Brief Introduction into Logistics Support Analysis (LSA)

ASD/AIA Spec S3000L

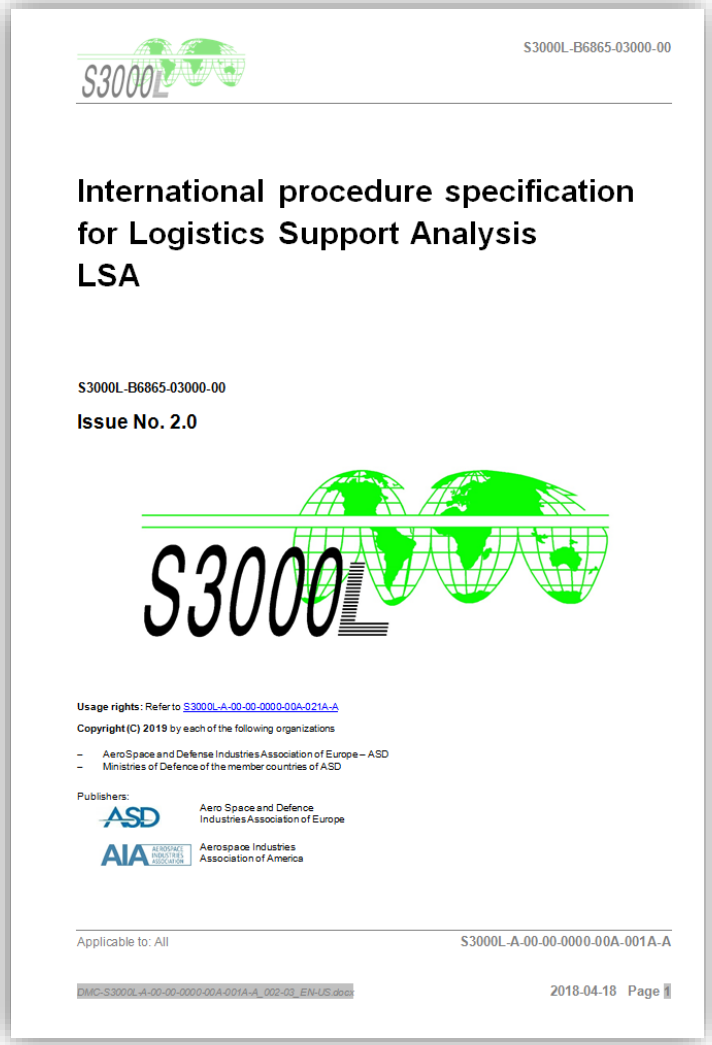
S3000L – International procedure specification for Logistic Support Analysis (LSA)

Name of Presenter: **Mr. Peter EICHMÜLLER**
Rank/title of presenter: Expert Logistic Support Analysis (LSA) | Vice Chairman ASD/AIA S3000L Steering Committee
Company/Organization: **AIRBUS Defence & Space** {ADSG}

Abstract-No: **A#27**

Content of the presentation

- Introduction
- LSA in the context of IPS, engineering and supportability engineering
- Content of the specification
- LSA activities and results
- S3000L data model and data exchange
- Summary


S3000L-B6865-03000-00

International procedure specification for Logistics Support Analysis LSA

S3000L-B6865-03000-00

Issue No. 2.0

S3000L

Usage rights: Refer to S3000L-A-00-00-0000-00A-021A-A

Copyright (C) 2019 by each of the following organizations

- AeroSpace and Defense Industries Association of Europe – ASD
- Ministries of Defence of the member countries of ASD

Publishers:

ASD Aero Space and Defence Industries Association of Europe

AIA Aerospace Industries Association of America

Applicable to: All S3000L-A-00-00-0000-00A-001A-A

DMC-S3000L-A-00-00-0000-00A-001A-A_002-03_EN-US.docx 2018-04-18 Page 1

Challenge of product supportability

Cost optimized and effective **support concept** for complex and long living technical products

Preventive maintenance

Corrective maintenance

Servicing and operational support

Consideration of upgrades and overhaul

Each complex technical product requires an

- optimized support concept throughout the whole life cycle -

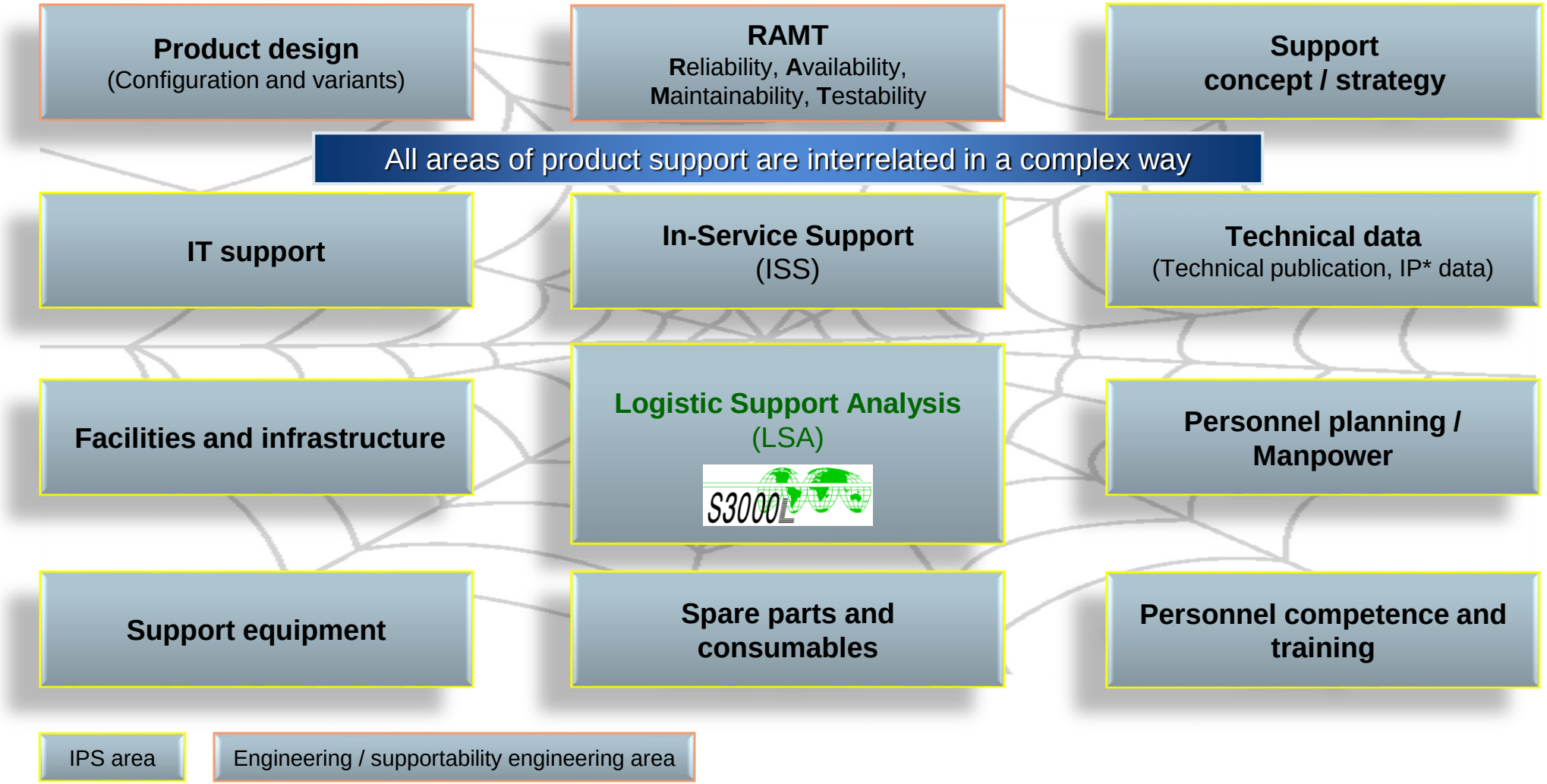
... to guarrantee a ***smooth and safe product operation*** and

... to implement an applicable and effective ***maintenance concept***

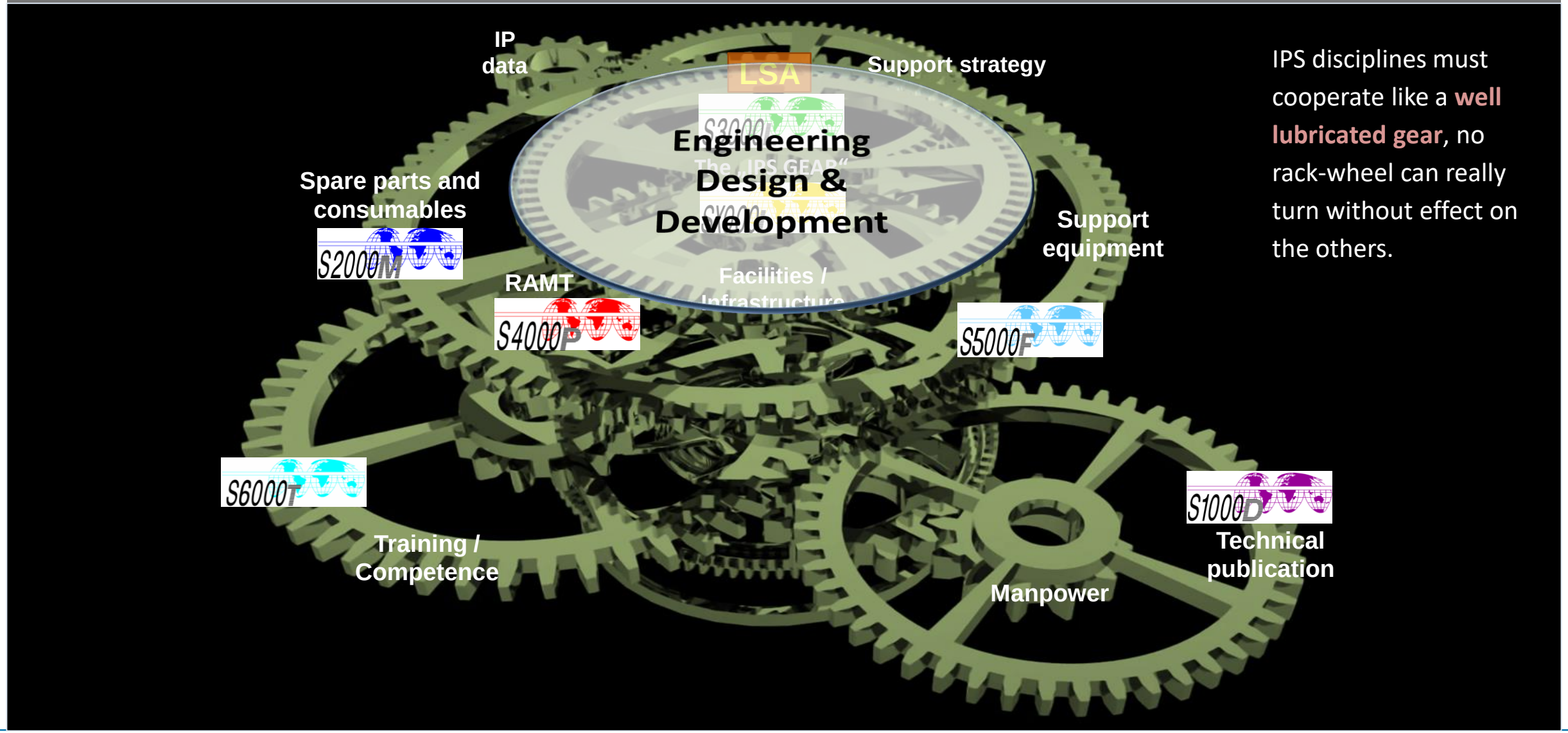
considering ***corrective*** maintenance as well as ***preventive*** and/or ***predictive*** maintenance (if applicable)

The framework of supportability for complex technical products

IPS elements, supportability engineering and engineering (design & development)



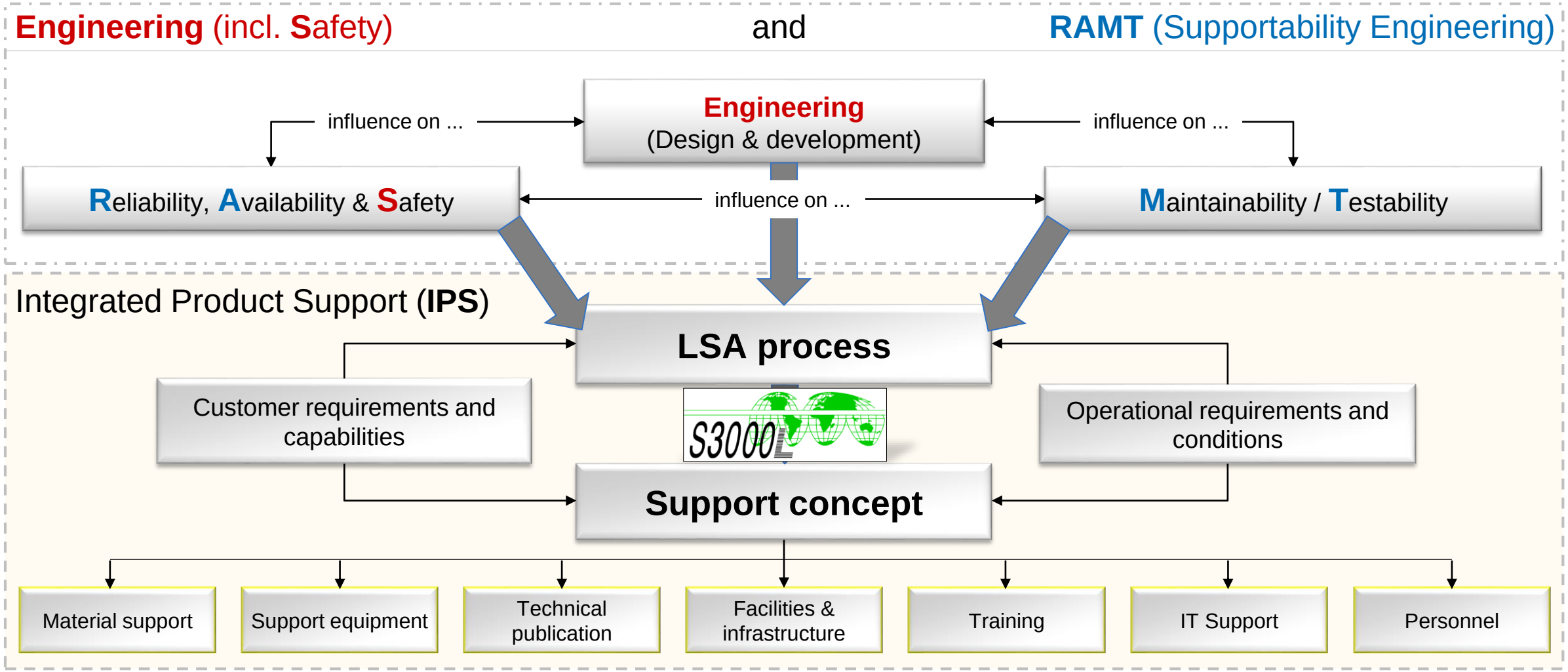
The „IPS Gear“



IPS disciplines must cooperate like a **well lubricated gear**, no rack-wheel can really turn without effect on the others.

Development of supportability

LSA as the **connecting element** between product development and IPS elements



S3000L, Issue 2.0 ⇨ Content of the specification

Chapter overview

Chap 1	⇨	Introduction to the specification
Chap 2	⇨	General requirements
Chap 3	➡	LSA process
Chap 4	➡	Product structures and change management in LSA
Chap 5	⇨	Influence on design
Chap 6	➡	Human factors analysis
Chap 7	➡	Failure Mode Analysis for corrective maintenance
Chap 8	➡	Special event and damage analysis
Chap 9	➡	Operational support analysis
Chap 10	➡	Development of a preventive maintenance program
Chap 11	➡	Level of repair analysis
Chap 12	➡	Task requirements and maintenance task analysis
Chap 13	➡	Software support analysis
Chap 14	⇨	Life cycle cost considerations
Chap 15	⇨	Obsolescence analysis
Chap 16	➡	Disposal analysis
Chapter 17 - In Service LSA (new !)		
Chap 18	⇨	Interrelation to other ASD specifications
Chap 19	➡	Data model
Chap 20	➡	Data exchange
Chap 21	⇨	Terms, abbreviations and acronyms
Chap 22	➡	Data element definitions

⇨ Introduction
➡ Setting the baseline
➡ Identify task requirements
➡ Identify tasks and perform MTA and LORA
➡ Support implementation of IT solutions
⇨ Supplementary information and In-service LSA

LSA process - What must be analyzed?

The basic questions to be answered in the context of an LSA process ⇨ a simplified approach to a complex problem

What is the item under analysis? ⇨ the **PRODUCT**
Which systems, subsystems, equipments, components, etc… are impacted?
⇨ **Product breakdown / product structure** including selection of **LSA candidates**

Why something must be done?
What is the justification for any maintenance or operational support task?
⇨ identification of **task requirements**

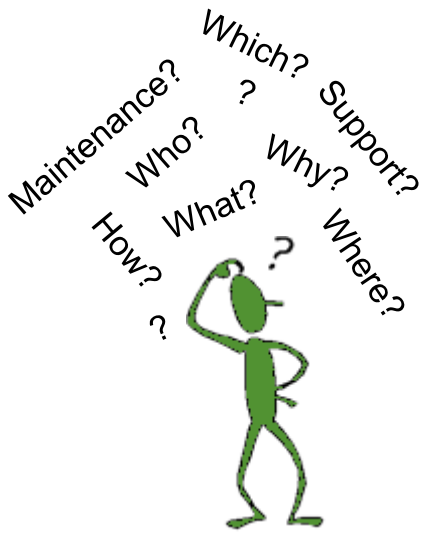
Which tasks are necessary and are performed on product operator level?
Determination of **rectifying tasks** to cover all tasks requirements?

How do you perform the task?
Task description? Which working steps? Sequence? Warnings and cautions?

Who performs the task?
Which **personnel** repairs, maintains, inspects, etc…? Which **competence** is required?

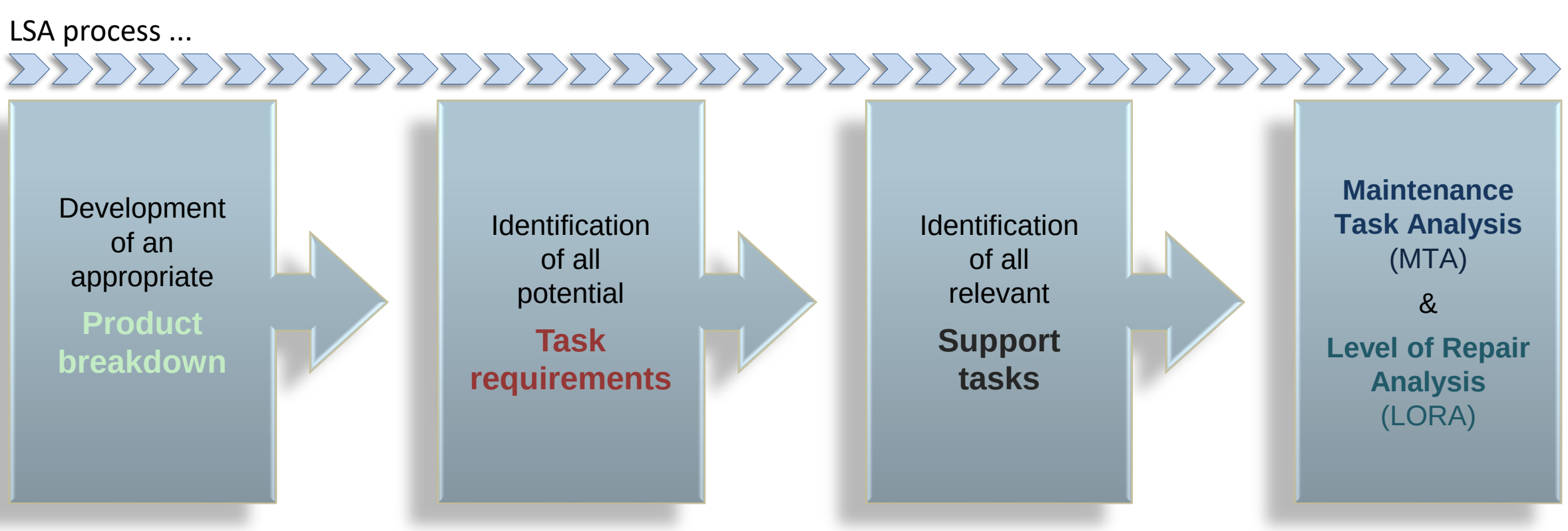
What do you need for the task?
Which **manpower** and **material resources** are required?

Where to perform the task?
Which **maintenance level**, which concrete **physical location**?



The LSA activities within the LSA process - generic overview

The way from product breakdown to the complete support/maintenance concept



Development of an appropriate product breakdown (1)

Hierarchical structured product breakdown for LSA purpose

A **systematical** and **hierarchical** breakdown of the **product**, which is subject to an LSA process, is **essential**

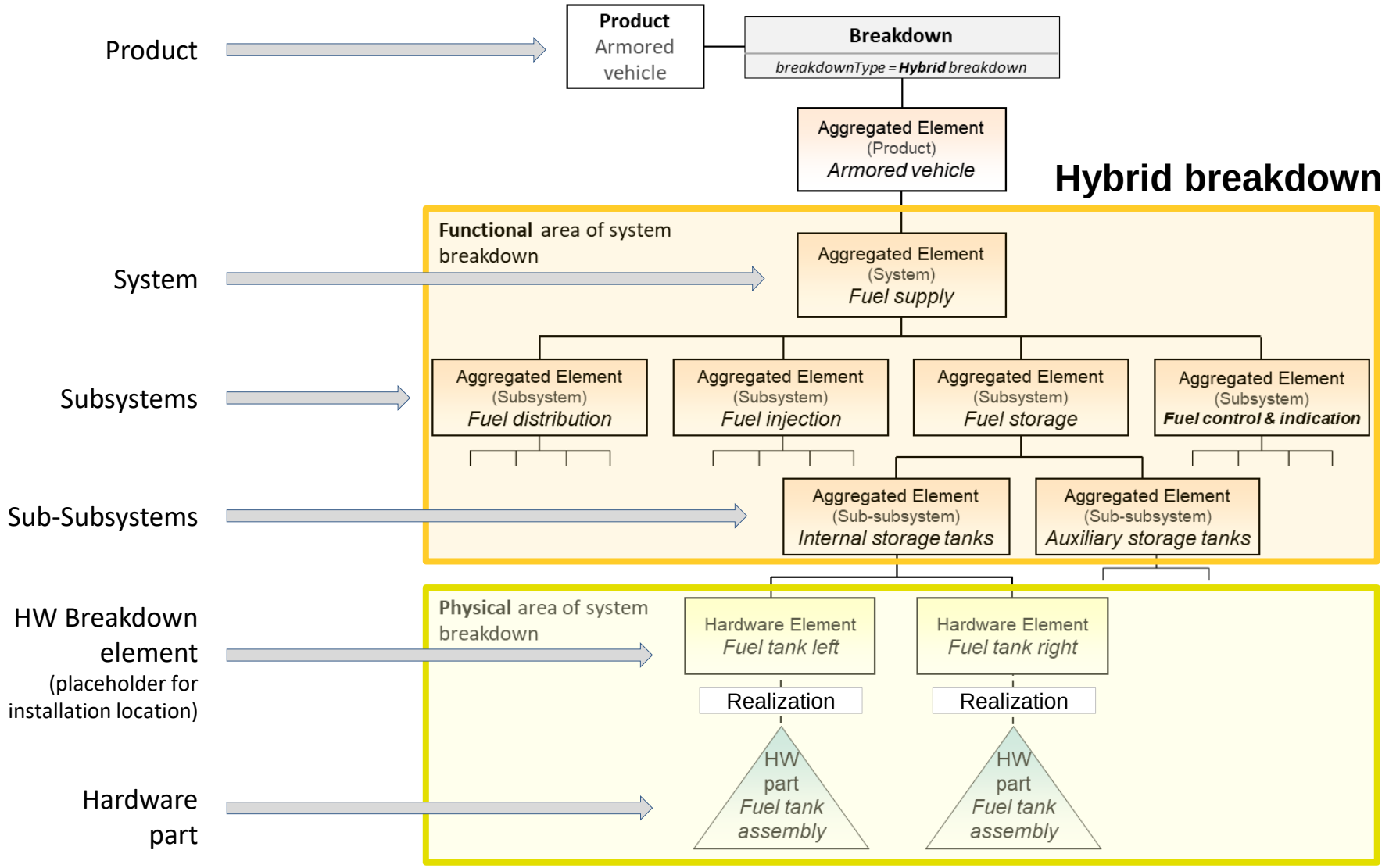
To create an appropriate product breakdown, different breakdown methodologies can be considered and are supported by the S3000L data model:

- **Functional** product breakdown
  E.g. relevant to perform a System FMEA* based on S4000P
  * FMEA - Failure Mode and Effects Analysis
- **Physical product** breakdown
  E.g. relevant for spare part identification / calculation
- Mixture of functional/physical approach ⇨ **Hybrid** product breakdown
  Typical product breakdown approach to support an LSA process ☑

→ Main aspects of the **hybrid** approach in the context of LSA:

- **Breakdown elements** as objects to represent installation locations (for hardware/software) and zones
- **Breakdown elements** as objects to represent systems, subsystems and generic chapters (e.g. based on S1000D chapterization of different product types like an aircraft, land vehicle or ship)
- Establish **relationship** between breakdown elements and e.g. physical hardware part / software package / software module (called “realization” in S3000L)
- Enables proper **LSA candidate** selection from product breakdown

Development of an appropriate product breakdown (2)



Task require

Justification for rectifying tasks in the

General ru

Each **rectifying** task in the context of proc ification

In the LSA perimeter, this justification is defined nt

The **task requirements** are documented in the LSA data. Task requirem

- **Preventive** Maintenance Task Requirement (PMTR), refer to S
  - **P**reventive **M**aintenance **T**ask **R**equirement with repetit
  - **P**reventive **M**aintenance **T**ask **R**equirement for a speci
- **Predictive / on condition** maintenance task requiren itoring system data)
- **Corrective** maintenance task requirement (e.g. triggered
- **Operational support** task requirement (e.g. triggered by need to tr , refuel, service)
- **Software support** task requirement (e.g. triggered by the need to lo ad data or software packages)
- **Disposal** task requirement (e.g. triggered by the need to dispose hazardous waste)

Maintenance Task Analysis (MTA) and Level of Repair Analysis (LORA)

The **core analysis activities** within the LSA process

The main results of the **MTA** are:

- **How** to perform the task
  Task structuring by subtasks / working steps, sequence, pre-work and post-work, narrative description, warnings & cautions
- **Personnel** resources, including required competence
  ⇨ training to enable task performance
- **Material** resources, including spare parts, consumables and support equipment
- **Facilities** and **infrastructure**
- Required **technical publication**
- Required **IT support**

Additional **MTA** aspects:

- Optimized application of the S3000L task **referencing** capabilities concerning
  (e.g. a replace task refers to install/remove tasks)
- Task **location** aspects (maintenance level and concrete location, e.g. a specific work shop)
- Product and/or system **availability** during task performance
- Support solutions (**task variants**) for different environments
- Task **duration** and task **frequency**
- **Parallel activities** within tasks

Aim of the **LORA** process:

Determine the **optimal Maintenance Level (ML)** for each relevant task. Decision finding is often dominated by economic aspects, but also technical, organizational or strategic/tactical (military !) aspects can influence the decision.

The S3000L UML data model ⇨ 41 so-called Units of Functionality (UoF)

Unified Modeling Language™ (UML)

UML is a widely used technique to model not only application structure, behavior and architecture, but also business processes and **data structures**.

UML class model

Class models are the most widely used part of UML. Class models define a static view of information (classes, attributes and relationships) which are required to document a specific business process.

- Attributes
  Single data element ⇨ an attribute can be interpreted as a **column** in a table.
  Example: the narrative description of a subtask
- Class
  A group of attributes which logically belong together ⇨ can be interpreted as **tables** within a database.
  Example: A table which contains all attributes which belong to a subtask
- Relationships
  Classes can be linked together via **relations**
  Example: a task (*class 1*) includes at least one or many subtasks (*class 2*) ⇨ parent / child relationship

Unit of Functionality (UoF)

A UoF contains a set of classes which logically belong together.
Example: all classes which are required to describe a maintenance task ⇨ **UoF Task**

The S3000L data exchange format

⇨ more than 21.000 lines of XML schema definition

eXtended Markup Language (XML)

XML schema development for ASD/AIA S3000L, Issue 2.0:

- The **S3000L XML schema** is derived from the S3000L data model (Chapter 19)
  Note: The method of mapping the S3000L XML schema to the S3000L data model is in accordance with the **XML Schema Authoring Rules** (documented in ASD/AIA **SX005G** developed by the S-Series Data Model and Exchange Working Group, DMEWG).
- S3000L XML schema supports **complete (baseline)** and **update messages** to enable minor as well as major changes to the LSA data
- For S3000L, Issue 2.0, the XML schema approach is implemented
  - XML was already used as the data exchange format in S3000L, issue 1.1
  - XML schema for issue 2.0 is adapted according to the changes in the UML data model and harmonized with the Common Data Model (CMD) published by the specification **SX002D**.

Remark:
The data exchange format for ASD/AIA S3000L, Issue 1.0 was predicated on the generic data model from **ISO 10303 AP239 Product Life Cycle Support (PLCS)**.
Implementation or practical usage in a project is not known.

Conclusion

the enabler of a proper LSA process, because:

- ✓ S3000L provides a guideline how to establish a proper **LSA process** for the entire life cycle of a product (from concept phase to disposal)
- ✓ S3000L provides guideline how to create an appropriate **product breakdown** and to select potential **LSA candidates**
- ✓ S3000L defines how to derive **task requirements** from several supportability analysis results
- ✓ S3000L defines how to document all types of **support tasks**
- ✓ S3000L provides a guideline how to perform **MTA** and **LORA**
- ✓ S3000L covers additional aspects in **complementary chapters** like PHST, human factors, obsolescence, Software Support Analysis (SSA) or disposal
- ✓ S3000L enables IT solutions and data transfer by inclusion of an **UML data model** and an appropriate **XML schema**

Final remark: We are on an **IPS** User Forum, what about changing from **Logistic** Support Analysis (**L**SA) to **Product** Support Analysis (**P**SA)?

On the agenda of S3000L Steering Committee for next S3000L issue ✓

Thank You

for your attention!

Questions?

AIRBUS DEFENCE AND SPACE

Peter Eichmüller, Dipl.-Ing. (Univ.)
Expert Logistic Support Analysis (LSA)

T +49 (0) 8459 81 8 00 17
M +49 (0) 151 11 16 96 37
E peter.eichmueller@airbus.com

Airbus Defence and Space GmbH
Rechliner Strasse
85077 Manching
Germany