International guide for the use of the S-Series Integrated Logistic Support (ILS) specifications

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Chapter 1

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Chap 6	Comparison of specification terminology
S1000D	International specification for technical publications using a common source database

Chap No./Document No.	Title
S2000M	International specification for materiel management - Integrated data processing for military equipment,
S3000L	International procedure specification for Logistics Support Analysis (LSA)
S4000P	International specification for developing and continuously improving preventive maintenance
S5000F	International specification for operational and maintenance data feedback
S6000T	International specification for training analysis and design
SX001G	Glossary for the S-Series ILS specifications
SX002D	Common Data Model for the S-Series ILS specifications
SX003X	Compatibility matrix for the S-Series ILS specifications
SX004G	Unified Modeling Language (UML) model reader’s guidance
SX0005I	Implementer’s guide for the S-Series messaging schemas
ISO 10303-239	Product Life Cycle Support (PLCS)

1 General

SX000i provides information, guidance and instructions to ensure compatibility and the commonality of Integrated Logistics Support (ILS) processes among the suite of ILS specifications jointly developed by the AeroSpace and Defence Industries Association of Europe (ASD) and the Aerospace Industries Association of America (AIA).

1.1 Background

Over the past 20 years, the international aerospace and defense community has invested considerable effort in the development of specifications in the field of ILS. The work was accomplished by integrated Working Groups (WG) composed of industry and customer organizations in a collaborative environment. Working group participants included representatives from national ministries and departments of defense from Europe and the United States. Aerospace and defense associations provided guidance and supported the work as required. The structure and functional coverage of these specifications was largely determined by North Atlantic Treaty Organization (NATO) requirements specified during an international workshop in Paris in 1993.

Beginning in 2003, the relationships between supporting industry organizations were formalized through a series of Memoranda of Understanding (MOU). Initially AIA and ASD signed an MOU to jointly develop and maintain S1000D (International specification for technical publications utilizing a common source database). In 2007, AIA, ASD and the Air Transport Association of America (ATA) signed a new MOU expanding S1000D development and maintenance to cover commercial aviation.

In 2010, AIA and ASD signed an MOU “to promote a common, interoperable, international suite of Integrated Logistics Support (ILS) specifications” and jointly develop, what was originally, the ASD suite of S-Series ILS specifications.

The 2010 AIA/ASD MOU authorized the formation of an ILS specifications Council with members from AIA and ASD. The Council’s tasks include liaising between AIA and ASD, developing and maintaining the current ASD/AIA suite of S-Series ILS specifications, administering joint meetings, and identifying additional areas of harmonization. Multiple ILS specifications are currently available or in the process of development, including:

- S1000D - International specification for technical publications using a common source database
- S2000M - International specification for material management - Integrated data processing for military equipment
- S3000L - International procedure specification for Logistics Support Analysis (LSA)
- S4000P - International specification for developing and continuously improving preventive maintenance
- S5000F - International specification for in-service data feedback
- S6000T - International specification for training analysis and design
- SX001G - Glossary for the S-Series ILS specifications
- SX002D - Common Data Model for the S-Series ILS specifications
- SX003X - Compatibility matrix for the S-Series ILS specifications
- SX004G - Unified Modeling Language (UML) model reader's guidance
- SX0005I - Implementer's guide for the S-Series messaging schemas

The development of the specifications is managed by WGs operating under the supervision of the ILS specification Council. Once approved for release, a specification's maintenance and future development are guided by a Steering Committee (SC), which also operates under guidance of the ILS specification Council.

Development and maintenance of S1000D is accomplished through a separate ASD/AIA/ATA S1000D Council. Representatives from the S1000D Council and S1000D SC participate in the ILS specifications Council as observers in order to achieve harmonization between S1000D and other specifications from the S-Series ILS specifications.

1.2 Vision for the S-Series ILS specifications

The vision for the S-Series ILS specifications is that all stakeholders will be able to apply common logistics processes so as to enable the sharing and exchange of data securely through the life of Products and services.

1.3 Objectives of the S-Series ILS specifications

The objective for the S-Series ILS specifications will be achieved by establishing and adopting a coherent set of global ILS specifications, which will accomplish the following objectives:

- Establish a common understanding of ILS and its global processes that integrate all the necessary elements and resources throughout the whole Product life-cycle
- Optimize the life cycle cost and performance of the Product and its support system
- Respond quickly to initial and changing requirements, to further optimize processes, improve data quality and drive out unnecessary costs, by identifying the most appropriate solutions and their integration
- Enable collaboration between customers and industry through the simplification of electronic information exchange

1.4 Value proposition for using the S-Series ILS specifications

It is evident that the use of specifications provide added value. The S-Series ILS specifications is intended to bring value not only at individual specification level, but also through the combined application of the specifications.

The S-Series ILS specifications are globally accepted because:

- It is industry and customer driven, hence focused on results
- It includes a broad range of customer stakeholders to ensure suitability
- It is integrated and interoperable
- It is international: US and Europe

It reduces the set-up costs of projects and associated IT tools by:

- Minimizing project dependency by defining clear guidance and by avoiding the inclusion of project and national specific rules and constructs
- Ensuring commonality between the ILS related specifications to support the re-use across projects
- Sharing a common core data model, which ensures the specifications' interoperability
- Establishing well defined data transfer mechanisms between the different logistic disciplines based on ISO 10303-239 Product Life Cycle Support (PLCS)
- Preventing tool lock-in and not requiring partners/customers to share proprietary tools
- Enabling the establishment of organic and Performance Based Logistics (PBL) and other support contracts

It is global and reduces project complexity by:

- Covering all aspects of supportability over the entire life cycle of a Product.
- Being the contractual baseline for industry and customers
- Being a single solution for Product support data (buy in)
- Providing a standard approach to Product Lifecycle data (repeatable)
- Enabling seamless global knowledge transfer (collaboration)
- Providing a common architecture and data model (common attributes/element)
- Supporting the common theme of Trust and Efficiency

It guarantees being future-proof by:

- Being up to date with the technical development and changes in support philosophy
- Building on the ISO 10303-239 PLCS specification
- Supporting the LOng-Term Archiving and Retrieval (LOTAR) strategy for long-term archiving
- Not trying to "re-invent the wheel" but by collaborating with other standardization groups so as to ensure specification interoperability with other domains (eg, engineering, manufacturing, trade, environmental policy, etc)

2 Introduction to SX000i

During the development of the S-Series ILS specifications, the different WGs identified the need for a top level specification that would ensure compatibility and commonality of ILS processes among those specifications. In 2011, the decision was made to develop, publicize and maintain an ILS Guide that would provide a common ILS process for use in the other ILS specifications. Development of SX000i was viewed by the ILS specifications Council as an essential step to achieving the vision for the S-Series ILS specifications.

In June of 2011, the SX000i WG was formed and SX000i development commenced. The current title of SX000i, (International guide for the use of the S-Series Integrated Logistics Support (ILS) specifications), was approved by the ILS specifications Council in June of 2012.

Following the formation of the SX000i WG, the ASD/AIA Data Model and Exchange Working Group (DMEWG) was formed by the ILS specifications Council in October 2011. Working in close coordination with the SX000i WG, the DMEWG coordinates the data modeling activities that are performed within the ILS specification SCs committees and WGs, so that data requirements are harmonized and consolidated into one coherent data model.

Publication of SX000i, and continuing DMEWG coordination activities, enable the achievement of the vision for the S-Series ILS specifications, namely to apply common logistics processes to enable the sharing and exchange of data securely through the life of Products and services.

2.1 Purpose of SX000i

SX000i provides a guide for the use of the suite ILS specifications by ILS managers and practitioners, as well as for the management and future development of the specifications by the ILS specification Council and ILS specification SCs and WGs. This purpose is achieved by:

- Explaining the vision and objectives for the S-Series ILS specifications
- Providing a framework that documents the global ILS process and interactions
- Explaining how the S-Series ILS specifications interface with other standardization domains including Project Management, Global Supply Chain Management, Engineering, Manufacturing, Security, Safety, Configuration Management, Quality, Data Exchange & Integration, and Life Cycle Cost
- Describing the global governance of S-Series ILS specifications development and the different groups involved in such development
- Providing guidance on how to satisfy specific business requirements using an appropriate selection of defined processes and specifications

2.2 Scope

Using a global ILS framework, SX000i describes the synchronization and management of ILS processes. Based on existing ILS handbooks and standards, SX000i makes maximum use of lessons learned from current projects and Products.

SX000i defines global requirements for common ILS interfaces for the S-Series ILS specifications. The activity model and information exchange capabilities provided by ISO 10303-239 and other ISO/EN baseline documents were considered in the development of SX000i.

Guidance on tailoring the global ILS framework and the selection of the ILS specifications to satisfy specific business requirements for a particular customer or Product is also addressed in SX000i.

Global governance and an integrated configuration management framework for the development and maintenance of the S-Series ILS specifications are also included in SX000i for use by the ILS specifications Council and the specification SCs and WGs.

2.3 Intended use

SX000i is intended:

- To be a starting point for any potential users or new projects that would want to use the S-Series ILS specifications
- To be an overview and coordinating document for all members of the international ILS community, engaged in the use and development of the S-Series ILS specifications on existing projects

2.4 Target audience

2.4.1 Contractors

SX000i can be used by prime contractors, original equipment manufacturers, and suppliers as a reference for initially establishing their Product support strategies and plans, and selecting specifications to support those plans. SX000i can also be used to evaluate existing Product support strategies and projects.

2.4.2 Customers

SX000i can be used by customers to determine support requirements for new Products they are acquiring, or fielded Products for which they are seeking support, and to identify ILS specifications to be cited in solicitations.

2.4.3 ILS specifications Council

The ILS specifications Council uses SX000i to promote a commonality and interoperability among the S-Series ILS specifications.

2.4.4 ILS specification SCs and WGs

SCs and WGs developing specifications use SX000i as a basis for describing relationships and interfaces between the ILS element(s) that their specification covers and:

- the other integrated logistic support elements
- the standardization domains

SCs use SX000i to ensure the compatibility of their specification with the other ILS specifications.

The DMEWG uses SX000i to harmonize and consolidate data requirements into one coherent data model supporting all of the ILS specifications.

The SCs and WGs both use SX000i to ensure compliance with ILS specification Council governance requirements.

2.5 How to use SX000i

SX000i is organized into six chapters. A general description of each chapter is given below. Also described is how specific SX000i chapters and paragraphs can be used in new Product development, existing system or Product support, and ILS specification development and maintenance.

2.5.1 Chapters

- Chap 1, (Introduction) provides background information on the S-Series ILS specifications and SX000i
- Chap 2, (Integrated logistics support framework), documents a global ILS process and interactions at the ILS element level. This chapter establishes the foundation for the remainder of SX000i chapters and all of the S-Series ILS specifications.
- Chap 3, (Use of the S-Series ILS specifications in an ILS project), explains how the S-Series ILS specifications relate to the global ILS process and elements, and how to use them as part of an ILS project
- Chap 4, (ILS specification governance), describes the structure of the S-Series ILS specifications organization and the processes used to manage the development and maintenance of those specifications. The target audience for this chapter is primarily the ILS specifications Council, and the SCs and WGs of the individual specifications.
- Chap 5, (Terms, abbreviations and acronyms), provides the definition of the main terms used in this specification, as well as a list of all the abbreviations and acronyms
- Chap 6, (Comparison of specification terminology), provides a comparison of the terms, life cycle phases and ILS elements between SX000i and other international and military specifications, to enable users to better understand the underlying concepts

2.5.2 Using SX000i in Product support activities

SX000i was developed for three primary applications:

- New Product development
- Support of existing Products
- ILS specification development and maintenance

General instructions for using SX000i in these three primary applications are provided below.

2.5.2.1 New Product development

Chap 2, Chap 3 and Chap 6 provide guidance on defining requirements for, or development of a Product support strategy, for organizations that are acquiring Products or developing new Products.

- Chap 2:
  - Describes the life cycle phases of a Product, the standardization domains associated with Product development and support, and the roles and responsibilities of the various stakeholders involved in Product development and support
  - Provides an overview and an examination of ILS throughout a Product's life cycle, the role of ILS in the systems engineering process and identification of the ILS elements
  - Provides a global ILS process including a description of each ILS element and of the information exchanges among the ILS elements. Also provided is guidance on how to tailor the global ILS process to support specific business requirements.
- Chap 3:
  - Identifies the ILS specifications supporting the global ILS process by a mapping to specific ILS elements, as well as the interface between the ILS specifications and the other standardization domains. It also provides a detailed mapping between the specifications and the ILS elements and activities described in Chap 2.
  - Provides guidance on selecting the appropriate ILS specifications using specific criteria such as specification issue number, interoperability, customer requirements, business requirements, and tools required. It also describes the considerations for implementing the ILS specifications including organizational structure, personnel, skills, tool validation, data exchange methods, criteria for data integration, as well as criteria for the establishment of the necessary IT infrastructure.
- Chap 6:
  - Provides a matrix showing how the SX000i Product life cycle phases compare with other U.S. and European life cycle approaches
  - Provides a matrix comparing the SX000i ILS elements to other U.S. and European ILS/integrated Product support element approaches

2.5.2.2 Support of existing Products

Prime contractors, original equipment manufacturers, suppliers and customers seeking to evaluate their current Product support strategies and projects can use SX000i as a Product support baseline.

- Chap 2 defines the specific elements that an effective Product support strategy includes, as well as their interrelationships with each other and the standardization domains
- Chap 3 identifies the ILS specifications associated with each global ILS process element. Each specification can be used for a detailed evaluation of the specific ILS elements with which the specification is associated.
- Chap 6 provides a matrix allowing to compare the terminology used in SX000i to those familiar with other specifications

2.5.2.3 ILS specification development and maintenance

Used by the ILS specifications Council, SC and WG during specification development and maintenance, SX000i enables compatibility and interoperability among the S-Series ILS specifications through a common ILS process and governance.

- Chap 2 provides the specification SC/WG with the framework for the global ILS process that allows specifications to focus their development and maintenance efforts in a coherent way using this as their reference model. This framework, including standard ILS element and standardization domain descriptions and interfaces, enables each SC and WG to easily ensure their specification is compatible and interoperable with the other specifications in the S-Series ILS specifications.
- Chap 3 provides an explanation about how the ILS specifications are applied in an ILS project enabling a common understanding of the global application of the specifications

- Chap 4 provides for the global governance of the S-Series ILS specifications. Specifically, this chapter:
  - Describes the structure of the ILS specification organization including the roles of, and the relationship between the ILS specification Council, SCs and WGs, and the process for resolving conflicts between specifications
  - Identifies requirements applicable to all specifications including writing rules, data integration and exchange, guidance on protecting the specifications and archiving and repository requirements
  - Describes the specification publication process
  - Explains how the specification websites will be managed
  - Provides the standard processes for user community feedback
  - Clarifies how user forums are created and managed
  - Describes the standard specification change management process to include changes impacting a single specification as well as changes impacting multiple specifications

2.6 Current exclusions in SX000i

Due to the urgent need for an overarching document for the S-Series ILS specifications so as to ensure the interoperability of the different specifications, this issue had to exclude aspects that would have taken too long to develop.

For example, not all activities directly associated to the in-service phase have been taken into consideration. Similarly, ILS activities have not been broken down by life cycle phases and only a limited set of hardware outputs has been included in the ILS process.

These aspects will be included in future releases of this document. Users of SX000i are welcome to submit suggestions for the future versions, as highlighted in Para 2.7.

2.7 Maintenance of SX000i

SX000i is maintained by the SX000i SC operating under the supervision of the ILS specifications Council. Both the SX000i SC and the ILS specifications Council include representatives from AIA and ASD member companies and nations.

Technical issues related to SX000i can be raised using the issue form found in Chap 4 and at www.sx000i.org/CPF. Technical issues can, in due course, become a Change Proposal (CP). Technical issues and CPs should be submitted with the understanding that any revisions to SX000i can affect the S-Series ILS specifications, and that proposed changes are subject to international agreement among AIA and ASD member companies and nations.

Upon receipt of a CP, the SX000i SC will follow the change management process described in Chap 4, to include obtaining agreement from the participating organizations prior to the publication of changes. The SX000i SC considers CPs at each meeting and ratifies them for incorporation in the specification or otherwise. The SX000i SC also decides when changes will be published in SX000i.

3 Development of SX000i

SX000i could not have been developed without the contribution of a great number of AIA and ASD member companies and customer organizations. Their support and contribution, as well as that of the members that have represented them, is gratefully acknowledged.

The companies/organizations that have contributed to the development and publication of SX000i are (in alphabetic order):

- Airbus (France)
- Airbus Defence and Space (Germany & Spain)
- Boeing Defense Systems (USA)
- ESG Elektroniksystem und Logistik GmbH (Germany)
- FACC Operations GmbH (Austria)
- German Bundeswehr (Germany)
- HEME GmbH (Germany)
- Lockheed Martin (USA)
- O'Neil & Associates (USA)
- OCCAR-EA (European)
- Rockwell Collins (USA)
- Saab (Sweden)
- SELEX ES Finmeccanica (Italy)
- Turkish Aerospace Industries – TAI (Turkey)
- UK MoD (UK)

Chapter 2

Integrated Logistics Support framework

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Chap No./Document No.	Title
ISO/IEC 15288	Systems and software engineering - System life cycle processes
INCOSE-TP-2003-002-03	Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities
NASA/SP-2007-6105	NASA Systems Engineering Handbook
Chap 5	Terms, abbreviations and acronyms
Chap 6	Comparison of specification terminology

1 Introduction

1.1 Purpose

The purpose of this chapter is to establish a common understanding of Integrated Logistics Support (ILS) and to define a common and generic ILS process throughout the life cycle of the Product.

This generic ILS process is the basis for the next chapter where the use and the benefits of the AIA/ASD ILS specifications are explained and demonstrated.

1.2 Scope

The ILS process is based on existing logistics processes, handbooks and standard and makes maximum use of lessons learned from current systems. It is not the intention of this chapter to develop a new ILS process.

The ILS process in this chapter is generic and described to the level of detail necessary to be able to apply the AIA/ASD ILS specifications to it.

2 Product life cycle overview

2.1 Product life cycle phases

Every Product has a life cycle.

The Product life cycle describes the life of a Product from beginning to end using a functional model with distinct sequential phases.

The phases provide an organization with a framework for decision gates and ensuring high-level visibility and control of project and technical processes.

At each decision gate, the progress into the following phase is decided.

However, usually phases will overlap due to operational or organizational needs.

For example for a complex Product with different configurations some configurations could be at a development phase while the other ones are still in Production and In Service, which would lead to an overlap of three phases.

As depicted in Chap 6, there could be many different Product life cycle models, depending on the organization's approach. For the S-Series Integrated Logistic Support (ILS) Specifications, the following phases are defined and mapped in Chap 6 to other specification models:

- Preparation phase
- Development phase
- Production phase
- In service phase
- Disposal phase

2.2 Product life cycle domains

A domain is a specialized field of action, thought, influence or area of responsibility that contributes to the design, production, support or operation of a Product through the Product life cycle.

The following domains are considered for the Product life cycle. Their application at each phase of the Product life cycle depends on the complexity of the program and the requirements. These domains are:

- Program management
- Global supply chain
- Engineering
- Manufacturing

- Security
- Safety
- Configuration Management (CM)
- Quality
- ILS

Refer to Chap 5 for the definitions of these domain.

2.3 Stakeholders and their roles and responsibilities

Throughout the Product life cycle phases, the roles of the different stakeholders must be clearly defined. The target audience for the SX000i includes, but is not limited to: OEMs, prime contractors, suppliers and customers. In addition, application vendors are involved in providing the necessary tools for performing the different life cycle activities.

The different roles are:

- Prime contractors
- Subcontractors
- Original Equipment Manufacturer (OEM)
- Suppliers
- Application vendors
- Customers

Business case and requirements are subject to changes throughout the Product life cycle. The customer needs to manage these changes in coordination with the prime contractor and/or the OEMs.

3 ILS overview

ILS is the management and technical process through which the logistics activities (eg, supportability and logistics support considerations of material solutions -hardware or software-) and elements of logistics support are planned, acquired, implemented, tested and provided in a timely and cost-effective manner.

The objective of ILS is to develop the support solution to optimize supportability and life cycle costs while the Product meets the required performance, by:

- Designing for support focusing on Product designs that minimize operation, maintenance, training, support tasks and Life Cycle Costs (LCC) while optimizing operational readiness
- Developing support for the design, development, funding, and test of all support resources needed to assure optimum performance and readiness of the Product in its intended operational environment and mission profiles
- Acquiring the support to provide the resources required to support the Product for a given period. Ensuring that the physical deliverables of the Support Solution are in place to meet the Logistic Support Date (LSD) requirements.
- Providing the support from the beginning of the life cycle of the Product until the disposal phase is completed. Ensuring that the physical deliverables of the Support Solution are adjusted to changing operating requirements and new technologies.

Logistics, as viewed from a total Product perspective, includes activities throughout each phase of the Product life cycle. Logistics requirements are applicable in each of the phases of the life cycle of Product identified in Para 2.1. Furthermore, there is an overlap and it is essential that the logistics requirements be addressed together with the Product development.

The logistics requirements are initially determined during the early life cycle phases, and the design of the prime mission related elements of the Products must reflect the design for supportability.

3.1 ILS in the Product life cycle

ILS takes place within each of the Product life cycle phases, including preparation, development, production, in service and disposal phases.

ILS participates within the systems engineering process to ensure that supportability requirements are included within the Product design. ILS considerations ensure cross-functional coordination among the ILS elements and related domains.

The following summary descriptions show some of the major logistics activities within the life cycle phases.

3.1.1 Preparation phase

During the preparation phase ILS is responsible for the development of a support concept and defining the support requirements.

The support concept defines the strategies and basic logistics requirements for all future considerations of the Product life and is mainly based on the operational requirements and usage scenarios.

The support concept can include factors for affordability, availability, reliability, maintainability, supportability and testability.

The support concept can also include different support alternatives which have to be assessed and evaluated in terms of required resources, cost implications and associated risks.

3.1.2 Development phase

Throughout the detailed design and development process, ILS is supporting engineering while considering the support concept objectives. This can include:

- Performance of trade-off studies for supportability
- Participation in the selection of equipment and suppliers
- Making allocations and predictions for availability, reliability, maintainability and testability
- Participation in progressive formal and informal design reviews
- Participation in the test and evaluation of engineering models and prototype equipment

ILS is also responsible for the planning and development of the support system consisting of all ILS elements. Other activities that occur in this phase include the planning and development of key support resources that enable the support of test and evaluation activities and Product deliveries.

3.1.3 Production phase

During the production phase, ILS is responsible for the development of all ILS elements, associated activities and deliverables, including but not limited to:

- Initial training for operating and maintaining the Product
- Technical data and documentation
- Initial provisioning (initial packages of spares and support equipment)
- Maintenance services including mission and test equipment
- Infrastructure and facilities

3.1.4 In service phase

During this phase, ILS is responsible for the following:

- Operational and supportability analyses throughout the in service phase, various feedback data (eg, operational and maintenance data) is collected for:
    - Safety analysis
    - Trend analysis
    - Trade-off analysis

  - Accident/incident investigation
  - Failure/event reporting and corrective actions

- Support services including:

  - Contractual logistics support (eg, Performance Based Logistics (PBL))
  - Technical documentation updates
  - New training and follow-on training
  - Product modifications/upgrades including software
  - Engineering and technical support
  - Obsolescence management
  - Maintenance services and repairs
  - Facilities management

- Hardware deliveries including:

  - Spare packages
  - Equipment
  - Consumables
  - Support and test equipment
  - Training equipment

In case of modifications/upgrades, the support system must be reviewed to ensure that the support is adapted to the modified/upgraded Product.

3.1.5 Disposal phase

When the decision for retiring the Product from operation is taken then the following tasks must be considered:

- Hardware components must be phased out of the inventory stock,
- Items must be disposed of or recycled as appropriate
- Support services and facilities must be decommissioned

Appropriate resources are needed for Product disposal and phase-out and respected processes have to be in place for recycling or disposing the items.

The applicable regulations must be taken in account for the disposal process.

3.2 ILS in the system engineering process

Systems engineering is a structured process for an integrated development and realization of a Product which meets the stakeholder expectations. In order to achieve this goal the system engineering process must:

- Plan and organize the technical factors of the project
- Consider the total Product including corresponding support as well as the internal and external operational environment
- Analyze the stakeholders needs:

  - Identify the stakeholders' issues and convert needs and expectations into requirements and measures of effectiveness
  - Develop technical requirements to the extent necessary to enable feasible and economical design solutions

- Evaluate the alternatives which can satisfy these needs and expectations and select a balanced solution for each Product element as well as a balanced solution for the total Product
- Design and implement the selected solution
- Ensure that the solution meets the stakeholder's requirements

For the purpose of finding the most cost-effective solution, the logistics activities must be integrated in the systems engineering process to deliver cost effective Product support while the Product meets the required performance.

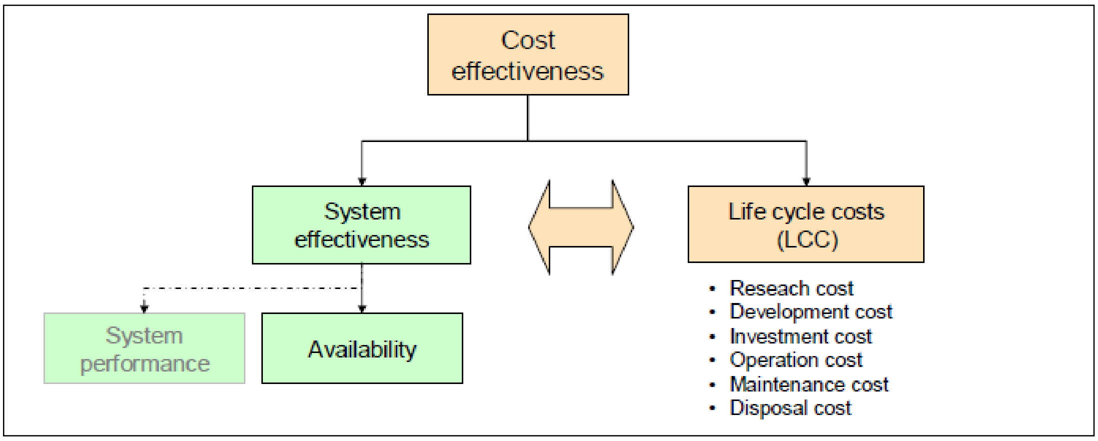

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Fig 1 Effectiveness - Balancing availability and life cycle cost

The ILS activities and associated logistics products differ in their extent according to technical complexity, flexibility, cost of the Product, etc.

Depending on the type of Product and the life cycle phase it might be necessary to perform the activities of all ILS elements (eg, new development item) or a set of activities to the specific needs (eg, maintain support functions) integrated in the systems engineering process.

This tailoring and alignment of logistics activities to the system engineering process will need to be modified during the Product's life cycle.

The International Standard ISO/IEC 15288, INCOSE-TP-2003-002-03 (SEBoK) and NASA/SP-2007-6105 call the activities that can be performed during the Product's life cycle "Product life cycle processes". Table 2 provides top-level mappings between the life cycle processes and exemplary content of ILS products. These mappings are provided as a resource and should not be interpreted as a substitute for customizing the ILS tasks to the project needs.

Table 2 Interface between system engineering processes and ILS tasks

System engineering process	ILS task/product
Project planning process	Systems Engineering (Management) Plan (SEMP), ILS plan, ILS element Plan
Stakeholder requirements definition process	Concept of operations, concept of support, concept of disposal, scenario analysis
Requirements analysis process	Feasibility study, scenario and what-if analysis, ILS requirements, health and safety, HFE/HSI-requirements
Architectural design process	Trade studies, sensitivity analysis, risk analysis, Product element requirements, technical performance measures, Life Cycle Cost Analysis (LCCA), preliminary safety and health analysis

System engineering process	ILS task/product
Implementation process	Realization of ILS products on elements hierarchy like packaging, training, electronic documentation, supply support procedures and supply chain agreements, LSA, cost-effectiveness analysis, LCCA, Safety and health hazards, human factors
Integration process	Inherent availability, realization of ILS products or total Product like packaging, training, electronic documentation, supply support procedures and supply chain agreements, LSA, cost-effectiveness analysis, LCCA, health and safety hazards, training needs analysis, human factors
Verification process	Verification of logistics requirements and products according to specification
Transition process	Logistics products finalized and ready for use
Validation process	Measured availability, verification of logistics requirements and products according to stakeholders issues
Operation process	Operational availability, sustaining service and usage, operational logistics, sustaining health and safety measures
Maintenance process	Sustaining Product capability, replacement services, logistics support, sustaining health and safety measures
Disposal process	Disposal concept, hazardous material, remaining hazards

3.2.1 Project planning process

The project planning process determines the scope of the project management and activities, identifies process outputs, project tasks and deliverables, establishes schedules for project task conduct including assessment criteria, and required resources to accomplish project tasks. In this process the following two interrelated planning activities must be implemented as a minimum:

- Inclusion of interfaces to the ILS elements in the SEMP. Approval and authorization of the SEMP involves the relevant ILS actors working together with roles such as process owners, chief engineers, project managers, head of design and relevant line managers.
- Inclusion in the ILS plan and specific ILS element plan interfaces to system engineering including Reliability, Availability, Maintainability and Testability (RAMT) activities.

3.2.2 Stakeholder requirements definition process

The stakeholder requirements definition process delivers the baseline for the Product’s development and therefore the basis for the technical description of the deliverables, typically at Product level, and defines interfaces at the Product boundaries. The operational and logistics scenarios of the Product need to be analyzed in its intended environment, taking the identification of potential stakeholders and their needs, expectations and constraints throughout the Products life cycle into account. Requirements can then be identified that were not formally specified by the stakeholder (eg, expected training or protective equipment). The concepts of operation, support and disposal must be established within this process.

3.2.2.1 Requirements analysis

During requirements analysis, the stakeholder requirements are transformed into functional, non-functional and performance requirements of the total Product including logistics requirements. A close collaboration of domains is necessary to provide a complete, practicable and accurate set of requirements. ILS requirements must be addressed from the earliest phases to ensure that they will be satisfied.

3.2.2.2 Architectural design

The architectural design is a creative process, and usually there is no unique solution to satisfying user requirements, especially for complex Products. If Product availability and operation, cost effectiveness, logistics functionalities or the In-service processes are affected by the requirements, the logistics engineer will perform studies and analysis. This involves:

- Establishing design criteria for each ILS element. Typically the criteria include physical, performance, behavioral, durability and sustainable service characteristics.
- Deciding which Product requirements are related to operators, to consider the limitations of human capabilities, integration of human performance and health and safety of personnel
- Modelling alternative designs, to the appropriate level of detail, so that a comparison between them ensures that the constraints are taken into account in the design and to perform effectiveness assessments, trade-off and risk analyses to determine an optimum design solution

3.2.3 Implementation process

The implementation process designs and manufactures Product elements in accordance with the detailed description of the element. This includes identifying ILS products, such as training, electronic publications, computer resources, supply support procedures and supply chain agreements. The implementation planning process starts with the definition of data needs for implementing the ILS Products. This includes taking into account analysis data such as failure detection and isolation, operation and maintenance of the Product, health and safety and human factors. Once these are in place, the initial ILS capabilities and products can be prepared. Finally, the implementation provides evidence that the architectural design meets the requirements on the element level and is consistent with legacy and organizational policy. Within this process most of the LSA analyses are performed on Product elements level. Refer to S3000L. With exception of the requirements processes the possibility to influence the design is most effective.

3.2.4 Integration process

The purpose of the integration process is to assemble the Product elements towards the total Product and to provide evidence that the total Product will perform the required functionalities expected. To achieve this, the internal and external interfaces must be validated and verified so that the correct flow of information can be confirmed and the constituent assembly is verified at the total Product level. These tasks include the validation of the Product and support products against the logistics acceptance criteria established in the requirements analysis process. The integration actions must be analyzed, recorded and reported so that any non-conformances are detected, recorded and reported and corrective and improvement actions recommended.

3.2.5 Verification process

The verification process is closely linked with other life cycle processes where the verification process is implemented. A key outcome of the verification process is the creation of project procedures and processes that specify the forms of Product and element assessments. Basic verification activities are inspection, analysis, test and certification.

3.2.6 Transition process

The transition process transfers the Product and its supporting elements, such as support services, operator and user training and warehousing, from one organization to another. Successful completion of the transition process typically marks the beginning of the In-service phase of the Product’s life cycle. As a result, the Product is installed in the operational environment and the requirements are met and all logistics products and services needed for keeping the Product available are in place.

3.2.7 Validation process

The validation process guarantees that the stakeholder requirements are met and provides the total Product including the related services the right solution to the customer's problem.

3.2.8 Operation process

The operation process provides the Products usage by assigning personnel for operating the Product and monitoring the performance. This includes operational logistics (eg, material consumption, service sustainment/handling activities, etc). The In-Service Phase accounts for a large portion of the total life cycle costs. Consequently have performance indicators and measurements to be monitored. If respective parameters are outside the acceptance levels, this can indicate the need for corrective actions. Constraints are reported with the objective to influence future design and specification of similar Products or Product elements.

3.2.9 Maintenance process

The maintenance process sustains the Product's capability. It accounts for the Product's availability, is responsible for replacements of Product elements and logistical support, maintenance, personnel and analysis, training and staff requirements. It develops the maintenance strategy and preventive maintenance plan for the total Product, plans the storage locations and stock of replacements/replacements rate and upgrade frequency. Reporting failures and recommendations for actions, recording maintenance constraints to influence future Product requirements, and gathering failure and lifetime performance data, is an ongoing task that is required in order to evaluate process performance.

3.2.10 Disposal process

The purpose of the disposal process is to end the existence of a Product. The process represents the interval from withdrawing a Product from operational service to its disassembly to parts and potential destruction. The withdrawal of a Product from operational service will also affect the maintenance and operation support functions provided to the end-user, in such a way that they can be scaled down in a controlled manner. The disposal concept must be reviewed and updated, taking into account hazardous material with the intention of defining the disposal strategy for deactivating and disassembling the Product.

4 An ILS process

4.1 Overall ILS process diagram

The top level ILS process defines the framework in which the planning, development, implementation, management, and execution of the logistics activities take place.

The process describes the methodology to develop the optimized support solution by:

- Designing for support
- Developing support
- Acquiring the support
- Providing the support

Refer to Para 3.

The different activities performed as part of the individual ILS elements throughout these activity groups are described in Fig 2.

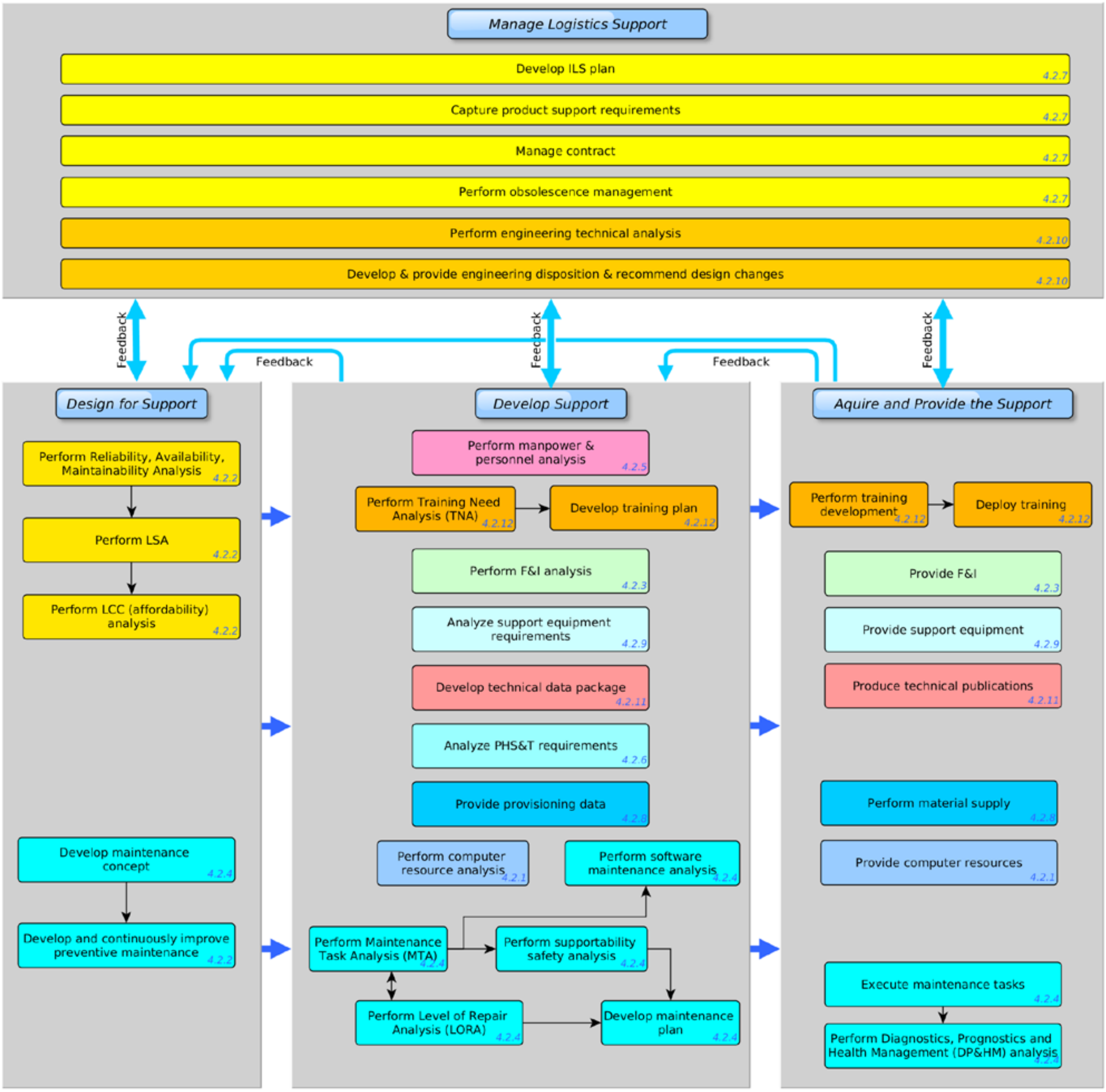

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Fig 2 Top level ILS process

Note

The numbers in the boxes of Fig 2 correspond to the Para numbers where such activity is described.

4.2 Description of ILS elements

ILS relies on understanding and integrating all the functions to develop the support solution in order to optimize supportability and life cycle costs while the Product meets the requirements.

These functions are grouped into twelve categories called the ILS elements.

4.2.1 Computer resources

The objective of the ILS element computer resources is to identify, plan and resource facilities, hardware, software, documentation, manpower and personnel necessary for planning and management of mission critical computer hardware and/or software systems.

Computer resources encompasses the facilities, hardware, software, documentation, manpower, and personnel needed to operate and support mission critical computer hardware/software systems. This ILS element consists of the following activities:

4.2.1.1 Perform computer resource analysis

This analysis determines and documents the computer resource requirements derived from the ILS plan or from demands identified by other ILS elements. Existing computer resources must be taken into account, as well as new, modified, expanded or upgraded computer resources. It should also take into account the disposal plans for computer resources (eg, data archiving)

4.2.1.2 Provide computer resources

This consists of developing, producing, procuring, installing and maintaining computer resources. During the Product life cycle phases the computer resources report gives a current summary of the computer resources conditions to the stakeholder's management.

Table 3 Main activities for computer resources

<table>
<tr><th>Input</th><th>Activity</th><th>Output</th></tr>
<tr><td>Contract</td><td rowspan="10">Perform computer resources analysis</td><td rowspan="10">Computer resources plan</td></tr>
<tr><td>F&I report</td></tr>
<tr><td>ILS plan</td></tr>
<tr><td>LSA database</td></tr>
<tr><td>Obsolescence report</td></tr>
<tr><td>SIA report</td></tr>
<tr><td>Support concept</td></tr>
<tr><td>Support equipment plan</td></tr>
<tr><td>Training equipment report</td></tr>
<tr><td>Training plan</td></tr>
<tr><td rowspan="2">Computer resource plan</td><td rowspan="2">Provide computer resources</td><td>Computer resources</td></tr>
<tr><td>Computer resources report</td></tr>
</table>

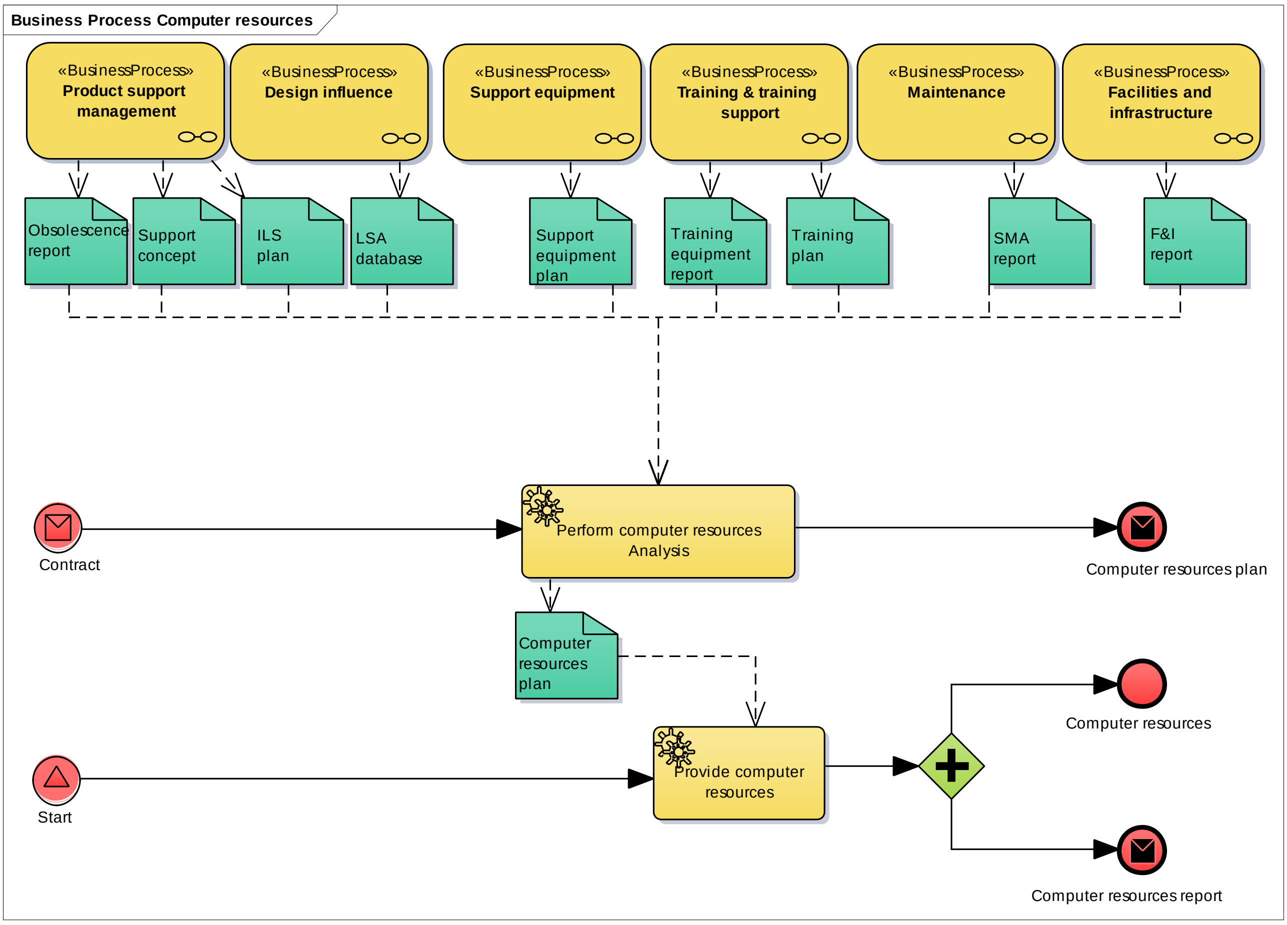

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Fig 3 Process view of the main activities for computer resources

4.2.2 Design influence

Participating in the systems engineering process to impact the design from its inception thru the Product life cycle to facilitate supportability and to optimize the design for availability, effectiveness, and ownership costs.

Design influence is the integration of the quantitative design characteristics of systems engineering (eg, RAMT, supportability, affordability) with the functional ILS elements. Design influence reflects the driving relationship of Product design parameters to Product support resource requirements.

These design parameters are expressed in operational terms rather than as inherent values and specifically relate to Product requirements. Thus, Product support requirements are derived to ensure that the Product meets its availability goals and design costs, and that support costs of the Product are effectively balanced. For that purpose, three activities are performed.

4.2.2.1 Perform LCC (Affordability) Analysis

This analysis determines the most cost effective option among different competing design alternatives for a Product.

4.2.2.2 Perform LSA

This activity builds a Logistic Support Analysis (LSA) database in accordance with standards such as S3000L. For S-Series ILS specifications, the LSA database is the single entity in which all logistics data is stored. This means that the data flow between ILS elements is always routed thru the LSA database to ensure data consistency among all ILS elements and domains.

4.2.2.3 Perform RAMT analysis

During this activity, the RAMT for the Product's design is analyzed.

Table 4 Main activities for design influence

Input	Activity	Output
Computer resource report	Perform LSA	LSA database
Configuration data		
Contract		
Design engineering data		
F&I report		
Feedback information		
ILS plan		
LORA report		
MTA report		
PHS&T plan		
RAMT reports		
Specification		
Supplier data		
Support equipment report		
Training equipment report		
Preventive maintenance task requirements		
Design engineering data	Perform RAMT analysis	RAMT reports
ILS plan		
LSA database		
Supplier data		
Computer resource report	Perform LCC (affordability) analysis	LCC report
Contract		
Design engineering data		
F&I report		
ILS plan		
LSA database		
Manpower and personnel report		
PHS&T plan		

Input	Activity	Output
Provisioning data		
Specification		
Support concept		
Support equipment plan		

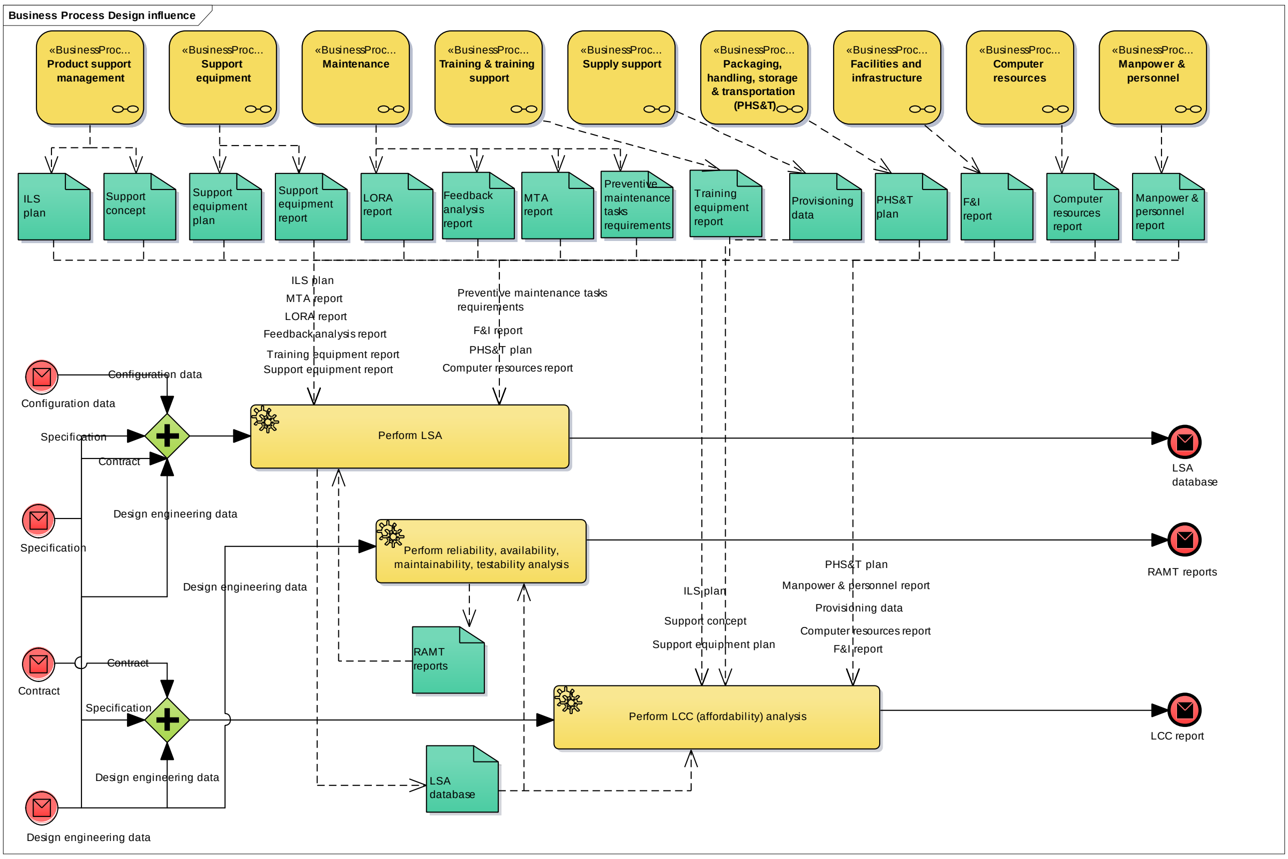

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Fig 4 Process view of the main activities for design influence

4.2.3 Facilities and infrastructure

Facilities and Infrastructure (F&I) consists of the permanent and semi-permanent real property assets or mobile facilities required to integrate, support and operate a Product. It includes studies to define types of facilities (eg, training, equipment storage, maintenance, supply storage, hazardous goods storage, computer hardware/software systems, network and communication systems) or facility improvements, location, space needs, environmental and security requirements and equipment.

Due to the potential long lead times in funding, acquisition or construction, planning F&I requirements must be considered as early as possible in the Product life cycle. To provide F&I, two activities are performed.

4.2.3.1 Perform F&I analysis

This analysis determines and documents the F&I requirements derived from ILS plan or from demands identified by other ILS elements. These F&I requirements form the basis for the optimal F&I solution. Existing F&I must be taken into account, as well as new, constructed, expanded or upgraded F&I. The analysis must also take into account the disposal plans for F&I (eg, sale, cannibalization, recycling or demolition).

4.2.3.2 Provide F&I

This activity consists of developing, building, acquiring and maintaining F&I. It is usually performed under separate contractual arrangements and goes thru its own life cycle. During the life cycle phases the F&I report gives a snapshot summary of the F&I conditions to the stakeholder’s management.

Table 5 Main activities for F&I

Input	Activity	Output
Computer resource plan	Perform F&I analysis	F&I plan
Computer resource report		
Contract		
ILS plan		
LORA report		
LSA database		
PHS&T plan		
Provisioning data		
Support concept		
Support equipment plan		
Training equipment report		
Training plan		
F&I plan	Provide F&I	F&I report
		F&I

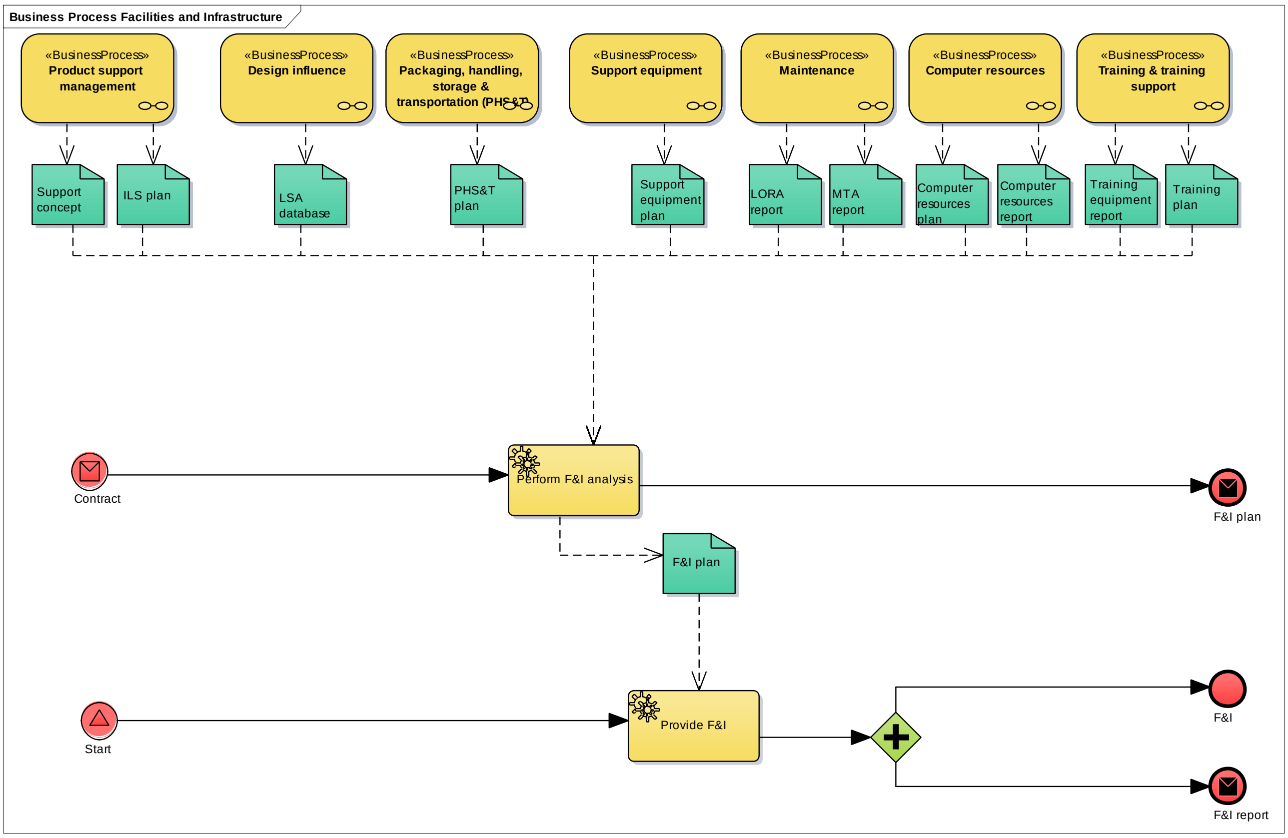

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Fig 5 Process view of the main activities for F&I

4.2.4 Maintenance

Maintenance establishes maintenance concepts and requirements for the life cycle of the Product. This element has a great impact on the planning, development, and acquisition of other logistics support elements.

The objective of maintenance is to identify, plan, resource, and implement maintenance concepts and requirements and to execute the maintenance to ensure the best possible equipment/capability is available at the lowest possible cost. For that purpose, nine activities are performed.

4.2.4.1 Develop the maintenance concept

During this activity the ILS plan and support concept are used to develop the maintenance concept.

4.2.4.2 Develop maintenance plan

Using the contract, ILS plan, LORA report and the maintenance concept, the maintenance plan is developed.

4.2.4.3 Execute maintenance tasks

Using the contract and the maintenance plan, the maintenance tasks are executed.

4.2.4.4 Perform Diagnostics, Prognostics and Health Management (D&PHM) analysis

Using the contract, design engineering data, ILS plan and RAMT reports, the D&PHM analysis is performed.

4.2.4.5 Perform level of repair analysis (LORA)
Using the contract, design engineering data, ILS plan, SIA report, RAMT reports and support concept, the LORA is performed.

4.2.4.6 Perform MTA
Using the contract, design engineering data, ILS plan, LORA report, RAMT reports, scheduled maintenance plan and support concept, the MTA is performed.

4.2.4.7 Develop and continuously improve preventive maintenance
Using the design engineering data, ILS plan and RAMT reports, supplier data and LSA database, the Preventive Maintenance Task Requirements (PMTR) are developed.

4.2.4.8 Perform software impact analysis
Using the Design Engineering Data, ILS plan, LORA Report, MTA Report, RAMT Report and Support Concept, the Software Impact Analysis (SIA) is performed so as to identify what impact software has on the product operation or maintenance.

4.2.4.9 Perform supportability safety analysis
Using the Design Engineering Data, ILS plan, LSA database, MTA Report and RAMT Report, the Supportability Safety Analysis is performed.

Table 6 Main activities for maintenance

<table>
<tr><th>Input</th><th>Activity</th><th>Output</th></tr>
<tr><td>Contract</td><td rowspan="3">Develop maintenance concept</td><td rowspan="3">Maintenance concept</td></tr>
<tr><td>ILS plan</td></tr>
<tr><td>Support concept</td></tr>
<tr><td>Contract</td><td rowspan="5">Develop maintenance plan</td><td rowspan="5">Maintenance plan</td></tr>
<tr><td>ILS plan</td></tr>
<tr><td>LORA report</td></tr>
<tr><td>Maintenance concept</td></tr>
<tr><td>PMTR</td></tr>
<tr><td>Contract</td><td rowspan="2">Execute maintenance tasks</td><td>Maintenance report</td></tr>
<tr><td>Maintenance plan</td><td>Feedback data</td></tr>
<tr><td>Contract</td><td rowspan="4">Perform D&PHM analysis</td><td rowspan="4">Testability report</td></tr>
<tr><td>Design engineering data</td></tr>
<tr><td>ILS plan</td></tr>
<tr><td>RAMT reports</td></tr>
<tr><td>Contract</td><td rowspan="4">Perform LORA</td><td rowspan="4">LORA report</td></tr>
<tr><td>Design engineering data</td></tr>
<tr><td>ILS plan</td></tr>
<tr><td>MTA report</td></tr>
</table>

Input	Activity	Output
RAMT reports		
Support concept		
Contract	Perform MTA	MTA report
Design engineering data		
ILS plan		
LORA report		
RAMT reports		
Support concept		
Design engineering data	Develop and continuously improve preventive maintenance	PMTR
ILS plan		
RAMT reports		
Supplier data		
LSA database		
Design engineering data	Perform SMAs	SMA report
ILS plan		
LORA report		
MTA report		
RAMT reports		
Support concept		
Contract	Perform supportability safety analysis	Supportability safety analysis report
Design engineering data		
ILS plan		
LSA database		
MTA report		
RAMT reports		

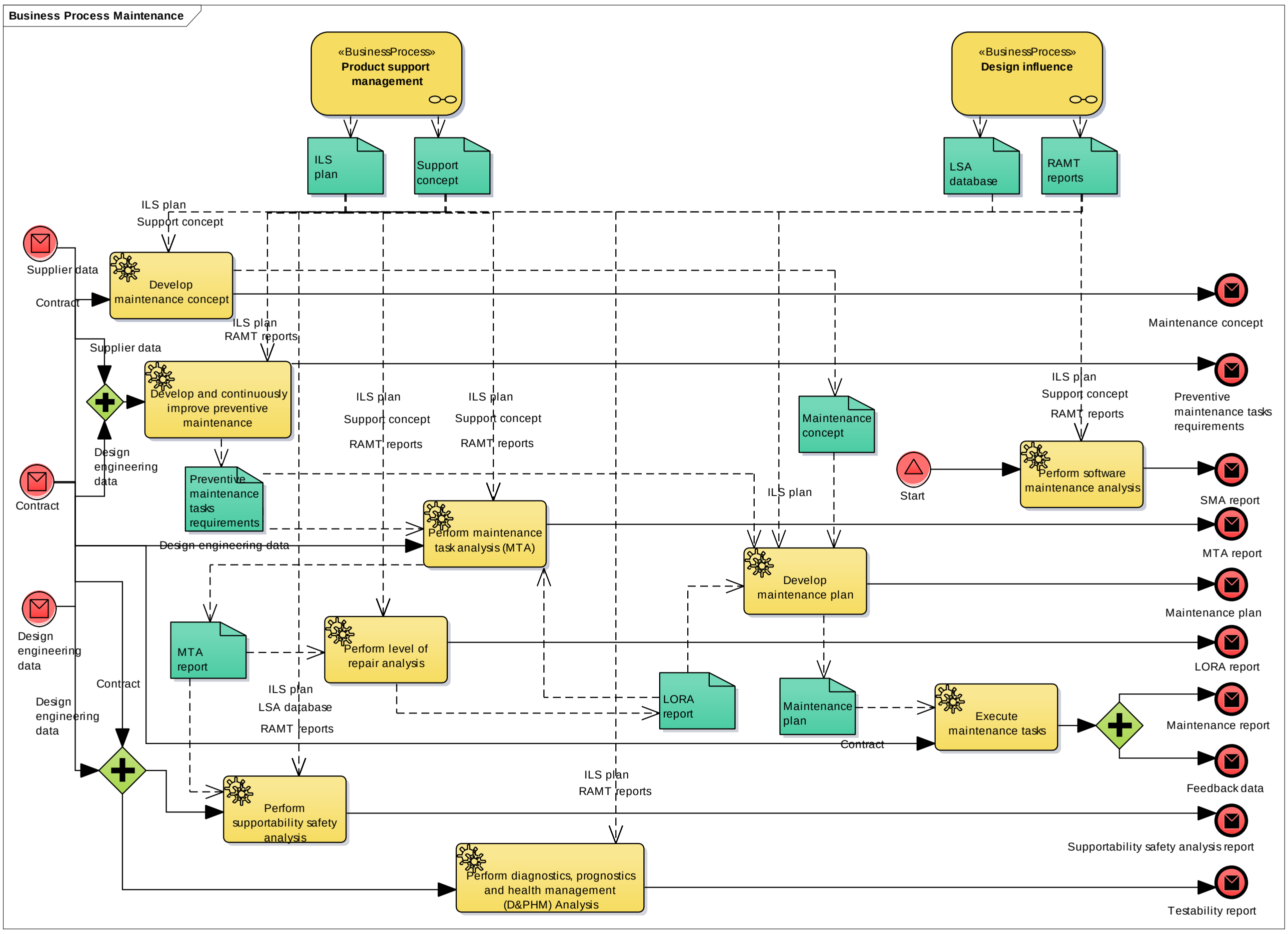

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Fig 6 Process view of the main activities for maintenance

4.2.5 Manpower & personnel

The objective of Manpower and Personnel is to identify, plan and resource personnel, which have the necessary qualifications and skills.

4.2.5.1 Qualifications and skills

The qualifications and skills are required to:

- Operate equipment and Product, to effectively complete the missions, and support the operations.
- Provide adequate logistics and to ensure the best capability is available when and as needed.

Manpower represents the number of personnel or positions required to perform a specific task. Personnel, on the other hand, indicate those human aptitudes and capabilities, knowledge, skills, abilities, and experience levels that are needed to properly perform a task. For that purpose, a manpower and personnel analysis is performed.

4.2.5.2 Perform manpower & personnel analysis

This analysis involves the identification and allocation of personnel with the qualifications and skills required to operate, maintain, and support Products over their lifetime.

Table 7 Main activities for manpower & personnel

Input	Activity	Output
Contract	Perform manpower & personnel analysis	Manpower & personnel report
ILS plan		
LSA database		

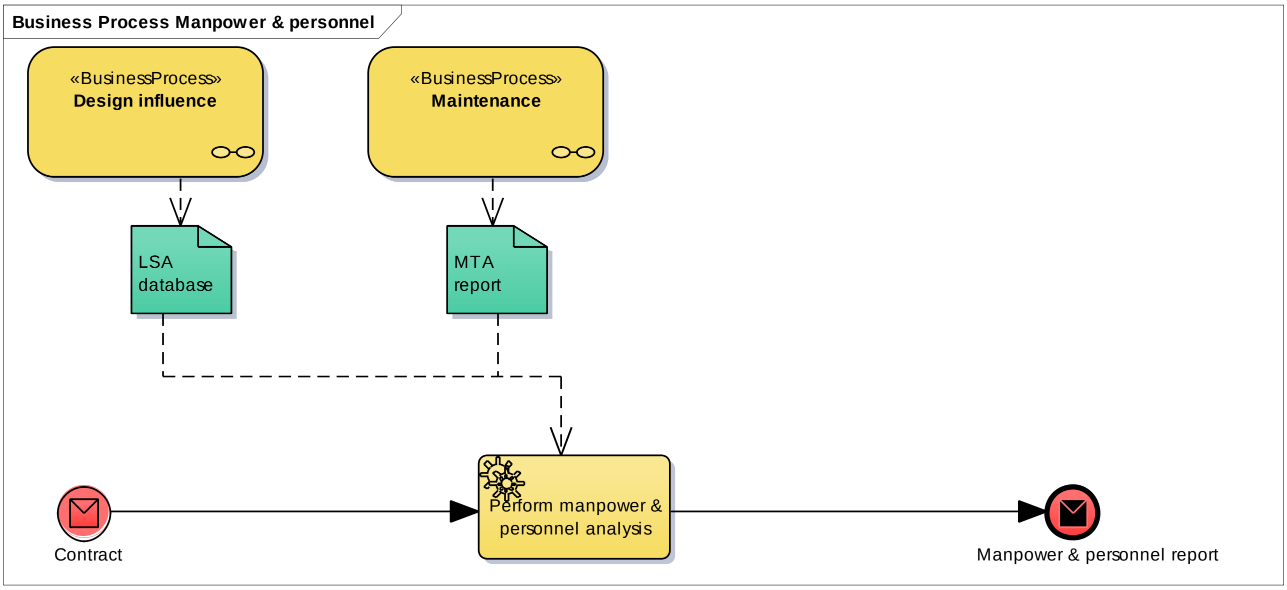

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Fig 7 Process view of the main activities for manpower & personnel

4.2.6 Packaging, Handling, Storage and Transportation (PHS&T)

As well as the activities associated with the maintenance and repair of a Product, there are additional aspects concerning the operation and the handling that must be considered. This ILS element covers tasks, which cannot be assigned to an area of the direct operation and maintenance of a Product. However, these tasks can be important for the proper use of a Product. For this purpose a PHS&T requirements analysis is carried out. This analysis includes the identification of PHS&T tasks and the related requirements concerning personnel, support equipment, consumables, spare parts, facilities and training. The outcomes are documented in the PHS&T Plan. Some of the tasks require very early consideration in the life cycle and some can be considered later, (eg, when a prototype of the Product is available).

The categories of tasks for this activity include, but are not limited to:

– Handling and usage supporting aspects:

  - Safety precautions
  - Preparation for usage
  - Servicing
  - Loading and unloading
  - Towing
  - Role change
  - Deployment
  - Product recovery
  - De-icing an aircraft or ship
  - Checking electrical charge

- Checking the strength of magnetic fields during storage
- Completing paperwork for statistical purposes

– Packaging, storage and transport aspects:

- Packing and unpacking
- Securing
- Conservation
- Storage
- Hazardous cargo
- Container concept
- Lifting
- Transportation

Table 8 Main activities for packaging, handling, storage, and transportation

Input	**Activity**	**Output**
Contract	Analyse PHS&T requirements	PHS&T plan
Design engineering data		
ILS plan		
LSA database		
Specification		
Supplier data		
Support concept		

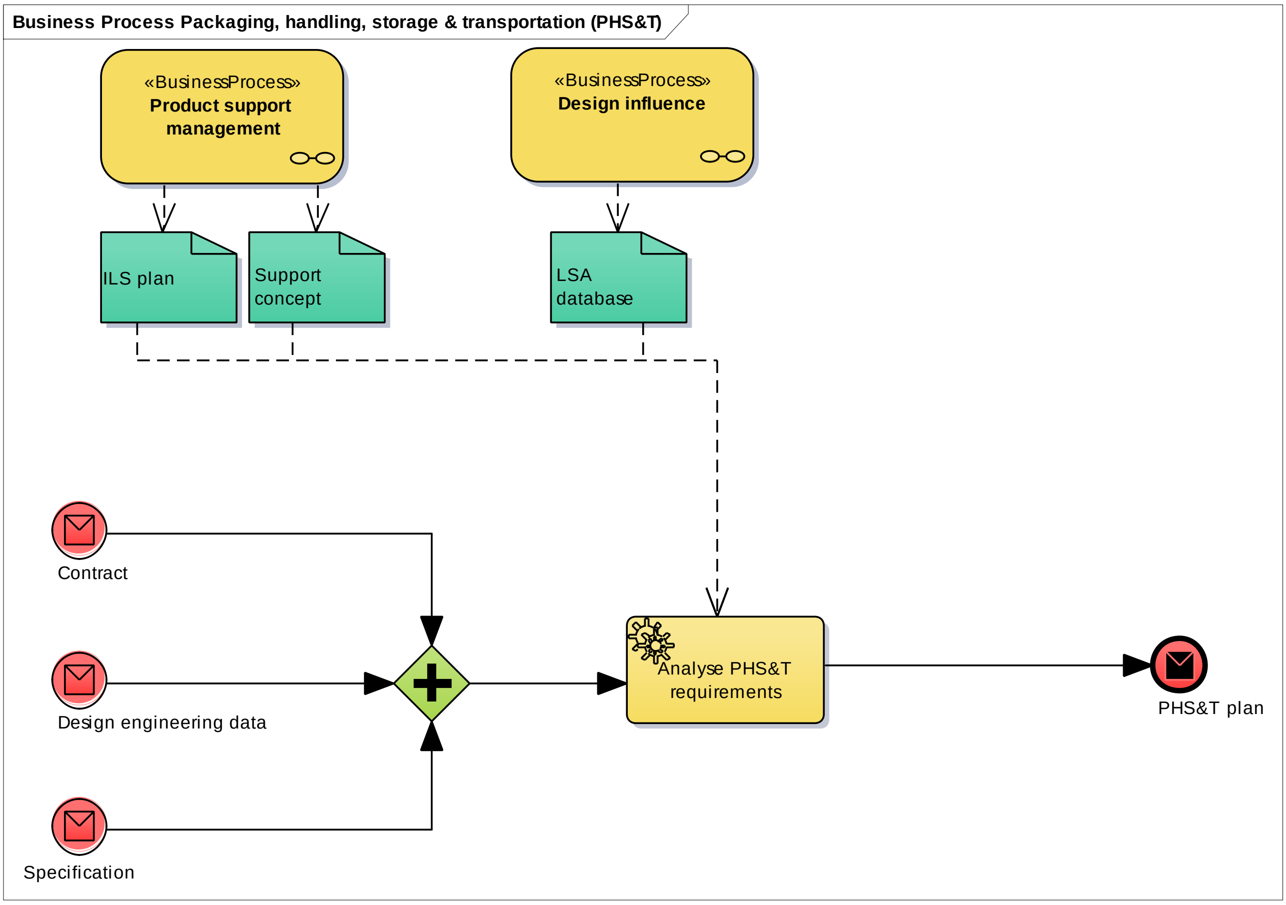

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Fig 8 Process view of the main activities for packaging, handling, storage, and transportation

4.2.7 Product support management

Product Support Management function consists of elaborating the Support concept, the ILS plan and providing Obsolescence Report. For that purpose, four activities are performed.

4.2.7.1 Capture product support requirement

Using the contract, the specification and the Design Engineering data are collected and used to:

- Conduct appropriate trade studies and analyses to determine and validate the Support concept
- Integrate all ILS elements to assure customer capabilities are expressed in terms of readiness and ownership costs.

4.2.7.2 Develop the ILS plan

Using the same information as above, this activity consists of describing the integration of sustainment activities into the acquisition strategy.

4.2.7.3 Perform obsolescence management

This activity consists of defining an obsolescence strategy, developing an obsolescence management plan and implementing obsolescence solutions. The results of these activities are collected in the Obsolescence Report.

4.2.7.4 Manage contract

This activity ensures the compliance and execution of existing contracts, including generation of subcontracts and agreement of support contracts.

Table 9 Main activities for product support management

<table>
<tr><th>Input</th><th>Activity</th><th>Output</th></tr>
<tr><td>Contract</td><td rowspan="3">Capture Product support requirements</td><td rowspan="3">Support concept</td></tr>
<tr><td>Design engineering data</td></tr>
<tr><td>Specification</td></tr>
<tr><td>Contract</td><td rowspan="3">Develop ILS plan</td><td rowspan="3">ILS plan</td></tr>
<tr><td>Design engineering data</td></tr>
<tr><td>Specification</td></tr>
<tr><td>Contract</td><td rowspan="5">Manage contract</td><td rowspan="3">Management reports</td></tr>
<tr><td>Feedback data</td></tr>
<tr><td>ILS plan</td></tr>
<tr><td>Specification</td><td rowspan="2">Support contract</td></tr>
<tr><td>Support concept</td></tr>
<tr><td>Contract</td><td rowspan="4">Perform obsolescence management</td><td rowspan="4">Obsolescence report</td></tr>
<tr><td>Design engineering data</td></tr>
<tr><td>ILS plan</td></tr>
<tr><td>Supplier data</td></tr>
</table>

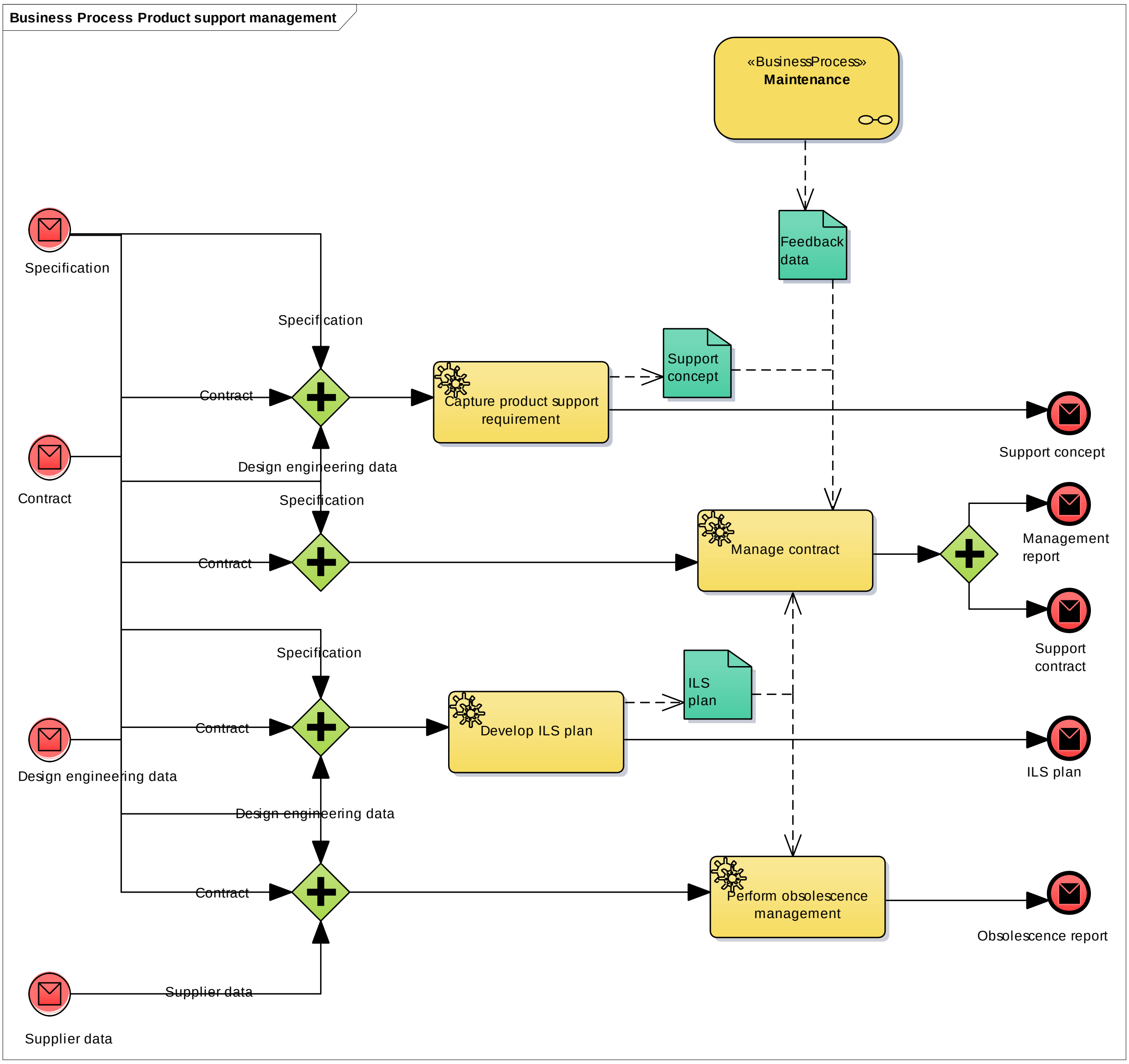

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Fig 9 Process view of the main activities for product support management

4.2.8 Supply Support

The objective of the ILS element, Supply Support is to identify, plan for, resource, and implement management actions to acquire repair parts, spares, and all classes of supply to ensure the best capability is available to support at the lowest possible life cycle cost.

This means having the right spares, repair parts and supplies available, in the right quantities and quality, at the right place, at the right time, at the right price.

Supply Support consists of all management actions, procedures, and techniques necessary to determine requirements to acquire, catalog, receive, store, transfer, issue and dispose of spares, repair parts, and supplies. The process includes provisioning for initial support, as well as acquiring, distributing, and replenishing inventories. For that purpose, two activities are undertaken:

4.2.8.1 Provide provisioning data
This activity consists of obtaining the provisioning data, including necessary quantities of the supplies that need to be procured in order to provide the necessary support. The codification ensures that equipment, components and parts of the supply systems are uniformly named, described and classified in a standard and unambiguous manner.

4.2.8.2 Perform material supply
This activity consists of the management of orders from customers and ensuring that they are fulfilled by means of existing stock or are relayed to suppliers in the event that no stock is available. It is executed partly by the customer and by the contractor, and also consists of the generation of quotations, orders, deliveries and invoices for supplies being delivered, as well as the management of the activity outputs.

Table 10 Main activities for supply support

<table>
<tr><th>Input</th><th>Activity</th><th>Output</th></tr>
<tr><td>Contract</td><td rowspan="7">Provide provisioning data</td><td rowspan="4">Provisioning data</td></tr>
<tr><td>Design engineering data</td></tr>
<tr><td>ILS plan</td></tr>
<tr><td>LSA database</td></tr>
<tr><td>Obsolescence report</td><td rowspan="3">Initial Provisioning List (IPL)</td></tr>
<tr><td>Supplier data</td></tr>
<tr><td>Support concept</td></tr>
<tr><td>Provisioning data</td><td rowspan="5">Perform material supply</td><td>SPL</td></tr>
<tr><td>IPL</td><td>Quotation</td></tr>
<tr><td>Contract</td><td>Provisioning order</td></tr>
<tr><td>Supplier data</td><td>Delivery</td></tr>
<tr><td>ILS plan</td><td>Invoice</td></tr>
</table>

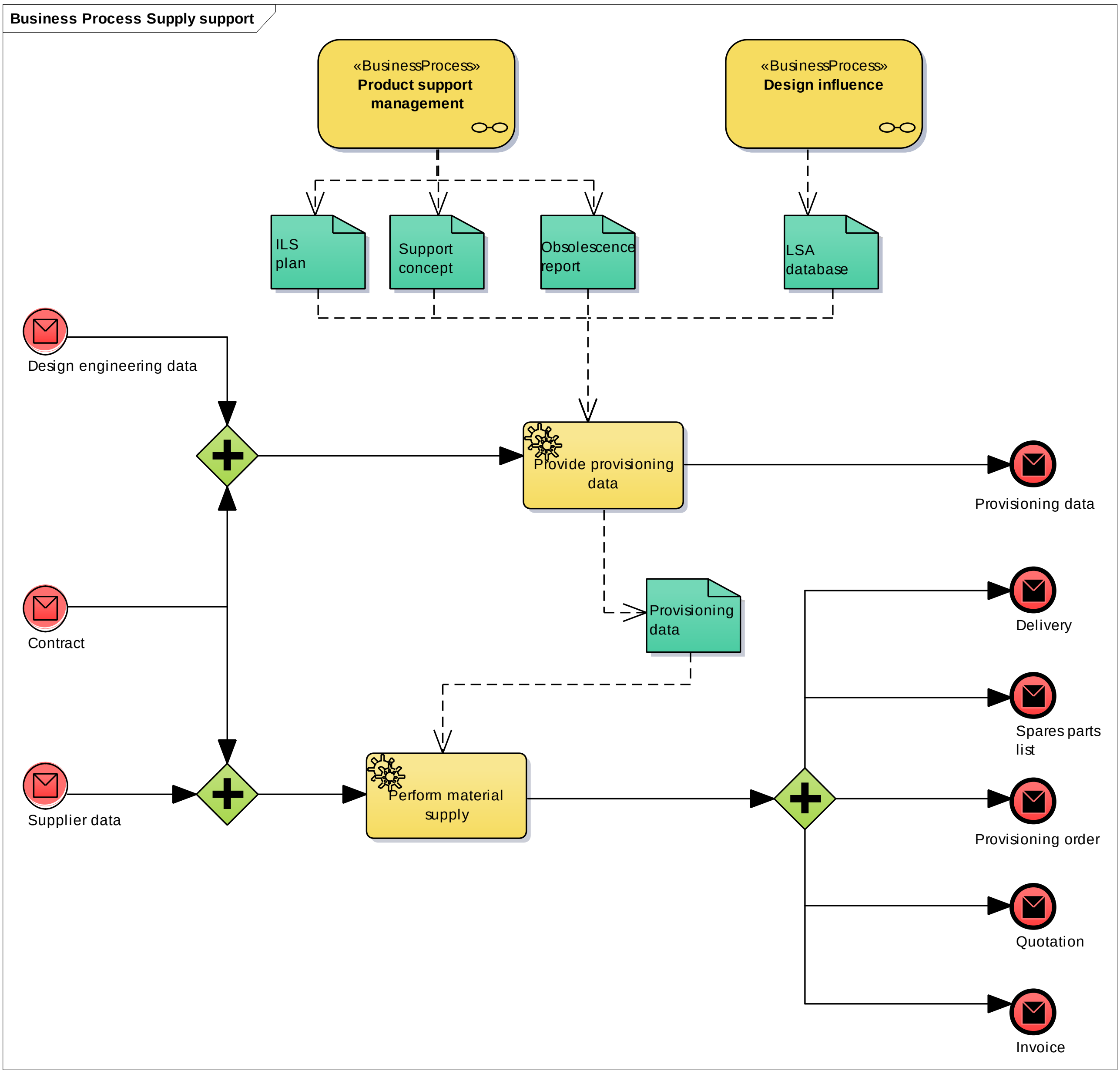

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Fig 10 View of the main activities for supply support

4.2.9 Support equipment

The objective of the ILS element support equipment is to identify, plan, resource and implement management actions to acquire and support the equipment (mobile or fixed) required to sustain the operation, maintenance and supply of the Product to ensure that the Product is available to the user when it is needed at the lowest life cycle cost.

During the acquisition of Products, program managers are expected to decrease the proliferation of support equipment into the inventory by minimizing the development of new support equipment and giving more attention to the use of existing equipment. For that purpose, two activities are performed.

4.2.9.1 Analyze support equipment requirements

This analysis determines and documents the support equipment requirements derived from the ILS plan or from requirements identified by other ILS-Elements. Existing support equipment must be taken into account, as well as new, modified, expanded or upgraded support equipment. It should also take into account the disposal plans for support equipment.

4.2.9.2 Provide support equipment

This activity consists of developing, producing, procuring, installing and maintaining support equipment. During the Product life cycle phases, the support equipment report gives a snapshot summary of the support equipment conditions to the stakeholder’s managements.

Table 11 Main activities for support equipment

<table>
<tr><th>Input</th><th>Activity</th><th>Output</th></tr>
<tr><td>Contract</td><td rowspan="7">Analyse support equipment requirements</td><td rowspan="7">Support equipment plan</td></tr>
<tr><td>Design engineering data</td></tr>
<tr><td>ILS plan</td></tr>
<tr><td>LSA database</td></tr>
<tr><td>RAMT reports</td></tr>
<tr><td>Specification</td></tr>
<tr><td>Support concept</td></tr>
<tr><td rowspan="2">Support equipment plan</td><td rowspan="2">Provide support equipment</td><td>Support equipment</td></tr>
<tr><td>Support equipment report</td></tr>
</table>

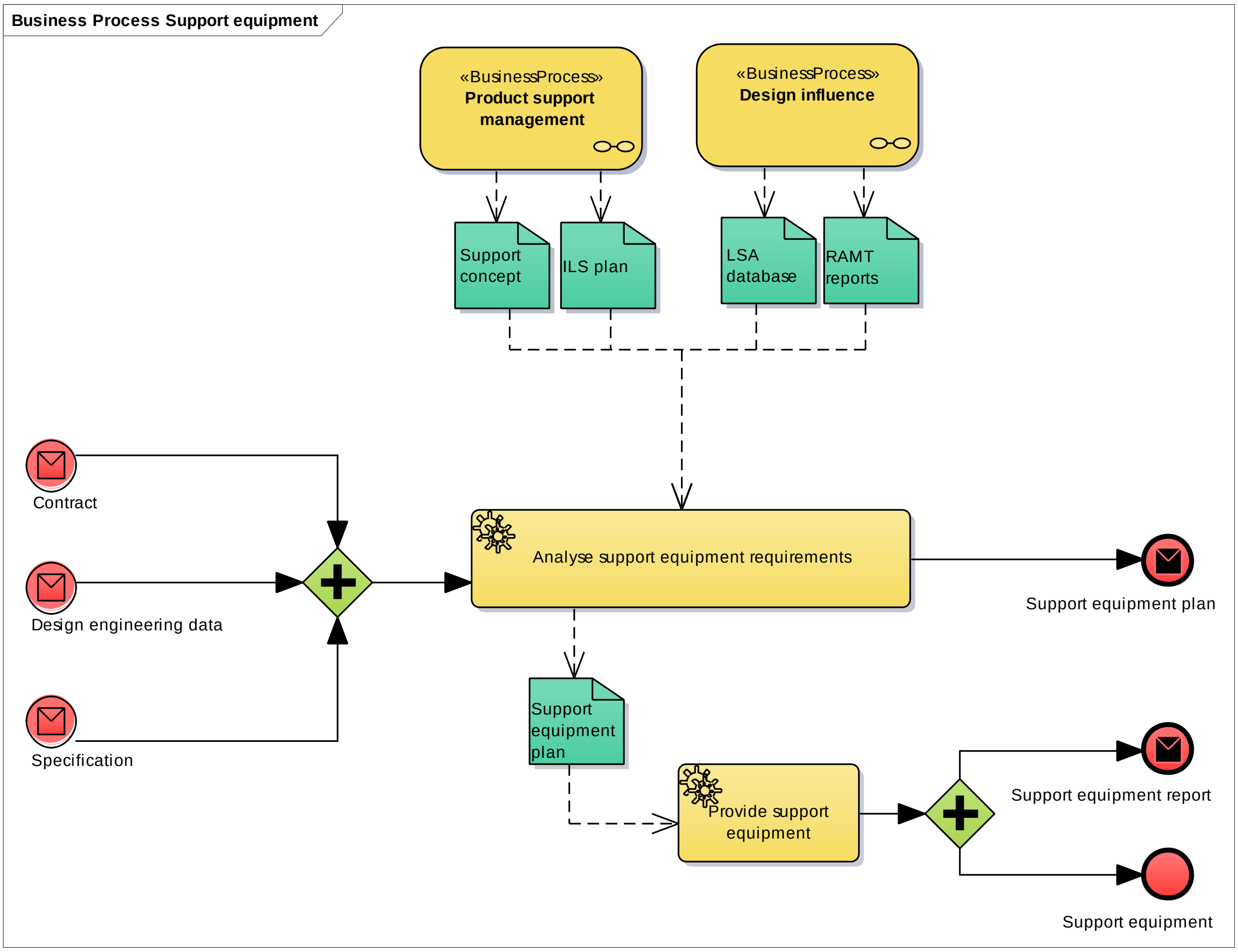

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Fig 11 Process view of the main activities for support equipment

4.2.10 Sustaining engineering

Sustaining Engineering supports Products in their operational environments. This effort spans those technical tasks (eg, engineering and logistics investigations and analyses) to ensure continued operation and maintenance of a Product.

It also involves the identification, review, assessment, and resolution of deficiencies throughout a Product's life cycle.

It returns a Product to its baselined configuration and capability, while identifying opportunities for performance and capability enhancement. It includes the measurement, identification and verification of Product technical and supportability deficiencies, associated root cause analyses, evaluation of the potential for deficiency correction and the development of a range of corrective action options.

Sustaining Engineering also includes the implementation of selected corrective actions to include configuration or maintenance processes and the monitoring of key sustainment health metrics. For that purpose, two activities are performed.

4.2.10.1 Perform engineering technical analysis

This activity conducts a scientific study to determine the issues related to the deficiency.

4.2.10.2 Develop and provide engineering disposition and recommend design changes

This activity evaluates the deficiency and develops actions to complete, improve, or correct a situation with the end result of improving sustainment metric outcomes, and developing proposed modifications to the Product.

Table 12 Main activities for sustaining engineering

Input	Activity	Output
Contract Customer request Design engineering data Feedback data ILS plan LSA database Supplier data	Perform engineering technical analysis	Feedback information
Contract Customer request Design engineering data Feedback information ILS plan LSA database Obsolescence report Supplier data	Develop & provide engineering disposition & recommend design changes	Engineering change request

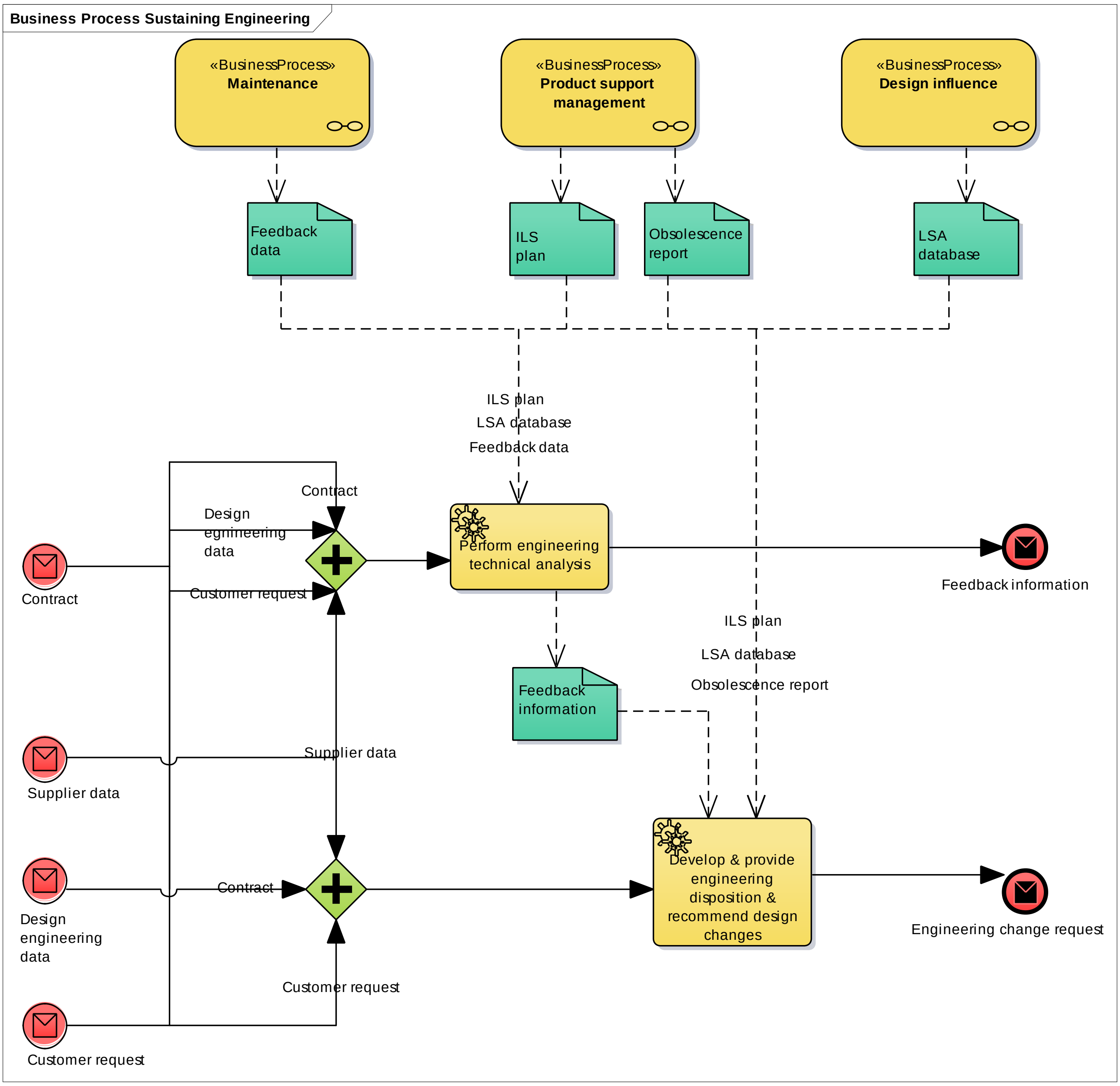

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Fig 12 Process view of the main activities for sustaining engineering

4.2.11 Technical data

Technical Data is recorded information, regardless of the form or method of the recording, of a scientific or technical nature including documentation. Technical data does not include computer software or contract administration data like financial or management information.

The objective of this ILS Element is on one hand to identify, plan, validate, resource and implement actions to develop, acquire and maintain information and on the other hand to plan, develop, produce and maintain technical publication. For that purpose two activities are performed.

4.2.11.1 Develop technical data package

A Technical Data Package (TDP) is a technical description of an item adequate for supporting an acquisition strategy, development, manufacturing development, production, engineering, and logistics throughout the Product's life cycle. It defines the required design configuration and procedures required to ensure adequacy of item performance. A TDP consists of a variety of data that defines the item. The categories of data that can be included in a TDP, include but are not limited to:

- Product Definition Data
- Engineering Drawings
- Associated Lists
- Specifications
- Standards
- Performance Requirements
- Quality Assurance Provisions
- Reliability Data
- Packaging Details
- Modeling Data

Technical data must be organized and managed to support a variety of functions. The development of a TDP includes the identification and control of data requirements and rights, the timely and economical acquisition of all related data, the assurance of the adequacy of data for its intended use, distribution or communication of the data to the point of use and actual data analysis.

4.2.11.2 Produce technical publications

Technical Publications refer to any type of documentation that describes handling, functionality and architecture of a Product. It normally includes operational and maintenance instructions, parts lists or parts breakdown, and related technical information and procedures. The intended recipient for technical publications is the end user. Technical publications can be presented in any format, which includes but is not limited to:

- Hard copy
- Audio and visual displays
- Magnetic tape, discs
- Other electronic devices

Table 13 Main activities for technical data

Input	**Activity**	**Output**
Contract	Develop technical data package	Technical data package
Design engineering data		
ILS plan		
LSA database		
Manufacturing data		
Supplier data		

Input	Activity	Output
Design engineering data	Produce Technical Publications	Technical publications
Feedback information		
ILS plan		
LSA database		
PHS&T plan		
Provisioning data		
Specification		
Supplier data		

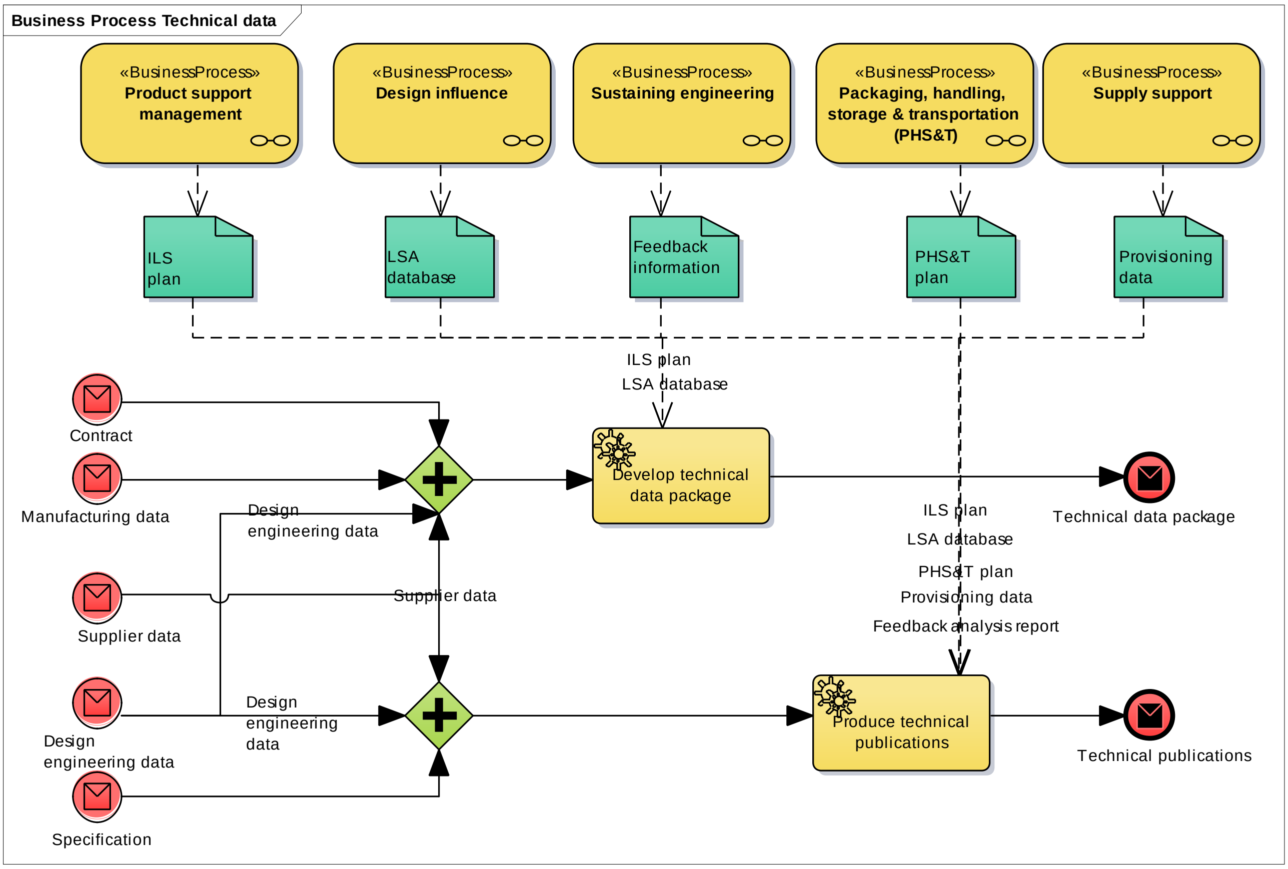

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Fig 13 Process view of the main activities for technical data

4.2.12 Training and training support

The objective for this is to identify, plan and resource training support and implement a training strategy and to train personnel to operate, maintain and support the Product throughout its life cycle to assure optimum performance and readiness of the Product.

To ensure that the correct training for the use of a Product is delivered, a Training Needs Analysis (TNA) must be carried out in accordance with the training requirements mainly derived from LSA results.

Training and Training Support consists of processes, procedures, techniques, training devices and equipment, used to train personnel to operate, maintain and support a Product, as determined by the Training Needs Analysis (TNA).

The training system integrates training concepts and strategies and elements of logistics support to satisfy personnel performance levels that are required to operate, maintain, and support the training systems. It includes the tools used to provide learning experiences such as computer-based interactive courseware, simulators, and the Product itself (including embedded training capabilities on actual equipment), job performance aids, and IETP. It is critical that any changes are evaluated to ensure that the impact on the training program is kept to a minimum and that Product design and the training program remain aligned. The training products themselves can require separate configuration management and supportability.

Two phases of training can be identified:

- Initial Training, which trains the operator and maintenance personnel who will operate or maintain the Product when it is fielded. This training is normally conducted just prior to and during initial fielding of the Product
- Sustainment Training, which provides refresher training to personnel that operate and maintain the Product, including training for new personnel. This training starts as Initial Training ends, and continues throughout the life cycle of the Product

On each phase, four categories of training can take place:

- Operator Training, which covers everything that the operator must do to place the Product into operation, perform scheduled and unscheduled operator maintenance, and identify Product failures
- Maintenance Training, which consists of training personnel who will staff the maintenance organizations responsible for performing maintenance of the Product. This can include Organizational, Intermediate, and Depot personnel. The training of maintenance personnel must reflect the maintenance concept developed by the ILS strategy
- Supervisor Training, which must be adequate enough to allow supervision of the activities of subordinate operators and maintenance personnel. This training should include all tasks to be performed and establish criteria for supervisors to use in determining whether the tasks are being accomplished properly
- Instructor Training, which must be adequate enough to prepare training personnel to provide training for operators and maintenance personnel

The overall concept of training personnel, who will operate and maintain a Product, is developed in the early phases of the acquisition cycle.

Training Requirements are identified by the TNA, which must align with the subject matter that personnel will be trained.

Then a Training Plan (or Program) must be defined which identifies:

- A training curriculum which identifies the number of sessions required to perform initial training of all personnel, by course type
- For each type of course:
  - Training Methods (eg, lectures, Hands-on Training, On-the Job Training (OJT), Self-Study)
  - Training Materials (eg, instructor Guide, Student Guide, OJT Handbook, Training Aids)
  - Training Support, which includes:
    - Instructors
    - Facilities (eg, the size and arrangement of classroom)
    - Training Equipment (eg, actual equipment, mock-ups, simulators)

Table 14 Main activities for training and training support

Input	Activity	Output
Contract	Perform TNA	TNA report
ILS plan		
LSA database		
Manpower & personnel report		
Contract	Develop training plan	Training plan
ILS plan		
TNA report		
LSA database	Perform training development	Training equipment report
RAMT reports		Courseware
Technical publications		Training equipment
Training plan		
Courseware	Deploy training	Training course
Training equipment		Training course report
Training plan		

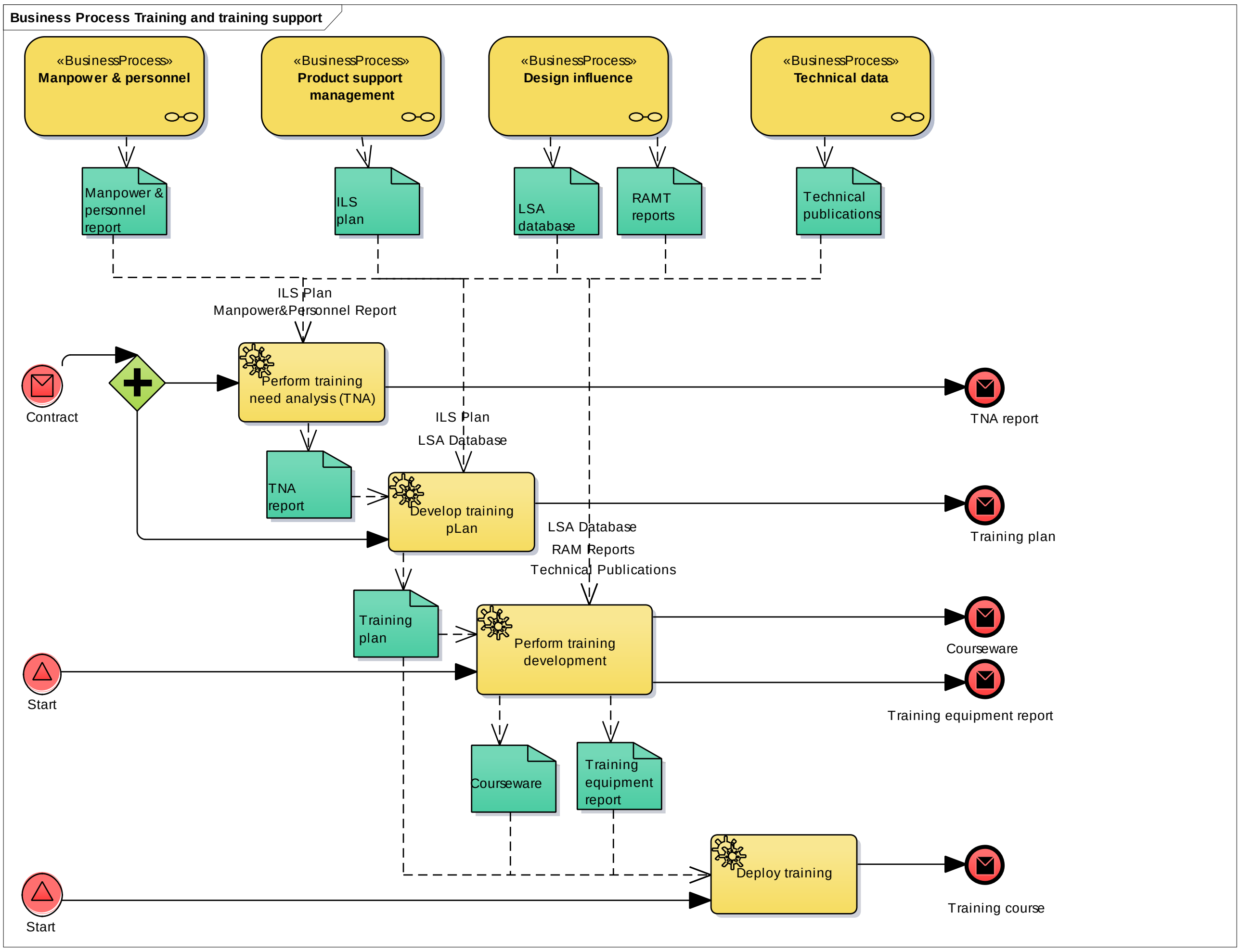

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Fig 14 Process view of the main activities for training and training support

4.3 Activity inputs/outputs

This chapter defines the data that are exchanged between ILS Elements and other ILS Elements or domains.

4.3.1 Computer resource

A Computer Resource can be hardware, software, facilities, documentation, personnel and manpower required to develop and sustain computer resources for operation and maintenance of a Product, including planning and support requirements for post-deployment software.

A Computer Resource is provided in the ILS element, Computer Resources.

4.3.2 Computer resource plan

The Computer Resource Plan defines all the management actions, procedures, and techniques used in determining requirements and acquiring hardware, software, facilities, documentation, personnel and manpower required to develop and sustain computer resources for operation and maintenance of a Product, including planning and support requirements for post-deployment software.

The Computer Resource Plan is generated in the ILS element, Computer Resources.

4.3.3 Computer resource report

The Computer Resource Report details necessary information about the acquired Computer Resources for operation and maintenance of a Product.

The Computer Resource Report is generated in the ILS element, Computer Resources.

4.3.4 Contract

A contract is a mutually binding agreement that obligates the seller to provide the specified Product or service or result and obligates the buyer to pay for it.

4.3.5 Customer request

A customer request is defined as a request for corrective action to be taken in respect to a particular matter based on contractual obligations.

4.3.6 Courseware

Courseware is training material on paper, on a diskette, CD or DVD, or downloaded from the internet, for use with a self-learning or coach assisted training program.

Courseware is developed in the ILS element, Training & Training Support.

4.3.7 Delivery

The delivery is the transfer of possession by actual (physical) delivery.

4.3.8 Design engineering data

Design Engineering Data is defined as any recorded or documented information of a scientific or technical nature whatever the format, documentary characteristics or other medium of presentation. The information can include, but is not limited to, any of the following:

- Experimental and test data
- Specifications
- Designs and design processes
- Inventions and discoveries (patentable or otherwise protectable by law)
- Technical descriptions and other works of a technical nature
- Semiconductor topography mask works
- Technical and manufacturing data packages
- Know-how trade secrets and information relating to industrial techniques

It can be presented in the form of documents, pictorial reproduction, drawings and other graphic representations, disc and film recordings (magnetic, optical and laser), computer software both programmatic and database, and computer memory, printouts or data retained in computer memory or any other form.

4.3.9 Engineering change request

An Engineering Change Request is a formal proposal to modify a Product/equipment, document or any other contractual item

4.3.10 F&I plan

The F&I Plan defines all the management actions, procedures and techniques and the requirements for facilities and infrastructure that are required to support and operate a Product.

The F&I Plan is generated in the ILS element, Facilities and Infrastructure.

4.3.11 F&I report

The F&I Report details the necessary information about the acquired Facilities and Infrastructure that are required to support and operate a Product.

The F&I Report is generated in the ILS element, Facilities and Infrastructure.

4.3.12 Feedback data

Feedback Data can be any data exchanged between different stakeholders during the operation and support of a Product or the operation of a service.

4.3.13 Feedback information

A Feedback Information summarizes the results of a technical analysis of raw Feedback Data for a Product or service.

A Feedback Information is generated in the ILS element, Sustaining Engineering.

4.3.14 ILS plan

The ILS Plan (ILSP) is the primary document that details the approach to ILS, tailored to meet the needs of a specific Product or service. The ILSP should include detailed information for the planning, implementation and co-ordination of the ILS program, together with element plans detailing how the appropriate ILS elements will be addressed and an ILS work breakdown structure.

It will be continuously updated and will apply throughout the whole life cycle.

The ILSP is generated in the ILS element, Product Support Management.

4.3.15 Initial provisioning list

IPL contains the range and quantity of items (i.e., spares and repair parts, special tools, test equipment, and support equipment) required to support and maintain an item for an initial period of service.

4.3.16 Invoice

An invoice is a non-negotiable commercial instrument issued by a seller to a buyer. It identifies both the trading parties and lists, describes, and quantifies the items sold, shows the date of shipment and mode of transport, prices and discounts (if any), and delivery and payment terms.

In certain cases (especially when it is signed by the seller or seller's agent), an invoice serves as a demand for payment and becomes a document of title when paid in full.

Invoices are generated in the ILS element, Supply Support.

4.3.17 LCC report

A LCC report summarizes the results of an LCC analysis for a Product or service.

The LCC Report is generated in the ILS element, Design Influence.

4.3.18 LORA report

The LORA Report summarizes the results of a LORA.

The LORA Report is generated in the ILS element, Maintenance.

4.3.19 LSA database

A Logistic Support Analysis Record (LSA database) is a database, which is used to record resultant data from the LSA process. It is used as the single source of information for the design and development of support resource requirements.

The LSA database is generated in the ILS element, Design Influence.

4.3.20 Maintenance concept

A Maintenance Concept is a statement of maintenance considerations, constraints, and strategy for the operational support that governs the maintenance levels and type of maintenance activities to be carried out for the Product/equipment under analysis.

The Maintenance Concept is generated in the ILS element, Maintenance.

4.3.21 Maintenance plan

The Maintenance Plan specifies when, where, and which maintenance tasks will be performed on the Product including both preventive and corrective maintenance. The purpose of the maintenance plan is to ensure that the Product can be maintained effectively and economically at the desired level of readiness after it is placed in operational use.

The Maintenance Plan is generated in the ILS element, Maintenance.

4.3.22 Maintenance report

A Maintenance Report documents a maintenance task and summarizes e.g. the performed corrective actions, used material or spares, test results or any other important data.

The Maintenance Report is generated in the ILS element, Maintenance.

4.3.23 Management report

The Management Report can be any official report generated by the Product Support Manager.

The Management Report is generated in the ILS element, Product Support Management.

4.3.24 Manpower & personnel report

The Manpower & Personnel Report defines personnel with the right skills and grades required to operate and support a Product over its lifetime or to provide a service.

The Manpower & Personnel Report is generated in the ILS element, Manpower & Personnel.

4.3.25 Manufacturing data

Manufacturing Data is defined as any recorded or documented information of a scientific or technical nature about the manufacturing of a Product whatever the format, documentary characteristics or other medium of presentation. The information can include, but is not limited to any of the following: experimental and test data, specifications, designs and design processes, technical descriptions and other works of a technical nature, semiconductor topography mask works, technical and manufacturing data packages, know-how trade secrets and information relating to industrial techniques.

4.3.26 MTA report

The MTA Report summarizes the results of a MTA.

The MTA Report is generated in the ILS element, Maintenance.

4.3.27 Obsolescence report

The Obsolescence Report summarizes the results of the obsolescence management (eg, survey data, risk analysis data and related recovery actions) or technology refreshment.

The Obsolescence Report is generated in the ILS element, Product Support Management.

4.3.28 PHS&T plan

The PHS&T plan identifies the program strategy for safely packaging, handling, storing, and transporting a Product or related material as well as any special requirements and interfaces with organizations responsible for transporting.

The PHS&T plan defines the resources, procedures, design considerations and methods necessary to ensure that all Product equipment and support items are packaged, handled, stored and transported properly and in conformance with appropriate legislation, particularly for hazardous materials and the project requirements. This also includes environmental limitations, equipment preservation requirements for short and long term storage and transport requirements.

The PHS&T plan is generated in the ILS element, PHS&T.

4.3.29 Preventive maintenance task requirements

The PMTR define and select the requirements for preventive maintenance tasks with intervals for systems, including installed components and equipment.

The PMTR are generated in the ILS element, Maintenance.

4.3.30 Procurement plan

The Procurement Plan defines the products and services that must be obtained from external suppliers and also describes the process to appoint those suppliers contractually. Generally the Procurement Plan defines the items that must be procured, defines the process for acquiring those items and finally, schedules the time frames for delivery.

The Procurement Plan is generated in the ILS element, Supply Support.

4.3.31 Provisioning data

Provisioning Data is defined as any recorded or documented information prepared expressly for the identification, description, installation location and verification of items, materials, supplies, and services that are to be purchased, inspected, packaged, packed and supplied, or delivered to users.

The Provisioning Data is generated in the ILS element, Supply Support.

4.3.32 Provisioning order

The Provisioning Order is a document that describes the required supplies or services so procurement can be initiated.

The Provisioning Order is generated in the ILS element, Supply Support.

4.3.33 Quotation

The Quotation is a formal statement of promise (usually submitted in response to a request for quotation) by a potential supplier to supply the goods or services required by a customer, at specified prices, and within a specified period. A quotation can also contain terms of sale and payment, and warranties.

The Quotation is generated in the ILS element, Supply Support.

4.3.34 RAMT reports

The RAMT Report summarizes the results of any analyses for reliability, availability, maintainability and testability. It can include the Capability of a Product.

The RAMT Report is generated in the ILS element, Design Influence.

4.3.35 SIA report

The SIA Report summarizes the results of software impact analysis of a Product, which identifies how software impacts on the product operation or maintenance.

The SIA Report is generated in the ILS element, Maintenance.

4.3.36 Specification

A specification is a document that defines, in a complete, precise, verifiable manner the requirements, design, behavior or other characteristics of a Product, result or service and the procedures for determining whether these provisions have been satisfied. Examples are: requirement specification, design specification, Product specification and test specification.

4.3.37 Spare parts list

The Spare Parts List (SPL) is a listing of spare parts mainly based on provisioning data charged with business data (eg, prices, contract numbers, effective/expiry dates). Its purpose is to enable customers and the contractors processing parts data without using complex provisioning processes by integration of the customer. It places negotiated parts data at customers' disposal (eg, for recording purposes of material) and enables material supply processes.

The SPL is generated in the ILS element, Supply Support.

4.3.38 Supplier data

Supplier Data is defined as any recorded or documented information provided by Supply Chain Management to support the ILS activities for a Product or for services.

4.3.39 Support concept

The Support Concept describes the scheme for logistics support, which is derived from the logistics support requirements. The concept is the basis for planning, executing and documenting the logistics support as well as for activation, use, maintenance/repair and disposal of a Product. It describes the required logistics resources.

The Support concept is generated in the ILS element, Product Support Management.

4.3.40 Support contract

A Support Contract is a contract for any service necessary to support and operate a Product.

A Support Contract is generated in the ILS element, Product Support Management.

4.3.41 Support equipment

Support Equipment can be all equipment (mobile or fixed) required to support the Operation and Maintenance (O&M) of a Product. This includes associated multi-use support items, ground-handling and maintenance equipment, tools, meteorology and calibration equipment, and manual/automatic test equipment.

The Support Equipment is provided by the ILS element, Support Equipment.

4.3.42 Support equipment plan

The Support Equipment Plan defines all Support Equipment. It also includes the acquisition of Logistics Support (LS) for the support equipment itself.

The Support Equipment Plan is generated in the ILS element, Support Equipment.

4.3.43 Support equipment report

The Support Equipment Report details necessary information about the acquired Support Equipment that is required to support and operate a Product.

The Support Equipment Report is generated in the ILS element, Support Equipment.

4.3.44 Supportability safety analysis report

The Supportability Safety Analysis Report summarizes the results of any analyses for safety of supportability task of a Product or service.

The Supportability Safety Analysis Report is generated in the ILS element, Maintenance.

4.3.45 Technical data package

A TDP is technical description of an item adequate for supporting an acquisition strategy, production, engineering, and Logistics Support. The description defines the required design configuration and procedures to ensure adequacy of item performance. It consists of all applicable technical information (eg, drawings, associated lists, specifications, standards, performance requirements, Quality Assurance (QA) provisions, Technical Publications, and packaging details).

A TDP is generated in the ILS element, Technical Data.

4.3.46 Technical publications

Technical Publications are manuals that contain instructions for the installation, operation, maintenance, training, and support of systems and support equipment. Technical Publications' information may be presented in any form or characteristic, including but not limited to hard copy, audio and visual displays, magnetic tape, discs, and other electronic devices. Technical Publications normally include operational and maintenance instructions, parts lists or parts breakdown, and related technical information or procedures exclusive of administrative procedures.

Technical Publications are generated in the ILS element, Technical Data.

4.3.47 Testability report

The Testability Report summarizes the results of any D&PHM analyses of a Product.

The Testability Report is generated in the ILS element, Maintenance.

4.3.48 TNA report

The TNA report summarizes the results of an analysis of the requirements for training concerning the operational and maintenance activities.

The TNA Report is developed in the ILS element, Training & Training Support.

4.3.49 Training course

A Training Course is one or a series of lessons to teach the skills and knowledge for a particular job or activity.

A Training Course is developed and conducted in the ILS element, Training & Training Support.

4.3.50 Training course report

A Training Course Report summarizes the results of a conducted training course.

A Training Course Report is developed and conducted in the ILS element, Training & Training Support.

4.3.51 Training equipment

Training Equipment is any hardware, software, multi-media player, projector, etc., used in a training process.

The Training Equipment is defined in the ILS element, Training & Training Support.

4.3.52 Training equipment report

The training equipment report defines the qualitative and quantitative requirements for training equipment.

The training equipment report is developed in the ILS element, Training & Training Support.

4.3.53 Training plan

The training plan defines qualitative and quantitative requirements for the training of operating and support personnel throughout the life cycle of the Product. It includes requirements for:

- Competencies management
- Factory training
- Instructor and key personnel training
- New equipment training team
- Resident training
- Sustainment training
- User training
- HAZMAT disposal and safe procedures training

The training plan is developed in the ILS Element, Training & Training Support.

4.4 Tailoring

4.4.1 Introduction

Tailoring is fundamental to the cost effective application of ILS on a project. It is the process of identifying the range and depth of ILS activities that should be carried out and depends on the scope, size, complexity, life cycle phase and contractual arrangements of a project.

4.4.2 Factors affected tailoring

Factors that need to be taken into consideration in the tailoring process include:

- Type of program (national or multinational program)
- Nature of project (civil or military project)
- Phase of the project (Preparation Phase, Development Phase, Production Phase, In Service Phase, and Disposal Phase)
- Type of project (new item, modified item, existing item, leased item)
- Cost limitations
- Time and resources available
- Amount of design freedom involved
- Data availability and relevancy
- Work already completed on the project
- Past experience and historical data on comparable projects
- Estimated return on investment
- Contract agreement

4.4.3 Tailoring process basic activities

Tailoring is an iterative process that applies to all the elements detailed in the ILS plan.

The major factors to be considered are:

- ILS activities
- Output
- Input
- Resources

These factors result in four key tailoring activities:

- Identifying project mandatory ILS activities
- Cost analysis and budget allocation to meet mandatory activity costs
- Identification and costing of additional ILS activities in terms of added value against cost
- Overall ILS project acceptance

4.4.4 Main ILS tailoring procedure

Fig 15 shows how the ILS process can be tailored.

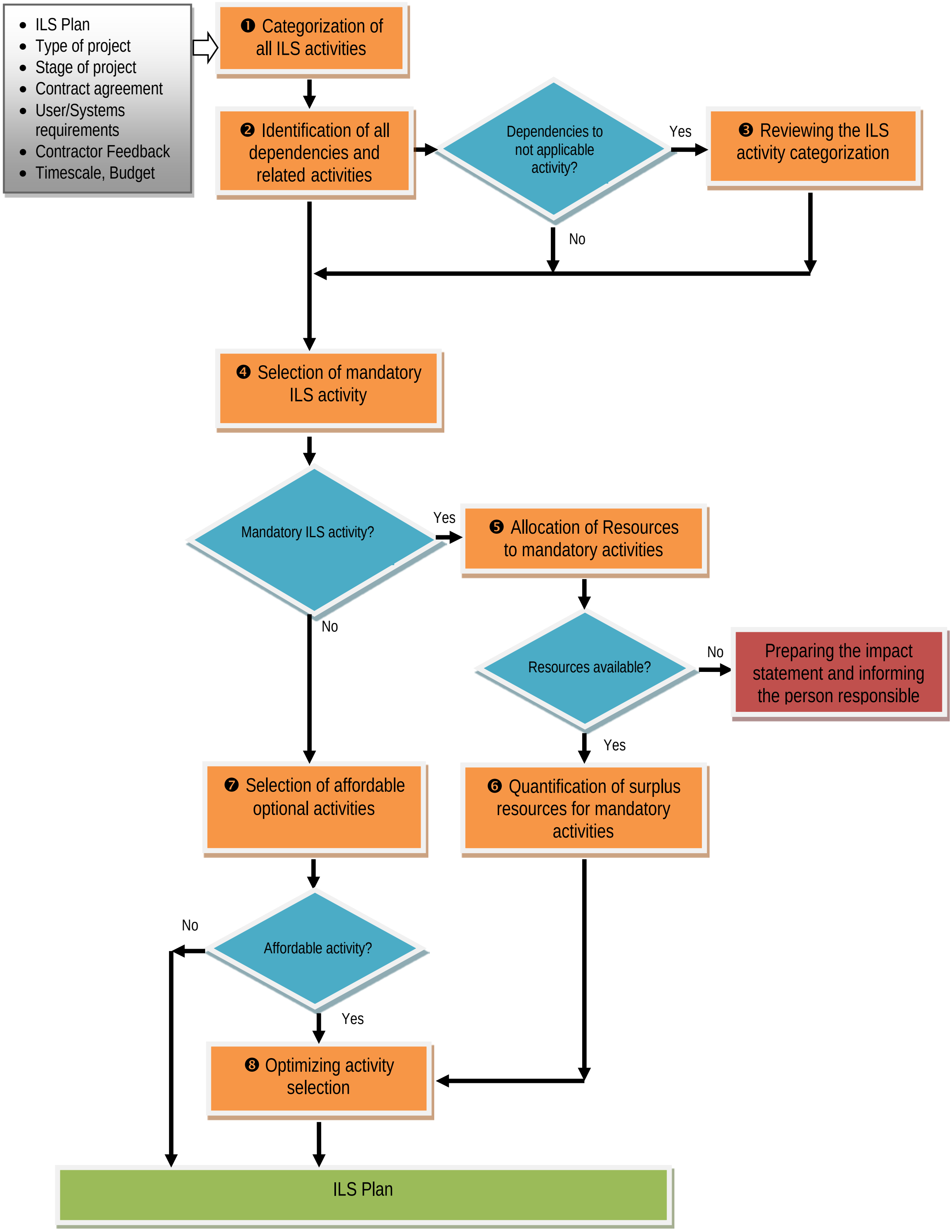

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Fig 15 Main ILS tailoring procedure

The individual steps of the tailoring procedure can be described as follows:

- ❶ Categorization of ILS activities. In accordance with the project constraints and ILS requirements, all activities on the ILS plan will be categorized as:

  - Mandatory
  - Optional
  - Not Applicable

  Note

  The ILS plan details all ILS activities and therefore includes the preparation of concepts, plans and reports, the acquisition of all data, all analyses and the modification of data bases related to the ILS program.

- ❷ Identification of all dependencies and related activities. The ILS activities identified as mandatory and optional activities from the ILS plan should be examined and their dependent and related activities should be shown, where relevant against WBS activities.
- ❸ Reviewing the ILS activity categorization. Where dependencies to activities identified as Not Applicable are shown, the activity categorization should be reviewed. The tailoring task can then recognize instantly the implications of not doing a particular activity.
- ❹ Selection of mandatory ILS activity. Selection of all the activities detailed in the ILS plan which are mandatory ILS activities for the project, under the given project and project ILS constraints.

  Note

  All stakeholders should be identified and a subjective assessment made of the impact of other project activities (eg, design and production) on the ILS scope of activities.

- ❺ Allocation of resources to mandatory activities. The estimated resources required to perform the ILS activity will be identified and compared with available resources. The balance of available resources will be quantified and used as a constraint for the optional activities. All ILS plan activities categorized as not applicable should be archived along with reasons and mitigating comments and justifications.
- ❻ Quantification of surplus resources for mandatory activities. The balance of available resources will be quantified and used as a constraint for the optional activities.
- ❼ Selection of affordable optional activities. The estimated resources required to perform the further consideration activities will be identified. The cost of doing each optional activity is to be compared to the available surplus resources.

  Note 1

  The possible benefits of undertaking each activity, in comparison with the required and available resources and the allocated priority levels will be evaluated

  Note 2

  The stakeholders will consider the final selection of affordable activities previously categorized as optional.

- ❽ Optimizing ILS activity selection. The ILS plan will have been updated at all stages of the tailoring procedure, consolidating all ILS activity information. The output will be a project specific ILS plan.

End of data module

Chapter 3

Use of the S-Series ILS specifications in an ILS program

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References

Table 1 References

Chap No./Document No.	Title
Chap 1	Introduction to the specification
Chap 2	Integrated Logistics Support framework
S1000D	International specification for technical publications using a common source database
S2000M	International specification for materiel management
S3000L	International procedure specification for Logistics Support Analysis (LSA)
S4000P	International specification for developing and continuously improving preventive maintenance
S5000F	International specification for in-service feedback
SX001G	Glossary for the S-Series ILS specifications

Chap No./Document No.	Title
ISO 10303:239 PLCS	Product Life Cycle Support (PLCS)

1 Introduction

The successful operation and use of a Product, depends to a great extent on diligent planning, proper management and successfully providing logistics support to achieve the required level of performance throughout the entire Product life cycle.

This chapter provides guidance, for the utilization of defined Integrated Logistics Support (ILS) processes and specifications, to satisfy specific business requirements. It explains how the processes and specifications interface and relate with other life cycle domains, ILS elements and ILS activities along the life cycle of a Product.

1.1 Objective

This chapter provides an explanation how to apply the S-Series ILS specifications in an ILS program. It provides a set of suitable ILS activities to enable a standard-based communication and information/data exchange among involved stakeholders to achieve the main ILS objectives: design the Product for optimal support, initiate the most cost-efficient support solution, acquire and provide the support for the Product.

It provides guidelines for an appropriate tailoring to achieve an efficient and cost effective Product support that reflects the specific Product needs and application.

The support arrangements can range from informal agreements up to formal contracts.

1.2 Scope

This chapter is directed to Project Managers (PM) and ILS managers on the customer and contractor side.

This chapter comprises to all types of Products, like a one-of-a-kind Product, like mass-produced Products, adapted or customized ones. It also comprises to stand-alone Products and to Products to be embedded or integrated into larger systems.

The scope of this chapter applies to the entire Product life cycle starting with the first preparation phase until the final disposal phase (for exclusions, refer to Chap 1).

It is focused on S-Series ILS specifications including links to the life cycle domains.

2 Interfaces of the S-Series ILS specifications

This chapter explains where the connecting points are and what benefits can be achieved by using the S-Series ILS specifications in relation to the operational in-service support activities and associated ILS elements, with the goal to optimize the usage and the support system of any Product in operation.

The interdisciplinary character of supportability is highlighted through the next paragraphs for each of the ILS specifications.

2.1 S1000D

S1000D is an international specification for the production, distribution and management of technical publications and learning content. It can support any type of land, sea or air product (including both military and civil products) throughout their life cycle.

Information produced in accordance with S1000D is created in a modular form, in eXtensible Markup Language (XML) files called data modules. A data module is defined as “the smallest self-contained information unit within a technical publication". These are of such granularity that the data module can stand alone and still make sense.

A data module contains the following information:

- An identification and status section with all management information. The identification and status section contains metadata about the data module. The structure of the identification section is identical in all data modules and elements within that section are used by a Common Source Database (CSDB) to manage the technical publications being produced.
- A content section, which is different, depending on the data module type.

The use of S1000D must have the following objectives:

- Uniformity of the structures and data formats
- Durable, electronic, media-free, easy to change data, independent representation
- Platform independent, civilian and military
- International association of the industry and clients
- No unnecessary data processing, significant cost savings

Technical publications that are produced in accordance with S1000D are distributed as either page oriented (paper, PDF, etc) or in an on-screen format (Interactive Electronic Technical Publications, IETP) from the same data modules. The contents of the IETP are in small reusable information units (modules completed) divided so-called data modules that are managed by means of a unique key (the Data Module Code, DMC) in the database and are available for direct access.

The purpose of this modularization and database storage is both a procedural and an IT technical optimization of data that will ensure:

- Purely electronic entertainment (free of media breaks)
- Small amount of redundancy in the data documentation
- Massive support in the search for information
- Low maintenance requirements (change management by simple database update)
- Active support for troubleshooting

S1000D is not a software specification. Its focus is solely on the data. However, there are three main components of S1000D compliant software:

- CSDB management software
- Publishing software
- Viewer (for the IETP)

Since the data itself is S1000D compliant, any CSDB, publisher and viewer should be able to manage, publish and display the data without changing that data.

2.1.1 Domains

The mapping of S1000D to specific domains is shown in Fig 1.

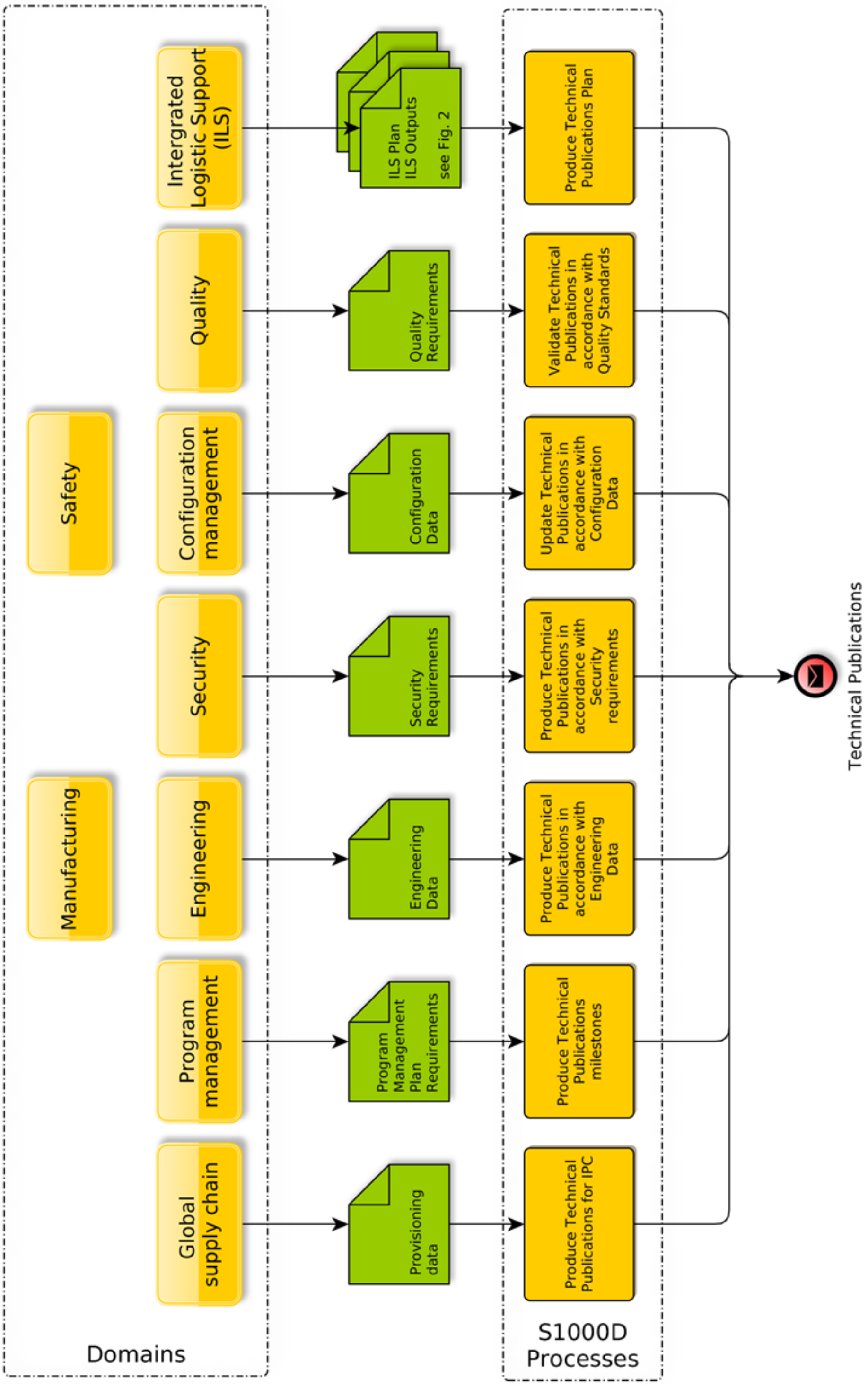

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Fig 1 Mapping of S1000D business process interfaces with specific domains

2.1.1.1 Global supply chain

The provisioning data generated by the global supply domain, contains information for the identification, description, and verification of items, materials, supplies, and services that are to be purchased, inspected, packaged and supplied, or delivered to users.

This information is generated in accordance with S2000M, which, among other things, defines the structure of the data. Since this structure is identical to S1000D IPD data modules, the data can be mapped directly and published as an Illustrated Part Data/Catalog that maintainers use as a common reference for identification of items used in maintenance procedures.

2.1.1.2 Program management

The program management plan generated by the program management domain and is used to define the technical publication program plan and corresponding milestones affected by the process.

2.1.1.3 Engineering

This interface between engineering and technical publications is related to the review of drawings and/or 3D models, specifications, or any other documentation from the engineering domain, in order to obtain adequate information suitable to produce technical publications to support the description, operation and maintenance of the Product.

2.1.1.4 Security

The security requirements generated by the security domain, identifies the process to protect the Product or its associated information against any harm due to unauthorized access or manipulation.

The data modules generated in accordance with S1000D contain the security information appropriate for the content of the data module, in the data module's identification and status section.

2.1.1.5 Configuration management

The configuration data generated by the configuration management domain includes the detailed recording, updating and control of information that describes an enterprise's hardware, software and data.

This interface refers to the implementation and control of the different Product configurations within the technical publication, at the beginning of the Product's life cycle. In the beginning, it must be taken into consideration the "as delivered" Product must be considered in the "as delivered" configuration in accordance with the production baseline build standard configuration. After that, there will be a delta build standard to be taken into account, where retrofit, modifications or service bulletin information will be incorporated into the technical publications.

2.1.1.6 Quality

The quality requirements generated by the quality domain ensure that the customer's requirements, enterprise's, national and international regulations for a Product or service are met during the life cycle.

This interface is intended to collect all checking activities that are carried out to ensure that the contents are safe to use, fit for purpose and technically accurate. These checking activities can vary between land, sea and air projects.

The technical publications produced in accordance with S1000D contain specific quality statements that give the quality status in each data module.

2.1.1.7 ILS

The ILS domain provides a series of outputs that are essential for the preparation of technical publications. Refer to Para 2.1.2.

2.1.2 ILS elements

The interface between S1000D and the ILS elements is shown in Fig 2.

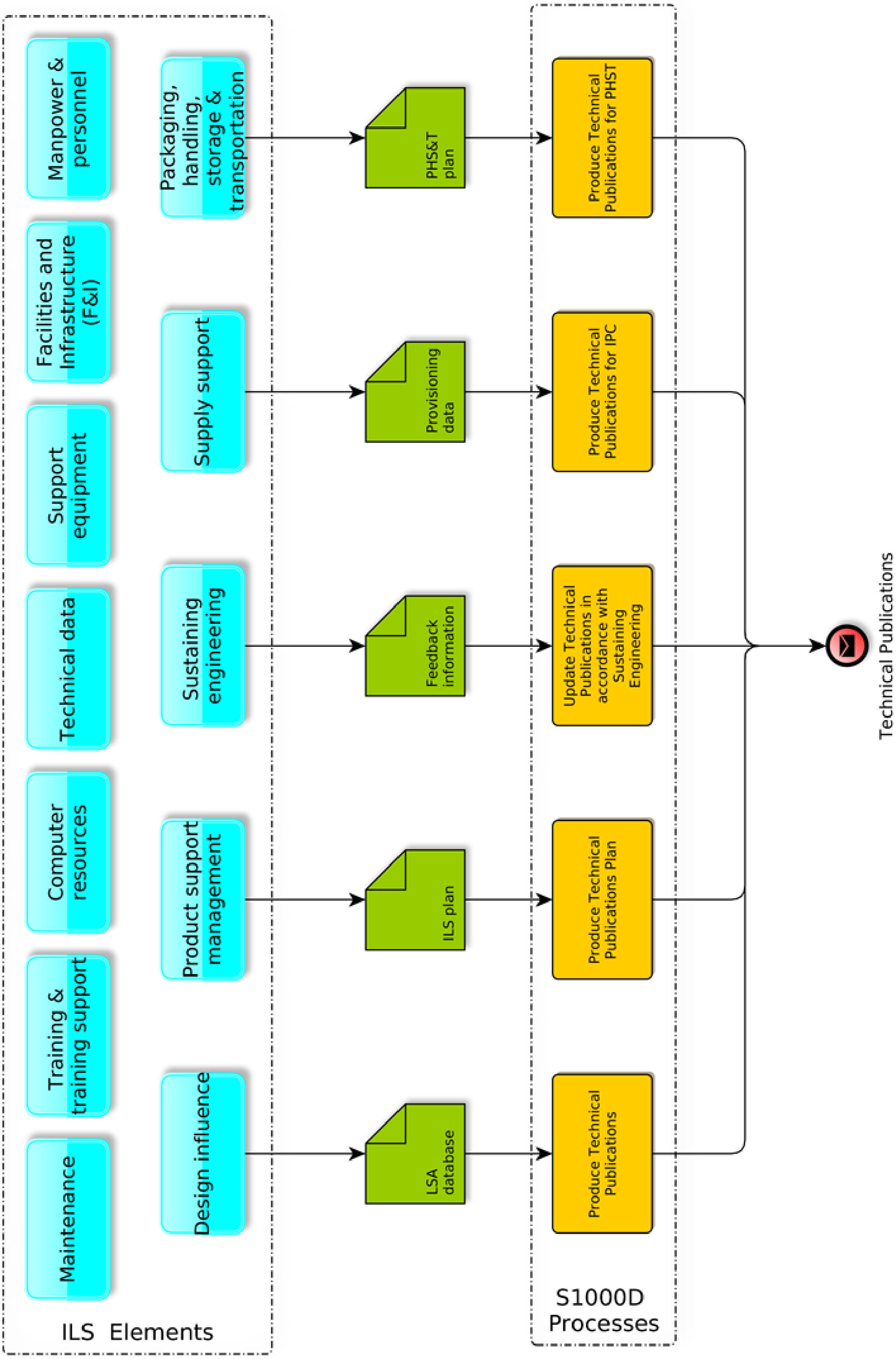

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Fig 2 S1000D business process interface with ILS elements

2.1.2.1 Design influence
The LSA database generated by the design influence ILS element, comprises the LSA database, and is used as the single source of information for the production of technical publications related to maintenance procedures. The LSA database is considered the single entity for storing all logistics data that is routed to all ILS elements and domains.

The LSA database contains configuration data, Level of Repair Analysis (LORA) and Maintenance Task Analysis (MTA) reports, Supplier data, maintenance concept and maintenance plans, fault diagnosis information, facilities and infrastructures reports, preventive and corrective maintenance tasks, etc.

These data elements stored in LSA database (from S3000L activities) can be directly translated to S1000D technical publications data elements contained in data modules, ensuring data consistency and optimizing Life Cycle Costs (LCC).

2.1.2.2 Product support management
The ILS plan generated by the Product support management element, is the primary document that details the ILS needs of a specific system or service. The ILS plan includes detailed information for the planning, implementation and co-ordination of all ILS elements.

This plan is used to setup a specific, low-level technical publication plan that includes the definition of the specific milestones and the related achievement reports.

2.1.2.3 Sustaining engineering
The feedback information generated by the sustaining engineering element summarizes the result of a technical analysis of feedback data for a system or service.

This feedback can be processed directly thru the technical publications Change Proposal Form (CPF) process or integrated into other ILS element's deliveries.

2.1.2.4 Supply support
The provisioning data generated by the supply support element, contains information for the identification, description, and verification of items, materials, supplies, and services that are to be purchased, inspected, packaged and supplied, or delivered to users.

This information is generated in accordance with S2000M, which, among other things, defines the structure of the data. Since this structure is identical to S1000D IPD data modules, the data can be mapped directly and published as an Illustrated Part Data/Catalog that maintainers use as a common reference for identification of items used in maintenance procedures.The IPD/IPC technical publication also provides a common reference for identification of items used in maintenance procedures.

2.1.2.5 Packaging, handling, storage and transportation
The Packaging, Handling, Storage and Transportation (PHS&T) generated by this ILS element identifies the project strategy for safely packaging, handling, storing, and transporting a Product or related material as well as any special requirements and interfaces with organizations that are responsible for transportation.

This information is stored in S1000D data modules and distributed to final users.

2.1.3 ILS specifications

The interface of S1000D to other S-Series ILS specifications is shown in Fig 3.

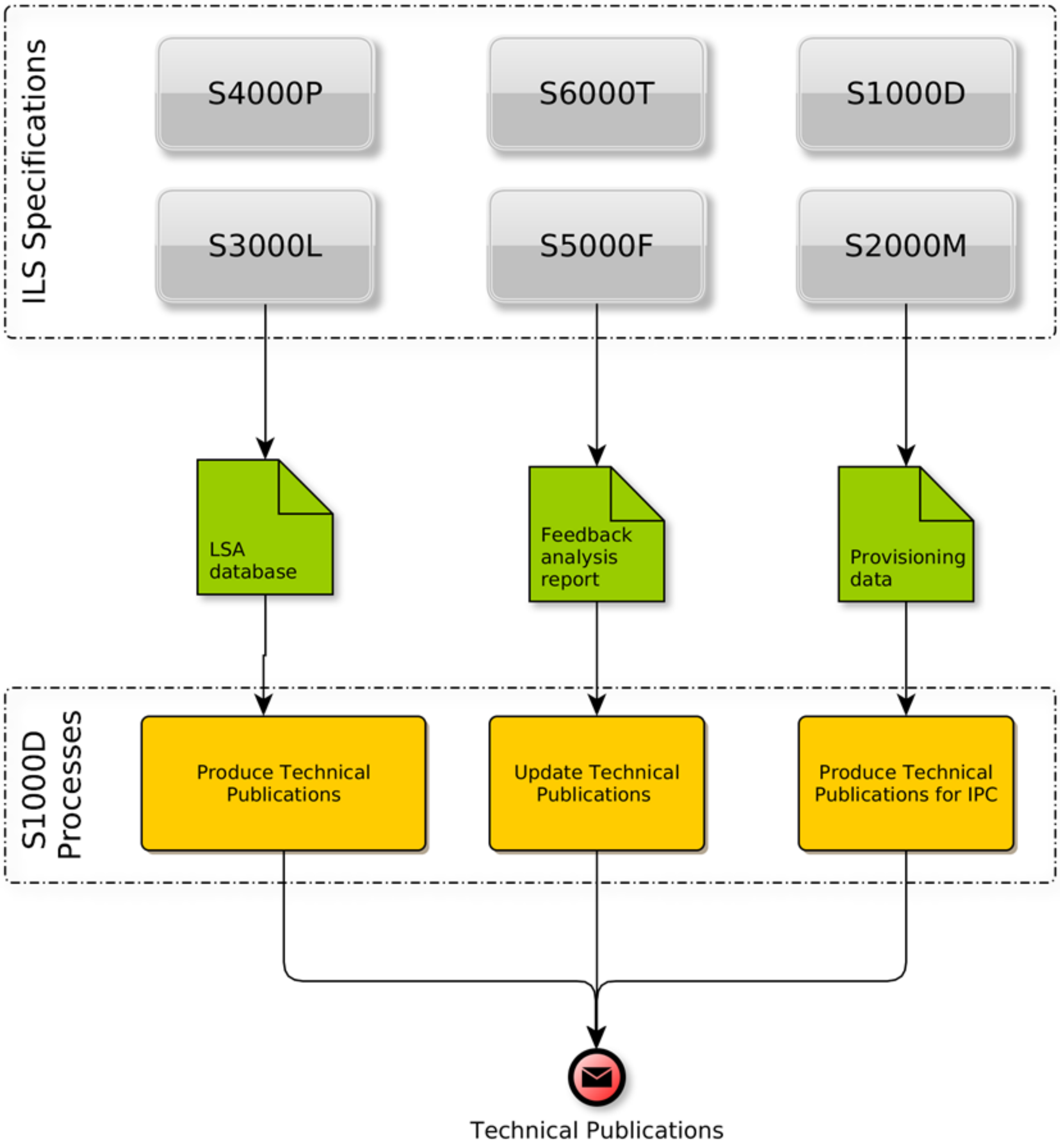

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Fig 3 S1000D business process interface with other S-Series ILS specifications

2.1.3.1 S2000M

The S2000M interface provides provisioning data and illustrations to produce the IPD/IPC, as a technical publication, defined by the S1000D process.

The provisioning data generated and stored in accordance with the S2000M process can be translated directly into S1000D Data Modules, ensuring data consistency and optimizing LCC.

2.1.3.2 S3000L

The S3000L interface provides the LSA database, which is used as the single source of information for the production of technical publications related to both preventive and corrective maintenance procedures that can be mapped to S1000D data modules, ensuring data consistency and optimizing LCC.

2.1.3.3 S5000F

The interface with S5000F includes the feedback information that is used to update the technical content of the technical publications. The feedback can be translated into CPF or used in other sources of authorised information used by the technical publications production process, even though there is not a direct and specific interface defined between the two specifications

2.2 S2000M

S2000M originally defined the materiel management processes and procedures to be used in support of aircraft and other aerospace airborne and ground equipment supplied to military customers. S2000M also included the business processes and data requirements applicable to any military Product. Although S2000M was designed for military Product support, it can be used to support any other land sea or air Product.

The processes described within S2000M cover the interfaces between the contractor and the customer, which, based upon contractual agreements, provide the typical deliverables of the logistics materiel management:

- Initial Provisioning Lists (IPL)
- NATO codification (the allocation of NATO Stock Numbers (NSN) in military projects)
- Illustrated Parts Catalogue (IPC)
- Procurement planning (including prices)
- Order administration (material spares services)
- Invoicing

The contract general terms, as related to the deliverables and procedures of logistics material management are summarized in Fig 4.

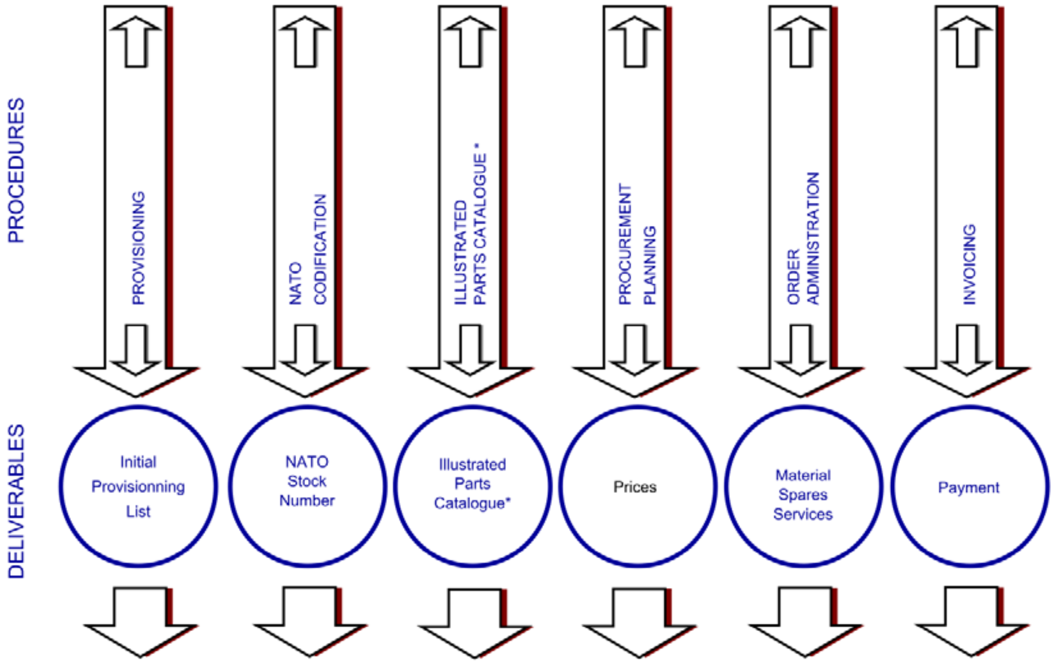

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Fig 4 Deliverables and procedures of logistics material management

Note: The Illustrated Parts Catalogue (IPC) is covered under S1000D.

It is intended that S2000M must be the common material support specification used by governments, procurement, support agencies, and industry.

By agreement between customer and industry, S2000M requirements can be supplemented by additional international or national requirements for specific projects.

2.2.1 Domains

The mapping between S2000M and other domains is shown in Fig 5.

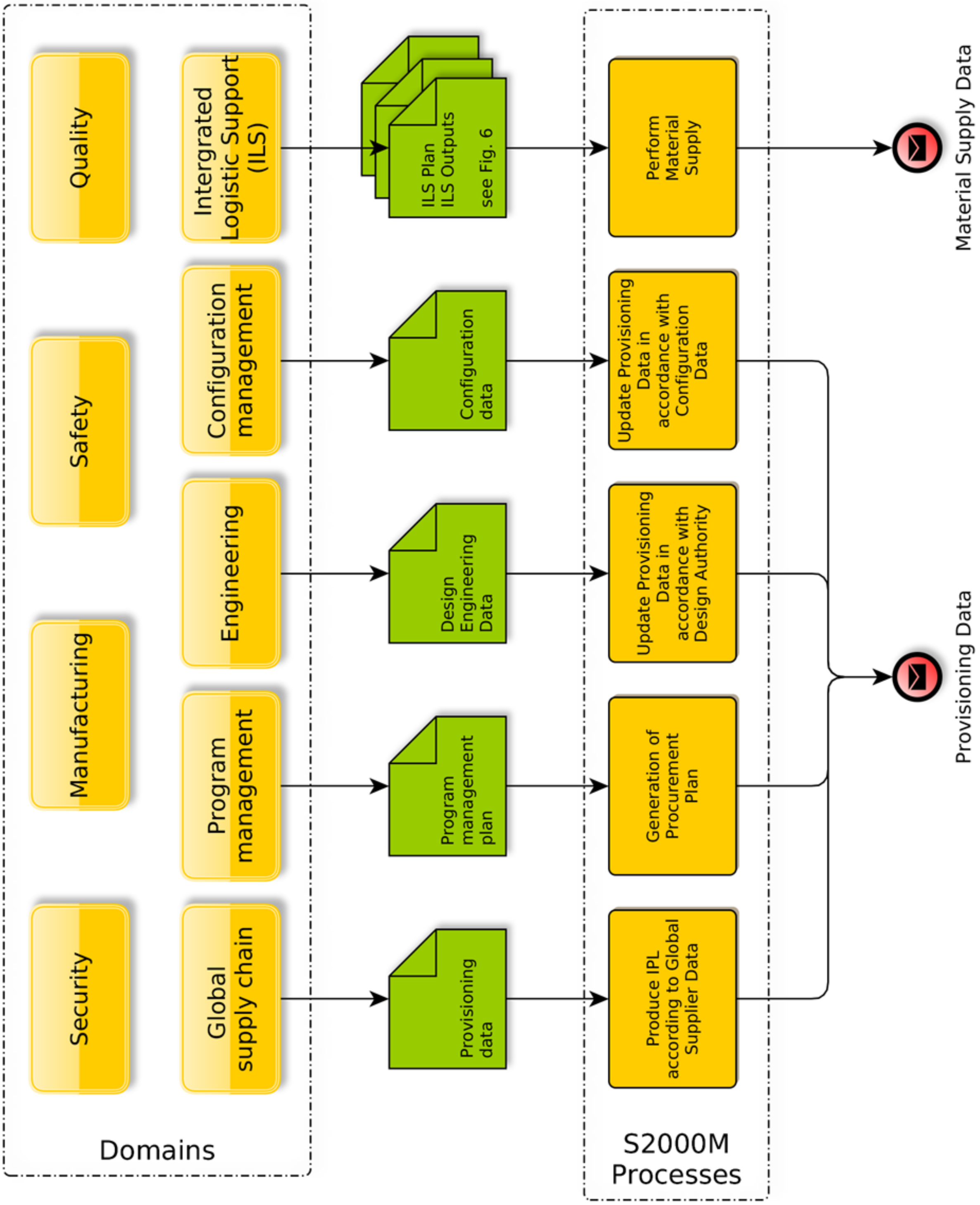

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Fig 5 S2000M business process interface with domains

2.2.1.1 Program management

The program management plan generated by the program management domain is used to define the provisioning program plan and associated milestones as defined by the S2000M process.

This plan includes the schedule for providing provisioning data in order to meet the date for its entry into service.

2.2.1.2 Engineering

This interface is related to the review of drawings and/or 3D models, specifications, or any other documentation from an engineering domain in order to support the maintenance levels defined by LSA database.

This information is used to create the logistics configuration, and spares breakdown that enable material supply to be carried out.

2.2.1.3 Configuration management

The configuration data generated by the configuration management domain includes the detailed recording, updating and control of information that describes hardware, software and data.

This interface covers the complete life cycle of the Product and includes the embodiment and control of all modifications, developed by design that will affect the logistics configuration and therefore the materiel support requirements, equipment spares and breakdown spares supplies.

2.2.1.4 Global supply chain

The provisioning data generated by the global supply chain domain contains supplier information related to identification, description, and verification of items, materials, supplies, and services that are been used to generated initial provisioning data to order and deliver to users.

The complementation of this information is used to perform the material supply and is utilized by S1000D to create the IPC.

2.2.1.5 ILS

The ILS domain provides a series of outputs that are essential for the preparation of material

2.2.2 ILS elements

The interface of S2000M to the ILS elements is shown in Fig 6.

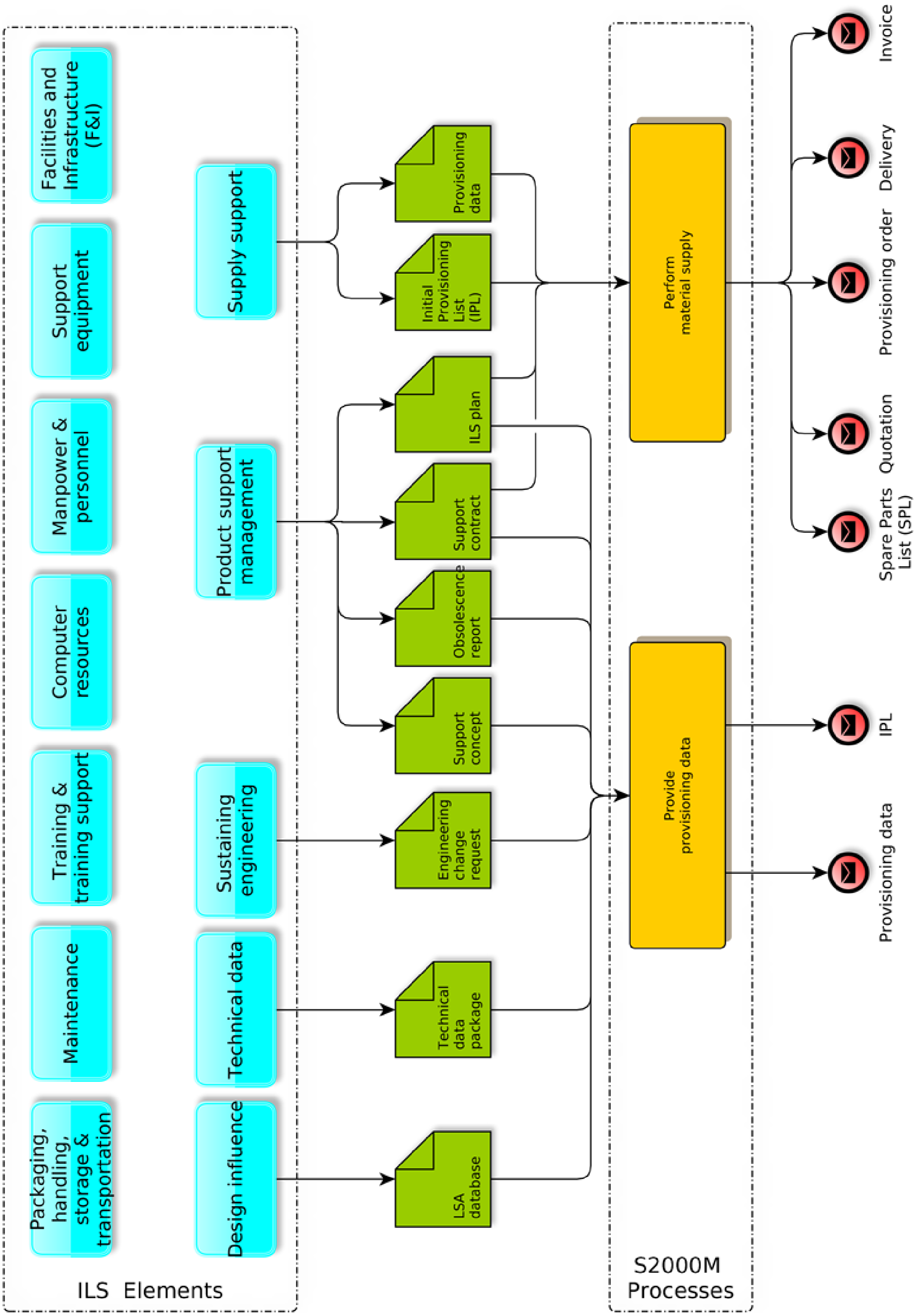

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Fig 6 S2000M business process interface with other ILS elements

2.2.2.1 Design influence
The design influence element is the major source of information to generate the LSA database. Refer to Para 2.1.2.1.

This information is used to compile all the provisioning data that is necessary for generating initial provisioning information.

2.2.2.2 Product support management
The Product support management element details the ILS needs of a specific system or service.

The relevant outputs of this ILS element used for the provisioning data activities are the:

- ILS plan, which includes detailed information for the planning, implementation and co-ordination of all the remaining ILS elements
- support contract
- support concept
- obsolescence report

The ILS plan and the support contract provides information that is necessary to perform material supply and its outputs ie, spare parts list, quotation, provisioning order, deliveries and invoices.

2.2.2.3 Technical data
The technical data package is the input required from the technical data element, which includes supplier data and PHS&T data and are the core data used to define the structure of the breakdown spares, modifications and their applicability.

All this information is used to develop the provisioning data and associated documentation.

2.2.2.4 Sustaining engineering
The sustaining engineering element refers to the engineering change data necessary to perform provisioning data activities and their associated documentation.

2.2.2.5 Supply support
The provisioning data generated by the supply support element, contains information for the identification, description, and verification of items, materials, supplies, and services that are to be purchased and delivered to users.

The major inputs to perform the material supply activity are the:

- provisioning data
- supplier Data
- IPL

This information generated in accordance with the S2000M process, is the basis for the provision of the spare parts list, quotation, provisioning order, deliveries and invoices to users.

2.2.3 ILS specifications
The interface of S2000M to the other S-Series ILS specifications is shown in Fig 7.

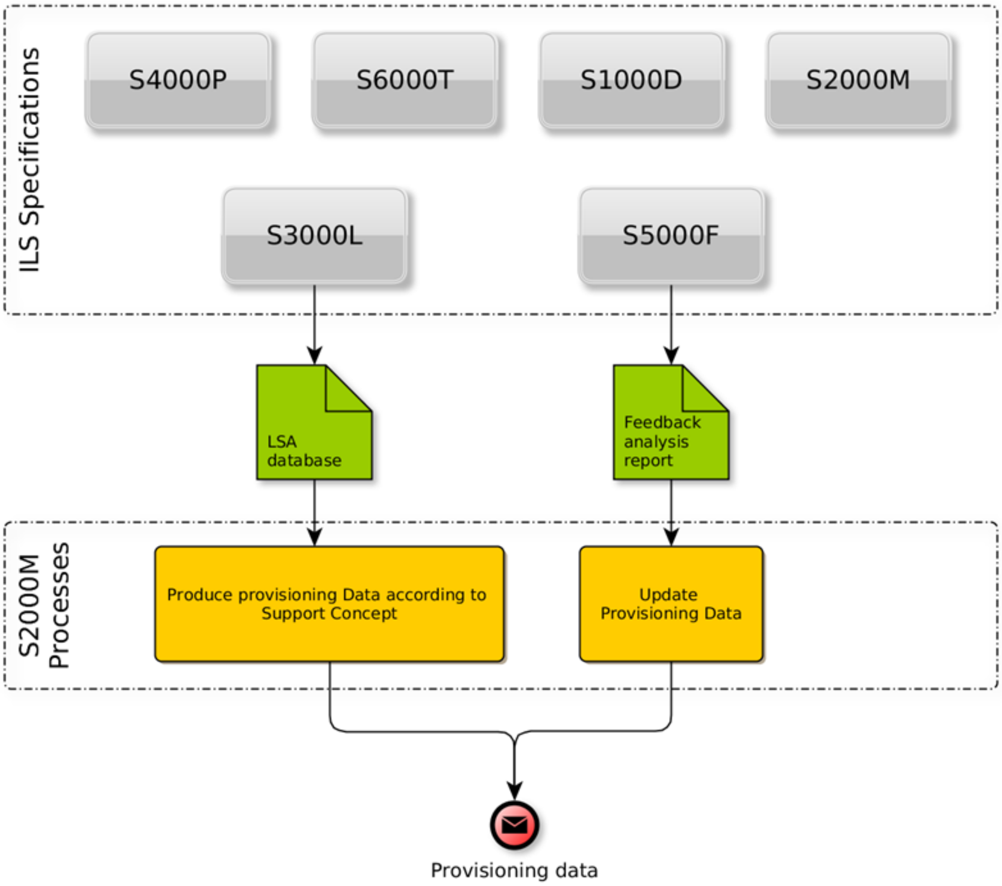

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Fig 7 S2000M business process interface with other S-Series ILS specifications

2.2.3.1 S3000L

S3000L provides the LSA database to the S2000M process, which is used as the major source of information through the:

- PHS&T requirements
- facilities and infrastructures report
- manpower and personnel report
- MTA report
- maintenance concept

2.2.3.2 S5000F

The interface with S5000F is defined through the feedback information, which is used to update the technical content of the provisioning data, Mean Time Between Failure (MTBF), etc.

2.3 S3000L

S3000L must not be considered as a standalone specification.

LSA is a crucial process to guarantee a proper implementation of the principles of ILS. It is the principal tool to:

- design products relevant to Reliability, Availability, Maintainability, Testability and Safety (RAMTS) and to optimize life cycle costs
- define and develop all required resources to support the Product in its intended use during in-service operation

- keep traceability of content of the ILS end-products back to the justifying analysis results in the area of support engineering during the complete life cycle of the Product
- define the processes, general requirements and related information exchange governing the performance of LSA during the entire life cycle of complex technical Products
- provide rules for the use of the Product breakdown for logistics purposes and for the selection of LSA candidate items
- describe type and methodology for performance of the specified technical/logistics analyses
- provide guidelines on how to process the results of the analysis tasks and on how to achieve a cost efficient support solution
- cover the interface between LSA and the support engineering functions (eg, reliability, maintainability and testability)
- cover the interface between LSA and the ILS elements

The procedures for performing the technical/logistics analysis activities (eg, performing a Preventive Maintenance Analysis (PMA) or performing a LORA) are documented and integrated into the LSA process, in accordance with S3000L and S4000P, respectively. These two specifications are closely interrelated. For example, the results of a PMA are documented in the LSA database in the form of Preventive Maintenance Task Requirements (PMTR). Based on the PMTR, S3000L conducts an MTA to develop the actual preventive maintenance task.

This close relationship between the two specifications enable traceability for each preventive maintenance activity, from the in-service phase, where the task is performed, to LSA and then back to the support engineering analysis results.

The same is true for unscheduled maintenance activities (eg, repair after failure or specific operational activities). Justifying events or requirements and the corresponding tasks are documented during the LSA process. Finally, only the complete view on the entire maintenance concept (preventive, unscheduled and operational) guarantees the realization of an optimized and harmonized support concept.

Due to the content of S3000L, which describes the process to define the support system for the operation of technical Products, the feedback from operation to S3000L is also related to the suitability of the identified and realized support system.

The entire feedback process showing the position of the S-Series ILS specifications, indicated by their symbols, and the several feedback paths to the different areas of design, support engineering and logistics, is shown in Fig 8.

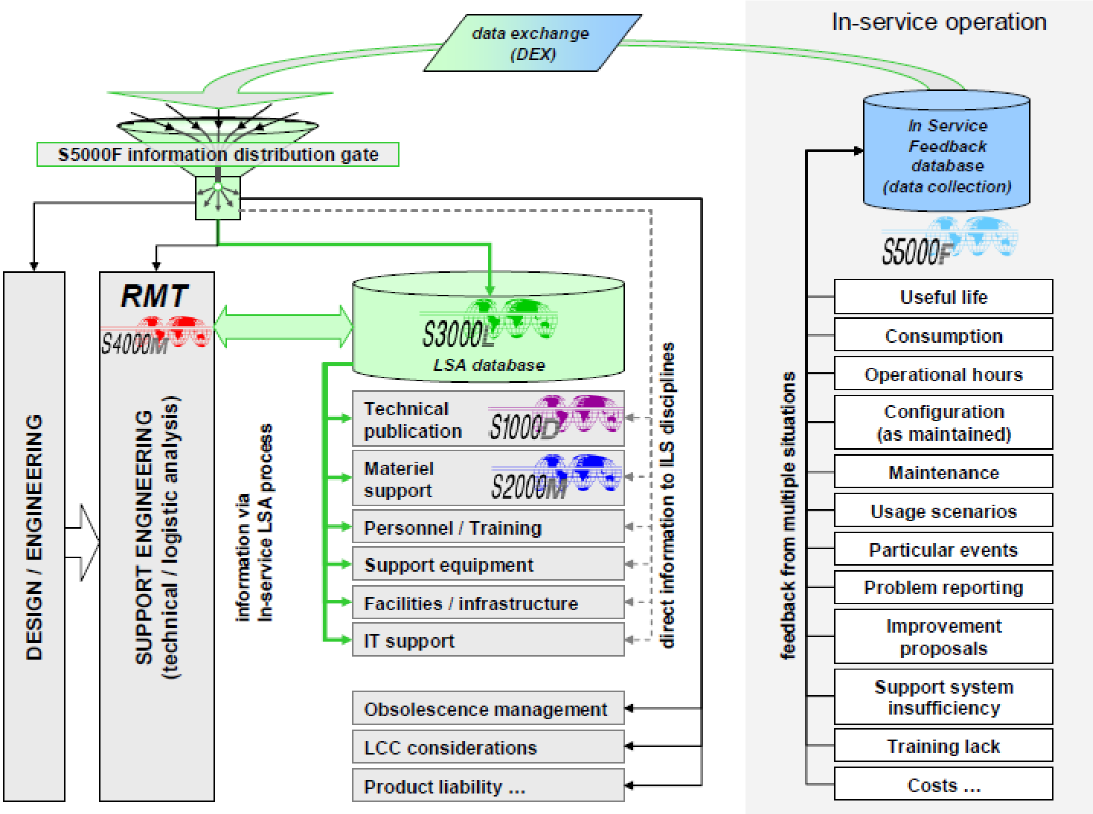

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Fig 8 In-service data analysis process as an example of S3000L feedback

The S-Series ILS specifications guarantee a harmonized maintenance and a systematic step-by-step extension, as required by the specifics of the project, to cover the major support functions of the Product life cycle.

The LSA process is central, because the entire ILS process is controlled by the mechanism of LSA. All information concerning functionality and effectiveness of the established support system is forwarded to the LSA, because all information concerning the maintenance concept is stored in the LSA database.

Additionally, relationships are established from LSA to the technical and logistics analysis activities within the support engineering function (eg, RAMTS).

During the entire life cycle of a Product, feedback information is used to improve the operability and the maintainability. Optimization is an ongoing challenge especially for complex and long living Products.

All information, which is directly related to the maintenance activities, is part of the in-service phase of the LSA process during the entire life cycle of a Product. The embodiment of the support system can be influenced significantly by in-service feedback.

2.3.1 Domains

The mapping of S3000L to specific domains is shown in Fig 9.

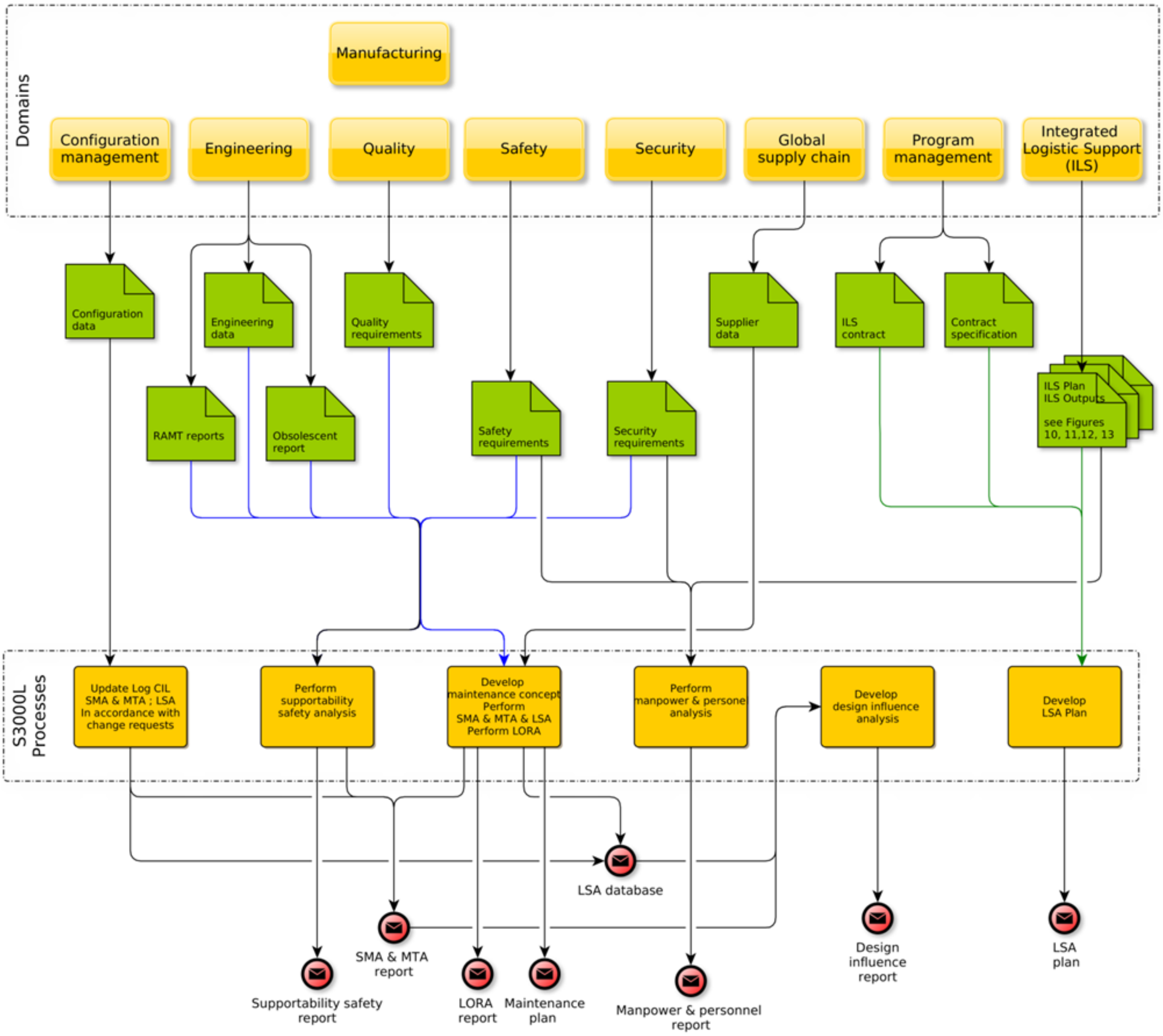

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Fig 9 S3000L interfaces with other domains

2.3.1.1 Supplier data

Suppliers are an integral part of the support, especially major suppliers within the project, must be integrated in the ILS process.

The prime contractor, which is in charge of executing the program, will integrate as much of the ILS program with suppliers as is practical, consistent with the suppliers' capability and in line with customer requirements.

The prime contractor conducts ILS procurement reviews at an ILS supplier's conference to evaluate candidate suppliers based on their logistics and supportability program capability. This effort, similar to a source selection evaluation, surveys suppliers to verify that are capable of providing the support necessary to satisfy ILS plan and project requirements.

The LSA process is tailored according to customer requirements as part of the ILS process for any project. S3000L describes the LSA process, which allows tailoring of LSA to ensure that support requirements from Customer are satisfied.

2.3.1.2 Engineering

Contractor objectives for the integration of supportability into the systems engineering process ensures that the traditional design process, and reliability and maintainability engineering are employed in the design-for-support parameters of the ILS program support system. This objective is part of the overall project management objective to:

- achieve operational availability and readiness thresholds
- achieve reliability and maintainability thresholds necessary to meet these objectives
- assign appropriate priorities to supportability requirements in system design trade-offs
- identify support and associated resources drivers

LSA interfaces with engineering in order to obtain engineering drawings and/or 3D models to produce maintenance tasks and identify support resources. Specifications and other engineering documents provide RAMTS requirements necessary to ensure that customer requirements are met.

Systems engineering is the application of scientific and engineering resources to:

- transform the operational need into a system configuration, which meets effectiveness standards
- integrate related technical parameters and assure compatibility in a manner, which optimizes the system’s design
- integrate the efforts of all engineering aspects into the integrated Product development systems engineering process

2.3.1.3 Configuration Management

Configuration Management (CM) ensures the correct identification and version of the configuration. It controls changes, and records the change implementation status of the physical and functional characteristics of the Product.

CM is performed at the lowest level of the breakdown of a Product. It identifies what is required, designed, produced and supported, and evaluates changes, including effects on technical and operational performance and ILS activities. It also provides visibility of the configuration.

The elements of CM include:

- configuration management planning
- configuration identification
- configuration control
- configuration accounting
- configuration verification and audit

The interface between CM and LSA provides the implementation and control of the different Product configurations and generation of Product breakdown, at the beginning of the project and throughout the life cycle of the Product. It also provides the implementation of changes, according to design, affecting supportability requirements.

2.3.2 ILS elements

In order to establish the most effective paths and interfaces of LSA, consideration must be given to:

- the numerous LSA interfaces/inputs of the majority of the ILS elements
- the variety of analysis and derived outputs that are impacting the overall ILS functions of the process
- the need to highlight and reflect the influence of the LSA results on design engineering and vice versa
- the impact of the LSA outputs on the in-service phase of the support and operation of the Product

All these considerations must be taken into account in the generation of the following charts to reflect in a clear way the most relevant paths and interfaces of the S3000L specification process.

The interfaces between S3000L and other ILS elements are given in Fig 10 thru Fig 13 and show a complete end-to-end approach in the areas of:

- Influence on design. These are outputs that influence the design with respect to the concept of design for support of a Product in terms of reliability, availability, testability, etc, and to enhance supportability in terms of standardization, interchangeability, human factors, etc, to achieve cost effectiveness.
- Maintenance. Maintenance is the main ILS element with respect to the S3000L process activities. It covers LSA activities that define the required capabilities and resources to support and maintain a Product in its intended use during the in-service phase.
- Facilities, and manpower and personnel. These are activities are not directly related to the system analysis but are essential to support the execution of maintenance and operation during the in-service phase of the life cycle of the Product.
- Sustaining engineering. This provides feedback information, evaluations and recommendations to design in the form of engineering changes that address any design shortfalls or that enhance supportability design factors.

2.3.2.1 Influence the design

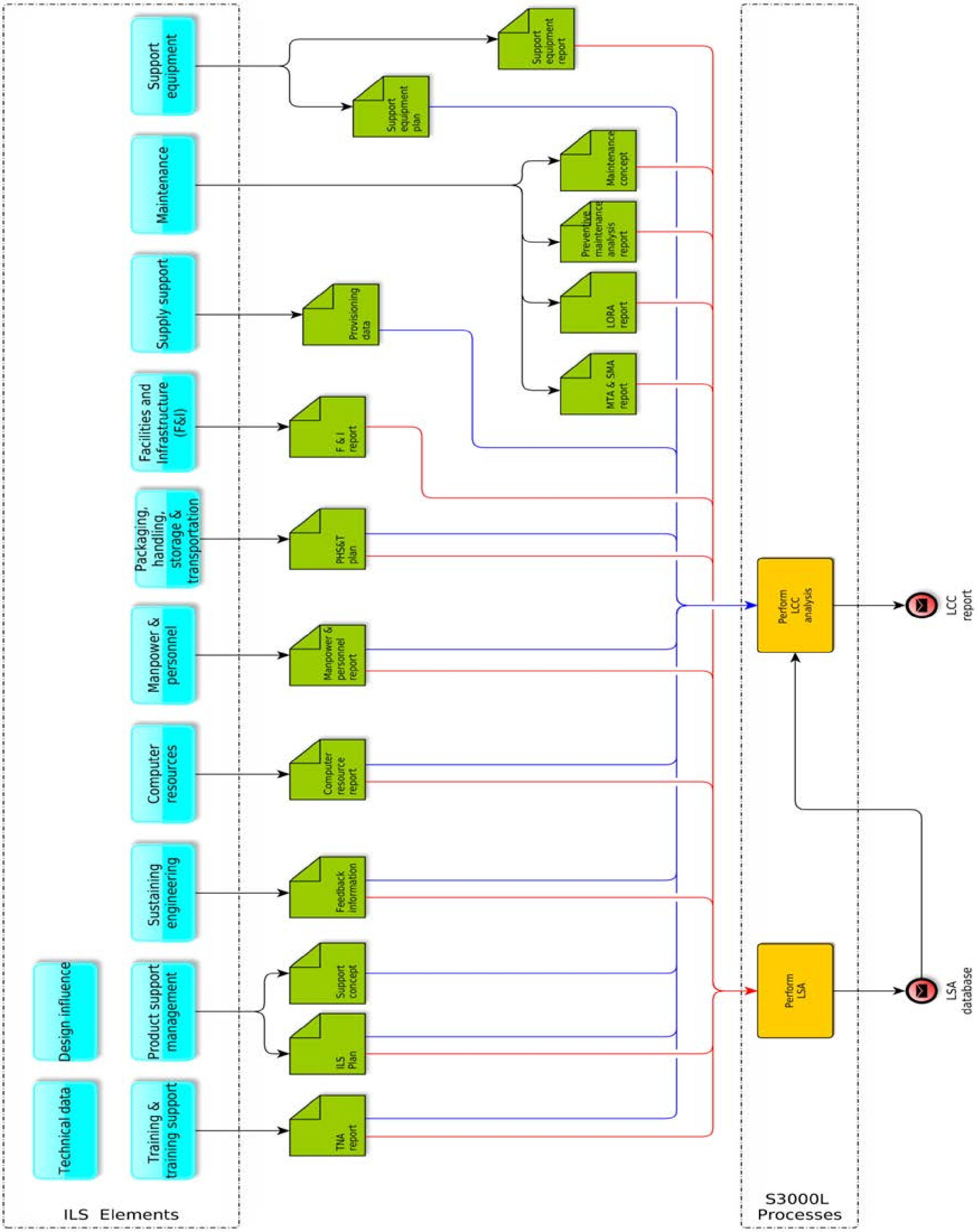

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Fig 10 S3000L design influence process interface with other ILS elements

2.3.2.2 Design influence

One of the main objectives of LSA is to identify opportunities for influencing the influence design, develop the most cost-effective support concept, and define logistics support resource requirements to minimize life cycle cost. The focus is put primarily on the influence of the Product design, however, it is not possible to isolate it from the iterative work needed for an effective support solution or from requirements on logistics support resources.

The opportunity for influencing design in order to fulfil LSA requirements is at its highest at the beginning of a project, during the conceptual phase. Early design influence can reduce or eliminate the need for later design changes (need for redesign) in order to make the Product fit for operation and support. LSA requirements are considered useful for designing a new Product concerning total system availability and cost-effectiveness. The purpose is to influence the design with LSA requirements in a manner similar to how the design of the support system is influenced by the primary Product design and requirements.

Design modifications that are relevant for any logistics analysis activity and relevant for the ILS functions/support elements must be taken into consideration. Logistics support functions must be triggered in case of changes in the LSA database and must be triggered where design changes have no connected information in the LSA database.

Experience shows that even in the design and development phase, many modifications will have an effect on the entire project. In addition, in later phases of the project, modification management for the ILS products is essential for both the customer and the contractor.

Supplier design, performed by a vendor or subcontractor, must be approached in the same manner as the contractor in-house design.

It is important to provide the supplier with specific LSA goals and requirements in order to influence supplier design before the design efforts commence.

2.3.2.3 Life cycle cost

The S3000L analysis determines maintenance baselines and support resources that impact the LCC and consequently, the ownership cost.

S3000L processes and methodology (eg, LORA) identify support cost drivers and cost- effective solutions, enabling further analysis to evaluate and select the most effective support solution.

LSA input/output data comparison and analysis enable support resource planners to give timely and effective feedback into the design process, which enables optimization of support at the lowest LCC.

2.3.2.4 Maintenance

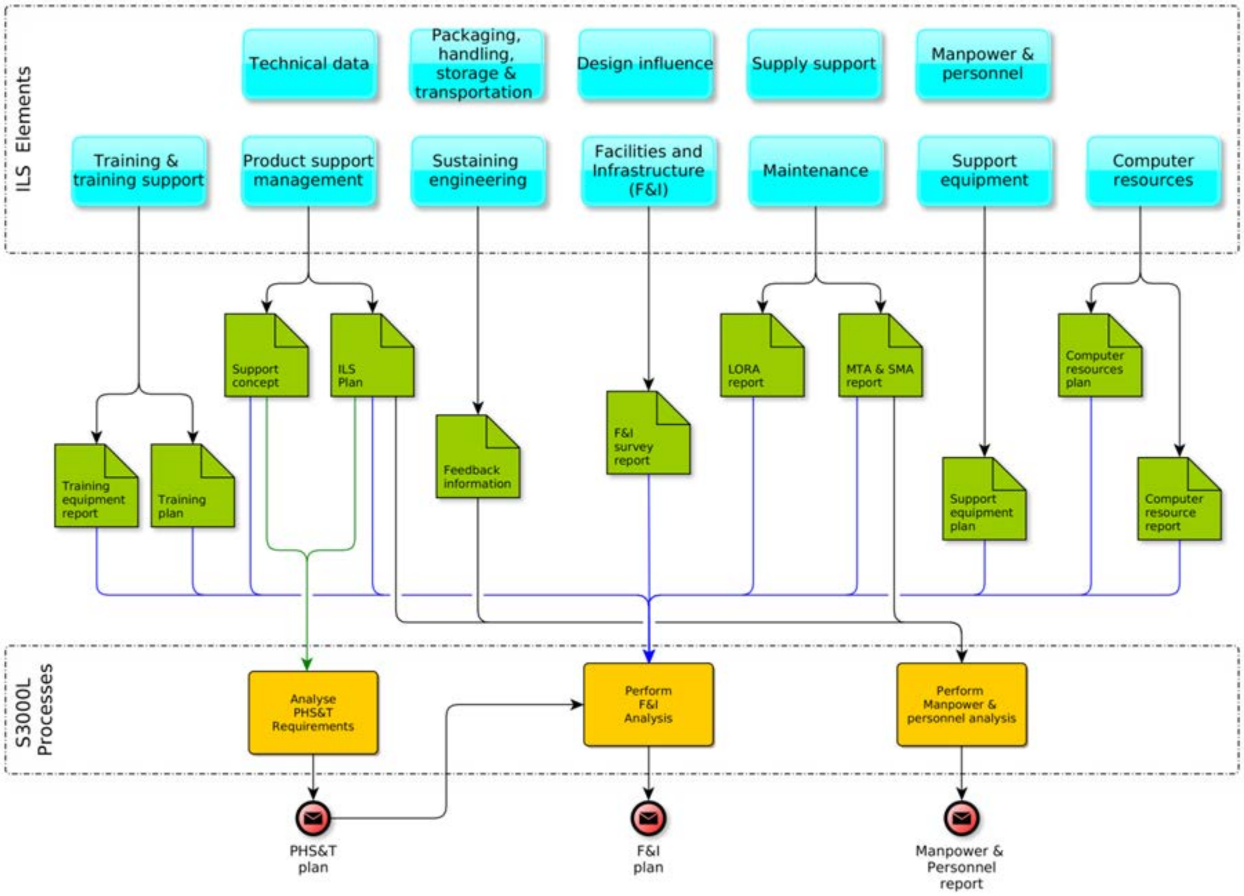

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Fig 11 S3000L maintenance process interface with other ILS elements

2.3.2.5 Product support management

The interface with Product support management is intended to define and plan the activities for LSA. Product support management monitors the performance of LSA activities along the project life to ensure LSA data is delivered to fulfill supportability requirements.

The LSA process is the central element of the contractor's ILS program and support, and provides the framework for monitoring and controlling the orderly and systematic development, and execution of ILS, including the identification of necessary corrective actions/activities, communications, and follow-up procedures.

LSA provides the data required to define and develop logistics support requirements. Data generated by performance of LSA activities is documented in the LSA database directly related to the ILS elements.

Through the integrated Product development system engineering process, the LSA process is the analytical tool for the determination of supportability requirements for the logistics elements.

Reports are provided to the functional members of the Product support organization and feedback occurs within the integrated Product organization. Support elements are directly related to each other through the LSA process and their impact on other elements is readily available through output reports using the LSA database. Using these outputs, the contractor can determine, for example, what effect the selection of a particular item of support equipment will have on maintenance planning, training requirements, technical publications, and supply support. This information enables support element resource planners to make timely and intelligent inputs into the design process, which in turn enables optimization of support at the lowest LCC.

2.3.2.6 Maintenance

The identification of required preventive maintenance is essential for the operation of a Product. Technical, commercial, operational, legal and environmental factors must be considered. It is a common tendency to minimize scheduled maintenance and to revert to condition based maintenance concepts. However, experience shows that a certain amount of scheduled maintenance cannot be avoided and must not be avoided in safety critical areas.

It is essential that PMA is conducted in accordance with S4000P and must be linked to the LSA process. Alternative methods such as or Reliability Centered Maintenance (RCM) analysis may be used instead of S4000P, but the integration with LSA remains essential.

This preventive maintenance, along with the corrective maintenance gives a complete view of what is expected of the overall maintenance activities throughout the life cycle of the Product. There are extensive analysis activities that are carried out outside the LSA database (eg, FMECA, or PMA). However, the results of these analysis activities are documented in the LSA database as agreed between contractor and customer for traceability. Refer to Para 2.3.

The LSA database not only documents the results from the analysis, which provides the identification of the preventive maintenance activities, but also documents the results of the corresponding MTA.

The preventive maintenance activities, including the threshold or interval information, is documented for affected LSA candidates within the LSA database using the PMTR. The PMTRs are analyzed in detail for personnel, support equipment, spares, consumables and facilities requirements. The connection between the final LSA tasks and the underlying PMA must be established as effectively as possible to guarantee the consistency of data.

LORA is an activity that establishes an optimized maintenance or support concept using technical, commercial, operational, legal and environmental data. LORA is an analysis performed to assist in the establishment of an optimized maintenance solution, based on a support philosophy, agreed to with the customer. This includes the determination of where repairable LSA candidates are removed, replaced, repaired or discarded. Repair decisions must consider both economic and non-economic factors such as costs, reliability values, maintainability/testability constraints or availability goals for the system. The results of the analysis influence maintenance tasks and corresponding task requirements (eg, support equipment, personnel and spare parts).The LORA must be performed on each LSA candidate item to determine the most cost-effective method to restore each item to its fully serviceable condition.

MTA methodology describes how to analyze an identified maintenance task concerning its support requirements including spare parts and consumables, support equipment, personnel, facilities and task duration information. Additional information such as task criticality, training needs, pre- and post-conditions, safety and environmental requirements must also be considered. The content of the maintenance solution is related to the corresponding maintenance activities as documented in maintenance tasks in the LSA database. Each task for an LSA candidate must be provided with attributes that reflect the maintenance solution. This information must contain, at a minimum, the following:

- Is the maintenance task to be performed scheduled or unscheduled?
- For preventive or scheduled tasks: interval or threshold data
- Is the maintenance task to be performed “on” or “off” the Product?
- The depth of maintenance at which the task must be performed
- The place at which the maintenance tasks are to be performed
- Special remarks or warnings (eg, when the Product is used under special circumstances, inspection interval must be reduced from, for example, six to three months)

- References to standard repair tasks
- Data source information for traceability (eg, identification of LORA report)

2.3.2.7 Support equipment

The identification of relevant support and test equipment is a main task within the LSA process. The timely provisioning of required support/test equipment is essential and whether it is common or special support/test equipment must be clearly identified.

The LSA process must identify any special requirements for support/test equipment. After the identification, a process for development or procurement can begin.

Each item of support/test equipment that was identified by the LSA as a requirement must be a part of the development or procurement process. The responsible department for support/test equipment is triggered by status information from the LSA. Alternatively, requirements for support/test equipment can also be derived from sources other than the documented LSA tasks, especially for common tools.

2.3.2.8 Supply support

The identification of relevant spare parts is a main task within the LSA process. The depth of the breakdown and the extent of analysis activities will be reflected in the identification of spare parts. Depending on the adopted maintenance concept, identification of spare parts can differ drastically. For example, in a simple two-level maintenance scenario, complete components will be replaced and the operator of the Product/system will no perform repair activities. In this case, only a small number of spare parts will be identified. However, additional spare parts (eg, standard parts) that are additionally required by the identified complete components must be identified.

The most important factor is the depth of the breakdown within the LSA. Theoretically, a breakdown down to the last piece part is possible, but that is impractical and not cost effective.

Therefore, the identification of spare parts within the LSA process will stop at a certain level of breakdown. Typically, the maintenance drivers and the cost drivers will be identified within the LSA process. This information is documented within the requirements of maintenance tasks in the LSA database. A similar process as described for technical publications must also be established for material support. Depending on progress of the LSA activities, the start of the creation of the logistics products with respect to material support must be triggered relevant maintenance and cost drivers from the LSA.

It is acknowledged that not all required spare parts are identified by LSA. However, all spare parts that are identified by an LSA task must be considered within material support.

2.3.2.9 Technical publications

In general, technical publications can be considered as:

- technical publications for Product maintenance and repair
- technical publications for Product operation

During the design and development process, the LSA activities are performed. Depending on the progress of these analysis activities, the determination of the ideal maintenance concept for the basis, the required personnel, support equipment and spares and how the task will be executed, as described by the task description become more clear.

Therefore, the development of technical publications for Product repair and maintenance starts later as the logistics analysis progresses. As the information from the logistics analysis activities matures, the risk of rework of the technical publications reduces. However, the production of technical publications will have contractual milestones that must be met, which also influences when production begins.

It is recommended to find a proper solution to trigger the technical documentation to begin the creation of real Products. This process must be harmonized between the Contractor's support engineering and the technical documentation departments. A good solution is to use status information for LSA candidates, or even for maintenance tasks, within the LSA Database.

It must be clear that each repair or maintenance task identified and documented in the LSA Database must have its corresponding part of technical documentation in the handbooks for Product repair and maintenance.

2.3.2.10 Training

The Training area must be specially considered. Training needs concerning maintenance activities cannot be identified until complete information concerning the required maintenance tasks is available (eg, details of performance, required support equipment, difficulty and criticality, duration, number of working steps, required personnel).

The first step in identifying training requirements is a Training Needs Analysis (TNA). This can be based on the maintenance tasks documented in the LSA database.

To help identify the best starting point for training activities, status information must be introduced. Additional information must be taken from the technical publications in order to support the identification of training needs that is not documented in the LSA database, and to support the creation of training documents in general.

The process to identify and create training must be agreed to with the customer through an agreement concerning LSA and/or technical publications that is available. The creation of training equipment can be expensive (eg, production of training videos, training rigs, training simulators). Therefore, decisions associated with Training, must be based on reliable information. For the best possible support, it is recommended that document training information that is within the LSA database be documented. The LSA database can contain simple markers such as “training required”, skill levels for personnel or more detailed information, if available. In addition to these data elements, all possible Information Technology (IT) support is recommended to be used to translate training requirements into corresponding queries within the LSA database.

2.3.2.11 Facilities, and manpower and personnel

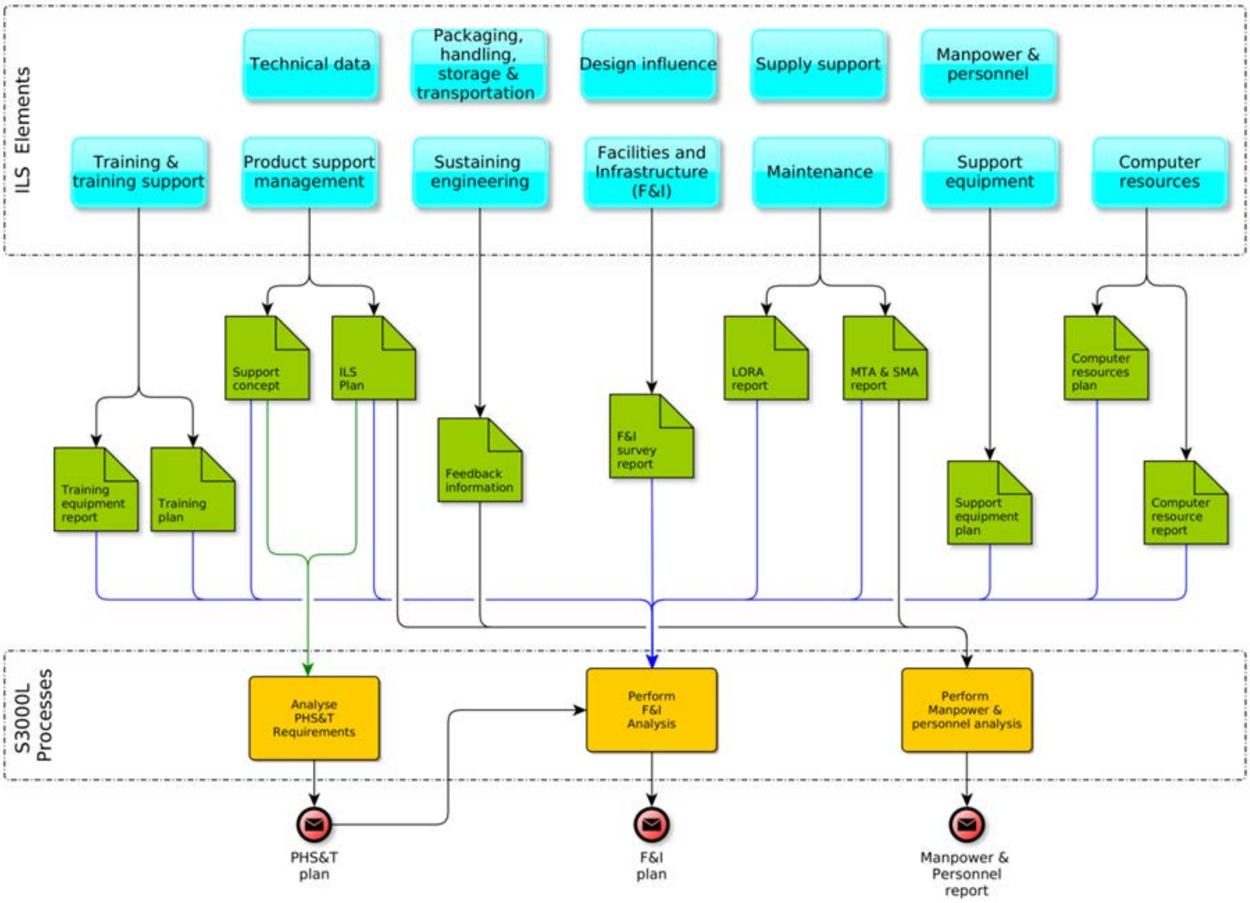

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Fig 12 S3000L facilities, and manpower and personnel process interface with other ILS elements

2.3.2.12 Facilities and infrastructure

Facilities and infrastructure activities identify, plan, resource, and acquire facilities to enable training, maintenance and storage to maximize effectiveness of Product operation and support system. Identify and prepare plans for the acquisition of facilities to enable responsive support for the Product.

This activity consists of the permanent and semi-permanent real property assets required to support a Product, including studies to define types of facilities or facility improvements, location, space needs, environmental and security requirements, and equipment. It includes facilities for training, equipment storage, maintenance and supply.

2.3.2.13 Manpower and Personnel

The functions of LSA, maintainability and supportability, respectively, must be closely coordinated to ensure that potential support solutions are within established support thresholds including the requirements of human factors. In the area of support particularly, human factors have a decisive influence on the practicability of operational or maintenance activities.

The results of the human factors analysis must be documented and must be available as early as possible during the project phase. Within the LSA database, the influence of human factors can appear at different places. Each modification or proposed design change will require changes in maintenance, which require a review of the human factor constraints and limitations.

At the end of the life cycle, during the disposal phase, human factors can be of crucial interest because of a potential need for handling material, which can have an impact on human health.

The LSA activity receives input from design and develops a trade-off analysis of each drawing alternative. From the first drafts of drawings, the LSA activity analyzes the design, compares support requirements between alternatives, and makes recommendations based on the supportability and life cycle cost. This process involves identifying all the possible maintenance actions.

Each maintenance action results in a list of resources, required to accomplish each task. These resources include parts, maintenance man-hours, training, support equipment and test equipment information. The specific effects on human factors are the number of maintainers and the amount of human factors related support equipment.

2.3.2.14 PHS&T

PHS&T activities identify, plan, resource, and acquire PHS&T requirements to maximize availability and usability of the material, including support items, whenever they are needed for training or mission.

PHS&T focuses on the unique requirements involved with packaging, handling, storing and transporting not only the major end items of the Product but also spare parts, other classes of supply, infrastructure items, and even personnel.

Additionally, PHS&T items can require their own life cycle support, such as maintenance of re-usable containers or special storage facilities.

2.3.2.15 Computer resources

Computer resources include computer hardware, network components, network wiring, communication protocols, software packages, data security aspects and standards. The computer resources activities identify, plan, resource, and acquire IT facilities, hardware, software, documentation, manpower and personnel necessary for planning and management of mission critical computer hardware and software systems. The activities coordinate and implement agreements between customer, contractor and suppliers that are necessary to manage technical interfaces, and to manage work performed by maintenance activities.

Computer programs and software are often part of the technical data that defines the current and future configuration baseline of the Product necessary to develop safe and effective procedures for operation and maintenance of the Product.

The interface between other ILS elements and computer resources is intended to identify specific requirements for computer hardware and software in the environment of maintenance and operation. The interrelation between software and hardware must be clearly defined and the method of integrating software aspects into the overall LSA process must be explained.

LSA identifies computer hardware resources to fulfill supportability requirements.

For software, a clear distinction between the operational/maintenance aspects and actual software modification, must be established. For example, operational aspects can include the simple act of loading software or required data to an equipment, whereas software modification covers aspects that deal with changes to the source code to correct a bug, improve the performance, or adapt to changes in procedures, data, or systems that affect the software performance. It should be kept in mind that software modification is a design activity, and will require following the full design process, including potential certification. Given that software will typically change more often than hardware, it is often necessary to identify the necessary computer resources to perform that design activity, especially if the responsibility of this software modification is going to be transferred to another party (eg, a customer).

2.3.2.16 Sustaining engineering

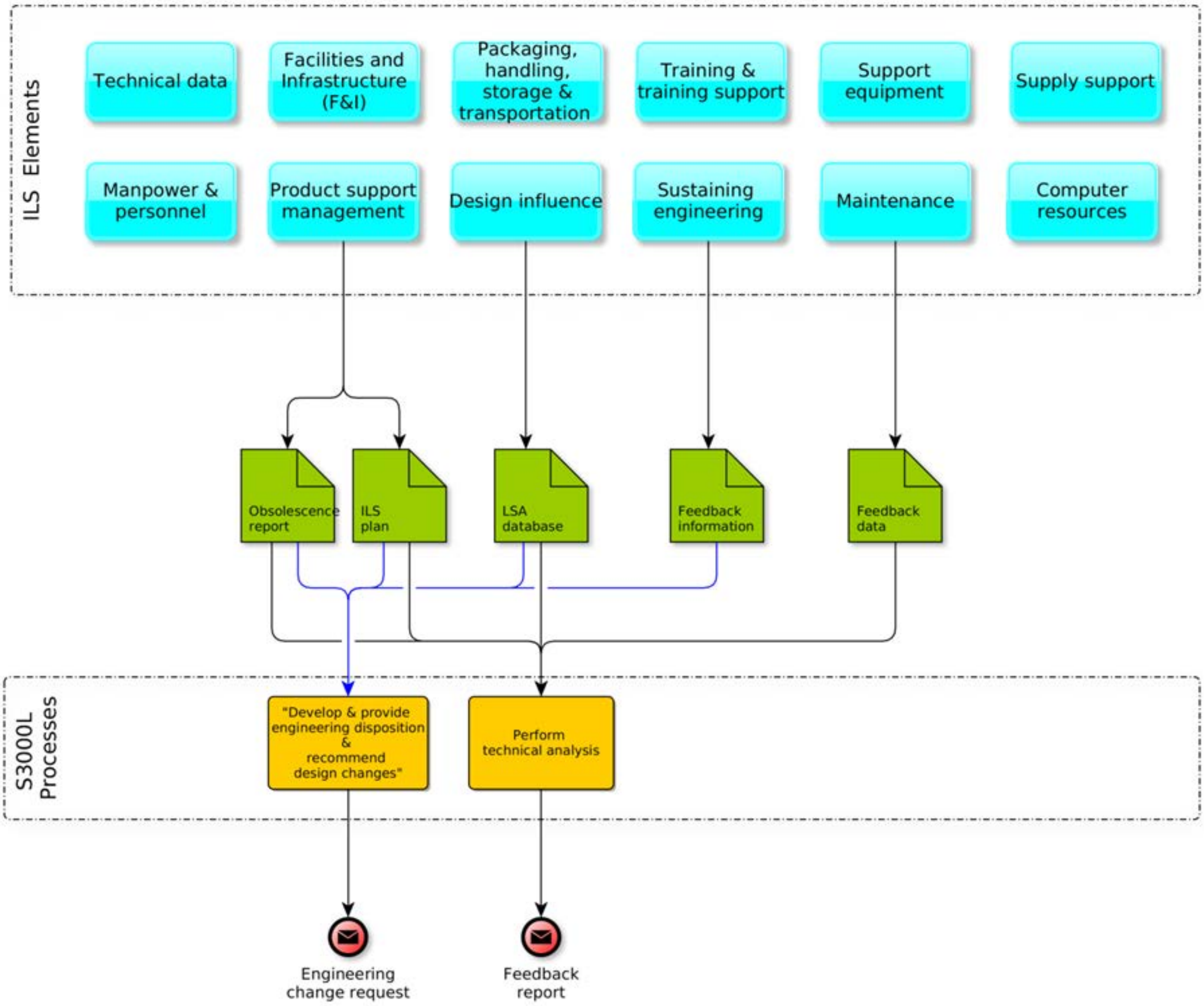

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Fig 13 S3000L sustaining engineering process interface with other ILS elements

2.3.2.17 Sustaining engineering

Influence on design is the goal of sustaining engineering. It influences those Product characteristics which are vital for enabling the operation of the Product in accordance with the performance and design requirements and reducing the LCC.

The Product characteristics influenced are primarily RAMTS.

The tools for supportability engineering are the early application of RAMTS activities/programs and the performance of LSA. Sustaining engineering is the enabler between design and development, and ILS.

2.3.2.18 Feedback information

The feedback of in-service information is a function of in-service support phase. It enables fleet and support managers, and system manufacturers to perform a thorough analysis of operational and maintenance performance of a Product.

The results of this analysis can be the basis for:

– enhancement of the operational effectiveness

- improvement of the Product by modifications and retrofit activities
- optimization of support requirements and cost

To ensure that the customer's contractual expectations are met, the customer must be involved in the industry interpretations and approaches, to an appropriate depth, during the whole LSA process.

Each supportability requirement must be based on an operational requirement, and that relationship must be clearly identified. If the basis for the supportability requirement is not clear, that requirement must be regarded with suspicion.

Supportability requirements are developed directly from the operational requirements. The main goal is to identify and document the pertinent operational requirements related to the intended use of the new Product.

The Operational Requirements Document (ORD) is required to identify key performance indicators. Any parameter not identified as a key parameter, must be a candidate for revision when supportability attributes are negatively impacted.

In-service feedback must optimize the supportability maintaining operational requirements into the ORD and customer requirements established in the Customer Requirements Document (CRD).

The feedback of in-service data is not only for logistics analysis purposes. The data that is captured in-service is also used for fleet planning and management, Product liability and warranty claims, material and stock forecasting and provisioning.

The overall aim to be achieved through in-service data feedback is to increase of availability of the Product and optimize its effectiveness and support resources, reduction of life cycle costs and to establish better information and data for future contract and projects.

2.3.3 ILS specifications

The interface between S3000L and other S-Series ILS specifications is shown in Fig 14.

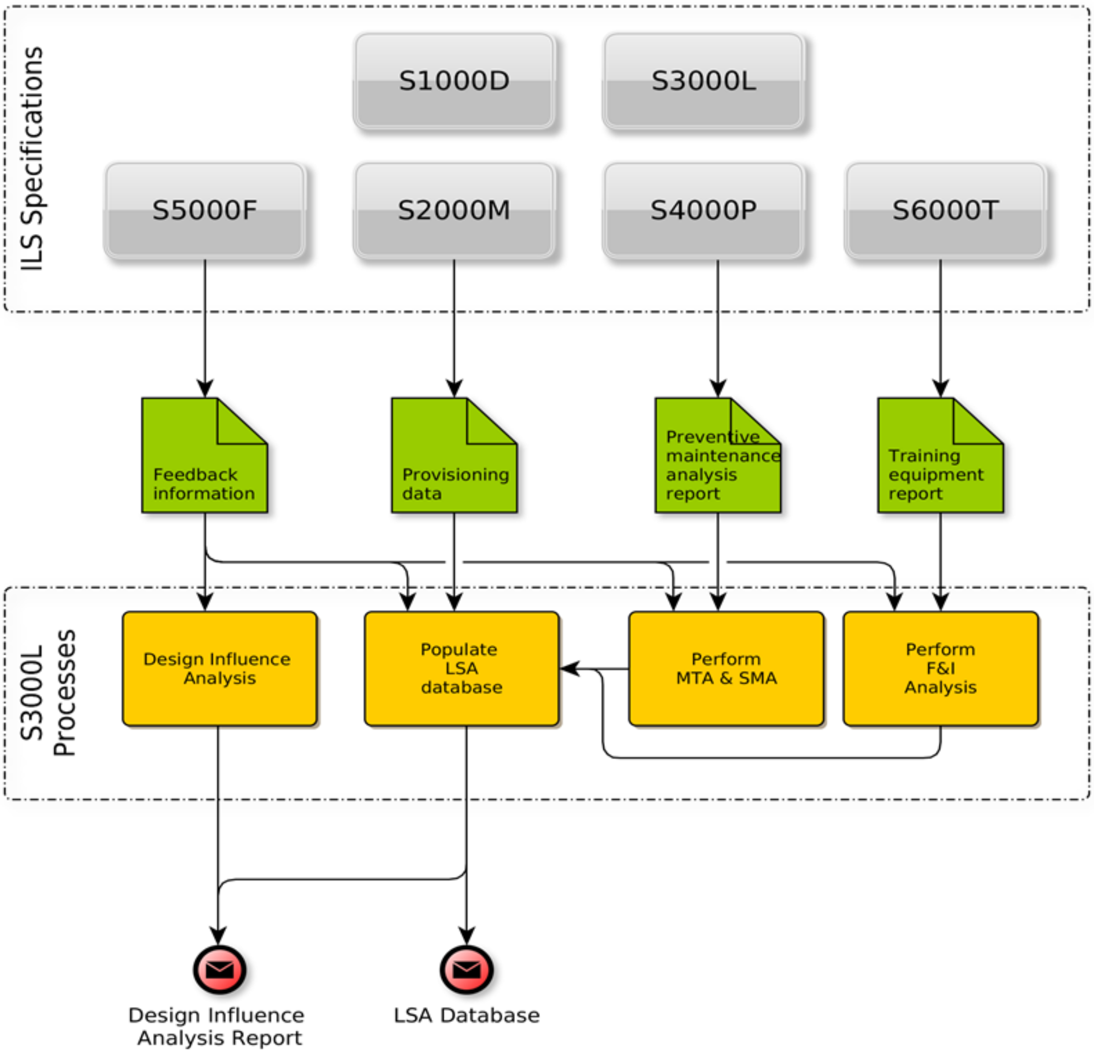

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Fig 14 S3000L interface with other S-Series ILS specifications

The individual specifications must not be considered as standalone entities. Of all the S-Series ILS specifications, S3000L plays a central role.

On the S2000M side, the appropriate functionality for the interface to S3000L is the provisioning functionality and particularly the provisioning data that are part of the process of selecting support items and spares, necessary for all categories of Products.

S3000L LSA and S4000P SMA are very closely interconnected. Only the common view on unscheduled maintenance and schedule/preventive maintenance respectively gives a complete impression of maintenance activities.

The LSA tasks derived from the original SMA can serve as the documentation of SMA results and it must be possible for an LSA application to link corresponding SMA documents.

S5000F provides a means for the feedback of in-service data and information collected and prepared for industry to support and improve maintenance and operation of the Product. In-service reality, maintenance concept/tasks and the Product support requirements developed by the S3000L LSA process, must be continuously compared to ensure the identification of required revaluation or adaptation. In-service defined data and specific data elements must be collected and compared to the existing maintenance situation for permanent optimization of logistics support.

The future development of the S6000T process supposed to reflect the core activity of Training and generate the Training Need Analysis (TNA).Part of this analysis must be the identification of Training Equipment requirements which are considered in the S3000L LSA process to perform the F&I analysis, as part of the LSA Database.

2.4 S4000P

For a new Product or Product variant, the maintainability of the intended Product design must be assessed by Engineering Support specialists based on their in-service experience.

PMTRs with intervals and/or redesign requirements must be determined in parallel to the Product design process and must be available prior to Product design-freeze milestones, which are the latest dates prior to the critical design review (CDR) of the Product.

S4000P can be applied to all Product types including any complex technical platform, system, equipment or facility (eg, on air/sea/land, under sea, underground, in space).

The S4000P analysis methodologies allow a structured, traceable and complete determination of PMTR with intervals for a Product, which are the basis to elaborate and document a Product maintenance program/Operator Maintenance Plan (OMP) prior to the start of the Product's in-service phase.

During the in-service phase, S4000P provides an additional process for reviewing the completeness and effectiveness of preventive maintenance tasks from a Product OMP perspective, taking into account the in-service experience and the analysis methodologies current at the time. That review of the OMP is again fully traceable and applicable for all Products types.

Every S4000P analysis methodology and processes must be tailored and precise for the Product under analysis in a guideline or handbook that is acceptable to regulatory authorities, maintainers, operators, manufacturers and suppliers.

The main purpose of this document is to assist regulatory authorities and all parties involved in the analysis process, in developing and releasing initial PMTR with intervals for new Products, prior entry into service. S4000P analysis methodologies can be applied again to later optimizations/modifications of the Product design in systems and/or structure and/or other Product zones.

Once developed, authorized Product OMP that are packaged into interval clusters, the S4000P In-Service Maintenance Optimization (ISMO) process can be applied, to continuously improve Product maintenance during its in-service phase.

Every development or improvement of a preventive maintenance task for a Product:

- ensures and maintains Product safety, including safety/emergency systems and/or emergency equipment
- avoids any conflict with law
- avoids significant impact on environmental integrity (ecological damage) during the Product's mission/operation and/or maintenance
- optimizes mission/operational capability/availability of the Product
- optimizes Product LCC

2.4.1 Domains

The mapping of S4000P to specific domains is shown in Fig 15.

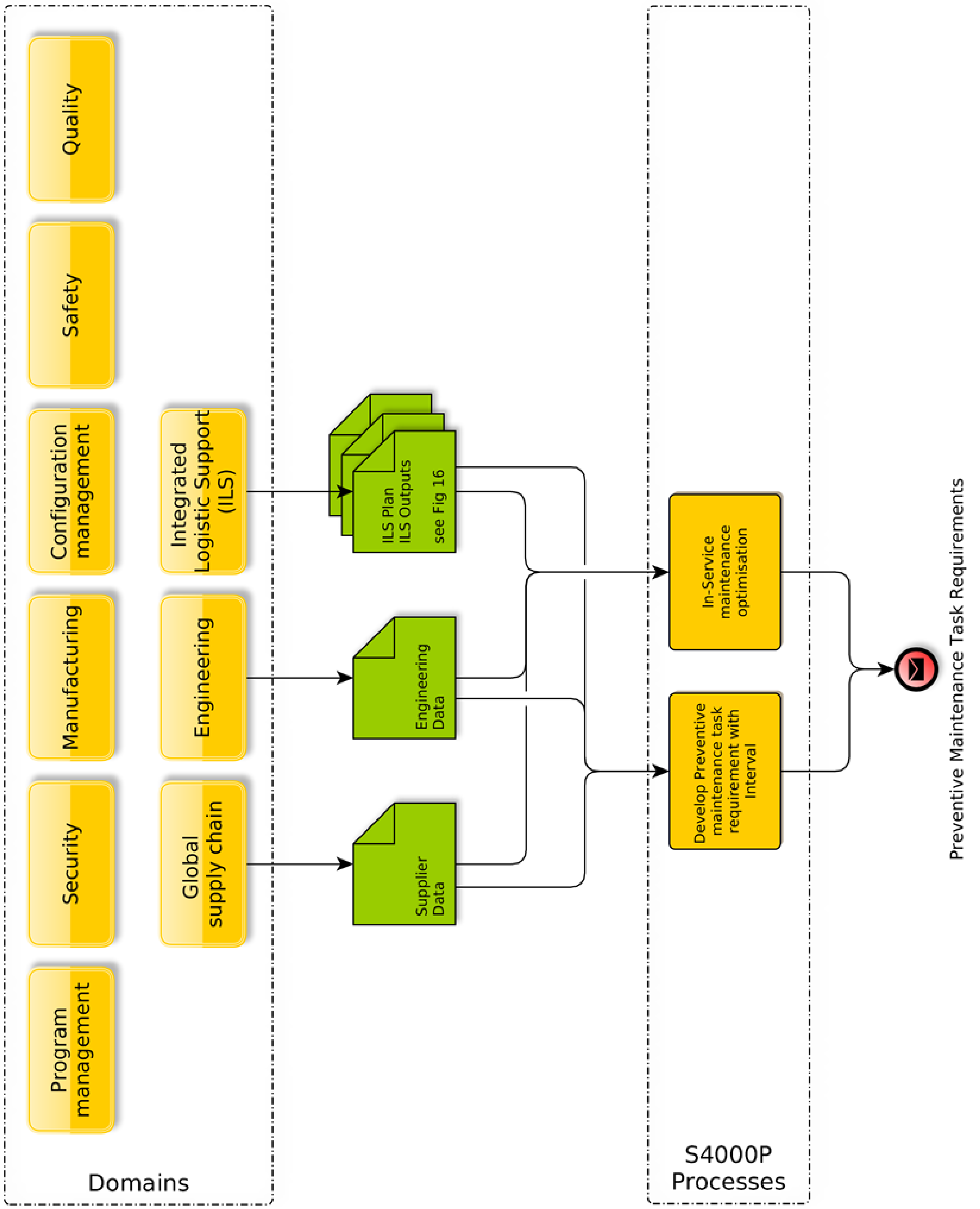

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Fig 15 S4000P business process interface to domains

2.4.1.1 Supplier data
Supplier data consists of:

- supplier technical data package
- In-Service data
- certification information

2.4.1.2 Supplier technical data package
This interface includes the supplier's technical publications, produced in accordance with S1000D.

2.4.1.3 In-service data
As additional knowledge and experience is gained from the Product's in-service phase (eg, failure reports, reliability analysis, inspection reports, etc) the individual preventive maintenance tasks with intervals are re-analyzed in order to adjust the tasks and/or intervals accordingly.

In order to facilitate and update the maintenance program during the in-service phase, the Failure Effect Category codes (FEC) for each task are identified. The traceability of each scheduled task and its interval with the related analyses is essential.

2.4.1.4 Certification authorities
To ensure the effective the management and implementation of the scheduled maintenance program for a Product, the organizational project structure must consist of appropriate stakeholders as representatives of the Product.

At a minimum, this must include:

- operators
- involved manufacturers
- regulatory authority/authorities (if required)

Certification of preventive maintenance programs (when required by customer) leads to the preparation of a customized policy and procedures handbook, guidelines, etc, that are agreed to by the customer, authorities and manufacturer. In general two different certification types exist:

- Civil certification (eg, for aircraft EASA/FAA/DGAC/other civil certification authorities)
- Military certification. This is often based on civil certification plus specific dedicated development, review of civil analysis to cover military operation and equipment.

It is up to the manufacturer to decide what organization is required, the necessary support documentation and the involvement of operators, authorities, Original Equipment Manufacturers (OEM), etc, for the process.

In addition to those tasks and intervals established through the S4000P SMA, preventive maintenance tasks can arise within the certification process.

2.4.1.5 Certification Maintenance Requirement
A Certification Maintenance Requirement (CMR) is a required periodic task, established during the design certification of the Product as an operating limitation of the Product certificate. A CMR is intended to detect and or to eliminate safety significant latent failures that would, in combination with one or more other specific failures or events, result in a hazardous or catastrophic failure effect.

The process for coordinating S4000P derived tasks with CMRs involves a certification committee.

2.4.1.6 Design engineering data

S4000P analysis activities are related to the close cooperation with the responsible Product design departments. S4000P evaluations are based on the item's functions, functional failures, functional failure effects and the respective failure causes.

A mandatory redesign requirement can be an outcome from the S4000P analysis and its effect on maintainability must be identified as early as possible, in order to reduce risks, and to save money and time.

The participation in the systems engineering process to affect the design from its inception throughout the life cycle will facilitate supportability and optimize the design for availability, effectiveness, and ownership costs.

2.4.1.7 Integrated logistics support

The ILS domain provides a series of information that are essential for the preparation of preventive maintenance task requirements. This information is covered by the ILS elements described in Para 2.4.2.

2.4.2 ILS elements

The interface between S4000P and the other ILS elements is shown in Fig 16.

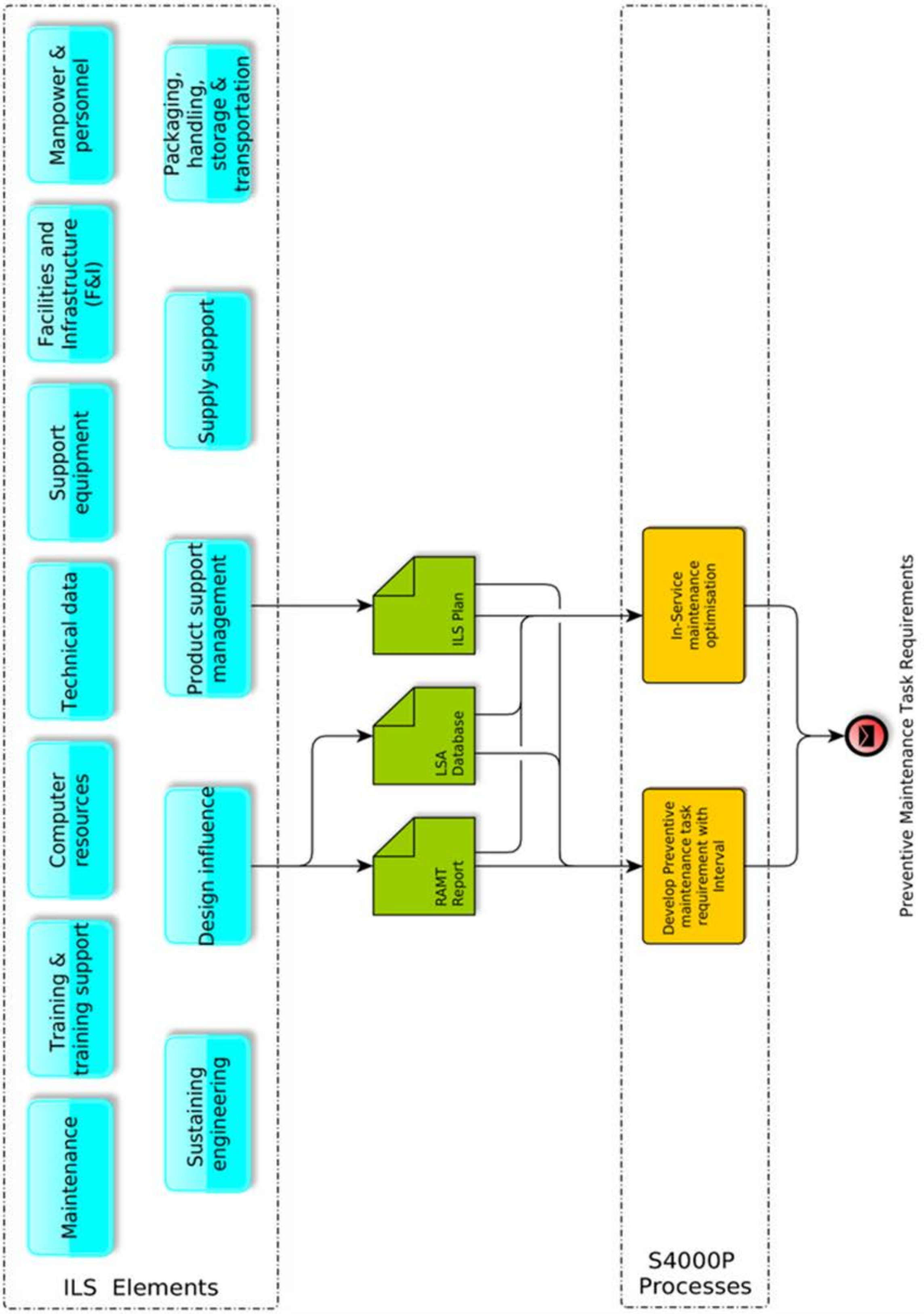

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Fig 16 S4000P business process interface to other ILS elements

2.4.2.1 Design influence

The ILS element, design influence provides two outputs to S4000P:

- RAMTS report
- LSA database

The analysis methodologies in S4000P start with the determination of Analysis Relevant Candidates (ARC) and candidates not being relevant for analysis (non-ARC). To determine them the RAMT report including a system Failure Mode and Effects Analysis (FMEA) is needed as a starting point.

Configuration management deals with functional and physical attributes with its requirements for the Product, design and operational information throughout its life. Before the S4000P analysis can be applied to a Product, the maintenance significant items and structural significant items and components must be identified.

Any modification on the Product must be recorded through the configuration management process and can result on a new (partial or total) S4000P analysis. The configuration management process is part of the perform LSA activity.

2.4.2.2 ILS Plan

The ILS Plan (ILSP) is the primary document that details the approach to ILS, tailored to meet the needs of a specific Product or service. The ILSP must include detailed information for the planning, implementation and co-ordination of the ILS elements and their activities, together with an ILS work breakdown structure.

2.4.3 S-Series ILS specifications

The interface of S4000P to the other S-Series ILS specifications is shown in the following Fig 17.

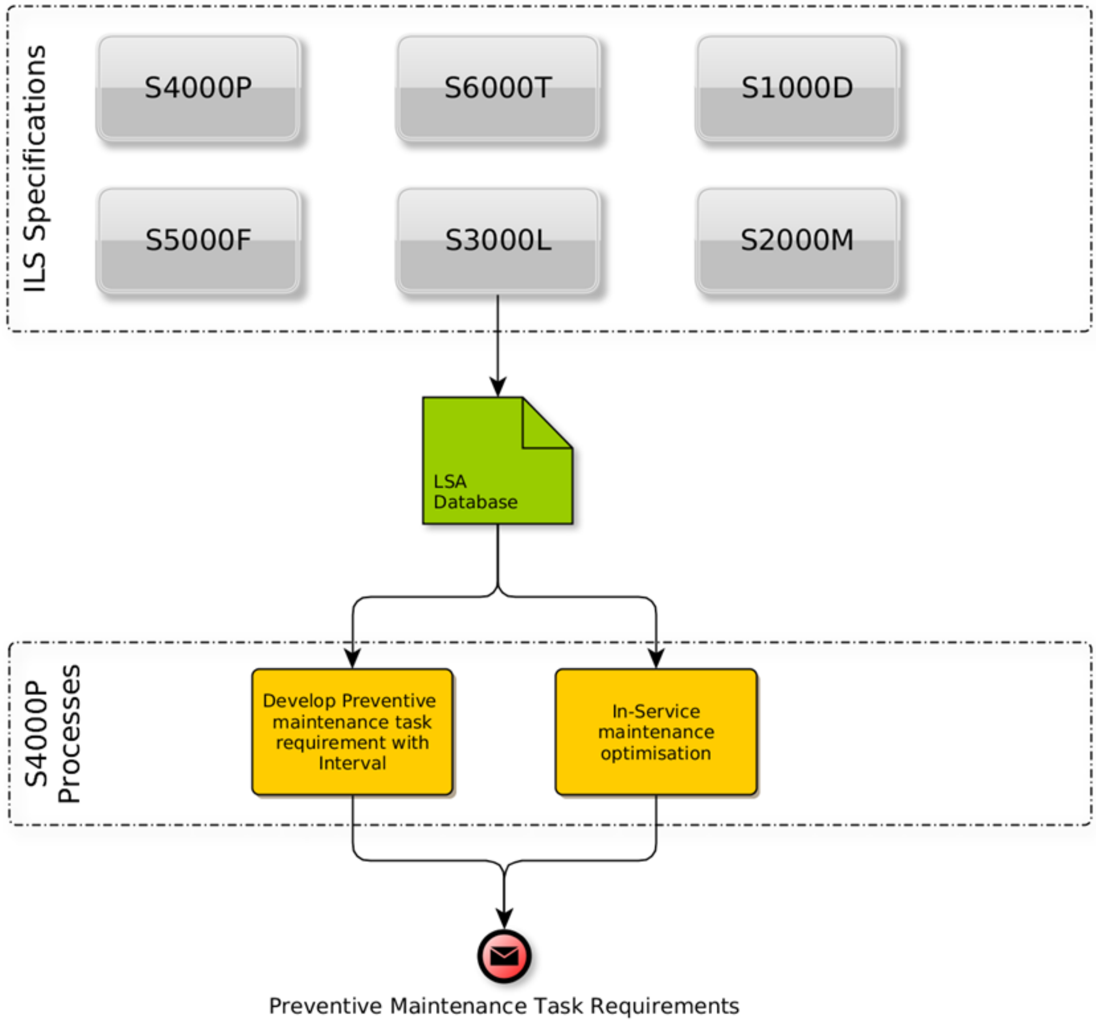

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Fig 17 S4000P business process interface to other S-Series ILS specifications

2.4.3.1 S3000L

The LSA database is used as the single source of information for the design and development of support resource requirements. For S4000P purposes, the LSA database must cover the latest/final configuration status of the Product. When modifications are embodied during the in-service phase, or if there are Product variants following other build statuses, the initial preventive maintenance tasks and intervals must be reviewed.

The analysis methodologies in S4000P, use selection logic to identify one or more applicable and effective preventive maintenance task types. After a harmonization and consolidation phase by analysts and those responsible for design, the remaining maintenance task types for systems, structure and zones must be documented as maintenance significant items or LSA candidates in the LSA database.

Within the LSA database, all PMTR must be allocated to effective task packages with interval values and interval types in so that the total maintenance effort for a Product is reduced. Packaging solutions and rules must be in accordance with S3000L. When the packages are complete, a Maintenance Task Analysis (MTA) must be carried out for each of the final packages.

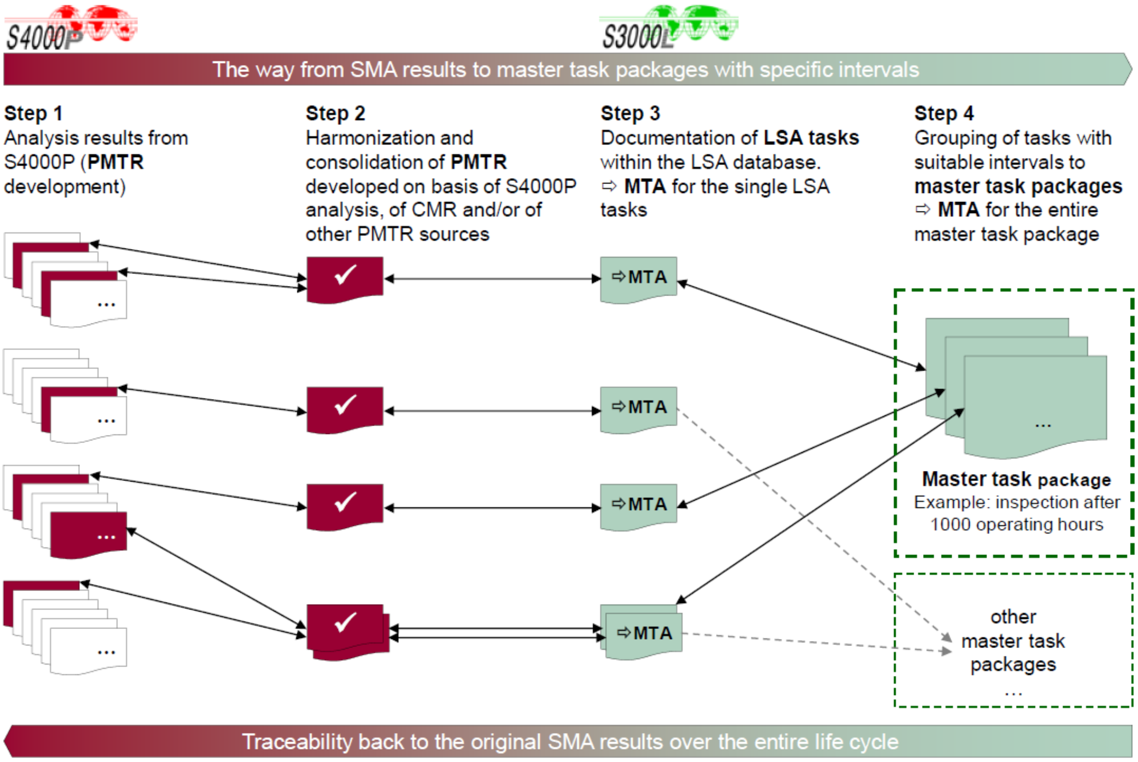

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Fig 18 Traceability of preventive maintenance tasks with intervals

Fig 18 shows the complete traceability path from the original PMTR developed in accordance with S4000P, to the point of LSA tasks and the final master task packages for Product Maintenance, repair and overhaul (MRO).

The maintenance task packages for Product MRO are the source data for the technical publications. Refer to S1000D.

2.5 S5000F

The scope of S5000F is to feedback information from the in service operation/operator to the OEM or the maintainer and vice-versa. The main processes in S5000F focus on the in-service data feedback information and the activities that take place during the operational phases of the life cycle of the Product.

The purpose of S5000F is to provide a structured way to handle the information from the operator, maintainer or OEM during the in-service phase.

S5000F is an interface between the customer and the different ILS activities and covers all the unified in-service feedback information, interfaces and domains related to the project's ILS activities and guarantees the integrity of information across the different ILS elements. It also provides an integrated communications path for the contractor and the customer.

The feedback data is automatically transferred, according to the defined schedule, to and from an in-service database. The data exchange process will provide the requested data in XML format, based on ISO 10303:239 PLCS.

In-service feedback is one of the most important functions of in-service support. It enables fleet and support managers, and system manufacturers to perform a thorough analysis of operational and maintenance performance of a Product.

The results of this analysis are the basis for:

- enhancement of the maintenance and support concept
- improvement of the Product by modifications and retrofit activities
- sophisticated operational planning

The in-service use data feedback is considered a subset of the ILS.

ILS has overall responsibility for the development of technical information and the support environment that will be used to support a Product throughout its intended life cycle. The different disciplines in the context of supportability (eg, technical documentation, spare parts, support equipment, personnel and training) must be harmonized.

The main ILS elements taking advantage of this feedback are:

- design influence
- product support management
- supply support
- support and test equipment
- technical data/technical documentation
- personnel and manpower
- IT/software support
- facilities and infrastructure
- scheduled maintenance/maintenance planning
- PHS&T
- training and training devices

Fig 19 shows how S5000F exchanges data with the other S-Series ILS specifications. It does not manipulate or change the data in any way but provides it to organizations or users of the other specifications who use the data in different ways, according to their business needs.

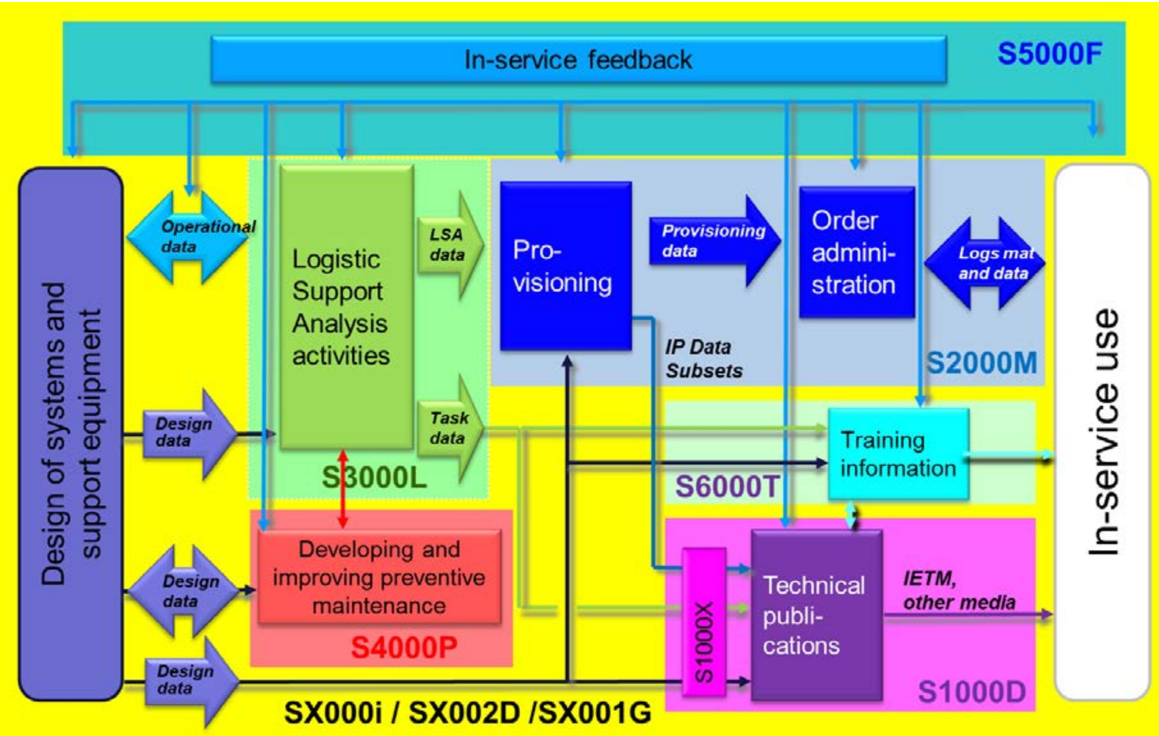

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Fig 19 Scope of S5000F: in-service feedback to other S-Series ILS specifications.

2.6 Mapping table overview

The S-Series ILS specifications cover a great number of the activities defined in this specification, but do not map directly one-to-one to the activities defined here. This is due in part to historical reasons, but also because a same activity might be required for two different major business processes, as defined in the individual specifications. Nonetheless, the different specifications do not overlap, except in a few exceptional cases.

Fig 20 provides a detailed mapping of the different ILS elements and associated activities to the different S-Series ILS specifications. The mapping table cross-references each activity of all ILS elements with the individual specifications, using a color code to indicate the specification coverage of or relationship to the activity. The purpose of this mapping is to:

- validate the ILS process defined in Chap 2 regarding consistency and completeness
- provide the framework for this chapter
- verify the interfaces between the specifications
- ensure that there are no overlaps between specifications
- identify potential gaps within the ILS process, so as to be able to launch new specifications to cover such gaps

The mapping has been prepared by the SX000i SC and has been validated by the individual specifications.

The codes used in the mapping depicted in Fig 20, are as follows:

- F - Full in-depth coverage.
  Full in-depth coverage by a specification means that it describes an activity in detail, explaining how to carry it out to its full extent, and identifies the information that is required to perform it, as well as the detailed data that result from the activity. The characteristic of a full coverage is that no other specification is required to carry out this activity.

- P - Partial in-depth coverage.
  Partial in-depth coverage by a specification means that it describes part of an activity in detail, explaining how to carry it out, and identifies the information that is required to perform it, as well as the data that result from the partial activity. A characteristic of a partial coverage is that it is necessary to refer to another specification to perform all aspects of the activity.

- I - No coverage, but information is supplied by the specification.
  The activity in question is not described by the specification, but the specification provides information that is required to perform the activity.

- S – Support.
  The activity in question is not described by the specification, nor does it provide information necessary to perform the activity, but the specification provides supporting material that will facilitate carrying out the activity, allow the exchange of information required for that activity, or supply material required for the activity.

- T - Top-level coverage.
  Top-level coverage by a specification means that the activity in question is described at a high level only and placed in context with other activities of the same or other ILS element(s). The input and output information, associated to the activity, is also only described at a high level.

- (Blank) - No coverage.
  No coverage means that the specification does not describe how to carry out an activity. In most cases, no coverage by a specification is because the activity is not required. It does not imply that the specification is incomplete.

ILS Element	Activities	ASD Specifications coverage									
		S1000D	S2000M	S3000L	S4000P	S5000F	S6000T	SX000i	SX001G	SX002D	STE-100
Computer resources	Perform computer resource nnalysis			P				T			
	Provide computer resources							T			
Design influence	Perform reliability, availability, maintainability, testability analysis			I		I		T			
	Populate LSA database		S	F		I		T		S	
	Perform LCC (affordability) analysis			P		I		T			
Facilities and infrastructure	Perform F&I analysis			P				T			
	Provide facilities and infrastructure							T			
Maintenance	Develop maintenance concept			F				T			
	Perform level of repair analysis			F		I		T			
	Develop maintenance plan		S		P	I		T			
	Execute maintenance tasks	S	S			I		T			
	Perform supportability safety analysis					I		T			
	Develop and continuously improve preventive maintenance			F		I		T			
	Perform scheduled maintenance analysis				P	I		T			
	Perform d Prognostics and health management (D&PHM) analysis					I		T			
	Perform software Impact analysis			F				T			
Manpower & personnel	Perform manpower & personnel analysis			P		I		T			
Packaging, handling, storage & transportation (PHS&T)	Analyse PHS&T requirements		S	I		I		T			
Product support management	Manage contract					I		T			
	Capture product support requirement		S	P				T			
	Develop ILS plan		S					P			
	Perform obsolescence management		S	F		I		T			
Supply support	Provide provisioning data		F			I		T		S	
	Perform material supply		F			I		T			
Support equipment	Analyse support equipment requirements			P				T			
	Provide support equipment		I					T			
Sustaining engineering	Perform engineering technical analysis			P		I		T		S	
	Develop & provide engineering disposition & recommend design changes	S	S	P	P	I		T			
Technical data	Develop technical data package		I			I		T		S	
	Produce technical publications	F	I			I		T			S
Training and training support	Perform training need analysis (TNA)						F	T			
	Develop training pLan						P	T			
	Perform training development							T			
	Deploy training	S						T			
Other activities (not covered in first SX000i issue)	Manage In-service ILS activities		S			I					
	Perform in-service maintenance optimization (ISMO)				F	I					
	Operational suitability evaluation					I					
	Fleet management					I					
	Manage stocks / stores		I			I					
	Manage warranty		I	P		I					
	Disposal		S	P							

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Fig 20 Activity-specification mapping table

3 Applying the S-Series ILS specifications

3.1 Introduction

The application of the S-Series ILS specifications provides advice for the required management activities and criteria for tailoring and customizing. It also provides guidance on the policy, implementation and responsibilities for the application of the S-Series ILS specifications. It does not specify the use of specific tools, but establishes the essential information required to initiate, maintain and schedule the ILS activities, that apply through the entire Product life cycle, as well as the necessary deliverables.

Considering the variety of Products with regards to their purpose, application, complexity, quantities, innovation and lifetime and taking into account the objectives of the stakeholders involved, the ILS activities need to be customized. Specific Products or objectives will not need to use all of ILS activities. Therefore, implementation of the S-Series ILS specifications typically involves the selection or tailoring of a suitable set of activities.

Successful accomplishment of the ILS objectives requires diligent planning and management. There are procedures that have been developed, which provide effective planning and management to enable ILS to achieve its goals. There is no standard organizational structure, but there are typical areas that customer or contractor must use.

3.2 Project objectives and involved stakeholders

The project objectives are to meet contractual requirements in terms of time, cost and quality.

The ILS process contributes to these objectives by ensuring that its goals are met (refer to Chap 2) in the areas of:

- design for support
- develop support
- acquire the support
- provide the support

While a project could be restricted to, for example, the development and production phases of the Product, ILS takes a broader view that can go beyond the initial project objectives because it considers the entire life cycle of the Product to develop the support solution to optimize supportability and life cycle costs while the Product meets the required performance.

There are different Stakeholders with different roles and objectives. Refer to Chap 2. These Stakeholders comprise:

- prime contractors and subcontractors
- OEMs
- suppliers
- customers

Stakeholders can have different roles as buyers or sellers, depending on the contractual framework in which they interact. For example, the prime contractor acts as seller for the customer, but as a buyer for the suppliers.

Typical objectives of the seller role are profit, market share increase, and technical capability improvement while meeting customer requirements. The customer's objectives however, are to achieve the lowest life cycle cost while exploiting the Product to the maximum.

In order to reconcile these different views, it is necessary achieve a consensus through a proper common framework and understanding using the processes detailed in the S-Series ILS specifications. This provides a win-win situation that satisfies all involved stakeholders.

3.3 Selecting appropriate S-Series ILS specifications

3.3.1 Introduction

One aspect that can have an important impact on the overall support of the Product is the selection of the specifications and their versions that are used to develop/maintain the ILS products. This must be addressed at the beginning of a project, as it will have a severe impact later on.

The reason for this impact is that a specification indicates how an ILS product is developed and maintained, s often detailing the use of specific ILS activities and elements, which are tailored for a particular specification and often to a specific specification version. Changing the specification for the development of an ILS product later on usually has a significant impact.

Specification version change can also be a problem if the IT tools have been selected for a specific specification version, and cannot support a different version. Since the specification itself will have changed, rework could be required to perform the conversion of the ILS product. Though backwards compatibility of specifications is attempted, it is not always possible, or the specifications would never be able to evolve.

While this is complex enough for one single specification, the issue becomes even more complex when multiple specifications have to work together. An appropriate selection of the specifications will ensure proper integration and interoperability, typically in a more cost-effective manner.

3.3.2 Stakeholders involved in specification selection

Many stakeholders are involved in the specification selection and influence the final decision. The stakeholders include but are not limited to:

- The business function: Usually this refers to an ILS team, which identifies the specification that best suits its business needs.
- The IT group: While, in principle, the IT group does not select the specification for use, it can have an influence in the specification choice. For example, the group can be equipped with a legacy toolset, or a toolset to implement the selected specification do not exist or are still immature.
- The ILS/product support manager: The responsibility for the integration of the different ILS elements lies with the ILS/product support manager. That responsibility extends to ensuring that the specifications that are selected are interoperable and allow for integration of ILS products.
- The PM: It is the PM’s responsibility to ensure that the use of specifications does not lead to unnecessary costs or excessive risks. That responsibility extends to ensuring that the use of the specifications complies with the project contractual requirements. He also might request the usage of specific specifications or specification versions so as to take advantage of other opportunities or position the Product in a specific market or offer.
- The companies involved: Especially on complex programs, a lot of companies might be involved, either as full partners or suppliers, and each has internal best practices and IT tools. Agreement between these stakeholders must also take the volume and frequency of data exchange into account.
- The customer**:** The customer often selects the specifications used for a Product as part of a contract, or at least is involved in their selection. In the case of a Commercial off the Shelf (COTS) Product or systems selected for a Product developed as COTS, the customer can choose to adopt the specification under which the system was developed or request the usage of a different one. While it can be feasible to convert to a preferred specification, the costs to do so can be prohibitive. The customer represents the voice of the end user.

All these stakeholders have their own interests and priorities, and it can be challenging to achieve a harmonized view, especially when several customers and ILS elements are involved.

3.3.3 Basic criteria for specification selection

The selection of the individual specifications, unless contractually mandated, must consider the basic criteria of the:

- project requirements
- parties involved
- ILS activities on the project
- added value of the specifications
- available tools
- risks and opportunities
- interoperability of specifications and ILS products

3.3.3.1 Program requirements

Program requirements and deliverables impacting the support will define the selection of ILS specifications. Particular customer needs can also dictate the selection.

For example, performing a TNA when the customer does not require any kind of training is an unnecessary expenditure of resource. In this case, S6000T would not be required.

In some cases only one, or a limited set of specifications is required. For example, a bicycle will require a manual for the end customer, but not necessarily spares, or a maintenance plan. If there is a need for the manual to be in a standard format, S1000D can be selected, but not necessarily any of the other S-series ILS specifications.

3.3.3.2 Parties involved

The selection of specifications can be dependent upon the need of data exchange between different partners, the capabilities of the different partners and suppliers, and the experience from the contractor and user perspective.

For example, the full use of one or a combination of specifications can exceed the capability of small or medium enterprise.

Similarly, a specification could be unusable by one of the project partners, suppliers or end customer because such stakeholder does not have the necessary skills. This is also true if the specification defines a process that the organization supposed to implement it has never applied. This can require additional training and substantial effort. On the other hand, experience with a specific specification (even if it is a different version) can significantly reduce the project risk.

3.3.3.3 ILS activities on the project

A key criterion that is used is the necessity to adapt to the tailoring of the ILS program, (refer to Para 3.3.8). If some ILS activities are not required, then the associated specifications are not required either.

At the other extreme, in complex projects where a full-scale ILS program is necessary, use of the whole suite of S-Series ILS specifications could be required in order to implement all ILS elements.

3.3.3.4 Added value of the specifications

A criterion that is often used is the added value that a specification can bring to the business function. This can be as simple as reusing existing tools and processes, or adopting a standard to streamline the internal processes or gain a competitive advantage. Additional benefits can include, but are not limited to:

- faster time to market
- easier data exchange and consolidation
- cost reduction in the long term

3.3.3.5 Available tools

Often the availability of tools required to support a specification, drive the selection, without considering the other aspects listed at Para 3.3.3. Thus, the aim to consolidate the information in the existing tools can prevail over other criteria. Though important, this must not be the main criterion.

3.3.3.6 Risks and opportunities

The selection of a specification entails some risks to the organization that is adopting and implementing it. However, adopting the specification can provide the organization with new skills and competences that will be required in future projects or by new contracts.

3.3.3.7 Interoperability of specifications and ILS products

A final critical criterion is the interoperability between the specifications. In principle, interoperable specifications yield better support in terms of higher quality and improved efficiency. If the processes of the adopted specifications are incoherent, and the information exchanged between them is inconsistent, effort spent on standardization is wasted. However, there are situations where such interoperability is not feasible or desirable, (eg, the use of COTS or legacy systems).

3.3.4 Selection of the specification versions

Once the specifications have been selected, it is necessary to select the versions. Though ideally the latest version of a specification must be used, this cannot always be possible because of project or organizational restrictions, existing infrastructure, interoperability issues or even user skills.

Usually, legacy specification versions are implemented in the producer and user organizations. There is a strong temptation to use the same version, so that all Products are consolidated to the same standard and version. For example, if an organization used S1000D Issue 2.3 for a previous project, it will be reluctant to move to a later version because of the impact.

Though the basic criteria used for the specification selection also apply here, there are three aspects that have particular importance. These are:

- functionality of a specific version
- interoperability with the other specifications
- available IT tools

3.3.4.1 Functionality required by the business function

This is a critical factor in the selection a version of a specification. If there are legacy applications, but the business function needs a functionality that is required by a later specification version, then the previous version cannot be selected. On the other hand, if the previous version is adequate, then justification of the additional cost and effort to move to a more advanced version can be difficult.

3.3.4.2 Interoperability between the selected specifications

Though the functionality is important, it is also essential that the selected specification versions can exchange data. As specifications evolve, data and data formats also evolve, and so, versions will not always be as interoperable with each other as they were previously. It is advised to check SX003X, Specification interoperability matrix, for this purpose.

3.3.4.3 IT tool compatibility

Existing IT tools are a factor that must be taken into account, as these represent a significant investment. As the tools are implemented to support specific version of a specification, supporting a different version is not guaranteed. The cost and time taken to adapt such IT tools can have a significant influence on the decision.

3.3.5 Upgrade path for specifications during the project

Even if there is initially no intent to upgrade the specifications used to develop the ILS products, there can be compelling arguments to do so. Reasons for upgrading include, but are not limited to:

- obsolescence of the specification
- obsolescence or consolidation of the IT tools
- modernization or mid-life upgrade of the supported Product
- new customer or major requirements change
- new requirements that the old specification version cannot meet
- requirements harmonization across projects and business domains
- adoption of new or additional specifications

The upgrading starts with the selection of the version(s) of the specification(s) that would be required for the upgrade. The process for this is similar to that at Para 3.3.3.

Once the necessary infrastructure is in place it is necessary to convert the data to the new version of the specification, but also to review specific business rules that are no longer be relevant. It might be also necessary to reconcile data from two or more specifications if the interfaces between them have been affected. Whilst acknowledging the impact on a project, it is essential to take into account that a specification upgrade can:

- require significant effort
- take a long time to implement
- imply
  - acquiring new skills
  - process changes
  - organizational changes

All this usually means an impact on the program whose specifications are upgraded, so it is not a decision that must be taken without a proper impact study.

3.4 Scheduling

The purpose of the scheduling process is to define and assure availability of specifications, procedures, resources and data exchange mechanisms, for use by the organization to meet the project needs.

3.4.1 Objectives

The objectives to be achieved by scheduling processes are to:

- proactively manage the completion of project milestones
- provide repeatable/predictable processes, outputs and data flows across the Product life cycle
- enable process improvement across the domains
- enable cost savings through economies of scale for ILS activities by standardization
- enable setup process improvements for new projects
- reflect dynamically changing organization, project scope and specification updates over the Product life cycle

Depending on risk and the situational environment, the scheduling process must be continually monitored and adjusted accordingly.

3.4.2 Activities

3.4.2.1 Establishing the schedule

The scheduling process must start no later than the preparation phase, by identifying sources for scheduling information (eg, activities defined in the support concept, work packages, outputs from ILS elements (refer to Chap 2) and the selected specifications. Information from the sources extracted and included in an appropriate timeline model that is aligned with the organizational resources, infrastructure and the required inputs and outputs. The established planning schedule must be documented in the ILS plan.

The requirements of the selected specifications must be constantly taken into account during the Product's life cycle to ensure that all inputs and data exchanges are in place when outputs are required by downstream activities.

The communications criteria for reviewing the planning schedule, during the Products life cycle, must be determined.

3.4.2.2 Assessing the schedule

Periodic assessments of the project schedule must be carried out to confirm the adequacy and effectiveness of the scheduling process.

3.4.2.3 Improving the schedule

Opportunities to improve the schedule, on a regular basis, based on individual project assessments, individual and organisational feedback and changes in the specifications, must be identified. Changes in the schedule according to the project guidelines must be documented and communicated. Major changes which lead to the selection or elimination of specifications must be documented in the ILS plan.

3.5 Establishing common rules and requirements between ILS specifications

Since one of the major goals of ILS is to provide a cost-effective support, the efforts spent during the identification and development of support resources must be kept to a minimum.

To achieve this, common requirements between the S-Series ILS specifications must be defined and established, taking into account the Product life cycle phases, including preparation, development, production, in-service, and disposal phases.

Proposed general common rules and requirements that must be accounted for and referenced to the S-Series ILS specifications include, but are not limited to:

- ILS/LSA guidance and review conferences
- Product use data
- Concept of Operations (CONOPS)
- Support/support concept
- Maintenance concept
- Common business rules
- Legacy data context
- Design engineering data
- Bill of Material (BOM)
- LSA/LORA candidates
- ILS plan
- Content of the LSA database
- MTA report
- Data feedback
- Data exchange rules
- IT hardware, software and architecture requirements

Business information and terms must be expressed in clear business rules that are agreed to by the customer and contractor at the ILS/LSA guidance conference and updated as required at the ILS/LSA reviews. Further internal rules can be required between the different involved ILS functions.

3.6 Coordination between ILS functions

It is the ILS manager's responsibility to coordinate ILS functions to ensure that integration and optimization of functions, among all ILS activities, meet the project objectives.

3.6.1 Establish a Product support group

The Product Support Group (PSG) manages all activities associated with the development, maintenance and implementation of ILS. It focuses on the cost-effective life cycle support in an integrated contractor- customer scenario.

The main objectives of the PSG are to:

- develop, maintain, support and enhance ILS process to meet the evolving requirements
- liaise with related stakeholders
- improve and facilitate the use of ILS specifications by the adoption of new concepts and technologies
- conduct guidance conferences between related stakeholders to:
  - review the Guidance Document (GD)
  - incorporate changes and raise new requirements
  - identify commonality between the GD and the existing contracts
  - provide guidance to external stakeholders
  - facilitate understanding of contractual requirements
- Conduct ILS functions review meetings to:
  - identify and address dependencies of the ILS functions
  - adjust planning and execution of deliverables
  - ensure proper integration among the required ILS processes
  - ensure the timely availability of the necessary resources which are performing the different ILS functions

3.6.2 Coordination with domains and business related functions

Since ILS is a discipline that integrates many individual elements and has a complex set of relationships through the life cycle phases, it must be implemented a coordination with domains and business related functions of the individual ILS elements.

3.6.2.1 Domains

The domains that must be coordinated are:

- program management
- global supply chain
- engineering
- manufacturing
- security
- safety
- configuration management
- quality
- ILS

3.6.2.2 Business related functions

Business related functions that must be coordinated are:

- sales and marketing
- intellectual property
- human resources
- finance and accounting
- commercial

For coordination each of the 12 ILS elements with domains, inputs and outputs must be harmonised in accordance with project milestones.

With business related functions, it essential that the required information and agreements are available for meeting the project milestones.

3.7 Tailoring for the use of the ILS specifications

The ILS process needs to be tailored according to the project requirements. Therefore, the use of the S-Series ILS specifications must be tailored for the ILS process and the corresponding project organization. Refer to Chap 2.

Tailoring is an integral part of ILS management and must be applied to all ILS elements and must be carried out during the early stages of the project life cycle with the development of the ILS strategies, but with fine adjustments being made through life.

The application of ILS specifications to a project can be considered at various levels of granularity during the project lifecycle. During the early phases of the project life cycle decisions can be made as to the applicability of individual specifications within the S-Series ILS specifications and those deemed unnecessary can be removed. Refer to Para 3.3.

As the project matures, the need and suitability of specifications and their support of specific ILS activities must be reviewed. Any changes to the use of specifications must be documented.

There are six key tailoring activities that must be considered when tailoring the S-Series ILS specifications to:

- identify project essential ILS activities and associated ILS specifications processes
- determine essential activity costs
- identifying and costing of additional ILS activities in terms of added value against cost
- manage project acceptance of tailored ILS activities
- identify the necessary information and data elements
- establish project specific specification business rules

The ILS team must tailor the ILS activities by considering the amount of design freedom and the availability and applicability of information in all the ILS elements. Efforts must then be concentrated on the areas where most benefit can be achieved.

Considerations which must be addressed in the tailoring process include:

- phase of the project/schedule constraints
- time, financial and other resource availability
- impact on other ILS activities
- amount of design freedom involved
- information availability and relevancy
- impact on data exchange and IT systems
- work already completed on the project
- past experience and historical data on comparable projects
- desired tasks which are non-standard
- estimated return on investment

Tailoring is an iterative process that applies to all the ILS elements.

The major factors to be considered are outlined in Table 2.

Table 2 Main factors to be considered for tailoring

Factor	Description
ILS activities	What activities are needed to optimise the ILS disciplines and related elements for the program?
Outputs	What information, deliverables and plans are required to define and meet the support requirements?
Inputs	What information is required to support the analysis?
Resources	What resources are available to perform the ILS activities required by the project, in terms of cost, time, and manpower?

3.8 Integrated logistics support plan

The ILSP establishes the essential information required to initiate and maintain through-life integrated logistics support activities and provides general guidance on the policy, implementation and responsibilities for the application of ILS. Refer to Para 2.4.2.2.

The ILSP serves as a working document for those activities responsible for the planning, management, and execution of ILS activities during the life cycle phases. The ILSP supports system engineering and production processes, with related planning to support a seamless transition to the in-service phase.

This ILSP is used to evaluate, monitor, and approve the planning and performance of the ILS program tasks as specified by the contract.

3.8.1 ILS management

The ILS management functions to monitor and control the execution of ILS planning, coordinate efforts, monitor schedules, assess performance, and ensure timeliness and accuracy of inputs. ILS management also evaluates compliance with applicable specifications, requirements, and guidelines. Program status must be maintained for individual areas of responsibility.

ILS management meetings will be scheduled to be held in conjunction with other major program meetings, (eg, design reviews). Regular logistics technical interchange meetings will also be held.

The establishment and maintenance of an interface with the ILS element managers to provide continuity between ILS management direction and the development of the ILS outputs is of crucial importance. A smooth execution of the activities by maintaining proper interface between the different teams and the ILS managers must be ensured.

3.8.2 Roles and responsibilities

The PM must be the single point of accountability for accomplishing project objectives for total life cycle systems management, including sustainment.

The ILS manager, who reports to the PM, is responsible for providing logistics and supportability expertise and resources to the project teams. In the Product development process, each integrated Product team leader controls the budget and is held accountable for development of that team's products.

The logistics support team, coordinated by the ILS manager, is responsible for development of the support system. This team is a subset of the integrated product team responsible for the design, development, manufacture, operations, and support of a specific Product.

Logistics and supportability resources must be provided to the integrated Product teams to:

- incorporate supportability into the design of the system and support system by providing reliability, maintainability, testability, human engineering, integrated diagnostics, and environmental suitability resources
- develop the support system and training system, and plan logistics resources by providing supply support, support equipment, technical data, facilities, PHS&T, manpower and personnel, and training and training equipment personnel
- accomplish logistics engineering in the Product development systems engineering and design process
- provide for LSA, standardization, interchangeability and interoperability, and environmental assurance

The ILS manager with the direction, control and authority to:

- plan, coordinate, develop, produce and deliver quality products on schedule and within cost.
- assure the development of each logistics element is driven by and results mainly from the LSA process
- plan, coordinate, and schedule the resources necessary to test and evaluate the system, support and test equipment, training equipment, containers, associated logistics data and planned logistics resources
- ensure supportability and supportability related features are incorporated into the system, support system, and training system design

A significant feature of this organization is every product has a single point of responsibility, authority and accountability in the organization and the PM is the overall responsible. Each ILS manager is vested with total responsibility for all aspects of that team’s products. Product team leaders at each organizational level combine the responsibilities of all subordinate product teams

3.8.3 Logistics management objectives and policies

3.8.3.1 Logistics management objectives

Integration of logistics and supportability into the integrated product development program organization ensures that:

- the design reflects test data assessment, supportability alternatives and tradeoff evaluations
- the specification requirements are sufficiently detailed
- the logistics resource planning is adjusted as necessary
- the operational availability and readiness thresholds are met
- the item is supportable in the expected operational environment
- the operational environments is/are accurately assessed
- the support system achieves expected performance

An underlying logistics program objective is to identify and resolve supportability technical risk issues early, prior to beginning production and deployment of the Product.

3.8.3.2 Logistics management policies

To achieve logistics management objectives, a suitable organization must be established for design-for-supportability through the integration of design and the development of the support system and training system. This will be achieved by:

- structuring an integrated product development organization which provides for active logistics participation and influence on design
- structuring the ILS process to be continuously interactive, on a working level, with design engineering through the system engineering process
- planning to work closely with customers and suppliers to develop the system

Additionally, a LSA process must be established, which:

- provides the logistics analysis procedures for integrating supportability requirements into the baseline design
- requires the support system configuration match the system design configuration
- provides the detailed maintenance planning and bottoms-up identification of total logistics resource requirements

An ILS program progress, status and management reporting system which will document that program design, development, test and evaluation, and transition accomplishments meet or exceed logistics priorities and developing supportability requirements must be established to enable effective control.

3.8.4 Integrated logistics support program implementation

The level of implementation will be dependent on the degree of innovation and complexity of the project, materiel solution, support environment, and the availability of resources such as funding and specialized personnel. Decisions on support requirements have the greatest impact on system performance, life cycle cost and supportability, when taken early in the period of the life cycle of a project and a Product.

ILS disciplines must plan and develop logistics support requirements and ensure quality in terms of RAMST.

The ILS program is the central element of the contractor's logistics program and it provides the framework for monitoring and controlling the orderly and systematic development and execution of the support program, including the identification of necessary corrective activities, communications, and follow-up procedures.

LSA provides the data required to define and develop logistics elements of support and resources requirements. Information that is generated by performing LSA activities is documented in data records directly related to the various ILS elements.

Through the integrated product development system engineering process, the LSA program has been established as the analytical tool for determination of supportability requirements for the logistics elements. Since design and supportability requirements are fed into the LSA database, a direct relationship has been established between logistics related design parameters such as, reliability, maintainability, and availability to readiness resource requirements.

Evaluation of LSA output reports, coupled with design process feedback, assists the contractor in defining supportability drivers and requirements. Additionally, due to the iterative nature of LSA, an audit trail is formed which documents the process used to make supportability decisions.

Reports are provided to the logistics members of the integrated Product organization and feedback occurs within the integrated Product organization. Logistics elements are directly related to each other through the LSA process and their impact on other elements is readily available through output reports using the common LSA database. Using these outputs, the contractor can determine, for example, what effect selection of a particular item of support equipment will have on maintenance planning, training requirements, technical data, and supply support. This information permits logistics element resource planners to make timely and intelligent inputs into the design process, which in turn permits optimization of support at the lowest logistics LCC.

3.8.4.1 Master ILS program schedule

The ILS planning and control process provides the planning, scheduling and reporting system necessary for effective ILS management of the program. Generation, implementation and updating of the master ILS program milestone schedule can be established as a four step process:

- Design for support
- Develop support
- Acquire the support
- Provide the support

Refer to Chap 2 for these four process steps.

Initiate specified and expected contract requirements. These documents provide key system development, testing and operational dates, locations and hardware requirements. Major ILS milestones are identified and updated for use in ILS plans, schedules and status reports. This step requires a master ILS program milestone schedule for the purpose of integrating the overall ILS program, determining the relationship among logistics element tasks, and merging the ILS program into a master program schedule.

Logistics element plans and schedules provide the logistics elements leader with a planning and control system. Baseline logistics element schedules are linked to the master ILS program milestone schedule and are provided in an ILS program progress, status and management report or reports. It provides detailed logistics resource scheduling and status reporting for items such as, spares and repair parts, technical data and training equipment.

3.8.4.2 ILS in the system engineering process

Contractor objectives for integration of logistics and supportability into the systems engineering process is to ensure that the traditional design process disciplines, and reliability and maintainability engineering are employed in the design-to-support parameters for the program support system.

This objective is part of the overall program management objective to:

- achieve operational availability and readiness thresholds
- achieve reliability and maintainability thresholds necessary to meet these objectives
- assign appropriate priorities to logistics and supportability element requirements in system design tradeoffs
- identify support and manpower drivers

Systems engineering is the application of scientific and engineering resources to:

- transform the operational need into a system configuration which meets effectiveness standards
- integrate related technical parameters and assure compatibility in a manner which optimizes the system and the system's design
- integrate the efforts of all engineering disciplines and specialties into the integrated Product development systems engineering process

In the systems engineering context, logistics and supportability:

- flows down system requirements
- develops logistics support requirements
- develops the support system
- interacts with and makes direct inputs to the integrated Product organization during trade studies
- participates in design analyses
- responds to customer requirements and expectations

3.8.4.3 ILS program supplier participation

Suppliers are an integral part of the logistics organization, especially main suppliers within the program who need to be integrated in the ILS process.

The contractor will impose as much of the ILS program on suppliers as is practical, consistent with the supplier's capability and experience and contractually acceptable to the supplier. The contractor conducts ILS procurement reviews to evaluate candidate suppliers based on their logistics and supportability program capability. This effort, similar to a source selection evaluation, surveys suppliers to verify that each supplier is capable of providing the logistics support necessary to satisfy project requirements.

3.8.4.4 Progress, status and management reporting

Management reports can include but are not limited to:

- master ILS program milestone schedule
- baseline schedule for each logistics element
- current status of each logistics element compared to the Statement of Work (SOW)

The required reporting system is dependent on the project. Standardized solutions for reporting requirements are often not available or not applicable to specific project needs.

3.8.5 ILS organization structure

The ILS organization must be established carefully. All responsibilities must be clear and transparent for all participants within the ILS and LSA processes, especially in projects where cooperation between several companies must be established. The top level ILS manager is responsible for establishing this organization.

ILS managers at the several cooperation partners can support the top level ILS manager. It is recommended that a top level LSA manager, who supports the top level ILS manager, is established. LSA managers at the participating stakeholders within a cooperation project have to report to the top level LSA manager. It is also essential that, for an effective ILS/LSA program, both the customer and contractor must have an ILS/LSA organization.

The operating organizational structure for a support program can be aligned with the Work Breakdown Structure (WBS). The hierarchical characteristics of the WBS can be used to establish lines of responsibility, authority, accountability and reporting chains from the lowest level member to the PM. Integration of logistics into the depicted organization is designed to:

- reflect each logistics and supportability element identified by the WBS and system specification.
- provide effective interfaces for logistics-related design functions most important to developing the support system, and achieving readiness goals.

Each ILS manager is vested with total responsibility for all aspects of that team’s products.

Product team leaders at each organizational level combine the responsibilities of all subordinate product teams. This responsibility and reporting chain continues to the point that the PM, as leader of the system team, has responsibility for all products. A significant feature of this organization is every product has a single point of responsibility, authority and accountability in the organization.

Functional leaders such as product support, production, and engineering department leads, are members of the product team and provide support to the PM. In that capacity, these leaders bring functional expertise and resources to assist in project execution and ensure uniform, timely assignment of appropriate skills to the product teams, to assist in project execution by the integrated product teams.

3.9 Necessary IT concept

An ILS program must identify the IT architecture that can ensure the implementation of the ILS specifications.

Such tools must be selected using a global IT concept and architecture to avoid integration problems. IT is an essential enabler for an efficient business process.

It is recommended that a functional IT architect is present at least at the ILS guidance conference (Refer to Para 3.3.6) and, if necessary, at the individual ILS element guidance conferences, as it is critical that the IT architect is aware of the business needs, to establish a global IT concept that covers all ILS elements. IT tools supporting the ILS program must be documented in the ILS plan.

The IT concept must be documented and distributed to all stakeholders so that all IT development and integration is performed in a homogeneous way. This documentation consists of one global architectural document and one or more lower-level detail documents.

The IT concept (including architecture and technical data exchange documents) can be an official delivery and must be considered as being contractual. These documents will contain all technical aspects agreed at the guidance conference and possible ad-hoc additional technical meetings. They will be approved by the parties involved in the project and its modifications must be approved by authorized personnel.

3.9.1 IT architecture document

The IT architecture document outlines the global IT concept and provides the overview of the IT infrastructure, associated stakeholders and IT systems, including but not limited to:

- parties involved (companies or organizations)
- point of contact points at each party for IT issues
- IT infrastructure (including firewalls, IP addresses, etc)
- affected IT tools, databases
- data exchange process between organizations/IT tools and global data delivery responsibilities
- data integration responsibilities
- help desk
- reporting on exchange issues
- security requirements (eg, https, encryption, etc)
- planning/implementation timescales, including testing
- service level agreements

3.9.2 Technical data exchange document

In addition to the IT architecture document, one or several technical data exchange documents can be required. Not to be confused with an interface control document (ICD), which is the exchange mechanism between two or more IT systems, the technical data exchange document provides a detailed description of the data exchange between two or more parties, including but not limited to:

- responsible organizations and contact points at both sides (for IT and data quality)
- planning/implementation timescales, including testing
- infrastructure details (eg, IP addresses)
- help desk
- reporting on exchange issues
- security requirements (eg, https, encryption, etc)
- responsible for delivery of each individual data set and delivery frequency
- exchange mechanisms
- exact data to be exchanged
- XML schema for project-specific values
- business rules for data validation
- service-level agreement, exchange times (if synchronous)

Chapter 4

Governance of the S-Series ILS specifications

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References

Table 1 References

Chap No./Document No.	Title
S1000D	International specification for technical publications using a common source database
S2000M	International specification for material management
S3000L	International procedure specification for Logistics Support Analysis (LSA)
S4000P	International specification for developing and continuously improving preventive maintenance
S5000F	International specification for in-service data feedback
SX001G	Glossary for the S-Series ILS specifications
SX002D	Common data model for the S-Series ILS specifications

Chap No./Document No.	Title
SX003X	Compatibility matrix for the S-Series ILS specifications
DMEWG-2011-005	UML writing rules and style guide
DMEWG-2012-006	DEX writing rules and style guide
DMEWG-2011-007	SX001G Glossary style guide
S1000D-PPWG-2013-077-003-00	Authoring S1000D Issue 4.2 and the S-Series ILS Specifications
ISO 10303-239 PLCS	Application protocol: Product life cycle support
ISO 639-1	Codes for the representation of names of languages
EN/NAS 9300	LOng-TERm Archiving (LOTAR)

1 General

The development, production, publication, maintenance and management of the S-Series ILS specifications are the responsibility of the ILS specification Council and the Steering Committees (SC) and/or Working Groups (WG) of each specification.

1.1 Purpose

The purpose of this chapter is to provide the guidelines and procedures for the development, production, publication, maintenance and management of the S-Series ILS specifications and its supporting elements. This includes the relationship between the Council, each specification's SC and the requirements for their governance.

1.2 Scope

This chapter defines the governance of all the S-Series ILS specifications, as well as the relationship between the SCs. As such, the rules stated in this chapter are mandatory for all S-Series ILS specification groups. Change Proposals (CP) for modifications to this chapter must be in accordance with the rules herein and agreed by the ILS specification Council. The governance described in this chapter does not include the maintenance of S1000D.

2 Organizational structure

2.1 ASD/AIA ILS specification organization

Each of the S-Series ILS specifications is developed by an SC that manages the development and maintenance the specification. During the initial development phase, the group is a WG. Once the specification is published, the WG becomes an SC. A special transversal working group, called the Data Model Exchange Working Group (DMEWG) works on issues that are common, in some way, to the specifications. Refer to Para 2.2.

The coordination and global management of a SC and their WG is performed by a joint ILS specification Council.

2.1.1 ILS specification Council

The ILS specification Council is the governing body of the suite of the S-Series ILS specifications, which establishes the global policy for the specifications. It defines the Charter for SC and resolves potential disputes. The history of the ILS specification Council is given in Chap 1.

The role of the ILS specification Council is to maintain the vision and mission for the specifications so that the mission can be achieved, provide overall administrative management, direction to the SC for the individual specifications and provide general promotion of the use of the S-Series ILS specifications. The organizational structure of the ILS specification Council is shown at Fig 1.

Specifically, the ILS specification Council:

- liaises between ASD and AIA and ensure that the interests of its member's organizations are met
- liaises with the S1000D Council to ensure harmonisation
- maintains the vision, mission and roadmap for the future development and maintenance of the specifications
- oversees the administration of the specification's development programs
- established, maintains and oversees the specification's SC
- maintains the User Agreement for the "suite of information" for each of the specifications
- encourages the adoption and use of the specifications by initiating educational and promotional events/materials
- identifies additional areas of harmonization, within the scope of the Memorandum of Understanding (MoU)
- assures the S-Series ILS specifications conform to and are compatible with other international standards and specifications such as ISO 10303-239 PLCS, where appropriate
- engages with other organizations, bodies and standards to promote and support the use of the specifications
- arbitrates in case of conflicts between the different SC

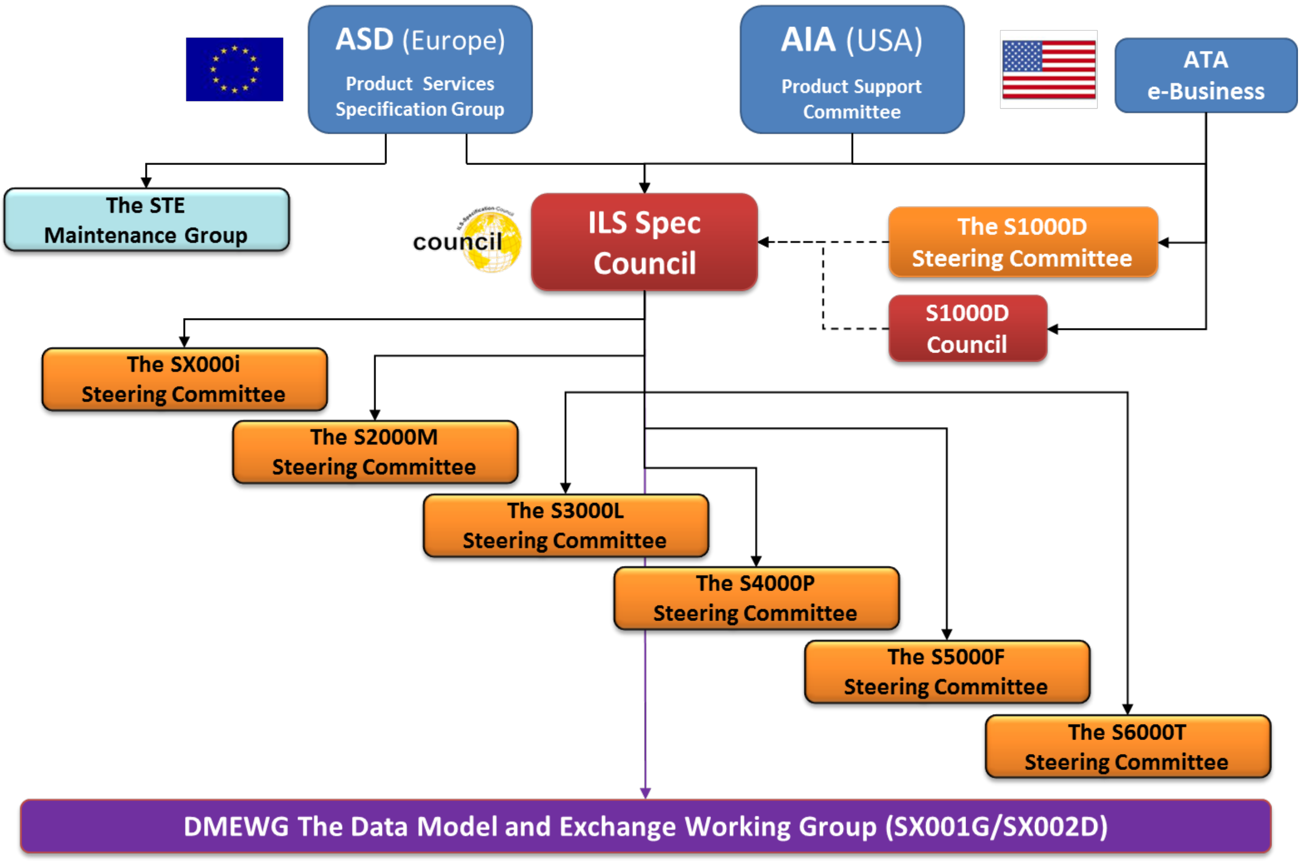

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Fig 1 ILS specification Council organizational structure

The ILS specification Council consists of:

- Three members appointed by AIA
- Three members appointed by ASD
- The Chair and/or co-Chair of each SC or WG
- The Chair of the S1000D Council. Refer to Fig 2.

The ILS specification Council has a Chair and a co-Chair appointed from the AIA and ASD members. Chairmanship rotates between AIA and ASD every two years.

The ILS specification Council is based primarily on consensus and detailed in the ILS Specification Council Terms of Reference (ToR), Refer to ILS-C 2010-001_001_01 TOR. If no consensus can be achieved, a vote is conducted under the following:

- The AIA and ASD representatives have both veto and voting rights. Veto is only exercised in exceptional circumstances and would imply escalating the issue in question to AIA and ASD levels.
- The WG and SC Chairs have voting rights but no veto rights
- The Chair of the S1000D Council and a S1000D SC representative are observers of the ILS specification Council, but have no voting rights

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Fig 2 ILS specification Council organization

The ILS specification Council will continually monitor the structure and performance of the S-Series ILS specifications and provide direction for change, as appropriate. The ILS specification Council will foster a collaborative environment throughout the entire ILS Specification community.

2.1.2 Steering Committees and Working Groups

SCs and WGs are the groups dedicated to the development of the ILS specifications or to specific supporting tasks that are essential for such specifications. SC are created by the ILS specification Council that work in accordance with their Charter.

There is one SC or WG for each specification. A WG is usually created to develop one single specification, and becomes a SC once the specification has been published. A WG can be also created within a SC to handle a set of permanent tasks inside a SC. In this case, the WG reports to the parent SC.

An exception is the DMEWG, which has several transversal specifications under its responsibility.

Each SC or WG has a Chair and a co-Chair, one representing AIA and another representing ASD. For historical reasons, some of the SC have a Chair and Vice-Chair, one from each association, who alternate periodically between US and Europe. The Chairs are nominated by their respective associations (AIA and ASD).

The work performed by the SC is defined by the Charter that is approved by the ILS specification Council. This includes approving any changes proposed by the SC. The SC officers seek approval from their respective associations (AIA or ASD) before submission to the ILS specification Council for approval.

The internal working of the SC is in accordance with their ToRs defined by the SC itself. The ToRs are submitted by the SC to the ILS specification Council, who ensure that the ToRs comply with the ILS specification Council vision, mission and policies.

A WG created by a SC can have the Charter and ToR combined into one document. Changes to that document will always be approved by the parent SC, without any need for higher-level approval.

Every SC are ruled by consensus, and in accordance with the ToRs. The rules regarding consensus are provided in Para 2.1.7.

2.1.3 Steering Committee membership

With the exception of the DMEWG, members of a SC are nominated by their parent organisations or MoDs/DoDs. In the case of ASD member organizations, members represent their respective countries, with a maximum of 2 different companies per country and report back to their national associations. These representatives have votes on the specification. AIA SC members have one vote in the SC, as indicated in Para 4.4.

The members of the DMEWG are the data modellers that have been nominated by the individual specification SC. A minimum of one data modeller is required for each specification.

Additional members can be approved by the SC provided they belong to one of the AIA or ASD organizations.

Members are expected to contribute to the development and maintenance of the specifications and attend the SC meetings. Members have unrestricted access to all the SC documentation and collaboration areas. Members and their companies accept that their participation in a SC means that any material contributed to the development of the specification can be used publicly without compensation. This means that proprietary information cannot be used or contributed by members towards the specification development without written consent by the copyright holder.

Only AIA and ASD members, or MoD/DoD of the countries represented by AIA and ASD, are allowed to participate as members or observers of a SC.

Observers have only limited visibility and access to the SC documentation (eg, meeting minutes and status reports) as defined in the SC ToR. Observers participating in a meeting do have a formal contribution, and their opinion is not subject to the consensus rule nor does it need to be considered by the SC. Observers do not have voting rights.

Members that do not actively participate and miss three consecutive meetings from a SC will automatically revert to observer status. If membership was due to the specific nomination of an AIA or ASD association, the specification Chair or Vice-Chair reports the lack of activity to the nominating organization and that the member has been moved to the observer status.

The SC Chairs can revert an observer back to member status if the non-participation was unavoidable, if the person in question is significantly contributing to the SC work, starts attending again regularly the meetings, or is reconfirmed by the corresponding AIA or ASD organization as a member. Re-instatement can also be proposed by any SC member but must be agreed by the SC.

In exceptional cases (eg, special expertise, other standardization bodies or ASD/AIA agreements with other associations), SCs can invite individuals or members of organizations that do not belong to AIA or ASD, as special observers. This special observer status must be specifically reported to the ILS specification Council. Special observers will have the same rights as normal observers, and can attend all meetings to which they are invited, but cannot become members of the SC.

In the event that another organization signs a Memorandum of Understanding (MoU) with ASD/AIA for the co-development of the specifications, the companies belonging to such organization can join the affected SC as members, under the same conditions as indicated above.

2.1.4 Working Groups

A WG is a group of individuals assigned to address specific tasks belonging to a certain subject area. WG are standing groups and are created by the SC and ratified by the ILS specification Council.

2.1.5 Task Teams

Task Teams (TTs) are groups that are created to carry out a specific task, and are dissolved after the task has been carried out. TTs are approved by the individual specification SC as required, and operate in a similar way as the SC, except for their limited scope of responsibility.

TTs performing tasks associated with more than one specification are approved by the ILS specification Council and placed under the responsibility of a SC, who will then manage it like any other TT.

2.1.6 SC reporting

The formal internal SC reporting will be defined and included in the ToRs. This formal reporting is only necessary when the SC has TTs dedicated to specific subjects, and a global vision is required by the SC members.

All SC will provide a status report to the ILS specification Council during each of the Council meetings.

Status reports will be archived in the corresponding SC/WG repository as per Para 3.8.1.

2.1.7 Decision making in the SC

Decisions within a SC will be made by consensus. Refer to Para 2.1.7.1 thru Para 2.1.7.5.

2.1.7.1 Consensus

Consensus requires the Chair/Vice Chair of the SC complete a check of understanding amongst the participants in the meeting of the matter to be decided upon. Consensus is a mutually acceptable agreement that takes into consideration the interests of all concerned parties.

Achieving consensus can require generating compromises. Compromise is defined as a settlement of differences or controversy through acts of concession until agreement is achieved.

When specifically representing the interests of their nation/organization, the Chair, co-Chair and Secretary will declare this fact during consensus discussions.

2.1.7.2 Checking for understanding

Before consensus, SC officers ensure that the SC has a full understanding of the issue. Opportunity for questions and clarifications must be given to ensure that reliable consensus can be reached.

2.1.7.3 Platform for disagreement

Members expressing concern or disagreement over a matter brought before the group will be given opportunity to pose their argument to the group. A re-check for consensus is to be conducted following the disagreement.

2.1.7.4 Reaching consensus

Reaching consensus is not a vote, and there is no weighted value given one member's opinion over another. If a single member does not agree, there simply is no consensus. Compromises must be offered and consensus sought until it is achieved or the matter becomes irresolvable at the group level.

2.1.7.5 Irresolvable issues

After repeated attempts at compromise have failed to result in consensus, a matter can still be deemed irresolvable. In this case, matters will be referred to the direct managing group (ILS specification Council or SC) for resolution. Sufficient information should be provided regarding arguments, counter arguments, and the need-date to allow the direct managing group to make a timely decision. The affected group will then be notified of the direct managing group's decision.

The only irresolvable issue that could be solved by means of a vote is the publication of a specification, as it is understood that if a specification has reached the point where it can be published, most of the major issues have been already solved by consensus and a minority (perhaps even one single individual) should not have a veto right on publication. The resolution of this special case is described in Para 4.4.

2.2 Transversal groups

Two groups have specific transversal responsibilities assigned by the ILS specification Council and provide the necessary guidelines that all SC must adhere to. These groups are the SX000i SC and the DMEWG.

2.2.1 SX000i SC

The international Aerospace and Defence community has over the past 20 years invested considerable effort to develop specifications in the field of Integrated Logistics Support (ILS).

The work was accomplished by integrated working groups composed of Industry and Customer Organizations (MOD's, etc.) in a collaborative environment. The international Aerospace Associations (ASD, AIA, and A4A) provided guidance and supported the work as required.

The structure and functional coverage of these specifications was initially determined by NATO requirements specified during an international workshop (HAW Acquisition Logistics) in Paris in 1993. This coverage has now developed as the need for additional specifications has been determined.

During the development of the different AIA/ASD specifications, the different working groups identified the need for an "umbrella" specification so as to ensure compatibility and the commonality of ILS processes among the AIA/ASD suite of ILS specifications.

The SX000i SC was established to develop, publicize and maintain an Integrated Logistics Support (ILS) Guide, named SX000i, so as to ensure compatibility and the commonality of ILS processes.

The purpose of the SX000i is to:

- Explain the vision and objectives for the S-Series ILS specifications
- Provide a framework that documents the global ILS process and interactions
- Explain how the S-Series ILS specifications interface with other standardization domains such as engineering, manufacturing, global supply chain, collaboration, security, etc
- Identify missing ILS specification needs for possible future development
- Execute the global governance of the S-Series ILS specifications development
- Provide guidance on how to satisfy specific business requirements using an appropriate selection of defined processes and specifications

The vision that the SX000i SC pursues is that all stakeholders will be able to apply common logistics processes so that sharing and exchanging data can be achieved securely throughout the life of Products and services. To meet the goals of this vision, SX000i SC has established and adopted of a coherent set of global information standards which:

- Provide a common understanding of ILS, and its global processes that integrate all necessary elements and resources throughout the whole Product life-cycle
- Optimize the life cycle cost and performance of the Product and support system
- Respond more quickly to initial and changing requirements, to further optimize processes, improve data quality and drive out unnecessary costs, by identifying the most appropriate solutions and their integration
- Enable collaboration between customers and industry through simplification of electronic information exchange

For this purpose, the SX000i SC:

- Describes the synchronization and global management of the ILS processes covered by the S-Series ILS specifications, including S1000D, S2000M, S3000L, S4000P, S5000F and S6000T, as well as future ILS specifications
- Provides a global governance and integrated configuration management framework (including rules, roles and responsibilities) for the development of the S-Series ILS specifications
- Bases its work on existing logistics processes, handbooks and standards, and makes maximum use of lessons learned from current systems without re-inventing the wheel
- Defines the global requirements for common interfaces for the S-Series ILS specifications
- Takes due account of the activity model and information exchange capabilities provided by ISO 10303-239 PLCS
- Takes into account current ISO/EN baseline documents
- Includes guidelines for tailoring
- Includes other aspects which are considered to be required during the SX000i development process

The SX000i SC does not:

- Define the detailed technical interfaces between the different S-Series ILS specifications.
- Use proprietary information of the participating members provided as reference material

To achieve the vision outlined above, all the common ILS specification rules and guidelines are included or referenced in this document and are adhered to by all SC.

The SX000i SC is authorized by and reports to the ILS specification Council, which owns all work produced by the SX000i.

2.2.2 DMEWG

The DMEWG is a transversal working group that integrates and harmonizes the data models of the different specifications, as well as the exchange of information between them. The responsible data modeller for the respective S-Series ILS specifications SC/WG must also be a member of the DMEWG. This ensures interoperability between the different specifications. Each specification can also nominate additional representatives to the DMEWG.

The purpose of the DMEWG is to coordinate data modelling activities that are performed within any one of the S-Series ILS specification, and to harmonize and consolidate data requirements into one Common Data Model, using UML (Unified Modeling Language). The Common Data Model includes all data elements that are common to more than one S-Series ILS specification. Data that are delivered from one spec to the customer, but are neither used by another specification nor matches any feedback data, can be excluded. The Common Data Model is published by the DMEWG as SX002D.

Data elements and business terms defined within any of the S-Series ILS specifications are published by the DMEWG as a separate specification, SX001G (Glossary). Refer to Para 3.5.

The DMEWG is also responsible for the technology to be used for the exchange and delivery of data, and to provide the necessary enablers to the respective specifications SC. However, it is responsibility of the respective specification SC to define and develop the individual data exchange specifications needed to support the specification and to publish it as part of the specification.

Finally, the DMEWG is responsible for all technical documents required for use by itself and all the S-Series ILS specifications SC.

The following activities are within the scope of the DMEWG:

- Provide guidance and technical governance, including approval, for all data modelling activities
- Develop and maintain one common business oriented data model, which consolidates all common data requirements coming from each of the S-Series ILS specifications
- Develop and maintain one Integration specification that maps the common data elements and attributes to each of the S-Series ILS specifications and provides the rules for interchange between them
- Be responsible for the definition of the technology to be used for the exchange and delivery of data for all specifications
- Governance of any supporting element developed to support exchange and delivery of data for the S-series ILS specifications
- Be responsible for the development, maintenance and publication of the SX001G Glossary.
- Influence standards and specifications which are either closely related to, or used as integral parts of, the common data model and Aerospace and Defense data exchanges

The following activities are not within scope for DMEWG:

- Creation or maintenance of sample data sets
- Modelling resources for the respective S-Series specifications, which is the responsibility of the individual SC

The DMEWG also liaises with other standardizations groups to ensure the interoperability of the Common Data Model and the defined DEXs with other standardization domains.

The DMEWG is authorized by and reports to the ILS specification Council, which owns all work produced by the DMEWG.

2.2.3 SX000i and DMEWG collaboration

Due to their common transversal nature, the collaboration between the SX000i and DMEWG groups is not only essential, but also continuous, to ensure the interoperability of specifications. The Chairs of each group will be kept informed by the Chairs of the other group on progress and issues within the individual groups, and will have a permanent position as Observers in the other group. The Chairs of both groups will communicate with each other as often as necessary for coordination and/or addressing common issues to both groups.

The SX000i SC and the DMEWG work closely on topics such as:

- Common tools for specification development/maintenance
- Policies regarding data modelling and data exchange
- Potential data gaps
- Generation of the Glossary (SX001G)
- Common Data Model (SX002D)
- Specification version compatibility matrix (SX003X)

Detailed guidelines for data modelling and data exchange are defined by the DMEWG. Their use is mandated for all specifications as detailed in Para 3. Providing input by each of the S-Series ILS specifications for the generation of SX001G, is described in Para 3.5.

2.3 Relationship between the working groups and steering committees

All official communications between SC will be always performed through the Chairs and co-Chairs of the respective SC of the same association. (eg, the ASD Chair of a SC would contact the ASD Chair of another SC, and the AIA Chair would contact the other AIA Chair). To expedite the communication process, a SC can nominate a representative in a different SC for all technical work, or for a specific task.

Members from different SC are encouraged to attend each other's meetings as observers, to ensure coordination and exchange ideas across specifications. In the event that a SC identifies a potential interface and/or issue with another specification, the group will invite the Chair/co-Chair of the other SC to assist to the meeting where that issue will be discussed, or ask them to nominate a permanent representative who could inform his own group.

In special cases where there are a significant number of common topics to be addressed, or especially important aspects to be discussed, the SC are encouraged to have a joint meeting.

2.4 Resolution of Conflicts between SC

In a similar way as the internal working of the SC, inter-group relationships are be based on consensus. If the issue is important enough, a joint session will be held between both SC.

If no global consensus be possible, the Chairs of the affected groups will appoint a specific reduced task team with members of the involved SCs, tasked with finding a compromise. If this compromise not be possible within a reasonable period of time, the issue will be escalated to the ILS specification Council, for final resolution.

Issues that could require agreement between specifications and are potential candidates for conflicts could be overlaps between specifications, mismatching processes and interfaces, contradicting content or change proposals impacting different specifications. Refer to Para 7.

3 Global requirements for the S-Series ILS specifications

3.1 Specification maintenance schedule

Any proposed changes to an existing specification must follow the change management process described in Para 7, so that potential impacts to other specifications are identified as soon as possible.

The change management process, used by the S-Series ILS specifications SC enables individual change proposals to be mapped to future specification issues, thus creating a roadmap for the evolution of the specification. Refer to Para 3.6.2

The schedule for the publication of the different specification issues is approved by the ILS specification Council, so that proper alignment between the specifications is ensured and hence, their interoperability. This alignment means that the incorporation of some change proposals is brought forward or pushed back within the schedule, so that the specifications stay synchronized.

3.1.1 Authoring rules

The specifications will adhere to the common Authoring Rules. Refer to S1000D-PPWG-2013-077-003-00. A chapter template is available at the ILS specification Council work space, and should be provided by the SC Chairs to their individual teams and stored in their individual working environments.

3.2 Integration and exchange of specification data

3.2.1 Model development

The baseline standard used for the S-Series ILS specification data models is ISO 10303-239 (AP239), PLCS.

Each of the S-Series ILS specification data models use, at their core, the Common Data Model as defined in SX002D by the DMEWG. The Common Data Model defines the structure of data that are shared by two or more specifications, as well as the relationships of those data.

The necessary primitives from AP239 are included in the Common Data Model, so that the compliance with it by the different S-Series ILS specifications is facilitated.

The specification data modellers participate in the DMEWG and develop the data models of their specifications using the UML Writing Rules and Style Guide developed by the DMEWG. Refer to DMEWG-2011-005. The models will be developed using the approved tools as defined in Para 3.6.2 using the latest UML profile released by the DMEWG.

3.2.2 Input data specifications

The specification specific data models ("process outputs") are included with each individual specification. The inputs required by each individual specification are documented in an input data specification. These specifications have the same number as the specification for which it provides input information, with the final character being replaced by an "X" (for "eXchange"). (eg, S3000X will define the data inputs required by S3000L).

The development of the input data specifications is the responsibility of the SC for which the data is provided, in coordination with the DMEWG.

If an SC finds that it needs an input that does not have a data element in the data model specification, then that SC raises a CP so that the specifications that would provide the input data can have its model changed. This CP will explicitly indicate a potential impact on SX000i and SX002D, as both the ILS process and the Common Data Model could also be impacted.

3.2.3 Data exchange

Data is exchanged between the domains of the S-Series ILS specifications using XML and a set of defined XML Schemas. Each individual XML schemas is generated from the specification specific data models in accordance with the rules and guidelines defined by the DMEWG.

The specification XML schema will be mapped to AP239 as defined by the DMEWG in the DEX Writing rules and style guide. Refer to DMEWG-2012-006.

3.3 Process modifications

Modifications to a specification's production process are managed by its SC.

However, if the modification of a process affects the external specification outputs and/or modifies the global ILS process flow, then that specification's SC raises a CP to propose changes to SX000i so that global ILS process integrity is maintained. Additional change proposals to SX002D are raised if the Common Data Model is affected by such process change.

It is the responsibility of the individual SC to track CPs raised by other specification SC that potentially impact their own input specifications. Refer to Para 3.2.2.

3.4 Inputs to synchronization and compatibility matrix

Prior to the release of a new specification issue, the SC submits a CP to the DMEWG for modification of the Common Data Model (SX002D). The DMEWG assesses those changes and informs all specification SC of the impact that the changes have, so that changes are incorporated into all other affected specifications and the integrity of the synchronization between specifications is maintained.

If changes to the Common Data Model are required, each specification SC will inform the DMEWG, the SX000i SC and the ILS specification Council of the issue number and publish date of the specification that will have the changes incorporated.

On each release of a new issue of a specification, the SC responsible for that specification informs the DMEWG, the SX000i SC and the ILS specification Council of the issue of the Common Data model that was used, any potential modifications to the specification DEX, and any backward compatibility issues. This information is provided in accordance with the SX003X (Compatibility Matrix Style Guide) for which the DMEWG group has the responsibility for its publication and maintenance.

The DMEWG then incorporates any required changes to SX003X, up-issues and publishes the new issue.

SX003X documents the interoperability between the specifications, and is used by projects to select the appropriate specification issue for the project. Refer to Chap 3.

3.5 Inputs to the SX001G Glossary

SX001G includes all terms, definitions and acronyms used across all the S-Series ILS specifications. In order to keep SX001G current, specification SC notifies the DMEWG of any new terms, definitions and acronyms.

On each release of a new specification version, the responsible SC will provide the list of terms and definitions of the corresponding specification to the DMEWG. These are then incorporated into the next issue of SX001G.

3.6 Standard development and management tools

3.6.1 Tool selection principles

In order to ensure the compatibility and interoperability of the different specifications, a standard set of development and management tools will be defined, whose usage is mandatory for all specifications. Wherever possible, such tools will be open source, so as to ensure unrestricted access to all SC members across all specifications. In exceptional cases, when no suitable open source tool can be found, or the use of such open source implies an excessive infrastructure cost, COTS tools could be acceptable. It is not foreseen to perform ad-hoc developments for such tools.

Reasonable efforts are be made to ensure that the selected tools are also interoperable between them as far as feasible and practical.

Should the need for a new tool be identified, the Chair(s) of the SC identifying such requirement for a new tool will report the need to the SX000i Chair(s), including rationale and potential candidates for the tool. The SX000i will consult the issue and need with the DMEWG, given its transversal cross-specification nature, as well as the suitability of such tool(s), and will raise a recommendation about the tool to be used to the ILS Specification Council for approval. Once approved by the ILS Specification Council, such tool will become part of the standard suite of tools and will be included in Para 3.6.2.

3.6.2 Approved tools

The list of currently approved tools for standards development and management is defined in Table 2.

Table 2 Approved tools

Name	Purpose	Type	Source	Notes
Mantis BT	Issue tracking, change proposals and community feedback for all specifications.	Open source	http://www.mantisbt.org/	Hosted on SX000i site. Contact SX000i Chair for new specification or specific needs.
Working space	Working environment for SC.	Commercial	ASD	Hosted by ASD. Request initial new group access through ILS Specification Council. Refer to Para 3.8.1.
Enterprise Architect	Data Modelling	Commercial	DMEWG participating companies	To be used by SC Data Modellers iaw. DMEWG-2011-005, UML Writing rules and style guide

3.7 Protecting the specifications

The copyright holder for all the S-Series ILS specifications is ASD. Refer to the copyright pages.

The copyright pages of each specification give detailed information on:

- the copyright itself
- special usage rights
- agreement on the use of the specification

In special cases, the S-Series ILS specifications can be trademarked and/or subject to patents in order to protect the intellectual property that they represent.

3.8 Archiving and repository requirements

3.8.1 Archiving of SC internal information

Each individual SC will have its specific working space in the common work space defined by the ILS Specification Council. The organization of such work space will follow a common structure, but the individual SC can create additional folders so as to cater for SC peculiarities.

All the SC information, including historical documents, will be preserved in this work space, for future reference. This information includes, but is not limited to, meeting agendas and minutes, status reports, position papers, working documents, old specification versions, change proposals, etc. Documents that must not be modified such as approved meeting minutes, status reports, change proposals, published specifications, etc, will be stored in PDF format, all other documents will be stored in the original format.

Only SC and TT members and specification stakeholders will have access to this SC repository. During the production and publishing of every specification, its master chapter documents, graphics files, output files and the published specification are archived.

3.8.2 Published specifications and public documents

A copy of all published specifications, both in source and publication format will be stored on the ILS Specification Council work space.

Similarly, every time that a new specification issue is generated, a CD-ROM will be generated with both the source files (original master text files, data model, graphics, etc) and the final publication document. All CD-ROMs are to be permanently marked with: "*SNNNNY, version x.y, issue date YYYY-MM-DD"* and include the signature of the Chairmen concerned.

The CD-ROMs are to be sent to:

ASD	*AIA*
Rue Montoyer 10	*1000 Wilson Boulevard, Suite 1700*
B-1000 Brussels, Belgium	*Arlington, VA, 22209, USA*

After the submission of the CD-ROM, the SC Chair will report this fact to the ILS Specification Council and the ASD PSSG Chair.

Each specification has its own website where issues of them are made available to the public. These websites are:

- ASD-STE 100 www.asd-ste100.org
- S1000D www.s1000d.org
- S2000M www.s2000m.org
- S3000L www.s3000l.org
- S4000P www.s4000p.org
- S5000F www.s5000f.org
- S6000T www.s6000t.org
- SX000i www.sx000i.org
- All transversal specifications (SX001G, SX0002D, etc): www.sx000i.org

3.8.3 Archiving of ILS data

To ensure an effective archiving mechanism for all ILS data, and to ensure the interoperability with other archiving mechanisms (eg, for Engineering information), ILS data will be archived using the specification developed by the LOng Term Archiving and Retrieval (LOTAR) project, EN/NAS 9300 and all ILS Specifications will use this common mechanism.

4 Specification publication process

When an SC considers that its specification is sufficiently mature for review, an initial editorial and publish are carried out. The review periods described in this process are limited to a maximum duration of 90 days.

4.1 Initial editorial work

The specification is reviewed by an editorial team that is made up of members of the specification's SC. This team's responsibility is to ensure that all changes satisfy the details of any CPs, comply with the requirements detailed in this chapter, and follow the S1000D Authoring rules. Ref. [S1000D-PPWG-2013-077-003-00].

Once the initial editorial work is complete, the editorial team publishes a PDF that is delivered to ASD/AIA for internal review and commenting.

4.2 Internal ASD/AIA review process

The specification is made available to ASD/AIA members for review by uploading to a protected area of a website. This fact is reported to the AIA/ASD national bodies, who in turn inform their member companies and national MoD/DOD.

Member companies then provide comments within the review period, in accordance with the Feedback Process. Refer to Para 7.

After the review period the SC reviews the comments and provides appropriate responses.

When all agreed comments have been incorporated, the specification is published a second time for public review.

4.3 Public review process

At this time, the S-Series ILS specification is made available to the public, for further review, to take advantage of any potential contribution from subject matter experts who belong to non-member companies.

The draft is published on the corresponding specification's website, clearly marked as a proposed draft, inviting the general public to submit comments using the feedback process. Refer to Para 6.

Comments received are handled in the same way as that for the internal ASD/AIA review process. Refer to Para 4.2.

In some cases, the public review process can be shortened or cancelled with the approval of the ILS specification Council.

4.4 Specification approval

AIA/ASD approval is required for all issues of the S-Series ILS specifications prior to publishing. To this effect, the final corrected specification is approved by the specification SC by consensus and in accordance with its ToR.

If consensus cannot be not be reached, there is a formal vote by the SC full members, with one vote per country and one per MoD/DoD. Should there be several national representatives for a same country, then they must agree previously the sense of their vote or, if they cannot agree, abstain from voting. Observers do not have a vote.

If the vote results in approval, the publication takes place. The concerns of those opposing publication are minuted so that they can be addressed in the future.

If the vote does not result in approval, the problem is escalated to the ILS specification Council for resolution.

As well as approval by the SC, changes to SX000i Chap 4 specifically, are also approved by the ILS specification Council.

Once the SC has approved publication the ILS specification Council is informed, and it authorizes the publication.

4.5 Final publication

As agreed as part of the joint AIA /ASD MoU, all ILS specifications will be made available to the public free of charge.

4.6 Specification maintenance

Maintenance of a specification consists of updating in response to CPs, or updating to keep pace with new business needs detected by the specification's SC or ILS specification Council. All proposed changes, whether from within the SC or from the public, are documented as technical issues and tracked. Refer to Para 6. The proposed changes are then processed, following the Change Process. Refer to Para 7.

At least once every five years, the complete specification is reviewed by its SC, so that its currency, accuracy, validity and relevance with regard to ILS practices at that time are ensured.

The results of this global review are documented and reported to the ILS specification Council, for their direction.

5 Management of specification websites

Each of the specifications has its own website, providing background information the facility for direct interaction with its users.

5.1 Domain names

Each specification has a domain name that corresponds to the specification number, followed by the top-level domain ".org". (eg, S2000M.org, S3000L.org).

The ILS specification Council appoints an overall domain manager, who reserves and renews the domain names on behalf of ASD/AIA. The domain manager has a deputy who provides backup, as required.

When a new specification is launched, the domain manager reserves the appropriate domain name to preserve the specification's website.

5.2 Domain hosting

The ILS specification Council approves a single hosting company who will host all the S-Series ILS specifications in accordance with criteria set by the domain manager.

Each specification's SC appoints a webmaster who manages the website in coordination with the ILS domain manager.

5.3 Website structure

A common website structure template is defined by the domain manager and approved by the ILS specification Council. All specification websites retain the same structure, and look and feel, applying to the domain manager, with any structural change proposals. Approval follows the same process as specification approval. Refer to Para 3.8.2.

Each website will provide information about its own specification only, referencing the other ILS specification websites as necessary. A "Links" page will provide links to all other specifications.

All cross-specification aspects will be hosted on the SX000i.org website, and the other websites will have to reference this site for common elements.

6 User community feedback

Feedback from the ILS user community is welcome and encouraged and will receive the appropriate attention.

6.1 Who can provide feedback?

The ILS user community that can provide feedback is considered to include AIA and ASD and their member organizations, their national MoD and the user community at large. Table 3 indicates the means through which such feedback must be provided.

Table 3 Feedback channels

Who	Through	Notes
SC members	SC	Companies should channel feedback through their SC representatives
AIA members	AIA SC Chair	Except SC members
ASD members	National SC representative(s)	If no national representative exists, through the ASD SC Chair
MoDs/DoD	National MoD/DoD representative in the SC	If the MoD/DoD does not participate in the SC, through their national representative (for US DoD: AIA Chair) or ASD SC Chair if there is no national representative.
General Public	AIA or ASD SC Chairs	Only to published specifications

6.2 Feedback process

The feedback related to an individual guide/specification must always be performed in accordance with Table 3.

Feedback across specifications, cross-specification issues or feedback about missing content is reported to the SX000i SC. The SX000i SC will evaluate the cross-specification, who will assess the impacts. If a single specification is impacted, the SX000i SC directs the feedback to that specification's SC.

If the assessment identifies that the issue is related to the overall ILS process, global interfaces, or any other common issue, the SX000i SC takes responsibility for the issue, creating a sub-issue for each individual specification. Refer to Para 7.1.

If the multi-specification issue is only related to the common data model (SX002D), detailed interfaces or data exchange, the SX000i SC will hand over the responsibility for the issue to the DMEWG. Refer to Para 7.1.

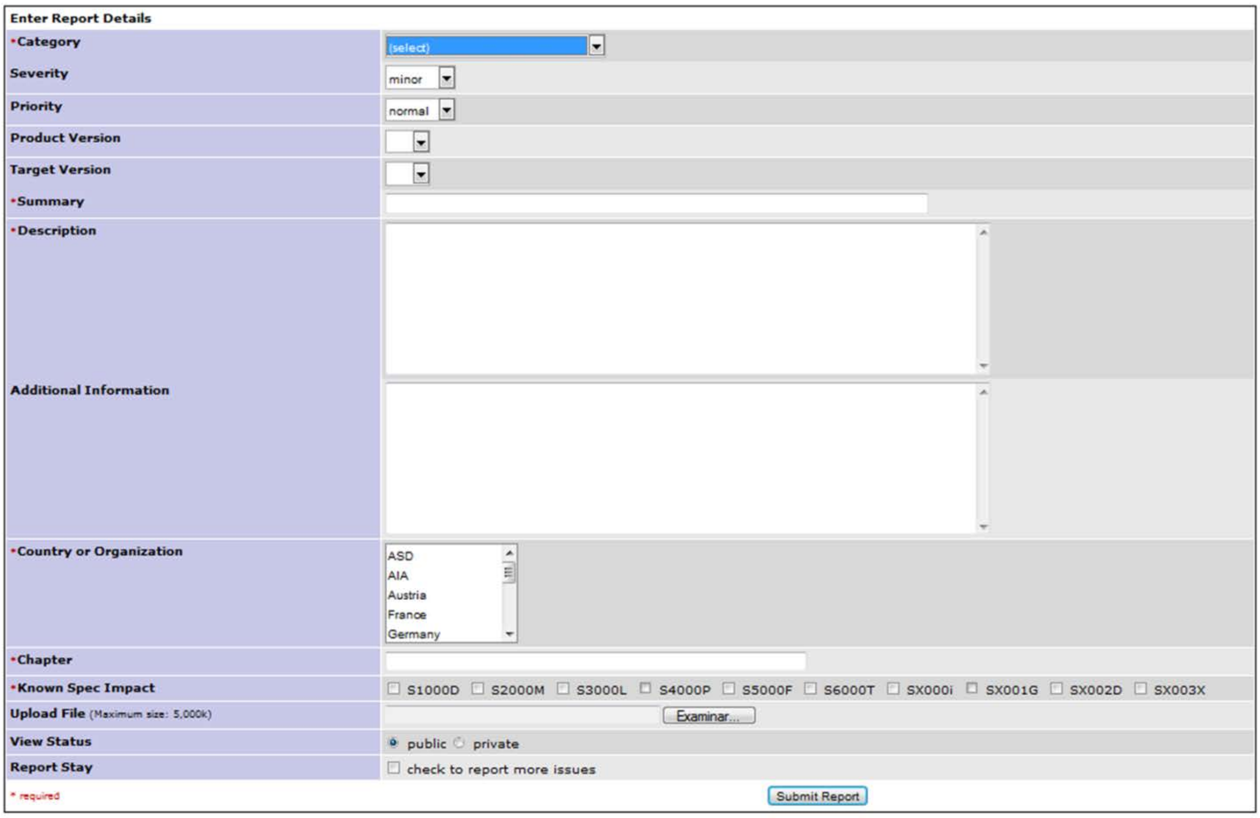
Reporting feedback uses a CP management website. Refer to http://www.sx000i.org/CPF/. Visitors to the website are required to register to gain access; however, registration is free of charge. Refer to Para 6.1.

Note that feedback that does not comply with the rules given in Para 6.1 can be discarded or deleted without explanation. The feedback form within the tool is shown in Para 6.3.

A response will be provided to the user by the designated national or organizational representative. Based on the feedback, a CP is raised for the affected specification. Refer to Para 7.2.

6.3 Feedback form

The form through which feedback is provided is shown at Fig 3.


Enter Report Details

*Category	(select)
Severity	minor
Priority	normal
Product Version	
Target Version	
*Summary	
*Description	
Additional Information	
*Country or Organization	ASD AIA Austria France Germany
*Chapter	
*Known Spec Impact	S1000D S2000M S3000L S4000P S5000F S6000T SX000i SX001G SX002D SX003X
Upload File (Maximum size: 5,000k)	Examinar...
View Status	public private
Report Stay	check to report more issues
* required	Submit Report

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Fig 3 Feedback form

Providing information in those fields marked with a * is mandatory in order for the form to be accepted and the feedback process started.

Feedback can provide an answer to the originator of the technical issue, or it can trigger a CP. Refer to Para 7.

7 Standard specification change management process

The change management process is applied to the S-Series ILS specifications, so that interoperability is ensured.

The standard change management process manages changes affecting a single specification or multiple specifications. The process coordinates changes across multiple specifications and manages delta changes and the timeline associated with CPs. This allows monitoring CPs, proposed by any SC, independently of the specification(s) affected. It is also possible to monitor CPs made by the S-Series ILS specification's SC to other standardization bodies to ensure interoperability of the S-Series ILS specifications with those of other domains.

Changes to specifications are always generated based on CPs and only SC members from any of the specifications and the ILS specification Council can generate them. The user community can only raise issues through the feedback process described in Para 6. Evaluation determines whether the raised issue becomes a formal CP or not.

7.1 Feedback evaluation

All feedback received is evaluated through the appropriate feedback channel. Refer to Para 6.1. If this is the respective SC Chair, then the evaluation of the feedback is assigned to one of the appropriate SC members to ensure that all SC members contribute. The SC Chairs can also reassign a specific issue to a specialist, in case the issue presents special challenges. The lead for a specific feedback issue is called the Technical Issue Contact Point (TICP).

All issues are given a unique tracking number, and a unique TICP. The TICP will evaluate the impact and fidelity of the issue, and request further information from the originator, so that all the information is reliable and complete. If necessary, specialists within the SC can be involved to confirm that there really is an issue.

If the initial assessment indicates that several specifications are affected, then the technical issue is transferred, by the specification's SC that received it, to the SX000i Chair, who will appoint a lead, who acts as a TICP and creates a team from the individual affected specifications. If the initial assessment shows that only the common data model or the technical interfaces between the specifications (data exchange) are affected by the issue, then it is assigned to the DMEWG.

If the issue is already covered by an existing issue or CP, the TICP associates the issue to the SC that is managing that issue or CP, in order to prevent duplication of effort.

After assessment of the issue, the TICP will provide a response to the user/originator and close the technical issue, or process the issue into a CP.

7.2 Change proposals

The user community at large is not allowed to raise a CP, only raise technical issues through the feedback process described in Para 6, which, after evaluation and acceptance, can be converted into a CP.

However, CP to a specification can be raised directly by:

- TICPs to confirm that a technical issue is a real problem
- SC members (only to their own specification)
- Other SC, requiring a change from a different specification
- ILS specification Council members

7.2.1 Initial evaluation

An initial evaluation confirms whether the CP is a legitimate problem or not. Information on five points are provided for the initial evaluation before the any further progress in the process can be made. These five points are:

- impact
- purpose
- coverage
- requirement
- justification

7.2.1.1 Impact

The impact indicates which of the S-Series ILS specifications are potentially affected by the CP.

7.2.1.2 Purpose

The purpose of the proposed change must be clarified in terms of:

- Enhancing capability or adding new functionality
- Clarifying or refining existing capability or functionality
- Editorial changes
- Bug fixes or corrections

7.2.1.3 Scope

The scope is an indication of the location in the specification that is impacted by the CP. This includes, but is not limited to:

- Chapter text
- XML Schemas
- Data Model
- Data Exchange
- Exchange business rules
- Sample files

7.2.1.4 Requirement justification

CPs not only describe the requirement for the change but also the justification for the proposal. Justification can include, but is not limited to, explanations of:

- How the current specification does not meet the requirement
- The benefit(s) that the requirement adds
- The use cases that support the requirement
- How the requirement supports the global ILS process, or the Council's vision, mission and goals statement

All CPs provide this information before they can be evaluated by the appropriate SC. If the information is not provided, the CP will progress no further.

Once this initial evaluation has been performed, the TICP will present the CP to the SC where the issue was raised, for further evaluation. If the SC agrees that it is a potential CP, then the process continues. Otherwise the CP status is reverted back to an issue. A response is prepared to the originator of the issue, and it is then closed.

If a CP affects only one specification, then the corresponding SC processes the CP. Refer to Para 7.2.2.

7.2.2 Single specification changes

Once a CP has passed initial evaluation and is accepted by the affected SC as a proposed CP, the SC processes the change proposal internally, so that it is incorporated in the specification. Implementation of this specification-specific CP is the responsibility of the respective SC in accordance with its own internal processes.

If the CP in question is a child of a multi-specification CP, the SC is responsible for coordinating its incorporation with the SC that is responsible for the parent CP. Refer to Para 7.2.3. If the CP is not related to any other specification, then responsibility lies exclusively with the affected SC.

7.2.3 Multi-specification changes

Upon assignment of a CP, the SX000i SC or DMEWG analyses it and generates associated child issues and/or CRs, as required, to each of the affected specifications, which processes the change. Refer to Para 7.2.4.

The CP remains open until all child issues and/or CPs have been closed by the impacted specifications. The SX000i SC or DMEWG ensures that the responses from the different SC are aligned. If they are not aligned, the SX000i SC or DMEWG assists the SC to reach consensus. If consensus still cannot be achieved, then the CP is escalated to the ILS specification Council for guidance and direction.

Once a common approach has been agreed, the CP is coordinated so that the corresponding changes are made in a timely manner. Incorporating the changes to each specification is performed as described in Para 7.2.4.

7.2.4 Change proposal status steps

As an issue or CP moves forward in the process, the status of the issue or CP changes. Refer to Fig 4.

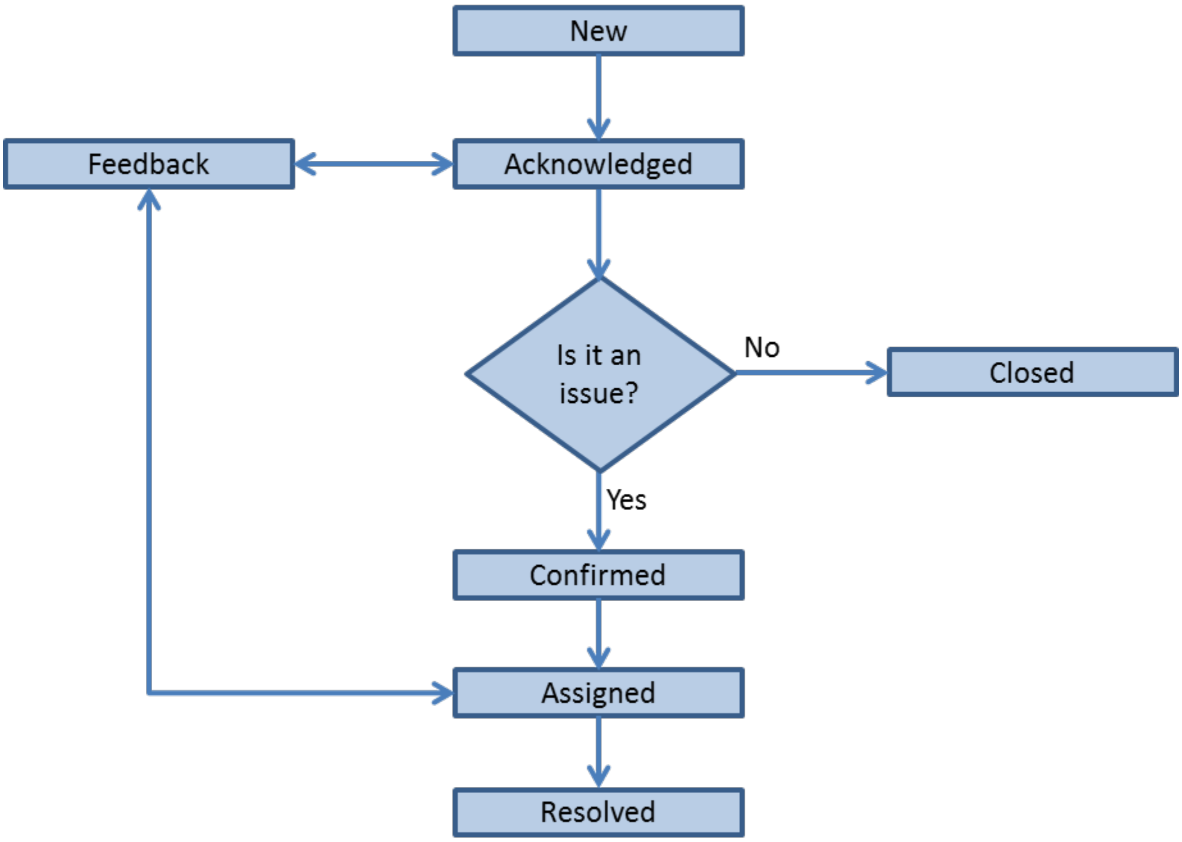

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Fig 4 Change proposal status steps

- **New**: The issue or CP has been received, registered and published on the website, and is ready for assessment.
- **Acknowledged**: The issue or CP has passed initial validation; a TCIP has been assigned and is under review by the corresponding TCIP.
- **Feedback**: The issue or CP lacks information, either for the initial evaluation and/or for the technical solution. The returned issue or CP will include comments to enable the originator to provide the missing information.
- **Confirmed:** The issue has passed the initial evaluation and the TCIP has confirmed that the issue or CP has all the necessary information and provides the necessary justification; the issue is now a formal CP to the specification. Refer to Para 7.2.1.
- **Assigned**: The CP has been assigned to a SC member or to a different SC for resolution and additional issues have been raised to other affected specifications as necessary. Refer to Para 7.2.3.
- **Closed:** The issue does not require a CP, and an explanation/clarification is provided to the originator. Note that a closed issue can be reopened by the originator in case that the response is not satisfactory.
- **Resolved:** The solution to the CP has been approved by the SC and has been incorporated into a new specification release.

Fig 5 shows the global progression of an issue/CP through the change process in more detail and shows the various responsible parties.

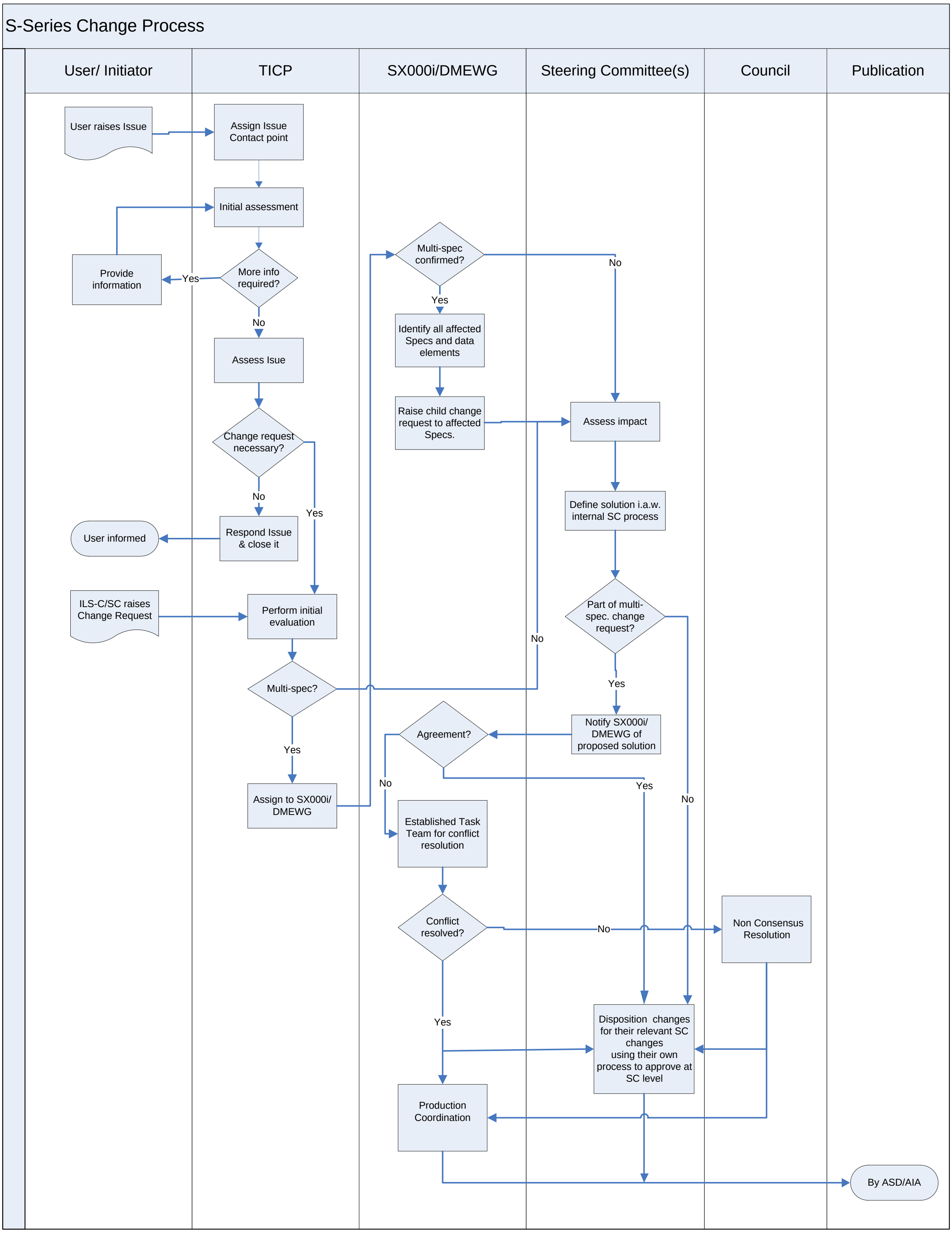

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Fig 5 Global ILS specification change process

Once the changes have been made, the corresponding CP is complete and archived with an annotation that indicates which issue of the specification it was incorporated. Refer to Para 4.

7.3 Periodic reviews

It is expected that changes to a specification will be requested periodically, so that it naturally evolves with time. Notwithstanding that, the ILS specification Council assesses the status of each specification every five years, to ensure that it is still valid and meeting the ILS business requirements.

If it is found that the specification requires changes, then the ILS specification Council tasks the corresponding SC to implement those changes. If the ILS specification Council considers that the specification no longer meets a specific ILS business need, then the ILS specification Council decides whether to cancel the specification and stand down the corresponding SC.

8 Translation of specifications

The S-series ILS specifications and other associated documents are officially published in English only. However, national industry associations (whether members of the ASD/AIA or not) can request permission to translate the specification into their own language(s) using the license agreement template, which is available from the ILS Council.

Though the request for a translation can, in principle, be received by any member of the ASD/ AIA community, the formal process for the authorization of the translation is shown in Fig 6.

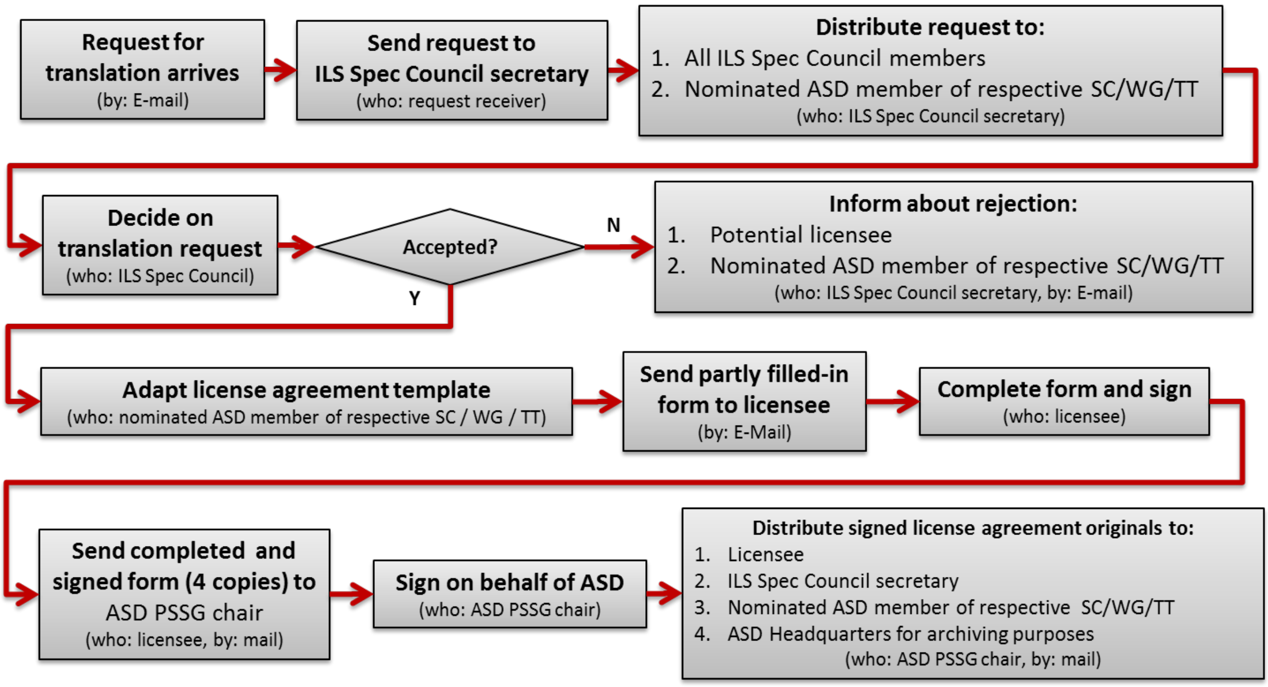

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Fig 6 Translation licensing agreement process

The translated specification is allocated its own number in the form of “Sn00nxLL”, where “Sn00nx” is the number of the original specification and "LL" is the two-character language code (eg, "ZH" for Chinese or “ES” for Spanish). Refer to ISO 639-1.

9 User forums

User forums are formal events at which the user community promote the S-Series ILS specifications, provide training, receive feedback and exchange experiences with their use.

For example, the ILS specification Council is responsible for the framework of the user forums and approves:

- host nations/organizations/locations
- forum themes
- proposed conference fees

Proposals for new User Forums will be raised by the Chair of the proposing Steering Committee to the ILS specification Council for approval. The organization of such User Forum, once approved, will be delegated by the ILS specification Council to the corresponding SC. Multi-specification User Forums will be organized by the ILS specification Council or delegated to a specific SC on a case-by-case basis.

The ILS specification Council will also ensure the alignment of User Forums to its vision/mission.

End of data module

Chapter 5

Terms, abbreviations and acronyms

Table of contents

List of tables

References

Table 1 References

Chap No./Document No.	Title
SX001G	Glossary

1 Introduction

1.1 General

A comprehensive terminology dictionary for terms used in this guide is given in Para 2. A dictionary of abbreviations and acronyms is provided in Para. 3. These include all SX000i specific definitions, abbreviations and some basic abbreviations to be used when using this guide. The terminology, abbreviations and acronyms will be included in SX001G.

2 Glossary of terms

Table 2 provides terms and their definitions that are used throughout this guide.

Table 2 Glossary of terms

Term	Definition
Acquisition Operating Framework	The Acquisition Operating Framework is the process by means of which the UK MoD conducts, governs and controls its defense acquisition process and is a main enabler for improving the delivery to the armed forces and for producing greater value for money for the taxpayer. (https://www.gov.uk/acquisition-operating-framework)
Computer resource	A Computer Resource can be hardware, software, facilities, documentation, personnel and manpower required to develop and sustain computer resources for operation and maintenance of a Product, including planning and support requirements for post-deployment software. A Computer Resource is provided in the ILS element, Computer Resources.
Computer resource plan	The Computer Resource Plan defines all the management actions, procedures, and techniques used in determining requirements and acquiring hardware, software, facilities, documentation, personnel and manpower required to develop and sustain computer resources for operation and maintenance of a Product, including planning and support requirements for post-deployment software. The Computer Resource Plan is generated in the ILS element, Computer Resources.
Computer resources report	The Computer Resource Report details necessary information about the acquired Computer Resources for operation and maintenance of a Product. The Computer Resource Report is generated in the ILS element, Computer Resources.
Configuration Management (CM)	Configuration Management (CM) is the detailed recording, updating and control of information that describes an enterprise's hardware, software and data. It is a process for establishing and maintaining consistency of a Product's performance, functional and physical attributes with its requirements, design and operational information, throughout its life cycle.
Contract	A contract is a mutually binding agreement that obligates the seller to provide the specified Product or service or result and obligates the buyer to pay for it.
Customer	A customer is a physical or legal person that procures a Product on behalf of the end user of that Product. In large organizations, the customer is usually not the same as the end user, but in small organizations (or in the case of individuals) these two tend to be the same.
Customer request	A customer request is defined as a request for corrective action to be taken in respect to a particular matter based on contractual obligations.
Courseware	Courseware is training material on paper, electronic media, or downloaded from the internet, for use with a self-learning or coach assisted training program. Courseware is developed in the ILS element, Training & Training Support.
Delivery	Delivery is the transfer of possession by physical or electronic means.

Term	Definition
Design engineering data	Design Engineering Data is defined as any recorded or documented information of a scientific or technical nature whatever the format, documentary characteristics or other medium of presentation. The information can include, but is not limited to, any of the following: - Experimental and test data - Specifications - Designs and design processes - Inventions and discoveries (patentable or otherwise protectable by law) - Technical descriptions and other works of a technical nature - Semiconductor topography mask works - Technical and manufacturing data packages - Know-how trade secrets and information relating to industrial techniques It can be presented in the form of documents, pictorial reproduction, drawings and other graphic representations, disc and film recordings (magnetic, optical and laser), computer software both programmatic and database, and computer memory, printouts or data retained in computer memory or any other form.
Domain	A domain is a specialized field of action, thought, influence or area of responsibility that contributes to the design, production, support or operation of a Product through the Product's life cycle.
End user	The end user is a person or organization that will operate a Product during the in-service phase.
Engineering	Engineering is a domain that utilizes knowledge and principles to design, build, and analyze Products and services during the whole life cycle. It encompasses a range of more specialized fields through the application of scientific, economic, social, and practical knowledge.
Engineering change request	An Engineering Change Request is a formal proposal to modify a Product/equipment, document or any other contractual item.
F&I plan	The F&I Plan defines all the management actions, procedures and techniques and the requirements for facilities and infrastructure that are required to support and operate a Product. The F&I Plan is generated in the ILS element, Facilities and Infrastructure.
F&I report	The F&I Report details the necessary information about the acquired Facilities and Infrastructure that are required to support and operate a Product. The F&I Report is generated in the ILS element, Facilities and Infrastructure.
Feedback data	Feedback Data can be any data exchanged between different stakeholders during the operation and support of a Product or the operation of a service.
Feedback information	A Feedback Information summarizes the results of a technical analysis of raw Feedback Data for a Product or service. A Feedback Information is generated in the ILS element, Sustaining Engineering.

Term	Definition
Global supply chain	Global supply chain is the management of a network of interconnected businesses that are involved in the provision of Product and service packages required by the customers in a supply chain. A global supply chain spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption.
In-Service Phase	That part of the life-cycle phase that is between the delivery of the Product to a customer to when the Product is disposed of.
Integrated Logistics Support (ILS)	Integrated Logistics Support (ILS) is the management and the technical process of support activities for a Product throughout its life cycle.
ILS plan	The ILS Plan (ILSP) is the primary document that details the approach to ILS, tailored to meet the needs of a specific Product or service. The ILSP should include detailed information for the planning, implementation and co-ordination of the ILS program, together with element plans detailing how the appropriate ILS elements will be addressed and an ILS work breakdown structure. It will be continuously updated and will apply throughout the whole life cycle. The ILSP is generated in the ILS element, Product Support Management.
Initial provisioning list (IPL)	IPL contains the range and quantity of items (i.e., spares and repair parts, special tools, test equipment, and support equipment) required to support and maintain an item for an initial period of service.
Invoice	An invoice is a non-negotiable commercial instrument issued by a seller to a buyer. It identifies both the trading parties and lists, describes, and quantifies the items sold, shows the date of shipment and mode of transport, prices and discounts (if any), and delivery and payment terms. In certain cases (especially when it is signed by the seller or seller's agent), an invoice serves as a demand for payment and becomes a document of title when paid in full. Invoices are generated in the ILS element, Supply Support.
Life Cycle Cost (LCC)	Life Cycle Cost (LCC) is the cumulative cost of a Product over its life cycle from entry into service to disposal, as determined by a process of economic analysis that allows for the assessment of the total cost of acquisition, ownership and disposal of the Product.
LCC report	A Life Cycle Cost (LCC) report summarizes the results of an LCC analysis for a Product or service.
Level of Repair Analysis (LORA)	LORA is a prescribed procedure for determining the most economical and efficient level at which maintenance is performed.
LORA report	The LORA Report summarizes the results of a LORA. The LORA Report is generated in the ILS element, Maintenance.
Logistics Support Analysis (LSA) database	The LSA database is used to record resultant data from the LSA process. It is used as the single source of information for the design and development of support resource requirements. The LSA database is generated in the ILS element, Design Influence.

Term	Definition
Maintenance concept	A Maintenance Concept is a statement of maintenance considerations, constraints, and strategy for the operational support that governs the maintenance levels and type of maintenance activities to be carried out for the Product/equipment under analysis. The Maintenance Concept is generated in the ILS element, Maintenance.
Maintenance plan	The Maintenance Plan specifies when, where and which maintenance tasks will be performed on the Product including both preventive and corrective maintenance. The purpose of the maintenance plan is to ensure that the Product can be maintained effectively and economically at the desired level of readiness after it is placed in operational use. The Maintenance Plan is generated in the ILS element, Maintenance.
Maintenance report	A Maintenance Report documents a maintenance task and summarizes e.g. the performed corrective actions, used material or spares, test results or any other important data. The Maintenance Report is generated in the ILS element, Maintenance
Management report	The Management Report can be any official report generated by the Product Support Manager. The Management Report is generated in the ILS element, Product Support Management.
Manpower & personnel report	The Manpower & Personnel Report defines personnel with the right skills and grades required to operate and support a Product over its lifetime or to provide a service. The Manpower & Personnel Report is generated in the ILS element, Manpower & Personnel.
Manufacturing	Manufacturing is the production of a Product for use, operation or sale using labor and machines, tools, chemical and biological processing, or formulation. Finished Products can be used for manufacturing other, more complex Products, such as aircraft, household appliances or automobiles. Modern manufacturing includes all intermediate processes required for the production and integration of a Product's components.
Manufacturing data	Manufacturing Data is defined as any recorded or documented information of a scientific or technical nature about the manufacturing of a Product whatever the format, documentary characteristics or other medium of presentation. The information can include, but is not limited to any of the following: experimental and test data, specifications, designs and design processes, technical descriptions and other works of a technical nature, semiconductor topography mask works, technical and manufacturing data packages, know-how trade secrets and information relating to industrial techniques.
Maintenance Task Analysis (MTA) report	The MTA Report summarizes the results of a MTA. The MTA Report is generated in the ILS element, Maintenance.
Obsolescence report	The Obsolescence Report summarizes the results of the obsolescence management (e.g., survey data, risk analysis data and related recovery actions). The Obsolescence Report is generated in the ILS element, Product Support Management.

Term	Definition
Packaging, Handling, Storage & Transportation (PHS&T) plan	The PHS&T plan identifies the program strategy for safely packaging, handling, storing, and transporting a Product or related material as well as any special requirements and interfaces with organizations responsible for transporting. The PHS&T plan defines the resources, procedures, design considerations and methods necessary to ensure that all Product equipment and support items are packaged, handled, stored and transported properly and in conformance with appropriate legislation, particularly for hazardous materials and the project requirements. This also includes environmental limitations, equipment preservation requirements for short and long term storage and transport requirements. The PHS&T plan is generated in the ILS element, PHS&T.
Preventive maintenance task requirements (PMTR)	The PMTR define and select the requirements for preventive maintenance tasks with intervals for systems, including installed components and equipment. The PMTR are generated in the ILS element, Maintenance.
Procurement plan	The Procurement Plan defines the products and services that must be obtained from external suppliers and also describes the process to appoint those suppliers contractually. Generally the Procurement Plan defines the items that must be procured, defines the process for acquiring those items and finally, schedules the time frames for delivery. The Procurement Plan is generated in the ILS element, Supply Support.
Product Life Cycle	The Product life cycle describes the life of a Product from beginning to end using a functional model with distinct sequential phases.
Program management	Program management is a process of managing one project or multiple, related projects at the same time and all working toward the same goal or end result, including contract management, sales, marketing and finance.
Provisioning data	Provisioning Data is defined as any recorded or documented information prepared expressly for the identification, description, installation location and verification of items, materials, supplies, and services that are to be purchased, inspected, packaged, packed and supplied, or delivered to users. The Provisioning Data is generated in the ILS element, Supply Support.
Provisioning order	The Provisioning Order is a document that describes the required supplies or services so procurement can be initiated. The Provisioning Order is generated in the ILS element, Supply Support.
Quality	Quality is a domain that ensures that the customer's requirements, enterprise's, national and international regulations for a Product or service are met throughout the life cycle.
Quotation	The Quotation is a formal statement of promise (usually submitted in response to a request for quotation) by a potential supplier to supply the goods or services required by a customer, at specified prices, and within a specified period. A quotation can also contain terms of sale and payment, and warranties. The Quotation is generated in the ILS element, Supply Support.

Term	Definition
Reliability, availability, maintainability and testability (RAMT) reports	The RAMT report summarizes the results of any analyses for reliability, availability, maintainability and testability. The RAMT Report is generated in the ILS element, Design Influence.
Safety	Safety as a domain is based on standards that are designed to ensure the safety of Products, services, activities or processes, etc. Safety is also a process that secures the freedom from conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment.
Security	Security is a process to protect the Product and/or its associated information, from any harm due to unauthorized access or manipulation.
Software Maintenance Analysis (SMA) report	The SMA Report summarizes the results of software maintenance analysis of a Product. The SMA Report is generated in the ILS element, Maintenance.
Specification	A specification is a document that defines, in a complete, precise, verifiable manner the requirements, design, behavior or other characteristics of a Product, result or service and the procedures for determining whether these provisions have been satisfied. Examples are: requirement specification, design specification, Product specification and test specification.
Spare parts list (SPL)	The SPL is a listing of spare parts mainly based on provisioning data charged with business data (eg, prices, contract numbers, effective/expiry dates). Its purpose is to enable customers and the contractors processing parts data without using complex provisioning processes by integration the customer. It places negotiated parts data at customers' disposal (eg, for recording purposes of material) and enables material supply processes. The SPL is generated in the ILS element, Supply Support.
Supplier data	Supplier Data is defined as any recorded or documented information provided by Supply Chain Management to support the ILS activities for a Product or for services.
Support concept	The Support Concept describes the scheme for logistics support, which is derived from the logistics support requirements. The concept is the basis for planning, executing and documenting the logistics support as well as for activation, use, maintenance/repair and disposal of a Product. It describes the required logistics resources. The Support Concept is generated in the ILS element, Product Support Management.
Support contract	A Support Contract is a contract for any service necessary to support and operate a Product. A Support Contract is generated in the ILS element, Product Support Management.
Support equipment	Support Equipment can be all equipment (mobile or fixed) required to support the Operation and Maintenance (O&M) of a Product. This includes associated multi-use support items, ground-handling and maintenance equipment, tools, meteorology and calibration equipment, and manual/automatic test equipment. The Support Equipment is provided by the ILS element, Support Equipment.

Term	Definition
Support equipment plan	The Support Equipment Plan defines all Support Equipment. It also includes the acquisition of Logistics Support (LS) for the support equipment itself. The Support Equipment Plan is generated in the ILS element, Support Equipment.
Support equipment report	The Support Equipment Report details necessary information about the acquired Support Equipment that is required to support and operate a Product. The Support Equipment Report is generated in the ILS element, Support Equipment.
Supportability	Degree to which the design characteristics of a standby or support system allow to meet the operational requirements of an organization.
Supportability safety analysis report	The Supportability Safety Analysis Report summarizes the results of any analyses for safety of supportability task of a Product or service. The Supportability Safety Analysis Report is generated in the ILS element, Maintenance.
Systems engineering	Systems engineering is an interdisciplinary field of engineering that focuses on the design and management of complex engineering projects over their life cycles. Issues such as reliability, logistics, evaluation measurements, different disciplines and coordination of different teams (requirements management), become more difficult when dealing with large, complex projects. Systems engineering deals with work-processes, optimization methods and tools to manage risks in such projects, overlapping with both technical and human-centered disciplines, such as control engineering, industrial engineering, organizational studies, and project management. Systems Engineering ensures all likely aspects of a project or system have been considered and integrated into a whole.
System of Interest	The system whose life cycle is under consideration. (ISO/IEC/IEEE 2008)
Technical data	Technical data is recorded information (regardless of the form or method of recording) that is of a scientific or technical nature (including computer software documentation).
Technical data package (TDP)	A TDP is technical description of an item adequate for supporting an acquisition strategy, production, engineering, and Logistics Support. The description defines the required design configuration and procedures to ensure adequacy of item performance. It consists of all applicable technical information (eg, drawings, associated lists, specifications, standards, performance requirements, Quality Assurance (QA) provisions, Technical Publications, and packaging details). A TDP is generated in the ILS element, Technical Data.
Technical publications	Technical Publications are manuals that contain instructions for the installation, operation, maintenance, training, and support of systems and support equipment. Technical Publications’ information may be presented in any form or characteristic, including but not limited to hard copy, audio and visual displays, magnetic tape, discs, and other electronic devices. Technical Publications normally include operational and maintenance instructions, parts lists or parts breakdown, and related technical information or procedures exclusive of administrative procedures. Technical Publications are generated in the ILS element, Technical Data.

Term	Definition
Testability report	The Testability Report summarizes the results of any D&PHM analyses of a Product. The Testability Report is generated in the ILS element, Maintenance.
Training Needs Analysis (TNA) report	The TNA report summarizes the results of an analysis of the requirements for training concerning the operational and maintenance activities. The TNA Report is developed in the ILS element, Training & Training Support.
Total Ownership Cost (TOC)	Total Ownership Cost (TOC) consists of all elements that are part of the Life Cycle Cost (LCC) plus the indirect, fixed and linked costs. These can include items such as common support equipment, common facilities, personnel required for unit command, administration, supervision, operations planning and control, and fuel and munitions handling.
Whole Life Cycle Cost (WLCC)	Whole Life Cycle Cost (WLCC) consists of all elements that are part of TOC plus non-linked costs. These can include items such as family housing, medical services, ceremonial units, basic training, headquarters and staff, academies, recruiters, employee busing or employee benefits. In WLCC all costs or expenses that are originated by the organization are attributed to the systems or Products they produce.
Training course	A Training Course is a series of lessons to teach the skills and knowledge for a particular job or activity. A Training Course is developed and conducted in the ILS element, Training & Training Support.
Training course report	A Training Course Report summarizes the results of a conducted training course. A Training Course Report is developed and conducted in the ILS element, Training & Training Support.
Training equipment	Training Equipment is any hardware, software, multi-media player, projector, etc., used in a training process. The Training Equipment is defined in the ILS element, Training & Training Support.
Training equipment report	The training equipment report defines the qualitative and quantitative requirements for training equipment. The training equipment report is developed in the ILS element, Training & Training Support.

Term	Definition
Training plan	The training plan defines qualitative and quantitative requirements for the training of operating and support personnel throughout the life cycle of the Product. It includes requirements for: - Competencies management - Factory training - Instructor and key personnel training - New equipment training team - Resident training - Sustainment training - User training - HAZMAT disposal and safe procedures training The training plan is developed in the ILS Element, Training & Training Support.

3 Abbreviations and acronyms

3.1 General

When an abbreviation or an acronym is used in this guide, it is written in full the first time it is used in a chapter.

The abbreviations used in this guide are defined in Table 3.

3.2 Word combination - Acronym

When an acronym combines multiple words, it is always presented the same way in this guide.

Single abbreviations can be combined where necessary, when there is no abbreviation listed for the combination.

3.3 Abbreviation and acronym list

Table 3 Abbreviations and acronyms

Term	Definition
A4A	Airlines for America
ADR	Alternative Dispute Resolution
AIA	Aerospace Industries Association
AOF	Acquisition Operating Framework
ASD	AeroSpace and Defense Industries Association of Europe
BREX	Business Rule EXchange
CC	Certification Committee
Chap	Chapter
CIP	Candidate Item List
CM	Configuration Management
CMR	Certification Maintenance Requirement

Term	Definition
CPF	Change Proposal Form
CR	Change Request
CRD	Customer Requirements Document
D&PHM	Diagnostics, Prognostics and Health Management
DEX	Data EXchange
DGAC	Direction Générale d'Aviation Civile
DMEWG	Data Model and Exchange Working Group
DoD	Department of Defense
EASA	European Aviation Safety Agency
F&I	Facilities and Infrastructure
FAA	Federal Aviation Authority
FAR	Federal Aviation Regulation
FEC	Failure Effect Category
FMECA	Failure Mode and Effects Criticality Analysis
HAZMAT	HAZardous MATerial
HFE	Human Factors Engineering
HSI	Human System Integration
ICC	International Chamber of Commerce
IEC	International Electrotechnical Commission
IETM	Interactive Electronic Technical Manual
ILS	Integrated Logistics Support
ILSP	Integrated Logistics Support Plan
IPC	Illustrated Parts Catalogue
IPD	Illustrated Parts Data
IPL	Initial Provisioning List
ISMO	In-Service Maintenance Optimization
ISO	International Standards Organization
IT	Information Technology
LCC	Life Cycle Cost
LCCA	Life Cycle Cost Analysis
LORA	Level of Repair Analysis
LOTAR	LOng-Term Archiving and Retrieval

Term	Definition
LRU	Line Replaceable Unit
LSA	Logistics Support Analysis
LSD	Logistics Support Date
MoD	Ministry of Defence
MoU	Memorandum of Understanding
MTA	Maintenance Task Analysis
MTBF	Mean Time Between Failure
NATO	North Atlantic Treaty Organization
O&M	Operation and Maintenance
OEM	Original Equipment Manufacturer
OMP	Operator Maintenance Plan
OPM	Optimization of Preventive Maintenance
ORD	Operational Requirements Document
OWL	Web Ontology Language
Para	Paragraph
PBL	Performance-Based Logistics
PHS&T	Packaging, Handling, Storage & Transportation
PLCS	Product Life Cycle Support
PM	Program Manager
PMTR	Preventive Maintenance Task Requirements
PSSG	ASD Product Support Steering Group
QA	Quality Assurance
RAMT	Reliability, Availability, Maintainability and Testability
RCM	Reliability Centered Maintenance
SC	Steering Committee
SEMP	Systems Engineering Management Plan
SEP	Systems Engineering Plan
SMA	Software Maintenance Analysis
SOI	System of Interest
SPL	Spare Parts List
TDP	Technical Data Package
TICP	Technical Issue Contact Point

Term	Definition
TNA	Training Needs Analysis
TOC	Total Ownership Cost
ToR	Terms of Reference
TT	Task Team
US	United States
WBS	Work Breakdown Structure
WG	Working Group
WLCC	Whole Life Cycle Cost
XML	eXtensible Markup Language

Chapter 6

Comparison of specification terminology

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References

Table 1 References

Chap No./Document No.	Title
S3000L	International procedure specification for Logistics Support Analysis (LSA)
Blanchard and Fabrycky	Systems Engineering and Analysis, Prentice Hall
Commandant Instruction M4105.8	United States Coast Guard System Integrated Logistic Support Policy Manual
DAU	Integrated Product Support (IPS) Element Guidebook, Defense Acquisition University
Def Stan 00-600	Integrated Logistic Support
DoD Instruction 5000.02	Operation of the Defense Acquisition System
ISO/IEC TR 19760: 2003	Systems engineering – A guide for the application of ISO/IEC 15288 (System life cycle processes)
JSP 886 Volume 7 Part 1	Integrated Logistic Support
NPD 7500.1D	NASA Policy Directive – Program and Project Life-Cycle Logistics Support Policy
NASA/SP-2007-6105 Rev1	NASA Systems Engineering Handbook
NATO AAP-20	Allied Administrative Publication 20 - Phased Armaments Programming System (PAPS)
NATO ALP-10	NATO Guidance on Integrated Logistics Support for Multinational Armament Programmes
OCCAR OMP1	OCCAR Management Procedure 1 (OMP1) - Principal Programme Management Procedures
SEMP	Florida's Statewide Systems Engineering Management Plan, Appendix U, Integrated Logistic Support Plan Template
UK MoD	Acquisition Operating Framework (AOF)
US Army Regulation 700-127	Integrated Product Support

1 General

This chapter provides an overview of the existing definitions related to the Product life cycle phases and the ILS elements. The matrix tables in this chapter help in understanding how the choice made in the current guide in terms of Product life cycle phases and ILS elements relates to existing standards in these matters.

2 Product life cycle

2.1 Comparison of SX000i life cycle as compared to other specifications and other reference information

Table 2 SX000i life-cycle phases vs other specifications

<table>
<tr><th>SX000i PHASE</th><th colspan="2">PREPARATION PHASE</th><th>DEVELOPMENT PHASE</th><th>PRODUCTION PHASE</th><th colspan="2">IN SERVICE PHASE</th><th>DISPOSAL PHASE</th></tr>
<tr><td>SX000i definition</td><td colspan="2">- Identify user needs
- Develop Product requirements
- Assess potential material solution
- Identify and reduce technology risks through studies, experiments and engineering models
- Establish a business case including analysis of alternatives, cost estimate (Life Cycle Cost) for the launch of the Development phase</td><td>- Develop a Product that meets user requirements and can be produced, tested, evaluated, operated, supported and retired
- Develop an affordable and executable manufacturing process
- Ensure operational supportability with particular attention to minimizing the logistics footprint</td><td>- Produce or manufacture the product
- Test the Product
- Conduct Product acceptance to confirm that the Product satisfies the requirements</td><td colspan="2">- Product utilization: Operate the Product
- Deliver the required services with continued operational and cost effectiveness
- - Assess, decide on modifications and upgrades
- Evaluate continuously the effectiveness and efficiency of the Product.
- Product support: Provide support that enables continued Product operation and sustainable service - Implement modifications and upgrades</td><td>- Demilitarize (if applicable)
- Dispose of the product in accordance with all legal and regulatory requirements and policy relating to safety (including explosives safety), security, and the environment - remove related operational and support services</td></tr>
<tr><td>NATO
AAP-20</td><td>Pre-concept stage</td><td>Concept stage</td><td>Development stage</td><td>Production stage</td><td>Utilization stage</td><td>Support stage</td><td>Retirement stage</td></tr>
<tr><td>US DoD
Instruction 5000.02</td><td>Material solution analysis phase</td><td>Technology development phase</td><td>Engineering and Manufacturing Development (EMD) phase</td><td>Production and deployment phase</td><td colspan="3">Operations and support phase</td></tr>
</table>

SX000i PHASE	PREPARATION PHASE		DEVELOPMENT PHASE		PRODUCTION PHASE		IN SERVICE PHASE		DISPOSAL PHASE
NASA *NASA/SP-2007-6105 Rev1, Systems Engineering Handbook*	Pre-Phase A: Concept Studies	Phase A: Concept and Technology Development	Phase B: Preliminary Design and Technology	Phase C: Final Design (and Fabrication)	Phase C: (Final Design and) Fabrication	Phase D: System Assembly, Integration and Test, Launch	Phase E: Operations and Sustainment		Phase F: Closeout
UK MoD *Source: AOF*	Concept phase	Assessment phase	Demonstration phase		Manufacture phase		In-Service phase		Disposal phase
OCCAR *OMP1*	Preparation phase	Definition phase	Development phase		Production phase		In Service phase		Disposal phase
ISO/IEC TR 19760: 2003	Concept stage		Development stage		Production stage		Utilisation stage	Support stage	Retirement stage
Wikipedia (Ref. Blanchard and Fabrycky)	Conceptual design stage	Preliminary system design stage	Detail design and development stage		Production/construction stage		Utilisation and support stage		Phase-out and disposal stage

2.2 NATO definitions for the life-cycle

Table 3 NATO AAP-20 life-cycle phases

Pre-concept stage	Concept stage	Development stage	Production stage	Utilization stage	Support stage	Retirement stage
The purpose of the pre-concept stage is to identify and document stakeholder requirements (eg, force goal). Also important, is the identification of risk areas (at a high level) to the capability delivery. This provides focus for research and industry capability/capacity to ensure delivery to an acceptable timescale and affordable cost.	Based on the stakeholder requirements identified and documented in the pre-concept stage, it is the purpose of the concept stage to refine and broaden the studies, experiments, and engineering models pursued during the pre-concept stage and to develop experiments, and engineering models pursued during the pre-concept stage and to develop preliminary system requirements and a feasible design solution. One of the key objectives of the concept stage is to provide confidence that the business case is sound and the proposed solutions are achievable.	The development stage aims at full validation of the technical solution through design engineering work to the point where production can begin. For software, the development, testing, and certification will ensure the software is ready for incorporation into new and existing hardware. The development stage is executed to develop a System Of Interest (SOI) that meets or exceeds the stated requirements and can be produced, tested, evaluated, operated, supported and retired.	The purpose of the Production stage is to manufacture and test the SOI, and produce related support and enabling systems as needed. This materiel solution is based on the stakeholder requirements and the programme Memorandum of Understanding (MOU)/stage approval document for production stage.	The Utilisation stage is executed to operate the product at the intended operational sites, including modification and upgrades, to deliver the required services with continued operational and cost effectiveness. This stage ends when the SOI is taken out of service.	The purpose of the pre-concept stage is to identify and document stakeholder requirements (eg, force goal). Also important, is the identification of risk areas (at a high level) to the capability delivery. This provides focus for research and industry capability/capacity to ensure delivery to an acceptable timescale and affordable cost.	Based on the stakeholder requirements identified and documented in the pre-concept stage, it is the purpose of the concept stage to refine and broaden the studies, experiments, and engineering models pursued during the pre-concept stage and to develop experiments, and engineering models pursued during the pre-concept stage and to develop preliminary system requirements and a feasible design solution. One of the key objectives of the concept stage is to provide confidence that the business case is sound and the proposed solutions are achievable.

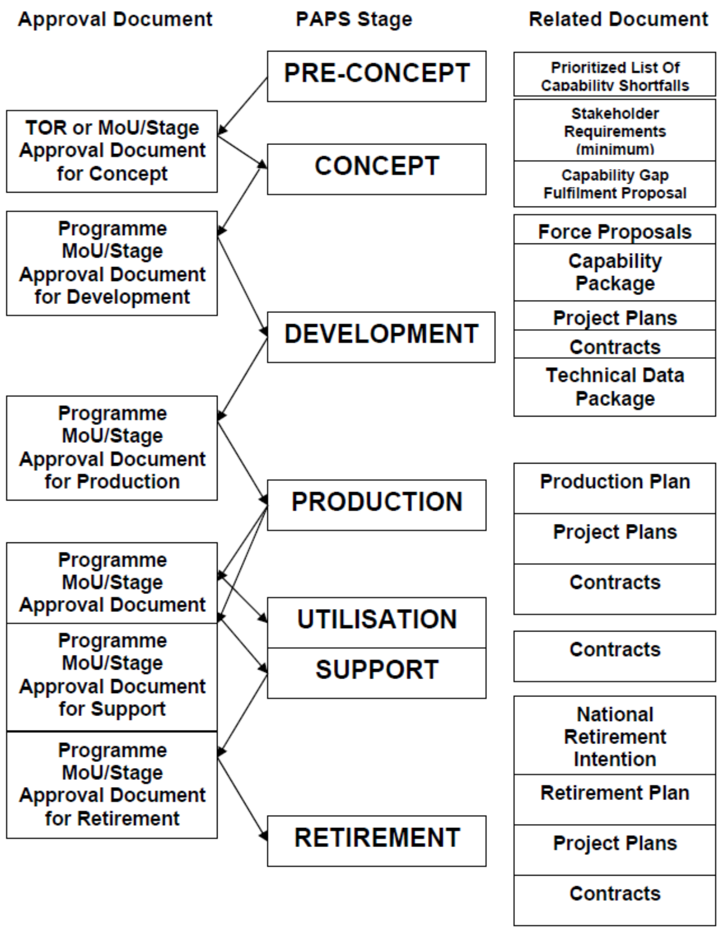

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Fig 1 The NATO AAP-20 (PAPS) (Source: NATO)

2.3 US DoD definitions for the life-cycle

Table 4 DoD Instruction 5000.02 life-cycle phases

Pre-Product acquisition		Product acquisition		Sustainment	
Material solution analysis phase	**Technology development phase**	**Engineering and Manufacturing Development (EMD) phase**	**Production and deployment phase**	**Operations and support phase**	**Disposal**
The purpose of the pre-concept stage is to identify and document stakeholder requirements (eg, force goal). Also important, is the identification of risk areas (at a high level) to the capability delivery. This provides focus for research and industry capability/capacity to ensure delivery to an acceptable timescale and affordable cost.	Based on the stakeholder requirements identified and documented in the pre-concept stage, it is the purpose of the concept stage to refine and broaden the studies, experiments, and engineering models pursued during the pre-concept stage and to develop experiments, and engineering models pursued during the pre-concept stage and to develop preliminary system requirements and a feasible design solution. One of the key objectives of the concept stage is to provide confidence that the business case is sound and the proposed solutions are achievable.	The development stage aims at full validation of the technical solution through design engineering work to the point where production actions can be taken. For software, the development, testing, and certification will ensure the software is ready for incorporation into new and existing hardware. The development stage is executed to develop a SOI that meets or exceeds the stated requirements and can be produced, tested, evaluated, operated, supported and retired.	The purpose of the Production stage is to manufacture and test the SOI, and produce related support and enabling systems as needed. This materiel solution is based on the stakeholder requirements and the programme MOU/stage approval document for production stage.	The utilisation stage is executed to operate the product at the intended operational sites, including modification and upgrades, to deliver the required services with continued operational and cost effectiveness. This stage ends when the SOI is taken out of service.	The purpose of the pre-concept stage is to identify and document stakeholder requirements (eg, force goal). Also important, is the identification of risk areas (at a high level) to the capability delivery. This provides focus for research and industry capability/capacity to ensure delivery to an acceptable timescale and affordable cost.

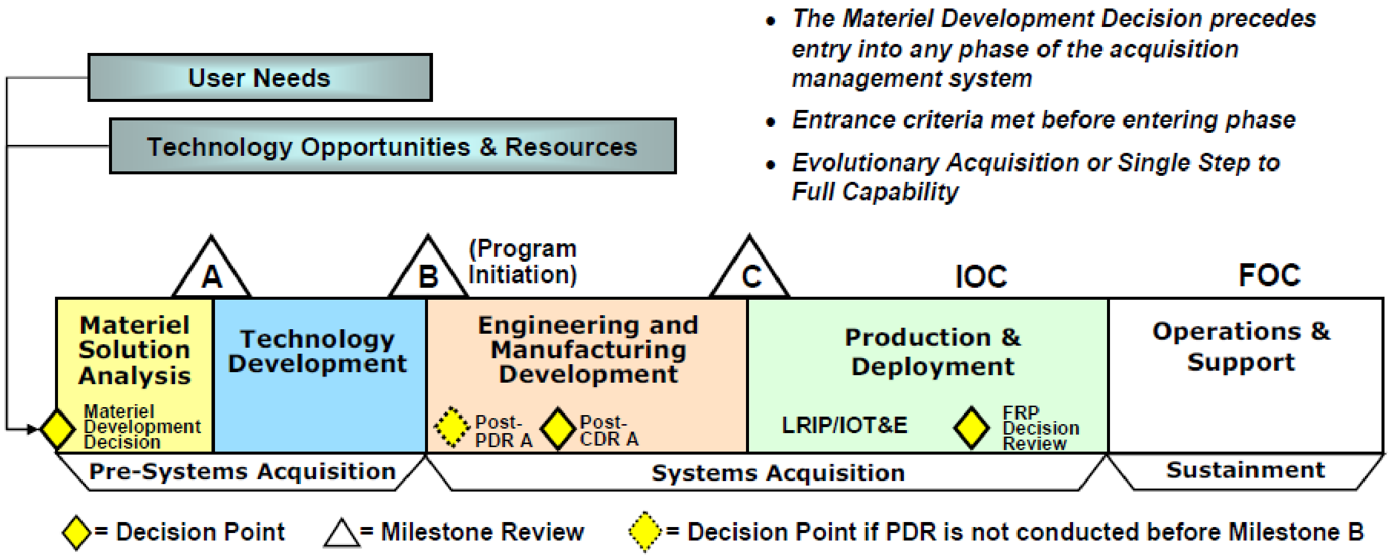

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Fig 2 US DoD Defense acquisition management system (Source: US DoD)

2.4 NASA definitions for the life-cycle

Table 5 NASA SP-2007-6105 Rev1, Systems Engineering Handbook Life Cycle Phases

Pre-Phase A Concept Studies	**Phase A Concept and Technology Development**	**Phase B Preliminary Design and technology Completion**	**Phase C Final Design and Fabrication**	**Phase D System Assembly, Integration, Test and Launch**	**Phase E Operations and Sustainment**	**Phase F Closeout**
The purpose of this phase is to devise various feasible concepts from which new projects (programs) can be selected. Typically, this activity consists of loosely structured examinations of new ideas, usually without central control and mostly oriented toward small studies. Its major product is a list of suggested projects, based on the identification of needs and the discovery of opportunities that are potentially consistent with NASA's mission, capabilities, priorities, and resources.	During Phase A, activities are performed to fully develop a baseline mission concept and begin or assume responsibility for the development of needed technologies. This work helps establish a mission concept and the program requirements on the project. Major products to this point include an accepted functional baseline for the system and its major end items.	During Phase B, activities are performed to establish an initial project baseline, Phase B culminates in a series of Preliminary Design Reviews (PDRs), containing the system-level PDR and PDRs for lower level end items as appropriate. The PDRs reflect the successive refinement of requirements into designs.	During Phase C, activities are performed to establish a complete design (allocated baseline), fabricate or produce hardware, and code software in preparation for integration. Phase C contains a series of Critical Design Reviews (CDRs) containing the system-level CDR and CDRs corresponding to the different levels of the system hierarchy. Phase C culminates with an System Integration Review (SIR). The final product of this phase is a product ready for integration.	During Phase D, activities are performed to assemble, integrate, test, and launch the system. These activities focus on preparing for the Flight Readiness Review (FRR). Other activities include the initial training of operating personnel and implementation of the logistics and spares planning. Phase D concludes with a system that has been shown to be capable of accomplishing the purpose for which it was created.	During Phase E, activities are performed to conduct the prime mission and meet the initially identified need and maintain support for that need. The products of the phase are the results of the mission. This phase encompasses the evolution of the system only insofar as that evolution does not involve major changes to the system architecture. For large flight Near the end of the prime mission, the project may apply for a mission extension to continue mission activities or attempt to perform additional mission objectives.	Phase F deals with the final closeout of the system when it has completed its mission; the time at which this occurs depends on many factors. For a flight system that returns to Earth with a short mission duration, closeout may require little more than disintegration of the hardware and its return to its owner. On flight projects of long duration, closeout may proceed according to established plans or may begin as a result of unplanned events, such as failures.

CDR	Critical Design Review
CERR	Critical Events Readiness Review
DR	Decommissioning Review
FRR	Flight Readiness Review
KDP	Key Decision Point
MCR	Mission Concept Review
MDR	Mission Definition Review
ORR	Operational Readiness Review
PDR	Preliminary Design Review
PFAR	Post-Flight Assessment Review
PIR	Program Implementation Review
PLAR	Post-Launch Assessment Review
PRR	Production Readiness Review
P/SDR	Program/System Definition Review
P/SRR	Program/System Requirements Review
PSR	Program Status Review
SAR	System Acceptance Review
SDR	System Definition Review
SIR	System Integration Review
SRR	System Requirements Review
TRR	Test Readiness Review

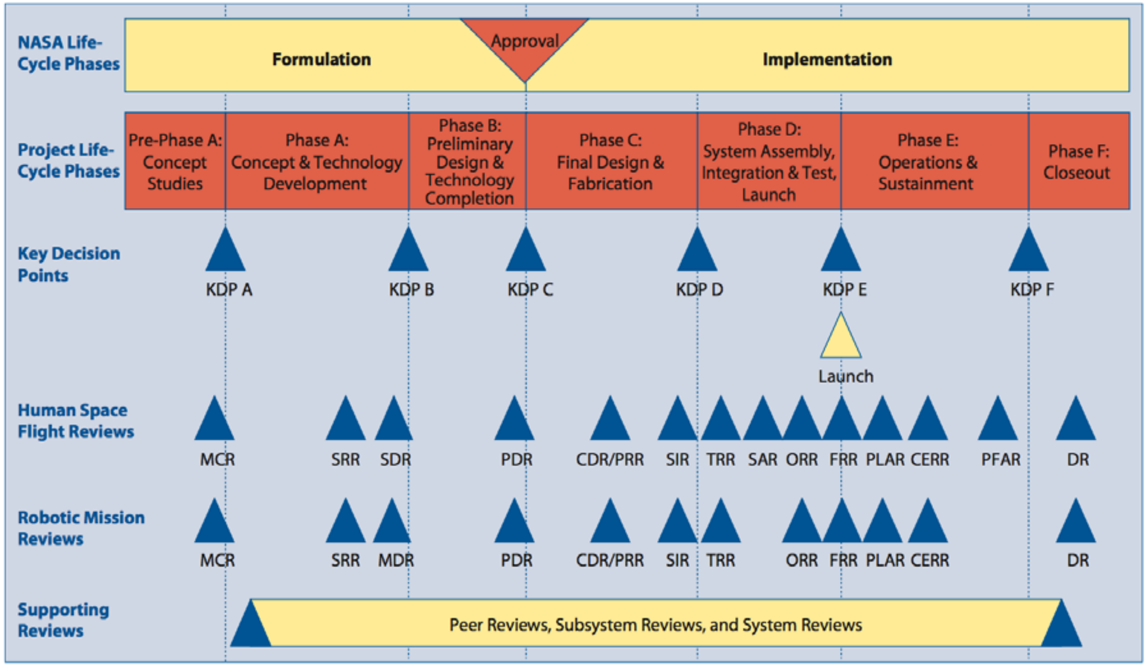

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Fig 3 NASA Project Life-Cycle Phases - (Source: NASA SP-2007-6105 Rev1)

2.5 UK MoD definitions for the life-cycle

Table 6 UK MoD Acquisition Operating Framework (AOF) life-cycle phases

Concept phase	Assessment phase	Demonstration phase	Manufacture phase	In-Service phase	Disposal phase
- Produce a statement of the outputs that users require from the system, framed as a User Requirements Document (URD) - Form the delivery team - Involve industry - Identify technology and procurement options for meeting the requirement that merit further investigation - Obtain funding and agree plan for the assessment (in detail) and subsequent stages (in outline), identifying performance, cost and time boundaries within which it is to be conducted - Initiate the Through Life Management Plan (TLMP) - Continuously monitor concept maturity and, when appropriate, construct and submit an initial gate business case seeking approval for the assessment stage within time, cost and performance boundaries	- Produce the System Requirements Document (SRD), defining what the system must do to meet user needs as stated in the URD - Establish and maintain the linkage between user and system requirements - Identify the most cost-effective technological and procurement solution - Develop the SRD, trading time, cost and performance to identify the technological solution - Reduce risk to a level consistent with delivering an acceptable level of system performance to tightly controlled time and cost parameters - Refine the TLMP, including detailed plans for the demonstration phase - Continuously monitor project maturity and, when appropriate, construct and submit a main gate business case seeking approval for the project within tightly defined performance, time and cost boundaries	- Eliminate progressively the development risk and fix performance targets for manufacture, ensuring there is consistency between the final selected solution and the SRD and URD - Place contract(s) to meet the SRD - Demonstrate the ability to produce integrated capability	- Deliver the solution to the military requirement within the time and cost limits - Conduct system acceptance to confirm that the system satisfies the SRD and the URD, as agreed at main gate - Transfer the lead customer function to the user, for equipment	- Confirm the defence capability provided by the system is available for operational use, to the extent defined at main gate, and declare the in-service date - Provide effective support to the front line - Maintain levels of performance within agreed parameters, whilst driving down the annual cost of ownership - Carry out any agreed upgrades or improvements, refits or acquisition increments	- Carry out plans for efficient, effective and safe disposal of the equipment

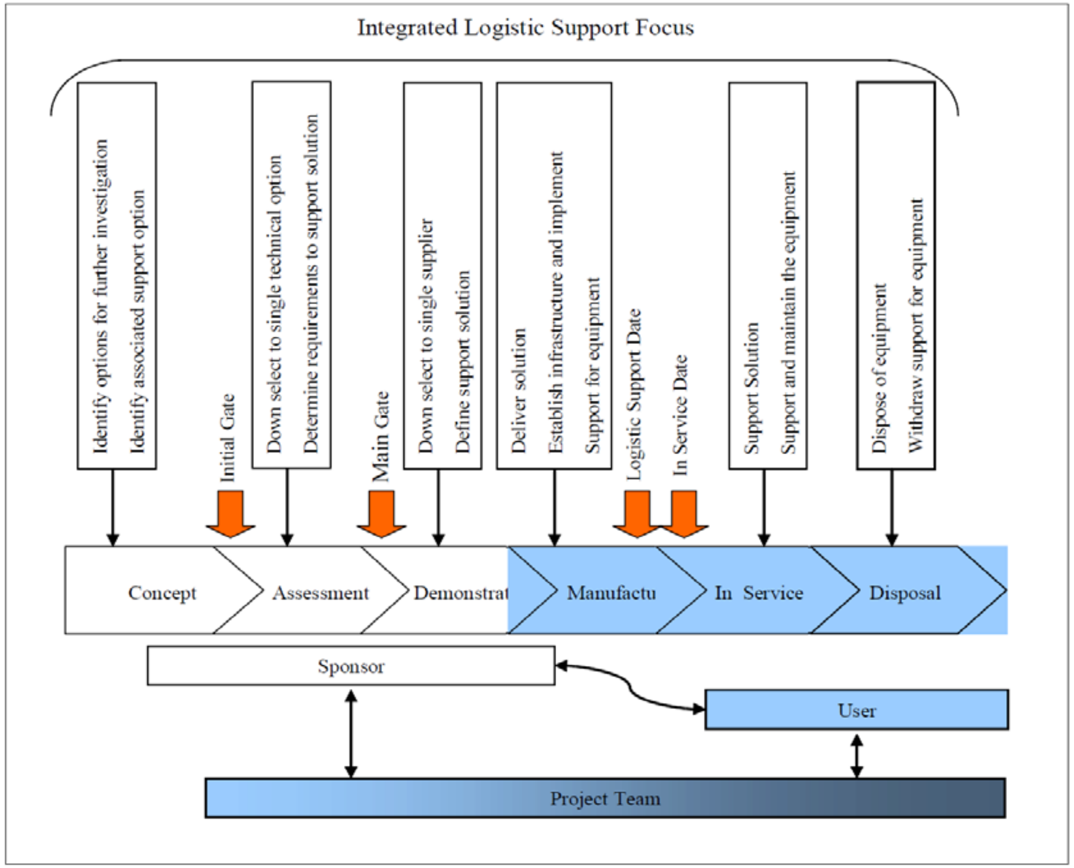

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Fig 4 ILS within the UK MoD AOF (Source: UK MoD)

2.6 OCCAR definitions for the life-cycle

Table 7 OCCAR OMP1 life-cycle phases

Preparation phase	Definition phase	Development phase	Production phase	In-Service phase	Disposal phase
During the preparation phase a prospective co-operative programme is prepared in terms of outline scope, time, cost, acquisition organisation and participation to meet harmonised capability requirements that can be feasibly taken forward. The basis of how the system will be supported in service needs to be established. It is essential that the stakeholders ensure that appropriate strategies and specialist resource requirements are well defined.	The definition phase consists of the selection of a solution from those explored under the feasibility studies conducted during the preparation phase. Programme requirements, technical specifications, ILS aspects, LCC and industrial conditions for realisation are refined during this phase. Risk reduction studies can be performed during or before the definition phase. At the end of the definition phase the visibility and reduction of the remaining risks must be sufficient defined/identified in order to allow a decision on future phases.	During the development phase, the Defence System and its support systems are designed in detail, developed, tested, qualified and certified, and the industrial production resources are defined and put in place. In principle the development phase is completed when the Defence System is qualified. The certification can also be performed during the production phase.	This phase consists of all activities required to produce and deliver the Defence System to the armed forces for its subsequent use (series production, training and support resources, etc). Formally there is a decision for service acceptance taken jointly or individually by participating states. This decision formalises the authorisation for operational use of the Defence System after its acceptance trials. In principle the production phase ends when all the individual systems are produced, accepted and delivered.	The In-Service phase is composed of two sub-phases: - Operational usage and support. While the operational usage is under the responsibility of the programme participating states, the Support sub-phase can be assigned to OCCAR. In this case, this support sub-phase will be referred to as In Service support phase - The in-service support phase aims to maintain the Defence System's capability to the required operational availability. It begins with the first delivery of the Defence System and ends when the use of the Defence System within the forces of the participating states stops	The aim of the disposal phase is to systematically remove the Defence System from service together with the related operational and support services and to support the disposal process

2.7 ISO/IEC TR 19760 definitions for the life-cycle

Table 8 ISO/IEC TR 19760 life-cycle phases

Concept stage	Development stage	Production stage	Utilisation stage	Support stage	Retirement stage
The concept stage is executed to assess new business opportunities and to develop preliminary system requirements and a feasible design solution.	The development stage is executed to develop a system-of-interest that meets acquirer requirements and can be produced, tested, evaluated, operated, supported and retired.	The production stage is executed to produce or manufacture the product, to test the product and to produce related supporting and enabling systems as needed.	The utilization stage is executed to operate the product, to deliver services within intended environments and to ensure continued operational effectiveness.	The support stage is executed to provide logistics, maintenance, and support services that enable continued system-of-interest operation and a sustainable service.	The retirement stage is executed to provide for the removal of a system-of-interest and related operational and support services, and to operate and support the retirement system itself.

2.8 Wikipedia definitions for the life-cycle

The Wikipedia definitions for the life-cycle were considered for comparison purposes because Wikipedia in an important reference for the public in general, who do not necessarily have access to other specifications mentioned elsewhere. The definitions used in Wikipedia are based on the book *"Systems Engineering and Analysis",* 4th edition, by Blanchard and Fabrycky, published by Prentice Hall

Table 9 Wikipedia life-cycle phases (based Blanchard and Fabrycky)

Conceptual design stage	Preliminary system design stage	Detail design and development stage	Production/construction stage	Utilisation and support stage	Phase-out and disposal stage
The conceptual design stage is where an identified need is examined, requirements for potential solutions are defined, potential solutions are evaluated and a Product specification is developed. The Product specification represents the technical requirements that will provide overall guidance for system design. Because this document governs all future development, the stage cannot be completed until a conceptual design review has determined that the Product specification properly addresses the motivating need. Key steps within the conceptual design stage include: - Need identification - Feasibility analysis - Product requirements analysis - Product specification - Conceptual design review	During this stage of the system lifecycle, subsystems that perform the desired system functions are designed and specified in compliance with the system specification. Interfaces between subsystems are defined, as well as overall test and evaluation requirements. At the completion of this stage, a development specification is produced that is sufficient to perform detailed design and development. Key steps within the preliminary design stage include: - Functional analysis - Requirements allocation - Detailed trade-off studies - Synthesis of System options - Preliminary design of engineering models - Development specification	This stage includes the development of detailed designs that brings initial design work into a completed with form of specifications. This work includes the specification of interfaces between the system and its intended environment and a comprehensive evaluation of the systems logistical, maintenance and support requirements. The detail design and development is responsible for producing the Product, process and material specifications and can result in substantial changes to the development specification. Key steps within the detail design and development stage include: - Detailed design - Detailed synthesis - Development of engineering and prototype models - Revision of development specification - Product, process and material specification	During the production and/or construction stage the product is built or assembled in accordance with the requirements specified in the Product, process and material specifications and is deployed and tested within the operational target environment. System assessments are conducted in order to correct deficiencies and adapt the system for continued improvement. Key steps within the Product/construction stage include: - Production and/or construction of system components - Acceptance testing - System distribution and operation - Operational testing and evaluation - System assessment	Once fully deployed, the system is used for its intended operational role and maintained within its operational environment. Key steps within the utilization and support stage include: - System operation in the user environment - Maintenance and logistics support - System modifications for improvement - System assessment	Once deployed, the effectiveness and efficiency of the system must be continuously evaluated to determine when the product has met its maximum effective lifecycle. Considerations include: - System operation in the user environment - Continued existence of operational need - Matching between operational requirements and system performance - Feasibility of system phase-out versus maintenance - Availability of alternative systems.

3 ILS elements

3.1 Comparison of ILS elements across different specifications and handbooks

Table 10 provides a comparison between the names of the ILS elements as defined in several specifications and guidebooks. The lines must be read across. If a table cell is blank, then that particular specification or handbook does not consider that aspect.

Note

Names (or equivalents) can cover different aspects (eg, the Product support management element in SX000i also covers obsolescence management).

Note

In the case of SX000i, missing elements are due to the exclusions defined in Chap 1.

Table 10 Naming of ILS elements across multiple specifications and handbooks.

SX000i	**JSP 886 Volume 7** Part 1 - Integrated Logistic Support	**Def Stan 00-600** Integrated Logistic Support	**US Army Regulation 700-127** Rapid Action Revision (RAR)	**NATO ALP-10** Guidance on Integrated Support for Multinational Equipment Projects (ILS)	**Integrated Logistic Support Plan Template** Florida's Statewide Sys.Eng. Mgt. Plan Appendix U, Integrated Logistic Support Plan Template	**United States Coast Guard** System Integrated Logistic Support Policy Manual Commandant Instruction M4105.8, 1 October 2002	**DAU Integrated Product Support Element Guidebook** Release: 2011 DoD (Draft for Review 23. Mar 2011)	**NASA Policy Directive Program and Project Life-Cycle Logistics Support Policy** Release: 2015 NPD 7500.1 – Effective Date: March 02 2015
ILS elements	**Current ILS elements**	**ILS deliverables**	**ILS elements**	**ILS elements**	**ILS elements**	**ILS elements**	**ILS elements**	**ILS elements**
Computer resources	Computer and software support		Computer resources support		Computer resources support	Computer resources support	Computer resources	Computer resources support
Design influence			Design influence/ interface	Design influence/ interface		Design interface	Design interface	Design interface
Facilities and infrastructure	Facilities and infrastructure	Facilities deliverables	Facilities	Facilities and infrastructure	Facilities	Facilities	Facilities and infrastructure	Facilities required for ILS functions

SX000i	JSP 886 Volume 7	Def Stan 00-600	US Army Regulation 700-127	NATO ALP-10	Integrated Logistic Support Plan Template Florida's Statewide Sys.Eng. Mgt. Plan	United States Coast Guard System Integrated Logistic Support Policy Manual	DAU Integrated Product Support Element Guidebook	NASA Policy Directive Program and Project Life-Cycle Logistics Support Policy
Maintenance	Maintenance planning	Maintenance planning deliverables	Maintenance planning	Maintenance planning	Maintenance planning	Maintenance planning	Maintenance planning and management	Maintenance planning
Manpower and personnel			Manpower and personnel	Personnel	Manpower and personnel	Manpower and personnel	Manpower and personnel	Manpower and personnel for ILS functions
Packaging, Handling, Storage and Transportation (PHS&T)	PHS&T	Packaging, handling and transportation deliverables	PHS&T	PHS&T	PHS&T	PHS&T	PHS&T	PHS&T
Product support management	ILS planning	Planning and management deliverables						
Supply support	Supply support	Supply support deliverables	Supply support	Supply support	Supply support	Supply support	Supply support	Supply support
Support equipment	Support and Test Equipment (S&TE)	S&TE deliverables	Support equipment	S&TE	S&TE	Support equipment	Support equipment	Support equipment
Sustaining engineering								
Technical data	Technical information	Information management deliverables	Technical data	Technical information and data	Technical data	Technical data	Technical data	Technical data

SX000i	JSP 886 Volume 7	Def Stan 00-600	US Army Regulation 700-127	NATO ALP-10	Integrated Logistic Support Plan Template Florida's Statewide Sys.Eng. Mgt. Plan	United States Coast Guard System Integrated Logistic Support Policy Manual	DAU Integrated Product Support Element Guidebook	NASA Policy Directive Program and Project Life-Cycle Logistics Support Policy
Training	Training and Training Equipment (TE)	Training and TE	Training and support	Training and training support	Training and TE	Training and training support	Training and training support	Training and training support
	Reliability and maintainability	Reliability and maintainability deliverables						
	Disposal and termination	Disposal and termination deliverables						
	Human factors integration	Human factors integration deliverables Technical documentation deliverables						
		Supportability case deliverables			Hardware/Software integration (HSI)			
		Supportability analysis deliverables						

3.2 Elements associated with ILS

Table 11 provides the relationship of other elements and/or domains associated with ILS and how they are named in other documents.

Note

The SX000i ILS element, Product support management includes several activities which will be included in a future issue of this specification. Refer to the exclusions defined in Chap 1.

Table 11 Other elements associated with ILS

SX000i	JSP 886 Volume 7	Def Stan 00-600	US Army Regulation 700-127	NATO ALP-10	Integrated Logistic Support Plan Template Florida's Statewide Sys.Eng. Mgt. Plan	United States Coast Guard System Integrated Logistic Support Policy Manual	US DoD Integrated Product Support Element Guidebook
Product support management	Asset management						
Product support management	Commercial and contract management						
Technical data	Configuration management	Configuration management deliverables			Standardization and interoperability		
Product support management	In-Service monitoring of logistic performance						
Product support management	Logistic information management						
Product support management	Obsolescence management	Obsolescence management deliverables					
	Quality management						
	Risk management						
	Safety management						
	System design						

End of data module