

2024 ESA Clean Space Days

Exploitation of Data Availability to Perform Simplified Life Cycle Assessment (LCA)

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- 1 LCI Challenges
- 2 LCI approach at TAS
- 3 LCI Simplification Methodologies
- 4 Suggestions & Way Forward
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Life Cycle Assessment / Methodology



Goal and scope definition

Modeling
And calculation of environmental impacts by means of SimaPro software

Communication



LCI Data collection
(= flow inventory)

Product BOM:

- Components
- Materials, process, finishes
- Mass

Packaging BOM (primary, secondary and tertiary) :

- Components
- Materials, process, finishes
- Mass

Manufacturing processes and conditioning:

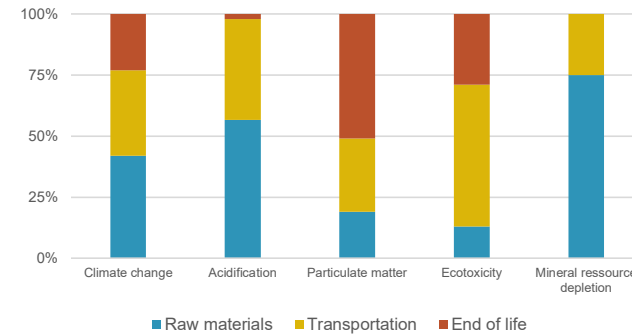
- Energy or (device's power * duration)
- Country
- Consumables & spare parts

Transports:

- Mode of transportation (Truck, boat, plane)
- Distance
- Occupancy rate



Interpretation



Life Cycle Assessment / Introduction & Approach



① MULTI-STEPS

All stages of the life cycle are taken into account



③ SYSTEMIC

Everything related to the product is taken into account: the product, packaging, associated and ancillary products, etc.



② MULTI-INDICATORS

All significant environmental impacts generated by the product are measured



Life Cycle Assessment / Introduction & Approach

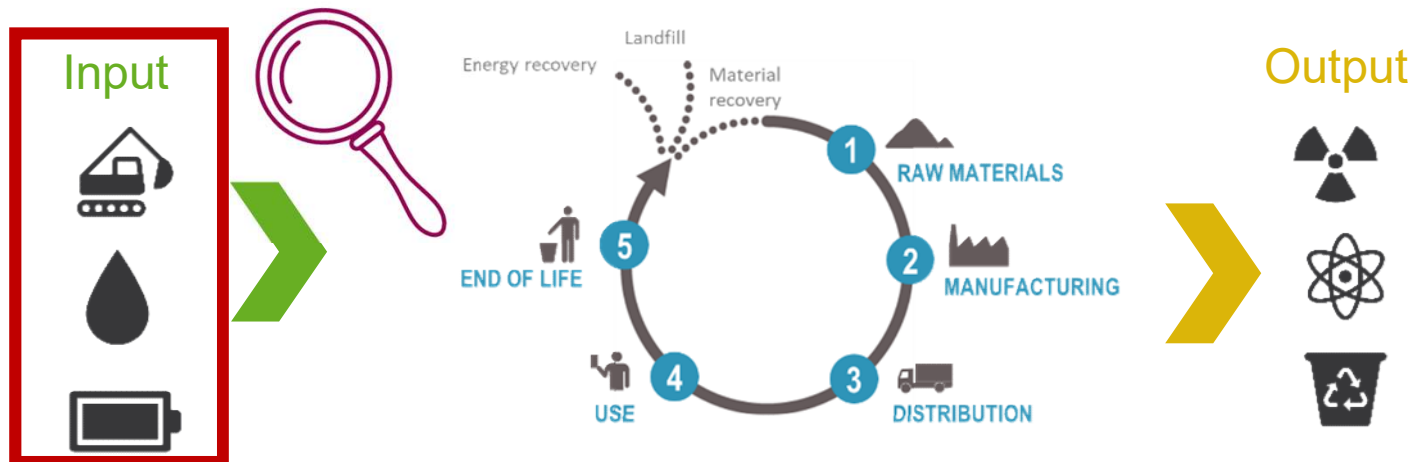


1 MULTI-STEPS

The "product" approach takes into account all stages of the life cycle

Definition of life cycle (ISO 14040:2006)

"Consecutive and linked phases of a product system, from the acquisition of raw materials or the generation of natural resources to the final disposal"

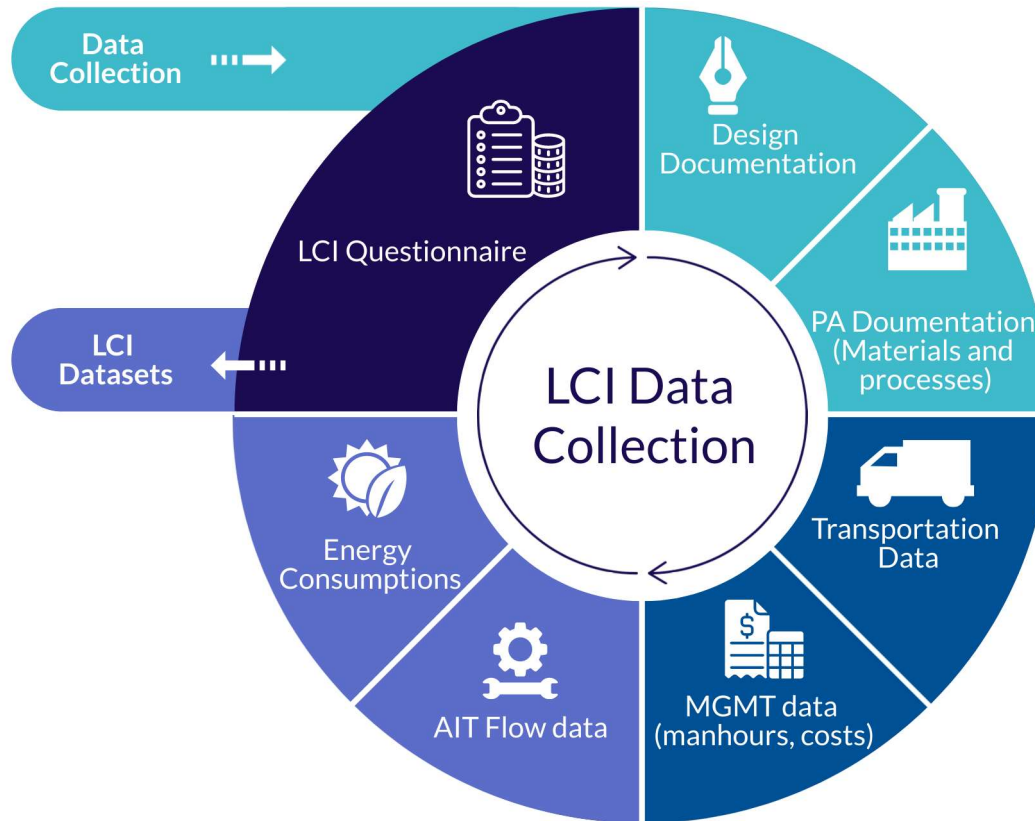


LCA Activities / Challenges

As Prime Contractor

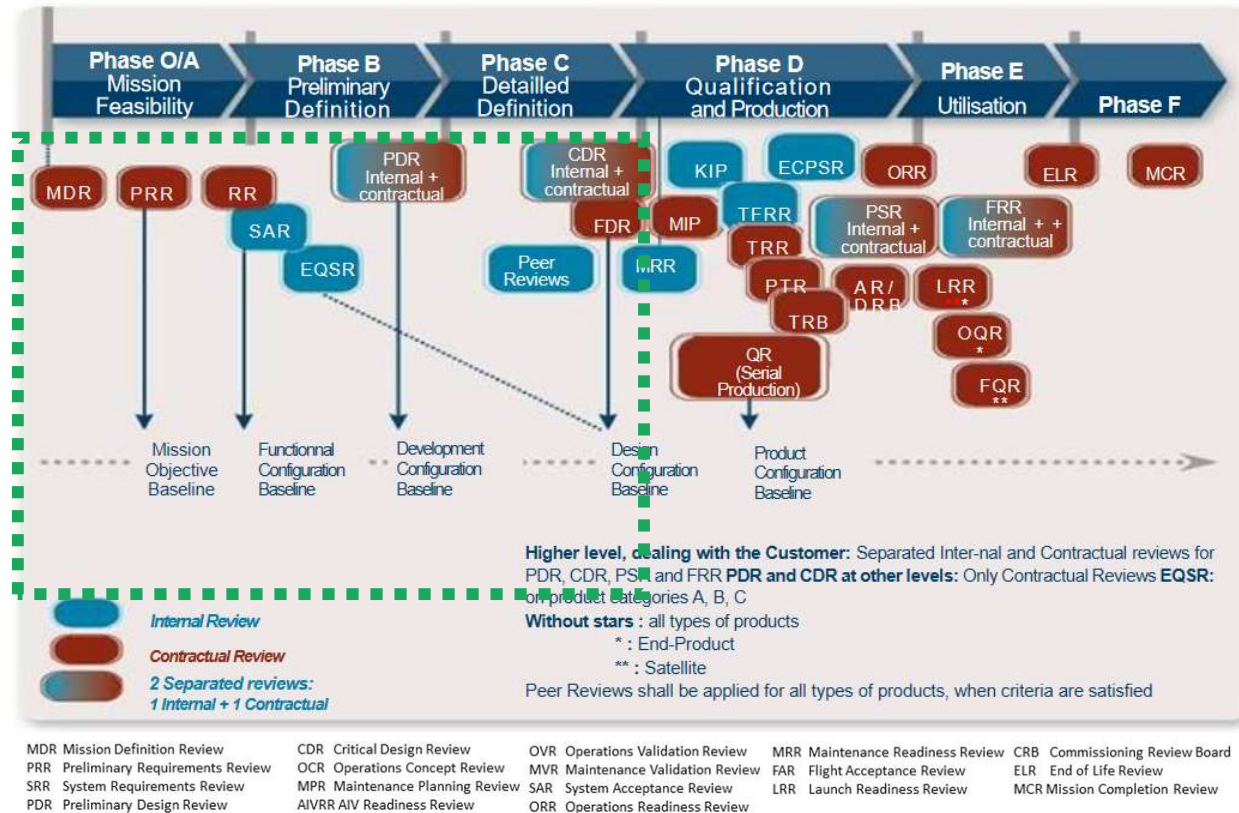
- *performing a comprehensive Life Cycle Assessment (LCA) as early as possible during Projects' evolution is nowadays crucial for minimizing environmental impact and to define Ecodesign strategies.*
- obtaining the necessary input data for the Life Cycle Inventory (LCI) can be challenging due to **delays or lack of feedback from the supply chain** and subcontractors.
 - complex supply chains and subcontractor dependencies can lead to delays or incomplete data
 - Poor and immature Design and Configuration at early stages leads to high level of uncertainties
- Thales Alenia Space ensures the efficient gathering and validation of LCI data by leveraging existing data packages and collaborating closely with subcontractors through dedicated workshops
 - Custom tailored LCI data Collection Questionnaire is available at TAS-I although:
 - Filling out the Input Data Collection Questionnaire requires time and effort not compatible with LCA performed in Early Project phases
 - Several sections of the LCI Data Collection Questionnaire must be necessarily skipped for 1st LCA iteration

LCI / Methodology



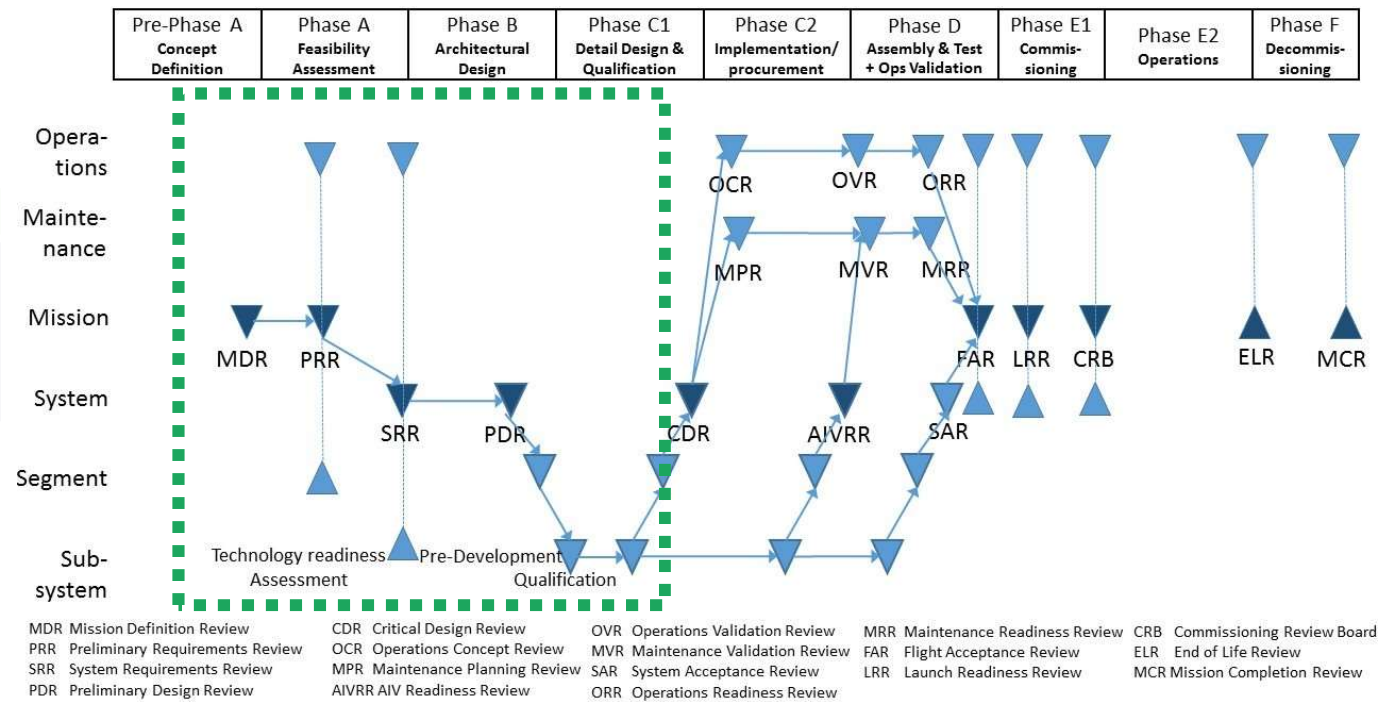
Space System Engineering- Project Life Cycle @ TAS

Project Phases & Reviews affected by LCI Data Collection



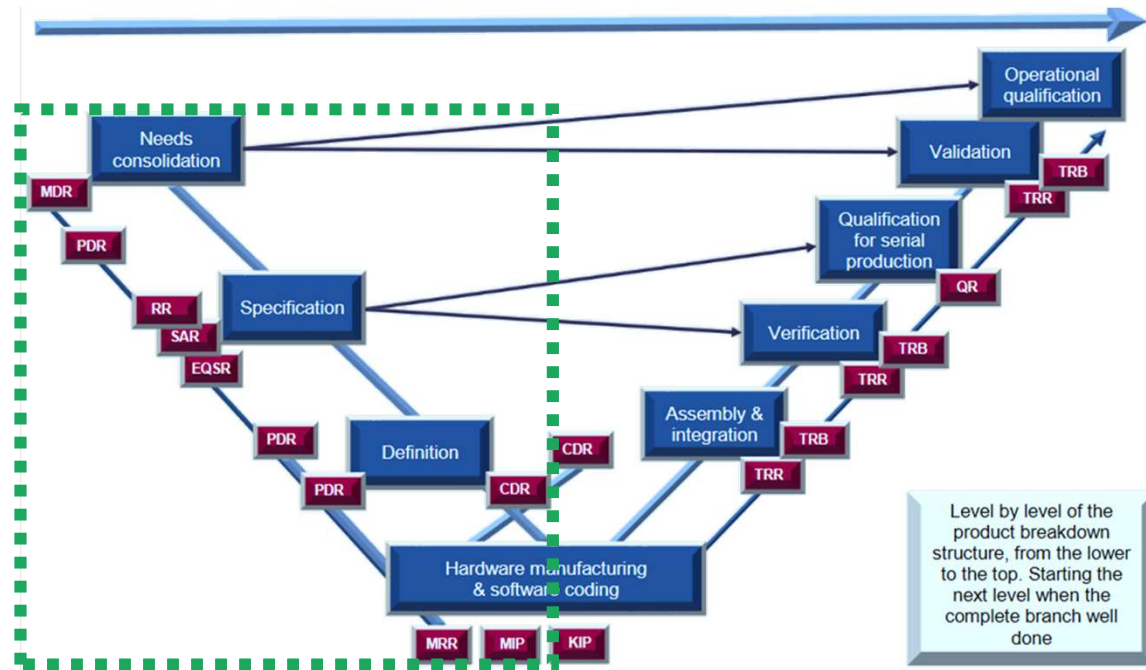
Space System Engineering- Generic V- Cycle approach

Project Phases & Reviews affected by LCI Data Collection



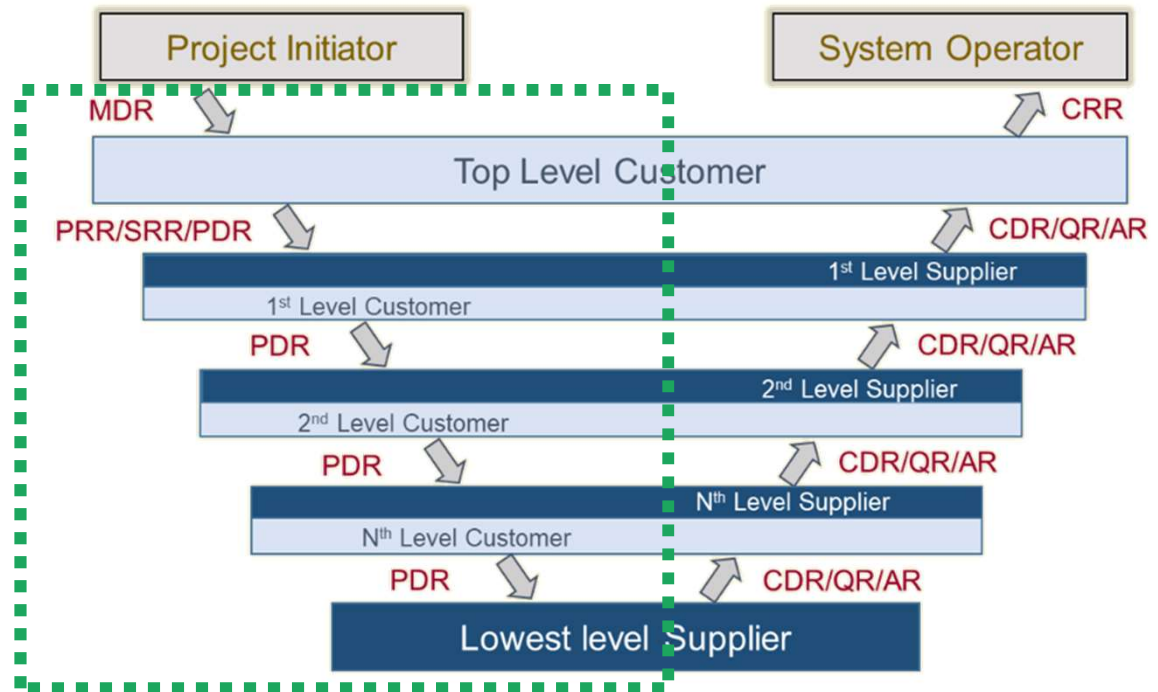
Space System Engineering- V- Cycle @ TAS

Project Phases & Reviews affected by LCI Data Collection



Space System Engineering- Customer/Suppliers Reviews Life Cycle

Project Phases & Reviews affected by LCI Data Collection



LCA / Life Cycle Inventory – LCI Data Collection

Activities / Contributions
Production / Assembly / Storage
Satellite Elements Production
GSE Production
Satellite Assembly
Satellite Storage
Bake-out / Testing
Elements Bake-out
Elements and Satellite Testing
Office Work / Travels
Office Work
Travels
New Infrastructures (mandatory for program execution)
New Infrastructures Construction and Dismantling
New Infrastructures Equipment Manufacturing and Disposal
Launch Campaign
Satellite Integration

Models / Items		STM	SM	EM	EQM	PFM	FM
S/S / Equipment	S/S 1	✓		✓			✓
	S/S 2		✓		✓		✓
	Equipment 1			✓			✓
	Equipment 2			✓			✓
	Platform					✓	✓
	Instrument			✓		✓	✓
	Satellite			✓		✓	✓

LCI Data Collection – Primary Source of input @ Prime Level



ThalesAlenia Space WAND

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Home CADM and Engineering Search: [] Go

Overview Assignments Updates Checked-Out Work Notebook Subscriptions Utilities

Documents Changes Parts Tools Go to Databases Quality Help

Search Options

Program: ROSEL

Number: []

Title: []

Organization: Thales Alenia Space Italia (TAI)

Typology: All

Only Last Versions: []

List of Documents

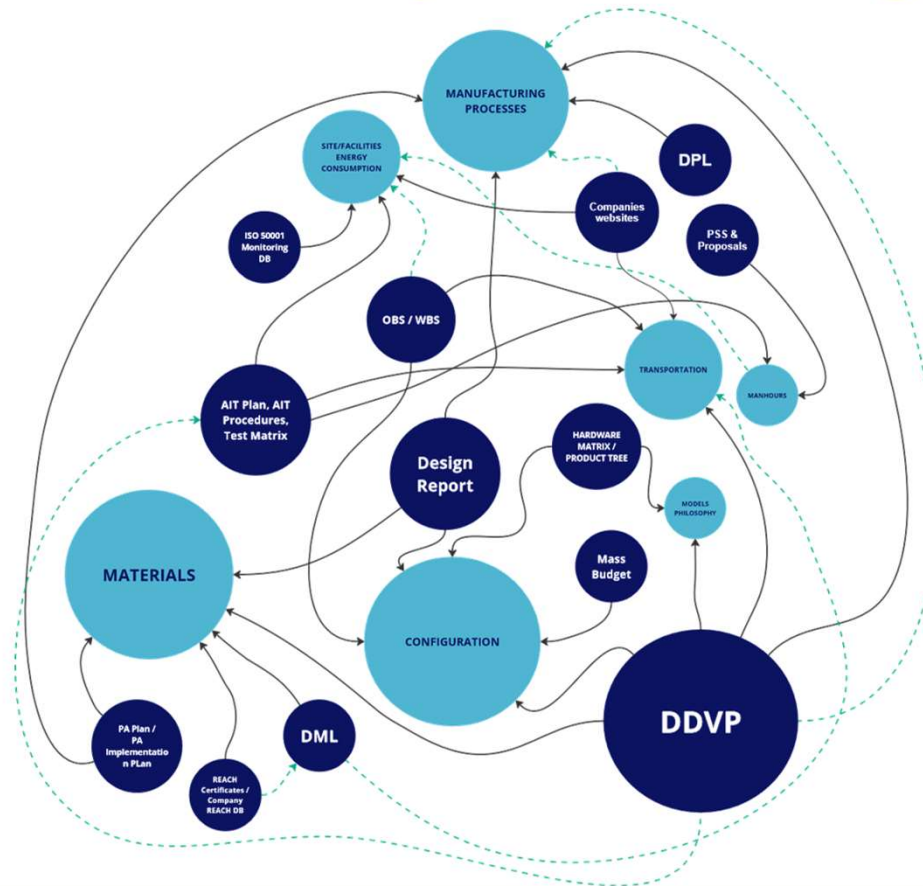
Number	Type	Date
No Items to Display		

Overview | Assignments | Updates

Powered by Windchill® About Windchill

- Analysis (AN)
- Back-up SW optical on Optical Disk (CD-DVD) (BO)
- Budget (BG)
- Certificate of Conformance (CE)
- Configuration Status List (CS)
- Contract (CO)
- Contract Change Notice (CCN)
- Contract Change Request (CCR)
- Critical Items List (CI)
- Data Package (Including End Item Data Package) (DP)
- Database (DB)
- Delivery Note (DN)
- Design Document (DD)
- Design Specification (DS)
- Document Change Notice (DCN)
- Drawing (DR)
- Email (EM)
- Handbook (HBK)
- Handout View graph (HO)
- Header (HDR)
- Interface Control Document (ICD)
- Interface Requirement Document (IRD)
- Letter (LE)
- List (LJ)
- Log Book (LB)
- Manual-User Manual (UN)
- Matrix (MX)
- Memorandum (MO)
- Minute of Meeting (MIN)
- Model (MDL)
- NCR (NCR)
- Offer - Tender - Proposal (OF)
- Part Approval Document (PAD) (PAD)
- PL (PL)
- Plan (PLN)
- Procedure (PR)
- Procedure - Inspection (IFR)
- Procedure - Installation-Assembly (IAP)
- Procedure - Manufacturing (MPR)
- Product Tree (PT)
- Proposal (PRO)
- Purchase Order (PO)
- Report (RP)
- Request for Approval (RFA)
- Request for Deviation (RFD)
- Request for Waiver (RFW)
- Requirement Specification (RS)
- Schedule (SC)
- Schema a blocchi (SBL)
- Software (SW)
- Specifica di Progetto (Drawing) (SDP)
- Standard (ST)
- Statement of Work (SOW)
- Support Specification (SS)
- Technical Note (TN)
- Telefax (FX)
- Test Procedure (TP)
- Test Report (TR)
- Test Specification (TS)
- Verification Control Document (VCD)
- Work Breakdown Structure (WBS)

LCI Data Collection through available Docs @ Prime Level



LCA / LCI Data Collection – Tools: LCI Data Sources

Data Type <small>For all model types (i.e. EM, STM, QM, PFM, FM...) manufactured in the frame of the Program, including dummies.</small>	Data Status ...					Data Source <small>Straight text: Generic data Italic text: Instantiated data</small>				Source Owner <small>Straight text: Generic data Italic text: Instantiated data</small>		Data Collection Method	Comments / Remarks
	... for "Copernicus Mission" Program...					Type	Title	Reference	Date	Role	Name		
	... PDR preparation		... CDR preparation										
Availability / Existence	Maturity	Availability / Existence	Maturity										
Bake-out / Testing													
Elements Bake-out													
Bake-out													
Bake-out Facility Energy Consumption													
Elements and Satellite Testing													
Acoustics Testing													
Test Type (Acceptance / Protolight / Qualification) => Duration													
Test Facility Energy Consumption													
Thermal Vacuum Testing													
Test Type (Acceptance / Protolight / Qualification) => Duration													
Test Facility Energy Consumption													
Test Facility Nitrogen Consumption													
Vibrations Testing													
Test Type (Acceptance / Protolight / Qualification) => Duration													
Test Facility Energy Consumption for Random Vibrations													
Test Facility Energy Consumption for Sine Vibrations													
Functional Testing													
Test Duration													
Element / Satellite Energy Consumption													
CEE Energy Consumption													
Test Facility HVAC Power Consumption													
Office Work / Travels													
Office Work													
System Integrator Collaborators													
"On site working" Workload (per site)													
"Home working" Workload (per country)													
Suppliers Collaborators													
"On site working" Workload (per site)													
"Home working" Workload (per country)													
Travels													
System Integrator Collaborators													
Plane Travels Distances													
Flight Types (national, international, intercontinental)													
Suppliers Collaborators													
Plane Travels Distances													
Flight Types (national, international, intercontinental)													
New Infrastructures (mandatory for program execution)													
New Infrastructures Construction and Dismantling													
System Integrator													
Building Type													
Building Surface													
Suppliers													
Building Type													
Building Surface													
New Infrastructures Equipment Manufacturing and Disposal													
System Integrator													
Dedicated Industrial Equipment Characteristics (type, quantity, ...)													
Dedicated Office Equipment (PCs, ...) characteristics (type, quantity, ...)													
Suppliers													
Launch Campaign													
Satellite Integration													
Transportation													
Integration Activities													

LCI Data Collection: LCI Data Sources Evolution

Data Type	LCI Data Collection Status				Data Source	
	for "ESA Mission" Program				Type	Template (as per CHORUS)
	PDR preparation		CDR preparation			
	Availability / Existence	Maturity	Availability / Existence	Maturity		
Production / Assembly / Storage						
Satellite Elements Production						
SS / Equipment						
SS / Equipment Composition (Component Material and Manufacturing Process)	Available	May evolve	Available	Frozen	Document	DML, DPL
SS / Equipment Mass	Available	May evolve	Available	May evolve	Document	Satellite mass budget
SS / Equipment Quantity	Available	Frozen	Available	Frozen	Document	Statement of work
SS / Equipment Production and Testing Location (Country City)	Available	Frozen	Available	Frozen	Document	Project management plan
SS / Equipment CRM (Critical Raw Material) Information	Available	May evolve	Available	Frozen	Document	Declared materials list
SS / Equipment REACH Information	Available	May evolve	Available	Frozen	Document/Database	Declared materials list
SS / Equipment Conflict Minerals Information	Available	May evolve	Available	Frozen	Document	Declared materials list
Propellant						
Propellant Composition and Production Process	Available	May evolve	Available	Frozen	Document	DML, DPL
Propellant Mass	Available	May evolve	Available	May evolve	Document	Satellite mass budget
Propellant Production Location (Country City)	Available	Frozen	Available	Frozen	Document	Project management plan
Instrument						
Instrument Composition (Material)	Available	May evolve	Available	Frozen	Document	Declared materials list
Instrument Mass	Available	May evolve	Available	May evolve	Document	Mass budget
Instrument Production Location (Country City)	Available	Frozen	Available	Frozen	Document	Project management plan
Instrument CRM (Critical Raw Material) Information	Existing	May evolve	Existing	Frozen	Document	Declared materials list
Instrument REACH Information	Existing	May evolve	Available	Frozen	Document/Database	Declared materials list
Instrument Conflict Minerals Information	Existing	May evolve	Existing	Frozen	Document	Declared materials list

LCI Data Collection: LCI Data Sources Evolution

Data Type	LCI Data Collection Status				Data Source	
	for "ESA Mission" Program				Type	Template (as per CHORUS) Title
	PDR preparation		CDR preparation			
	Availability / Existence	Maturity	Availability / Existence	Maturity		
Production / Assembly / Storage						
GSE Production						
GSE						
GSE Composition (Component Material and Manufacturing Process)	Existing	May evolve	Available	Frozen	Document	DML, DPL
GSE Mass	Existing	May evolve	Available	May evolve	Document	Mass budget (TBC)
GSE Quantity	Available	May evolve	Available	Frozen	Document	Statement of work
GSE Production and Testing Location (Country City)	Available	May evolve	Available	Frozen	Document	Project management plan
GSE CRM (Critical Raw Material) Information	Non-existing	May evolve	Existing	May evolve	Document	Declared materials list (TBC)
GSE REACH Information	Existing	May evolve	Existing	May evolve	Document/Database	Declared materials list (TBC)
GSE Conflict Minerals Information	Non-existing	May evolve	Existing	May evolve	Document	Declared materials list (TBC)
Satellite Assembly						
Satellite Elements Transportation						
SS / Equipment Transportation Description (Mean Distance)	Available	May evolve	Available	May evolve	Document	Project management plan TBC
Propellant Transportation Description (Mean Distance)	Existing	May evolve	Available	May evolve	Document	Project management plan TBC
Instrument Transportation Description (Mean Distance)	Available	May evolve	Available	May evolve	Document	Project management plan TBC
GSE Transportation						
GSE Transportation Description (Mean Distance)	Existing	May evolve	Available	May evolve	Document	Project management plan TBC
Assembly						
Satellite Assembly and Testing Location (Country City)	Available	Frozen	Available	Frozen	Document	Project management plan TBC
Assembly Facility HVAC Power Consumption	Existing	May evolve	Existing	May evolve	Document/Database	Specific technical documentation TBC
Assembly Duration	Existing	May evolve	Existing	May evolve	Document	Satellite AIT Plan / GSE Development Plan
Satellite Storage						
Storage						
Storage Location (Country City)	Available	May evolve	Available	May evolve	Document	Satellite AIT Plan
Storage Facility HVAC Power Consumption	Available	May evolve	Available	May evolve	Document/Database	Specific technical documentation TBC
Storage Conditions and Duration	Non-existing	May evolve	Non-existing	May evolve	Document	Storage Plan if storage is decided in D phase

Date : 09/10/2024

Ref. : N/A

Rif. Modulo : 83230347-DOC-TAS-IT-008

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LCI Data Collection: LCI Data Sources Evolution

Data Type	LCI Data Collection Status				Data Source	
	for "ESA Mission" Program				Type	Template (as per CHORUS)
	PDR preparation		CDR preparation			Title
	Availability / Existence	Maturity	Availability / Existence	Maturity		
Bake-out / Testing						
Elements Bake-out						
Bake-out						
Bake-out Facility Energy Consumption	Existing	May evolve	Available	May evolve	Document/Database	Specific technical documentation TBC
Elements and Satellite Testing						
Acoustics Testing						
Test Type (Acceptance / Protoflight / Qualification) => Duration	Existing	May evolve	Available	May evolve	Document	Satellite AIT Plan
Test Facility Energy Consumption	Existing	May evolve	Available	May evolve	Document/Database	Specific technical documentation TBC
Thermal Vacuum Testing						
Test Type (Acceptance / Protoflight / Qualification) => Duration	Existing	May evolve	Available	May evolve	Document	Satellite AIT Plan
Test Facility Energy Consumption	Existing	May evolve	Available	May evolve	Document/Database	Specific technical documentation TBC
Test Facility Nitrogen Consumption	Existing	May evolve	Available	May evolve	Document/Database	Specific technical documentation TBC
Vibrations Testing						
Test Type (Acceptance / Protoflight / Qualification) => Duration	Existing	May evolve	Available	May evolve	Document	Satellite AIT Plan
Test Facility Energy Consumption for Random Vibrations	Existing	May evolve	Available	May evolve	Document/Database	Specific technical documentation TBC
Test Facility Energy Consumption for Sine Vibrations	Existing	May evolve	Available	May evolve	Document/Database	Specific technical documentation TBC
Functional Testing						
Test Duration	Available	May evolve	Available	May evolve	Document	Satellite AIT Plan
Element / Satellite Energy Consumption	Existing	May evolve	Available	May evolve	Document	Satellite power budget
GSE Energy Consumption	Existing	May evolve	Available	May evolve	Document/Database	Specific technical documentation TBC
Test Facility HVAC Power Consumption	Existing	May evolve	Available	May evolve	Document/Database	Specific technical documentation TBC

LCI Data Collection: LCI Data Sources Evolution

Data Type	LCI Data Collection Status				Data Source	
	for "ESA Mission" Program				Type	Template (as per CHORUS)
	PDR preparation		CDR preparation			Title
	Availability / Existence	Maturity	Availability / Existence	Maturity		
Office Work / Travels						
Office Work						
System Integrator Collaborators						
"On site working" Workload (per site)	Available	May evolve	Available	May evolve	Document/Database	QDV, WPDs, Economic Plan, Program Schedule, Primavera/PCM Database - Project Management Plan (PMP) - PSS Files included in Prime's Proposal Internal Program Planning
"Home working" Workload (per country)	Non-existing	May evolve	Non-existing	May evolve	N/A	
Suppliers Collaborators						
"On site working" Workload (per site)	Available	May evolve	Available	May evolve	Other	- Industrial Procurement Plan - Subcos Proposals and annexes (WPD, PSS files) - Cost Point Management System DB
"Home working" Workload (per country)	Non-existing	May evolve	Non-existing	May evolve	N/A	
Travels						
System Integrator Collaborators						
Plane Travels Distances	Existing	May evolve	Existing	May evolve	Document/Database	QDV, WPDs, Economic Plan, Primavera/PCM DB - Project Management Plan (PMP) - PSS Files included in Prime's Proposal - Geographical Distribution of Work (PM-08 as per ROSE-L DRL) as per WBS and OBS in PMP - Cost Point Management System DB
Flight Types (national, international, intercontinental)	Existing	May evolve	Existing	May evolve	Other	QDV, WPDs, Economic Plan, Primavera/PCM DB - Project Management Plan (PMP) - PSS Files included in Prime's Proposal - Geographical Distribution of Work (PM-08 as per ROSE-L DRL) as per WBS and OBS in PMP - Cost Point Management System DB
Suppliers Collaborators						
Plane Travels Distances	Existing	May evolve	Existing	May evolve	Document/Database	- Industrial Procurement Plan - Subcos Proposals and annexes (WPD, PSS files)
Flight Types (national, international, intercontinental)	Existing	May evolve	Existing	May evolve	Other	- Industrial Procurement Plan - Subcos Proposals and annexes (WPD, PSS files)

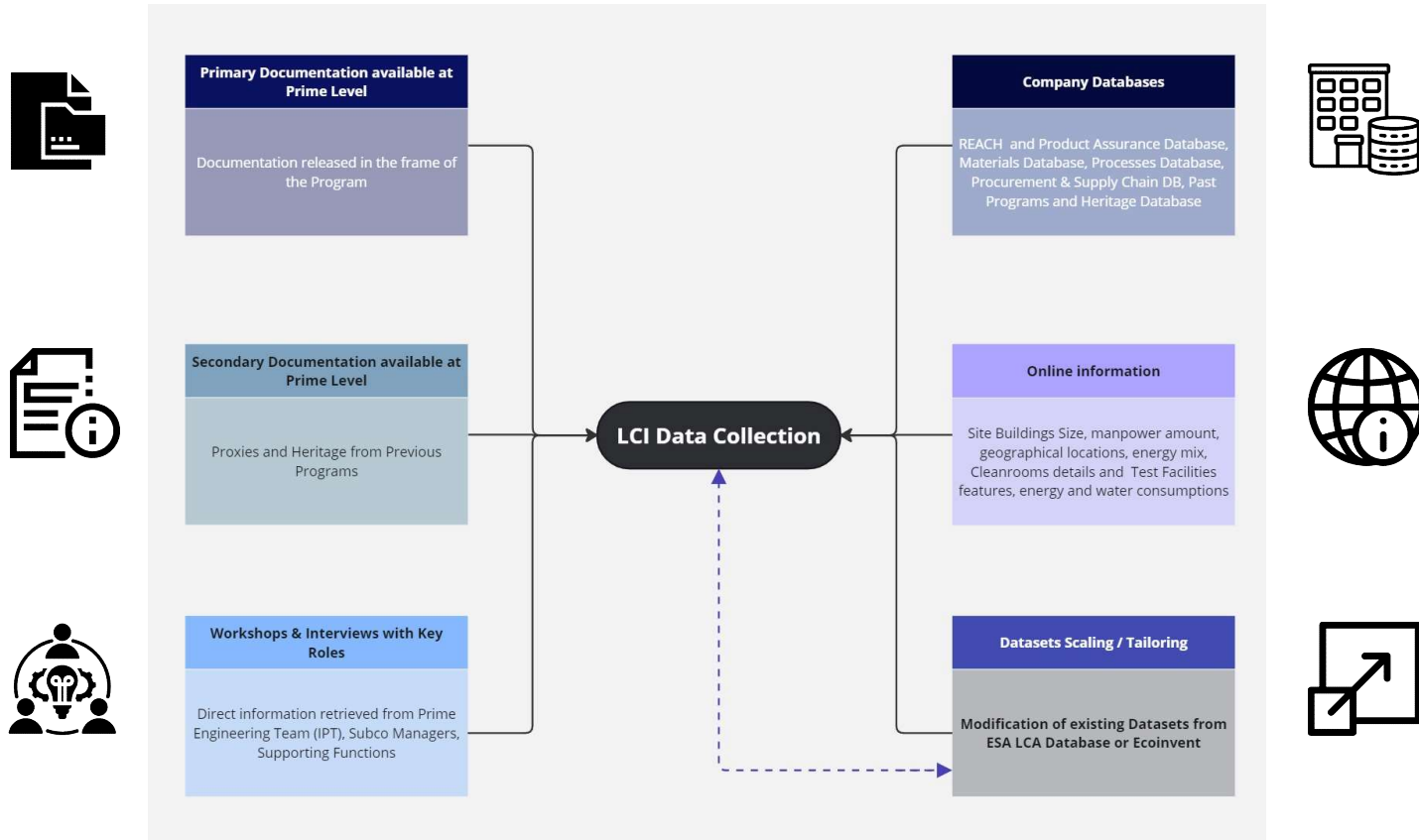
LCI Data Collection: LCI Data Sources Evolution

Data Type	LCI Data Collection Status				Data Source	
	for "ESA Mission" Program				Type	Template (as per CHORUS) Title
	PDR preparation		CDR preparation			
	Availability / Existence	Maturity	Availability / Existence	Maturity		
New Infrastructures (mandatory for program execution)						
New Infrastructures Construction and Dismantling						
System Integrator						
Building Type	Existing	May evolve	Available	Frozen	Document	- [PM-01] Project Management Plan (PMP) - Assembly, Integration and Test (AT) Plan [AV-03] - WPD (WBS) - OBS - Industrial Procurement Plan [PM-07] - Schedule Report [PM-17]
Building Surface	Existing	May evolve	Available	Frozen	Other	
Suppliers						
Building Type	Existing	May evolve	Available	Frozen	Document	- Instrument AIT Plan [N-05] - Subcos AIT Plans - Industrial Procurement Plan - Subcos Proposals and annexes (WPD, PSS files) - Subcontractor's ITT/Contract [PM-30 (in general)]
Building Surface	Existing	May evolve	Available	Frozen	Other	- Instrument AIT Plan [N-05] - Subcos AIT Plans - Industrial Procurement Plan - Subcos Proposals and annexes (WPD, PSS files)
New Infrastructures Equipment Manufacturing and Disposal						
System Integrator						
Dedicated Industrial Equipment Characteristics (type, quantity...)	Existing	May evolve	Existing	May evolve	Document	- [PM-01] Project Management Plan (PMP) - DDVP - Assembly, Integration and Test (AT) Plan [AV-03] - WPD (WBS) - Industrial Procurement Plan [PM-07] - Storage/De-Storage Plan [AV-09] - GSE Design and Development Plan [AV-11] - GSE Design Description [AV-13]
Dedicated Office Equipment (PCs...) characteristics (type, quantity...)	Non-existing	May evolve	Existing	May evolve	N/A	- DDVP - [PM-01] Project Management Plan (PMP) - Assembly, Integration and Test (AT) Plan [AV-03] - WPD (WBS) - Industrial Procurement Plan [PM-07] - Long Lead Items List (LLI) [PM-29]
Suppliers						
Dedicated Industrial Equipment Characteristics (type, quantity...)	Non-existing	May evolve	Existing	May evolve	N/A	- Subcos S/S / AIT Plan [AV-03] - Satellite, Instrument, Subsystem and Equipment Test Plans/Specifications [AV-04] - Storage/De-Storage Plan [AV-09] (at S/S and Instrument level) - GSE Design and Development Plan [AV-11] (at S/S and Instrument level) - GSE Design Description [AV-13] (at S/S and Instrument level) - Instrument AIT Plan [N-05] - WPDs, Subcos/Instrument Proposals - ICDS (IBC)
Dedicated Office Equipment (PCs...) characteristics (type, quantity...)	Non-existing	May evolve	Existing	May evolve	N/A	- Subcos S/S / AIT Plan [AV-03] - Satellite, Instrument, Subsystem and Equipment Test Plans/Specifications [AV-04] - Storage/De-Storage Plan [AV-09] (at S/S and Instrument level) - GSE Design and Development Plan [AV-11] (at S/S and Instrument level) - GSE Design Description [AV-13] (at S/S and Instrument level) - Instrument AIT Plan [N-05] - WPDs, Subcos/Instrument Proposals - ICDS (IBC)

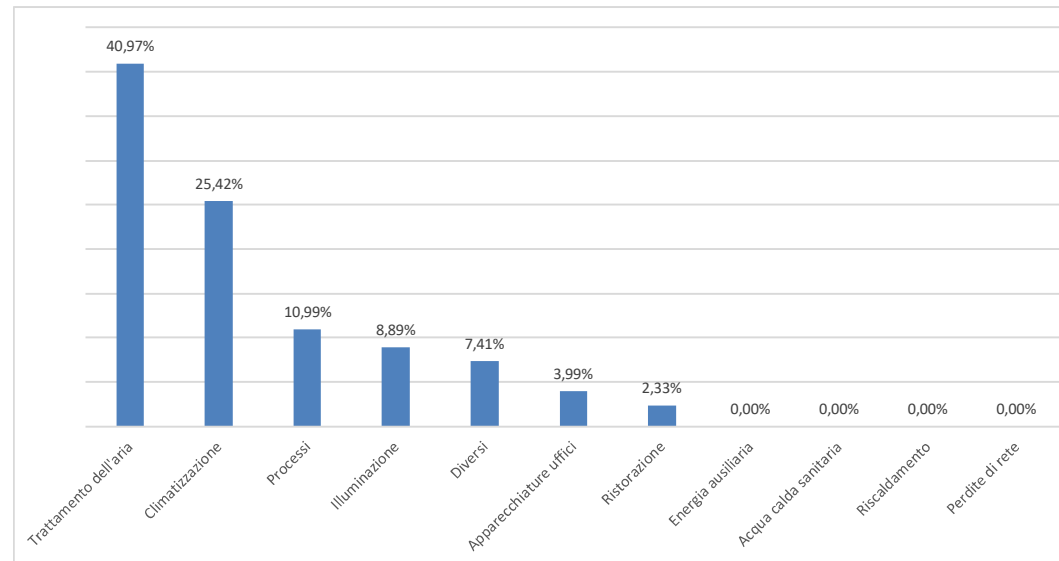
LCI Data Collection: LCI Data Sources Evolution

Data Type	LCI Data Collection Status				Data Source	
	for "ESA Mission" Program				Type	Template (as per CHORUS)
	PDR preparation		CDR preparation			Title
	Availability / Existence	Maturity	Availability / Existence	Maturity		
Launch Campaign						
Satellite Integration						
Transportation						
Satellite Dry Mass	Available	May evolve	Available	Frozen	Document	mass budget reported in "Satellite System Budgets Document", [SA-05]
Plane Identification	Existing	May evolve	Available	Frozen	Document	- Launch Site Transportation, Operations and Logistics Plan [AV-17] - Facilities Utilisation and Transportation Plan [AV-18]
Launch Site Location	Existing	May evolve	Existing	May evolve	Document	- Launch Site Operations Procedures [AV-19] - Launch Site Transportation, Operations and Logistics Plan [AV-17] - Facilities Utilisation and Transportation Plan [AV-18]
Satellite Container Description and Lifetime	Existing	May evolve	Available	Frozen	Document	- Launch Site Transportation, Operations and Logistics Plan [AV-17] - Storage/De-Storage Plan [AV-09] - GSE Design and Development Plan [AV-11] - Assembly, Integration and Test (AIT) Plan [AV-03] - Facilities Utilisation and Transportation Plan [AV-18] - (Ground Operations and Handling Constraints [AV-16])
Integration Activities						
Integration Duration	Available	May evolve	Available	Frozen	Document	- Assembly, Integration and Test (AIT) Plan [AV-03] - Launch Site Operations Procedures [AV-19] - Facilities Utilisation and Transportation Plan [AV-18] - Storage/De-Storage Plan [AV-09]
Integration Facility Energy Type and Consumption	Existing	May evolve	Existing	May evolve	Document/Database	- Facilities Utilisation and Transportation Plan [AV-18] - (Launch Site Operations Procedures, [AV-19]) - Launch Site Facilities Documentation to be provided by LSP (launch Service Provider) through ESA
Integration Facility Consumables (helium, nitrogen, water...) Consumption	Existing	May evolve	Existing	May evolve	Document/Database	- Facilities Utilisation and Transportation Plan [AV-18] - (Launch Site Operations Procedures, [AV-19]) - Launch Site Facilities Documentation to be provided by LSP (launch Service Provider) through ESA
Integration Facility Miscellaneous Emissions	Non-existing	May evolve	Existing	May evolve	N/A	- Facilities Utilisation and Transportation Plan [AV-18] - (Launch Site Operations Procedures, [AV-19]) - Ground Operations and Handling Constraints, [AV-16] - Launch Site Facilities Documentation to be provided by LSP (launch Service Provider) through ESA

LCI Data Collection through available Sources @ Prime Level

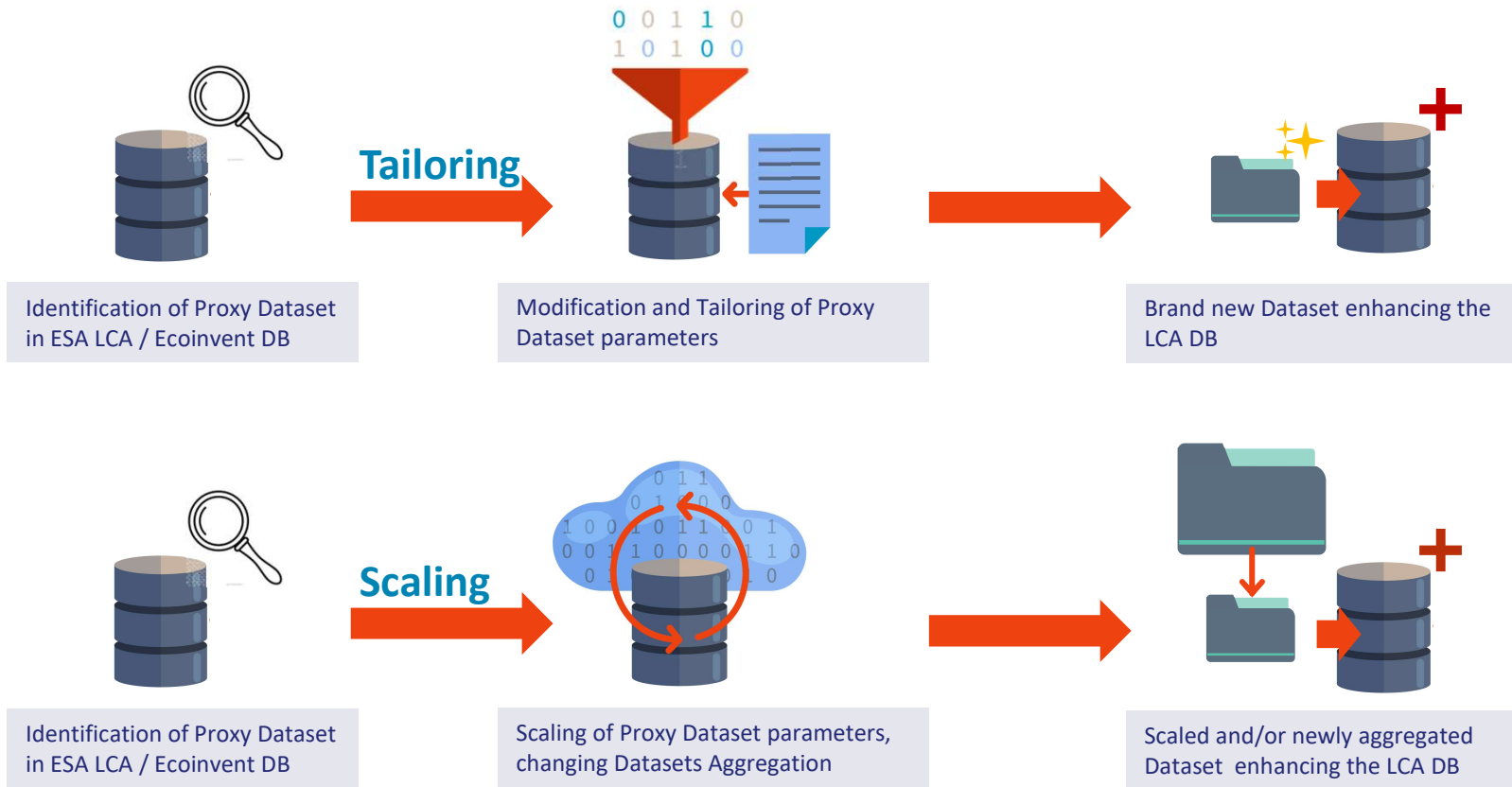


ISO 50001 TAS Company DB – Energy, Fluids, Consumables Consumptions monitoring system



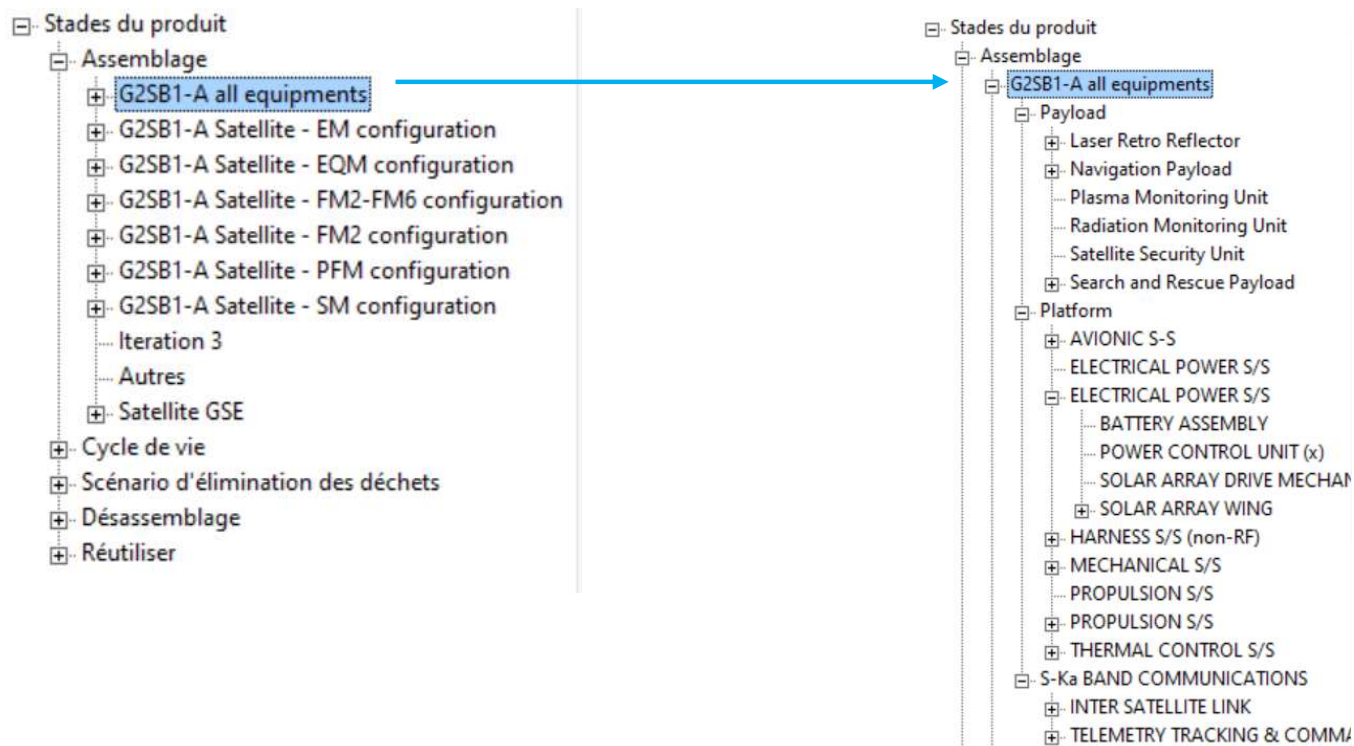
- Electrical energy Consumption, Water, Diesel, Methane Gas, LN2 consumptions are monitored monthly for all TAS sites / Buildings / Facilities;
- The Database is consistent and validated, thus can be scaled as a proxy if no primary input from suppliers is obtained in the frame of LCI

Datasets Tailoring and Scaling



LCI Data Collection / Configuration definition Methodology

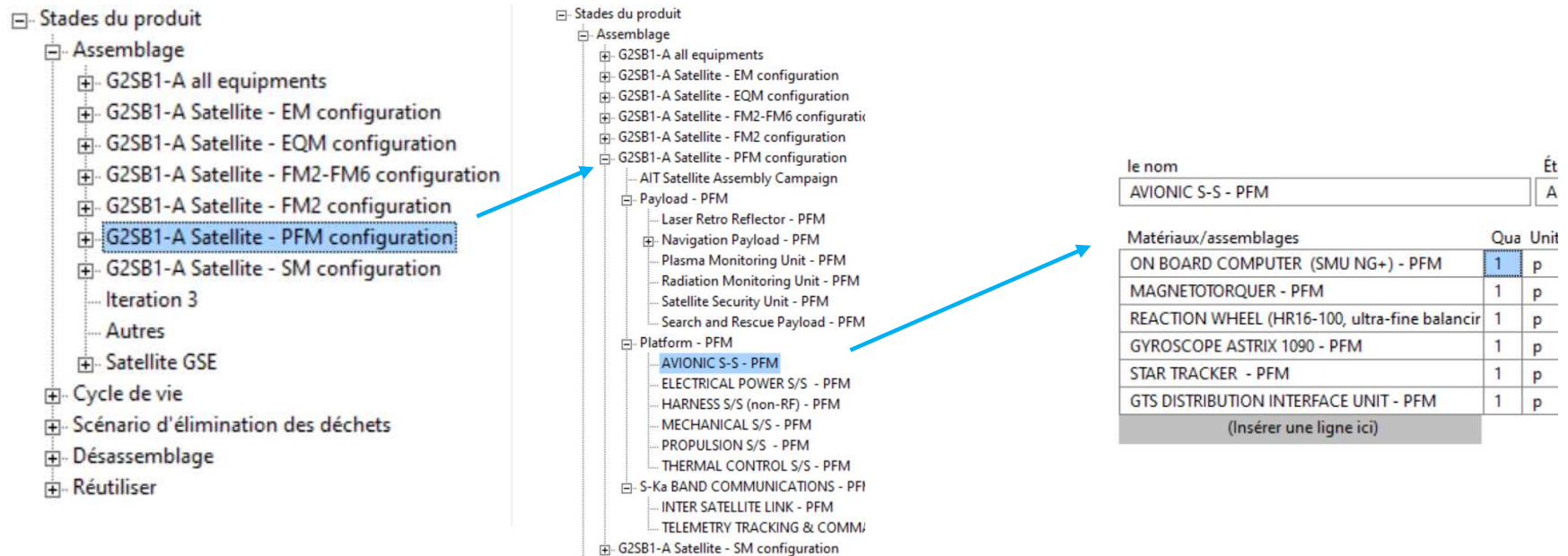
/// All equipment (lowest PT level) is modeled as a single and unique item in SimaPro (in the product stage, assembly category)



LCI Data Collection / Configuration definition Methodology

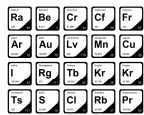
/// All Models PFM, FMs, QM etc. are then modeled in SimaPro (product stage, assembly category) by picking only needed equipment in the right amount. This solution implies to perfectly know the hardware matrix, which equipment is reused from other models and which is new ;

/// This modeling methodology is applicable to the Space Segment, Ground Segment and GSE



LCI Data Collection / Scaling Methodology

///For very similar equipment but with different masses/sizes:



Used **Materials** datasets are not modified (e.g. AL7076 is not replaced).



Masses, Manufacturing processes and Transportation Data are scaled following mass differences.



AIT and associated Consumptions Data are scaled proportionally to AIT Phase duration



Office Work & Travels Data are scaled proportionally to Team's size / Company's size / manifested costs

LCI Data Collection / Scaling and Aggregation - Disaggregation

- /// Example of direct scaling in SimaPro of a Dataset as percentage (mass, AIT duration...) of the corresponding PFM Dataset.
- /// Scaled or modified Equipment Datasets of lower level models (e.g. Equipment QMs) can then be aggregated to build an higher level model Dataset (i.e. Subsystem QM)

Éditer assemblage 'STAR TRACKER - EQM'

Entrées/sortants		Paramètres	
le nom	État	Commentaire	
STAR TRACKER - QM	Aucun		
Matériaux/assemblages	Quantité	Unité	Distribution
STAR TRACKER	0,7	p	Indéfini
(Insérer une ligne ici)			
Processus	Quantité		
(Insérer une ligne ici)			

Nouveau assemblage

Entrées/sortants		Paramètres	
le nom	État	Commentaire	
Star Tracker - STM	Aucun		
Matériaux/assemblages	Quantité	Unité	
STAR TRACKER	0,4	p	
(Insérer une ligne ici)			
Processus	Quantité		
(Insérer une ligne ici)			

Simplified LCA / Suggestions & Way Forward

/// Resources Optimization



/ Some input data are moderately easy to be retrieved (e.g. mass budget, design configuration, model philosophy, main materials and processes, manhours etc.) or hypothesized at a sufficient level of reliability, being defined since the Bid phase.

- **Reuse and scalability** to the maximum extent of proxy datasets from previous Space Missions LCA
 - Ask/Collect only mandatory data (except for new/not previously modelled equipment); MECO Principle as a minimum
 - Redundancies minimization
 - It is always preferable to Fill LCI Questionnaires even with rough hypothesis rather than blank entries: this allows the identification of main environmental impact contributors in LCIA (though approximated) to be refined in next stages



/ Other input data are typically very difficult to be retrieved since dedicated data collection processes are not fully deployed at all levels of the supply chain; therefore to enable Simplified LCA execution it is essential to fill the gaps **focusing the LCI Questionnaires completion on current low-maturity entries:**

- Energy Consumption of Building Sites and Test Facilities of lower tiers
- Water Consumption of Building Sites (and Test Facilities) of lower tiers
- Energy consumption and auxiliary materials, wastes and scraps relevant to manufacturing processes
- Raw materials origin and transportation data
- Buy-to-Fly ratio of equipment

Simplified LCA / Suggestions & Way Forward

///Resources Harmonization

/ Integration of LCA within Product Lifecycle Management (PLM) systems



- Harmonization and merging of Company's DBs for holistic management of LCI input data, fast and meticulous extraction of critical information



- Enabling early Ecodesign strategy implementation (and in the future a “real-time” Ecodesign”, when LCI data will be seamlessly incorporated into the PLM workflows →real-time environmental hotspots identification)
- Exploitation and link to already available information in existing DBs (REACH, PCDB, DML, DPL)
- Puts sustainability at the core of product development, automatically achieves the required DQR

Simplified LCA / Suggestions & Way Forward

/ Future Outlook



- Integration of CATIA metadata with LCI-based information
- **Adaptation of standard PA documents template** to optimize the LCI (e.g. tailored DML and DPL templates to collect environmental impact related data)
- Need for a **"Backward LCA"** process: systematic collection and analysis of environmental impact results to identify most critical materials and processes to start re-thinking DML and DPL in a greener but space qualified way;
- Exploitation of existing PA algorithms to adapt PCDB wrt specific aspects (e.g. algos to determine the soldering amount on PCBs)
- **Simplified and modular LCI Questionnaire** template to be evolved and complemented throughout Project phases

Q&A



Thank You for your Attention