"A day in the life of the S-Series"

International specification for in-service data feedback

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Purpose

The **In-service data feedback** is a completely new field that will allow us to finally improve our products over the whole life-cycle based on actual product usage and compile the data that will provide us with the insight to produce better and more supportable products by:

- Providing hard facts and measureable information about actual product usage in a standard way within a specific support environment
- Enable a two-way communication with the customer during the in-service life (yes, feedback is in **both** directions!)
- Provide the means to manage complex support programs and PBL or Full In-Service Support programs.

S5000F defines the **needs for in-service information and the data required to fulfill those needs**. It does **not** define in-service processes nor how that data will be actually used by the different ILS domains (sorry, no magic formulas that fit everybody’s needs!).
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Peculiarities of the specification

• S5000F provides **raw data** from the in-service. The reason is that such data might be used differently by different areas (e.g., do you use your NFF for reliability calculations?)

• It is based on Use Cases, each of which defines the data it requires.

• If you do not perform an activity that covers that particular use case, you should not request the data required for that use case in the first place.

• As data is used for multiple use cases, you might get a same data set for very different reasons (or users) than you might have expected.

• It allows for the transfer of non-structured data (videos, photographs, BITE files, etc.) and even extensions to cover project-specific information.

• It complies with the Common Data Model (SX002D Issue 1.1) and is therefore compatible with the other specs that comply with the CDM (e.g., S3000L Issue 1.1). This allows mapping feedback data to the S-Series data and therefore enables an in-service ILS!
Example of in-service application

- **The product**
  - Bike

- **The fleet**
  - 1560 bikes for hire
  - Mixed fleet (2 types)

- **The Support Concept of Operations (ConOps)**
  - User self-service
  - Fleet management service (2 bikes available at each station at all times)
  - Fixed-priced maintenance service (by number of bike usages)

**The environment**
- 123 stations
- 3126 bike bays

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Example initial data feedback

• Bike project defined initially with “classic” ILS methods – No systematic data feedback planned.

• Data compiled (manually) during the in-service:
  • Number of bikes damaged
  • Repair tasks performed
  • Spares consumed

HOWEVER:

• The project had **Computer Resources** developed for the bike users: A free app that implements a bike location system

➢ **This is ALSO feedback!**

(And why limit it to the user? Why not use it also for fleet management and other support aspects?)
Example of data for fleet management

- The Computer Resources used for the end user convenience also provide important logistic information:
  - Locations where the availability (2 bikes per station) is at risk (red)
  - Locations where an excess of products might strain the available infrastructure (blue)
- The **fleet management** function can call upon the **PHS&T** function to move those bikes to where they are needed.
- And this can be performed in almost real time!
Example of data feedback improvement

• We know where the bikes are, but not which bike is where.

• We can’t control the configuration of the individual bikes – the maintenance knows it has repaired a bike, but often not which one (serial numbers disappear by wear and vandalism)

• We have no clue about the usage of the individual bikes – we know that a bike has left a station or a bike has returned to a station, but we do not know whether it is the same bike

• We can therefore have only average data – not good enough!

• The Sustaining Engineering function performs an analysis and recommends a change: Tag the bikes inside with RFID and implement RFID readers at each station, which will transfer the individual bike’s ID back to the home base.

• The planning of the embodiment of the SB is easy, even though the bikes move around:

• We know at each moment how many bikes are at a station, and also how many have the SB already embodied!

• And we now also know which bike is where!
Example of data feedback improvement (2)

The embodiment of the RFID capability provides additional feedback data:

- Maintenance tasks performed can be associated to each individual bike
- Spares consumptions can be also traced to individual bikes
- We can now control configuration for each individual bike
- We know all the movements between stations of each individual bike, which allows us to detect user usage patterns and the likely environment in which each individual bike operates
- We now the exact usage time of each individual bike (a user obviously will not pay a rent for the duration of the use and not use it)
- We can now detect patterns in usage vs maintenance
- We can calculate MTBF based on actual use
- We can identify whether specific maintenance tasks are carried out more often on certain individual bikes and investigate the causes
The BEAST (Bicycle Expert Accident Survey Team) determines that it is due to faulty maintenance: **brakes failed because they were worn out! Nuts are also loose!**

Uh? The maintenance records show that this specific bicycle had all its regular scheduled maintenance inspections and the time limit was respected!

Aaaargh! The BEAST says that all the bicycles at the home station of the bicycle in question (station #47) have also worn-out brake pads. **S1000DBIKE-AAA-DA1-11-30-02AA-921A-A**

This is serious! The BEAST can revoke our ground-worthiness certificate and impose a pedaling prohibition!
How feedback data helps an accident investigation

• Individualized maintenance records of the whole fleet list all bikes that have an abnormal brake pad wear.

• The RFID records list all the places where those bikes have been.

• Only the bikes that have been located for longer periods at station #47 show significant wear of the brake pads.

• All bikes at other stations have a wear that is lower than the fleet average.

• Bikes at station #47 show four times as much wear as the bikes at other stations.

• Likely cause: Environmental or usage factor at station #47

• Ooops: Station #47 is at a city park with some very rough terrain

➤ Exceptional environment requiring specific maintenance plan or more frequent inspections

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How can we maintain our ground-worthiness?

• Possible solutions:
  • Increase all inspections (bad idea: more inspections -> more cost)
  • Special inspection at station #47 (but what if bikes mover around?)
  • Change brake pads for a more resistant version (but we have a lot in stock!)
  • Increase feedback by automatic measuring brake wear (mod to the whole fleet)
  • Additional problem: Bike usage is increasing! (More users and summer coming up, hence longer usage periods)
  • The fleet owner has also decided to increase the stations by 15% and add 470 more bikes to the fleet!
  • Since some bikes are being stolen, they have also decided to install a hidden GPS.

➢ We need to implement the changes, while using up the remaining spares stock and deploying the new bikes.

It’s about time to start an in-service ILS!
So what can in-service feedback (and S5000F) do for you?

During the in-service phase, ILS is responsible for the following:

- **Operational and supportability analyses throughout the in-service phase, including:**
  - 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, incl. software
  - Engineering and technical support
  - Obsolescence management
  - Maintenance services and repairs
  - Facilities management
  - Fleet management

- **Hardware deliveries including:**
  - Spare packages
  - Equipment
  - Consumables
  - Support and test equipment
  - Training equipment

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No data feedback => no informed support decisions possible!

Real-time feedback => real-time decisions
Some examples of feedback information:

- Maintenance tasks that are performed more often/less often than expected
- Documentation business rules that don’t apply to specific situations
- Real consumptions by location, individual warehouse stock
- Individual existing support equipment per site, including status (e.g., broken)
- Availability of maintenance slots or simulator slots
- Individual product location and specific P/N location for SB embodiment
- Detailed operating hours, including product movements if applicable
- Environment where each product operates, and for how long
- Maintenance costs, broken down by maintenance task, material, staff, etc
- Individual operational configuration for each serialized product
- Detailed failures, including NFF
- Embodied SBs
- Service KPIs
So how much feedback will S5000F provide to ILS?

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<td>Perform computer resource analysis</td>
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<td></td>
<td>Provide computer resources</td>
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<tr>
<td>Design influence</td>
<td>Perform reliability, availability, maintainability, testability analysis</td>
<td>3,4,8,9,10,12</td>
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<td></td>
<td>Populate LSA database</td>
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<td></td>
<td>Perform LCC (affordability) analysis</td>
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<tr>
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<td>Perform F&amp;I analysis</td>
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<tr>
<td></td>
<td>Provide facilities and infrastructure</td>
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<td>Perform level of repair analysis</td>
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<td></td>
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<td></td>
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<td></td>
<td>Develop and continuously improve preventive maintenance</td>
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<td></td>
<td>Perform scheduled maintenance analysis</td>
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<tr>
<td></td>
<td>Perform Prognostics and health management (D&amp;PHM) analysis</td>
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<td></td>
<td>Perform software impact analysis</td>
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<td>Perform manpower &amp; personnel analysis</td>
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A blank box does not mean S5000F will not provide it with information – it means that we have not yet identified what it needs!
But note:

- You will have seen that I have not mentioned feedback for individual specifications.

- The first reason is that a same data feedback (say, occurred failures) can be used by different specifications.

- But the most important reason is that the feedback is NOT for the specifications!

- The S-Series specifications are our best practices, our way of working.

- But the feedback is for the PEOPLE who use these specifications!

- It is them who will exploit this information, who will add value to it by deciding what to do with this feedback.

- It is YOU who will convert the feedback data into a support improvement.

- If the feedback data is not of use to you or your customer, then retrieving it is a waste of money.

- Therefore use S5000F wisely: Request what you need, and ignore what you don’t need. S5000F has a chapter on contracting for it that you should use.
More information needed?

- Please visit:  www.s5000f.org
- Please contact:  chair@s5000f.org

Download a free copy of draft S5000F:

http://www.s5000f.org/downloads.html

S5000F is currently at draft issue 0.2. Some of the features described here don’t appear in this issue.

Draft Issue 0.3 is expected by December 2015

Issue 1.0 is expected to be published in Q1 2016

And yes, you’re welcome both to comment and to participate!
Oh, one more thing:

You might think that the example I provided was somewhat exotic.

But you can find it right outside the hotel!
Thank you for your attention!

Any questions?

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