S1000D User Forum 2010
September 27-30, 2010, Aerostar hotel, Moscow, Russia

Track1: ILS implementation and experience

S3000L - Overview

by

Peter Zimmermann
Cassidian Air Systems, Customer Support
(on behalf of the S3000L European chair Peter Eichmueller)
Content

- **Introduction**
  Logistic Support Analysis (LSA) in the context of Integrated Logistic Support (ILS)

- **S3000L - Project progress** until today

- **S3000L - Overall content**

- **S3000L - Some aspects from selected chapters**

- **S3000L/S1003X - Overview of data model and data exchange**

- **SUMMARY**
Significance of logistic support
Feedback from customer

(Original German citation from KG UKdoLw)
„Wegen des hohen Anstiegs der Materialerhaltungskosten müssen heute logistische Forderungen bezüglich Zuverlässigkeit, Wartbarkeit, Prüfbarkeit und Betriebskosten gleichwertig neben den operationellen, technischen und wirtschaftlichen Forderungen stehen“.

„Because of the dramatic increase of support costs we have to consider the logistic requirements for reliability, maintainability and in service costs in the same way and on the same level as the operational, technical and economical requirements“.
Logistic Support Analysis (LSA) is an extended process to analyze carefully all elements of a complex technical system to guarantee optimal logistic support during the in service phase.

During an LSA process three main working aims can be identified:

• **Influence on design** to optimize the technical system for proper logistic support

• **Optimization** of the logistic resources (personnel, support equipment, materiel, facilities, software support, training, etc.)

• Establishment of the **basic information** for the subordinated logistic disciplines, which create the logistic end products

**LSA is not to be considered an own logistic discipline**
(eg like technical documentation, material support or training)
ILS - Integrated Logistic Support
Definition / position of LSA process

Integrated Logistic Support (ILS) is a management method to integrate and manage the elements of logistic support

- Logistic analysis tasks to optimize the design from the logistic point of view (product breakdown, maintainability, testability, reliability, scheduled maintenance analysis, etc…)
- Materiel Support (spares, consumables)
- Technical Documentation
- Support Equipment
- Personnel requirements and training / training facilities
- Facilities
- Software Support
during all phases of system design & development and in service phase.

The LSA process is the powerful management tool to support the achievement of the aims of Integrated Logistic Support.
**S3000L - Overview**

**ILS - Integrated Logistic Support**
Risk of non-integrated approach

- **Supportability insufficient or incomplete**
  - Spares not available
  - Product not reliable
  - Infrastructure and facilities incomplete
  - Transportability insufficient
  - Technical publication incomplete
  - Insufficient skill of personnel

- Support equipment inappropriate
- Packaging inappropriate
Aquisition Logistics
main Business Processes

Relations to the ASD/AIA ILS Specification Suite
… one of the starting points of the S3000L working group 2006 in Munich

Design of Systems and Support Equipment

Operational & Maintenance Data Feedback

S3000L - Overview
The specification S3000L is designed to cover the activities and requirements governing the establishment of the LSA process.

The concept of this specification was originated in 2006.

- **01/2006** Inaugural meeting in Brussels
- **2009-06-24** Publication of S3000L, Issue 0.1, in Brussels
- **10/2009** End of official commenting phase for organizations and companies
- **11/2009** Clarification of comments
- **04/2010** Finalization of issue 1.0
- **05/2010** Publication of S3000L, Issue 1.0
- **11/2010** Establishment of S3000L Steering Committee
**US and European Aerospace Industry** are represented each by a chairman of the entire working group

Both are supported by **work package managers** within the core team

A common **ASD/AIA Advisory Board** monitors the project
<table>
<thead>
<tr>
<th>Nr</th>
<th>Chapter</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction</td>
<td>Cassidian Air Systems</td>
</tr>
<tr>
<td>02</td>
<td>General Requirements</td>
<td>BOEING</td>
</tr>
<tr>
<td>03</td>
<td>LSA Business Process</td>
<td>Cassidian Air Systems</td>
</tr>
<tr>
<td>04</td>
<td>Configuration Management</td>
<td>EADS CASA</td>
</tr>
<tr>
<td>05</td>
<td>Influence on Design / RMT Interface</td>
<td>SAAB</td>
</tr>
<tr>
<td>06</td>
<td>Human Factors Analysis</td>
<td>BOEING / Cassidian Air Systems</td>
</tr>
<tr>
<td>07</td>
<td>LSA FMEA</td>
<td>EUROCOPTER</td>
</tr>
<tr>
<td>08</td>
<td>Damage and Event Analysis</td>
<td>DASSAULT</td>
</tr>
<tr>
<td>09</td>
<td>Logistics Related Operations Analysis</td>
<td>Cassidian Air Systems</td>
</tr>
<tr>
<td>10</td>
<td>Scheduled Maintenance Analysis</td>
<td>Cassidian Air Systems</td>
</tr>
<tr>
<td>11</td>
<td>Level of Repair Analysis</td>
<td>LOGSA</td>
</tr>
<tr>
<td>12</td>
<td>Maintenance Task Analysis</td>
<td>Cassidian Air Systems</td>
</tr>
<tr>
<td>Nr</td>
<td>Chapter</td>
<td>Responsible</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>13</td>
<td>Software Support Analysis</td>
<td>Cassidian Air Systems</td>
</tr>
<tr>
<td>14</td>
<td>Life Cycle Costs Considerations</td>
<td>EADS CASA</td>
</tr>
<tr>
<td>15</td>
<td>Obsolescence Analysis</td>
<td>OCCAR</td>
</tr>
<tr>
<td>16</td>
<td>In Service Feedback</td>
<td>BOEING</td>
</tr>
<tr>
<td>17</td>
<td>Disposal</td>
<td>DASSAULT</td>
</tr>
<tr>
<td>18</td>
<td>Interrelation to other ASD Standards</td>
<td>Cassidian Air Systems / MTDTT</td>
</tr>
<tr>
<td>19</td>
<td>Data Model</td>
<td>SAAB</td>
</tr>
<tr>
<td>20</td>
<td>Data Exchange</td>
<td>SAAB</td>
</tr>
<tr>
<td>21</td>
<td>Terms, definitions and abbreviations</td>
<td>AGUSTA WESTLAND</td>
</tr>
<tr>
<td>22</td>
<td>Data element list</td>
<td>SAAB</td>
</tr>
</tbody>
</table>
S3000L is designed to cover all processes and requirements governing the performance of the LSA:

- It provides rules for the **establishment of the product breakdown** and for the **selection of LSA candidate items**.
- It describes type and methodology of **performance of the specified analyses**.
- It gives guidelines on **how to process the results of the analysis tasks**.
- It covers the interface between LSA and the **support engineering areas**.
- It covers the interface between LSA and the **ILS functional areas**.
The business process - The heart of S3000L

- Establishment of **Product Usage Data**
- Establishment of **Product Design & Performance Data**
- LSA **Guidance Conference**
- Establishment of **Breakdown** according to agreed rules
- **Candidate Item Selection**
- **Analysis activities** for candidate items
- **Customer Involvement**
- LSA **Review / Assessment Conference**
- Starting Point / Interface to creation of **ILS products**
Technical/logistic analysis activities
List of potential analysis activities according to S3000L

- Analysis for identification of general LSA needs
- Comparative Analysis
- Human Factor Analysis

- System breakdown and Product configuration
- RAMTS (Reliability, Availability, Maintainability, Testability and Safety Analysis)

- LSA FMEA (Logistic FMEA)
- Damage Analysis
- Special Event Analysis
- Scheduled Maintenance Analysis (S4000M, MSG-3, RCM)
- Operations Analysis (PHST)

- Software Support Analysis (SSA)
- Level of Repair Analysis (LORA)
- Maintenance Task Analysis (MTA) → Task requirements

Additionally LSA provides information for:

- Simulation of operational scenarios
- Training Needs Analysis (TNA)

Analysis results are documented in the LSA database
Logistic Support Analysis

Logistic disciplines, which receive information from the LSA database

- Consumables supply
- Spare part supply
- Technical documentation
- Support Equipment
- Special tools AGE
- Training requirements and Training Needs Analysis TNA
- Personnel requirements
- Infrastructure
- IT and Software Support Tools

LSA database
All *events* which justify any maintenance activity must be considered. Additionally all relevant *operational* activities must be analyzed. These are covered in chapter 7 to 10:

- Chapter 7: **Failures** ⇒ LSA FMEA
- Chapter 8: **Damages** and **special events**
- Chapter 9: **Operational** activities
- Chapter 10: **Scheduled** Maintenance
Purpose:
Beside the activities concerning maintenance and repair of a product, there are **additional aspects concerning the operation and the handling** to be considered.

Logistic relevant operations are tasks, which can neither be assigned to the area of direct usage of a product (documented in operating instructions) nor to the area of maintenance (documented in a maintenance manual).
Maintenance Tasks
Chapter 12
Relation between events and tasks

Product breakdown

Failure modes
- Corrective maintenance tasks
- Damage modes
- Special events
- Thresholds / intervals

Corrective maintenance tasks
- Standard repair procedures

Inspections after special events

Scheduled maintenance tasks
- MRO packages

Operation tasks
Data and software loading

Maintenance Task Analysis
Task structure - How to document a task

Documentation of **supporting tasks** with the help of subtasks/working steps

Documentation of **rectifying tasks** with the help of referenced supporting tasks and additional subtasks / working steps, respectively

Integration of **preconditions, pre-work and post-work**

Brief **narrative description**
Task resources

The resources necessary to perform a maintenance tasks should be defined at the appropriate level within the task itself.

Generally, it should be possible to identify when a resource should be available within the sequence of the task. The resources can be (but are not limited to):

- Personnel and required training
- Material (spare parts and consumables)
- Support and test equipment
- Facilities and infrastructure
- Technical documentation
- IT support
Task requirements - Additional aspects

The following aspects concerning the performance of any maintenance task are additionally covered by S3000L:

- **Resources** out of supporting task references
- **Harmonization** of support equipment and spare parts
- Task **location** aspects
- Product and system **availability** during maintenance performance
- Support solutions **(task variants)**
- Task **duration** and **task frequency**
- **Parallel activities** within maintenance tasks
Why to consider software in an LSA process?

Comparison of „flying“ software in active weapon systems:

**F4**
nearly none (at first introduction)

**Tornado**
27 KLOC* (at first introduction)

* KLOC = KiloLines of Code
  Measurement base for amount of software

**EF 2000**
1600 KLOC
82 programmable computers interconnected via 8 network buses
Objective

- Describe a coherent S3000L **data model** and **data element definitions** for exchange of LSA data with related business processes
- Predicated on **ISO 10303 AP239 Product Life Cycle Support (PLCS)** data model
- Documents the data **originated within the S3000L chapters**
- Contains the data required to “build” task **related S1000D data modules**
- Basis for data exchange specifications **DEX1 A&D and DEX3 A&D**
Model overview

- **UoF Project**: Identifies the product(s) which is the target for the LSA project.
- **UoF Product Usage**: Defines the conditions under which the product is to be operated and maintained.
- **UoF Task Usage**: Identifies time limits (intervals) and maintenance levels for a task.
- **UoF Breakdown Structure**: Defines the breakdown of the product(s) that are within the scope of the LSA project.
- **UoF LSA Candidate Task Requirements**: Early recording of task that needs to be refined during the detailed maintenance task analysis.
- **UoF Task**: Detailed definition of a task and its subtasks.
- **UoF Breakdown Element Realization**: Defines the elements being used in the breakdown of a product and the parts that can realize the breakdown element.
- **UoF LSA Candidate Analysis Tasks**: Identifies and records the progress of logistics support analysis tasks that is performed on each LSA candidate.
- **UoF Task Resources**: Identifies material, facility, and personnel resources needed for the execution of a task.
- **UoF Part**: Defines hardware and software parts that can realize elements in the breakdown structure.
- **UoF LSA Candidate**: Selects the breakdown elements and parts that are identified as being LSA candidates.

**Data model and data exchange**

Chapter 19 - Data model overview
Objective

Define a coherent set of **Aerospace and Defence Data Exchange Specifications (DEX)** that supports the S3000L LSA process and its interaction with related business processes.

Scope

Exchange of product related data needed for support

Exchange of task data needed by eg Technical Publications and Maintenance Management
**S1003X - S3000L/S1000D interface specification**

Issue 0.1 is actually reworked by the S3000L working group, issue 1.0 is planned for 09/2010

**Purpose of S1003X:**
Specification of the required LSA data to create S1000D data modules for the description of the maintenance of the LSA candidates

**Content:**
Mapping of S3000L data elements to S1000D 4.0 data elements and feedback of the generated data modules (related data module codes to the corresponding maintenance activities)
Data exchange via DEX1 and DEX3 A&D

S1003X interface specification

tailoring of DEXes

S3000L LSA database

S1000D CSDB
S3000L gives a guideline **how to establish a proper LSA process** with special regard to the **involvement of the customer**

S3000L describes **the LSA business process** from the very first activities in a conceptual project phase to the recommendation when to start with the production of the logistic end products

S3000L gives a guideline **how to create a suitable system breakdown** and how to select the potential LSA candidates

S3000L gives an overview of **potential technical/logistic analysis activities** and how the results can be documented within a logistic database (LSA database)

S3000L gives a guideline how to document **maintenance or operational tasks** and the **corresponding resources**

S3000L offers a data model based on **ISO 10303 AP239 Product Life Cycle Support (PLCS) data model**

Additional specification **S1003X** offers data exchange baseline between S3000L and S1000D
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A&amp;D</td>
<td>Aerospace &amp; Defence</td>
</tr>
<tr>
<td>AGE</td>
<td>Aerospace Ground Equipment</td>
</tr>
<tr>
<td>AIA</td>
<td>Aerospace Industries Association of America</td>
</tr>
<tr>
<td>AP</td>
<td>Application Protocol</td>
</tr>
<tr>
<td>ASD</td>
<td>AeroSpace and Defence Industries Association of Europe</td>
</tr>
<tr>
<td>CSDB</td>
<td>Common Source DataBase</td>
</tr>
<tr>
<td>DEX</td>
<td>Data EXchange specification</td>
</tr>
<tr>
<td>FMEA</td>
<td>Failure Mode and Effects Analysis</td>
</tr>
<tr>
<td>ILS</td>
<td>Integrated Logistic Support</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standards Organization</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>KLOC</td>
<td>KiloLines Of Code</td>
</tr>
<tr>
<td>LSA</td>
<td>Logistic Support Analysis</td>
</tr>
<tr>
<td>LORA</td>
<td>Level Of Repair Analysis</td>
</tr>
<tr>
<td>MRO</td>
<td>Maintenance, Repair &amp; Overhaul</td>
</tr>
<tr>
<td>MSG</td>
<td>Maintenance Steering Group</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>MTA</td>
<td>Maintenance Task Analysis</td>
</tr>
<tr>
<td>MTDTT</td>
<td>Maintenance Task Data Task Team</td>
</tr>
<tr>
<td>OPS</td>
<td>Operations</td>
</tr>
<tr>
<td>PHST</td>
<td>Packaging, Handling, Storage and Transportation</td>
</tr>
<tr>
<td>PLCS</td>
<td>Product Life-Cycle Standard</td>
</tr>
<tr>
<td>RAMTS</td>
<td>Reliability, Availability, Maintainability, Testability and Safety analysis</td>
</tr>
<tr>
<td>RCM</td>
<td>Reliability Centered Maintenance</td>
</tr>
<tr>
<td>SC</td>
<td>Steering Committee</td>
</tr>
<tr>
<td>SE</td>
<td>Support Equipment</td>
</tr>
<tr>
<td>SSA</td>
<td>Software Support Analysis</td>
</tr>
<tr>
<td>TNA</td>
<td>Training Needs Analysis</td>
</tr>
<tr>
<td>TT</td>
<td>Task Team</td>
</tr>
<tr>
<td>UoF</td>
<td>Unit of Functionality</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modeling Language</td>
</tr>
</tbody>
</table>
Thank you for your staying power!

Questions?

Peter Zimmermann, Cassidian Air Systems
Phone: +49-8459-81-80313
Fax: +49-8459-81-80312
Email: peter.e.zimmermann@cassidian.com