features that become mandatory to achieve future programs that are more and more based on complex industrial organization
  - Integrate flexibility in data model to allow the implementation of new features of OBSW and equipments that need new data to be exchanged.
  - Integrate flexibility to allow the extension of data perimeter and volume with the associate consistency checks.

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Perceived trends and Recommendations : Supplier Data

- Electronic Data Sheet study
  - Appears to be the first step for the standardization of inputs covering the full SOIS architecture

- In parallel, TAS-F expects the definition of a standard that can be used on existing equipments covering electrical and functional interfaces (discrete interfaces, 1553 Message, …), that could be based on the EDS definition.

- Exchange Data for Software development and in flight maintenance
  - Studies in progress (e.g with CNES customer) to define exchange format
  - TAS-F will make it applicable for any future project, for internal or external software development.

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- **EGSCC – Core Concerning "static" data**
  - Includes a new data model for Monitoring and Control, Product structure, functional avionic architecture, Scoe command and control.
  - Standard M&C database (incl. all operation data) exchange format (based on XTCE), New procedure language (compliant with ECSS-E-70-32)
- **ISIS –standard**
  - Data exchange Based on ECSS-E-70-31and XTCE tailoring
  - Definition of an On Board Command Procedure Language
  - All Defined and already agreed by the three partners : Astrium, CNES and TAS
- **XTCE Use case in TAS**
  - World Wide Standard from OMG.
  - First industrial use case of XTCE language on Irridium Program
  - Reused of ISIS experience for the tailoring of XTCE according to Irridium needs

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Recommendations

- Exchange formats (ISIS and EGSCC) shall evolve to a common and compatible solution in order to guarantee the first investment done at industrial level.

- To promote the tailoring of XTCE in an European standard.

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