Thirteen Years of S1000D Work on AWACS

Brian Johnson, Boeing / Henry Ratzer, NATO AEW&C Program Management Agency (NAPMA) / Bob Volkmar, Boeing
• Circa 2005, Denny Raitz held a round robin of Boeing sites to introduce us to S1000D
  – When he inquired if the audience had heard of S1000D, everyone’s hands raised in recognition
  – When he inquired how we had heard of it, we responded that we had been developing in S1000D since about 1996
  – Denny’s response:

  *What rock have you been hiding under?*

  *It’s time to come out from under the rock!*
Thirteen Years of S1000D Work on AWACS

Henry Ratzer, NAPMA – NATO S1000D
Brian Johnson, Boeing – USAF S1000D
Robert Volkmar, Boeing – Where are we going from here
“S1000D: Realizing the Benefits of Integrated Logistics Support”

October 12- October 15, 2009
Crown Plaza Hilton Head Resort, Hilton Head, SC, USA

Thirteen Years of S1000D Work on AWACS – NATO AWACS Integrated Technical Documentation (ITD)

Henry Ratzer
NATO AEW&C Programme Management Agency (NAPMA)
In the mid 90’s, NATO planned a major upgrade to the NATO AWACS Mission Systems.

- NAPMA decided to look into the possibility for Interactive Electronic Technical Manuals (IETM).
  - No knowledge available.
  - No concept available.

A working group was established in 1995 to research the feasibility for IETM for NATO AWACS major Modernization Programme (NATO Midterm).

- Define basic concept.
• Working group
  – Members
    • Acquisition Agency (NAPMA)
    • Operational Command (HQ NAEW&C FC)
      – Inclusive on-site OC-ALC/TCD representative
    • Maintenance and Supply Agency (NAMSA)
    • End User (E-3A Component)
  – Market research
  – Standard evaluation
  – Pilot Project definition
CONCEPT PHASE

• Market Research
  – No system available that could be used

• Standard evaluation
  • AECMA (ASD) 1000D version 1.6 selected
  • Data in SGML required
    – ISO standard

• Pilot Project
  • Selected stand-alone sub-system with interface to the Mission System
    – Organizational and Intermediate Level Data, Support Equipment Data
    – Basic requirements defined
Pilot Project

• Data Conversion and Viewer development contracts awarded to ESG GmbH, Germany in 1996
• Close cooperation between contractor and NATO working group
  – Mandatory for success
• Final delivery of pilot project data and Viewer in 1997
  – Stand-alone and client/server requirements
    • No web based requirements
• Lessons learned report
Pilot Project -Viewer

• Viewer development
  – ATLANTIS - Automated Technical Library for AWACS NATO Technical Information System
  – SINGLE VIEWER FOR TM, IPB, WIRING
    • Relationship between TM, IPB, WIRING via context link
    – Standard and special functionalities
    – Main selection criteria definitions
Pilot Project – Data Conversion

• Data conversion
  – Source data
  – TM data converted to AECMA 1000D version 1.6
  – IPB data based on existing data base concept
  – Wiring data

• Conversion major effort
  – DMC
  – Lack of software tools
  – Data inconsistency
  – Fault Isolation procedures problematic
  – Data duplication problematic
VALIDATION

• Major effort to validate the converted data
• 100% validation of procedural data, warning, cautions, and parameters
• Descriptive data, IPB data, and wiring data validated based on statistical random sample approach
• Considerable re-write was required
Pilot Project - Result

• Advantages with ITD
  – Quick and easy access to data, easy to use
  – Distribution
  – Functionalities
  – Only limited user training required

• Major problems identified
  – Fault Isolation Procedures
  – Wiring diagrams

• 1000D
  – Several CPFs were submitted and were accepted
ITD Recommendation

• The Working Group recommended ITD for the Major Modernization Programme, conditioned major problems would be resolved

• Operational Command made ITD a requirement for NATO AWACS Modernization Programme/Projects based on the Working Group recommendation

• Agreement that NAPMA covers all new technical Orders and legacy Technical Orders impacted by 60% or more to be delivered as ITD
Production ITD

• ATLANTIS2000
  – Contractual arrangement between NAPMA, Boeing, and ESG GmbH to find engineering solutions to all identified problems
    • Catalogue of solutions to identified problems developed
    • Initial Government “Data interchange Document” developed (1st business rules)
      – Maintained and updated as required
  – ATLANTIS2000 viewer delivered 2000
    • Maintained and updated as required
Data Development

- Pilot Project ITD data conversion
  - FI Procedures re-written to 1000D version 1.7
- New TM Data
  - Written to 1000D version 1.7
- Wiring Data
  - Wiring data converted to EwdXplorer by Boeing
- IPB Data
  - IPB data in existing database format
  - Graphics and tabular data clean-up
  - hot spot generation
- TOC
  - Written to 1000D version 1.9
Software support tools

- QA Tool
  - Checks compliance with “Data Interchange Specification” document (business rules) requirements
  - Identifies location eventual errors
  - Required to pass prior to delivery
Software support tools

TOC Tool
Folder / Leaf:
- Rename
- Create
- Delete
- Move

Change DMC oriented TOC to a logical structured TOC

DOES NOT CHANGE DM
Software support tools

• Review Tools
  – Boeing review tool used during NATO Midterm
    • Collects comments in database, show comments in data
    • Very successful, as comments can be tracked throughout the Programme
  – Government owned review tool used for data contracts with other vendors
    – SGML, XML, PDF data format
  – Two major function groups
    • Tech Data review and comment generation
    • Comment consolidation and administration
Software support tools

Government Review Tool

- Comment Identifier
- Comment form

Consolidate comments from max 10 reviewers
Master data base
• Government contracted Northrop-Grumman and L-3 Com for another Modernization Programme
  – ITD data delivery in accordance with the same requirements as for the NATO Midterm Programme
  – Contractual relationship between data vendors and ITD vendor (training & engineering support)
• First event we received data from another vendor
  – All deliverables passed the QA tool without problems and we have had no issues with data integration
  – Data integrated as TCTO related data (applicability)
• The system proved to work
APPLICABILITY

- ATLANTIS2000 supports display of data for various aircraft configurations (TCTO implementation)
  - TM and IPB
  - Wiring Boeing standard (MOD number)

Provision for selection by aircraft tail number.

Selectable between basic, all, or per TCTO
The Operational Command requested “certification” of viewer and data integration.

This was accomplished by the German Airworthiness authorities.

The effort covers surveillance of data integration and all associated software tools.

Does not cover data content.
DISTRIBUTION

• Preliminary data
  – NAPMA is required to provide preliminary data reflecting ongoing Modernization Programme/projects
    • NAPMA has contracted for a max. 10 days turn around time for data integration
    • NAPMA distributes the data to limited recipients
    • Preliminary data is always integrated with latest official published baseline
    • Color coded yellow
  – Operational Command authorizes usage of preliminary data
DISTRIBUTION

• Official data
  – Official data is distributed following the USAF TO regulations and process
    • Data sustainment is outsourced to aircraft OEM
    • Data and viewer are published by OC-ALC under one TO number
• Future Modernization Programmes will be based on S1000D version 4.0
  – Currently NAPMA an USAF AWACS are in the preliminary phase of discussions for a common approach on a specific programme
  – Training data is planned to be included
  – Looking into including Flight manuals
• Legacy ITD data and remaining paper based Technical Orders to be converted to S1000D version 4.0
• WEB based system
SUMMARY

• NATO AWACS has successfully implemented an ITD system
• 1000D version 1.6, 1.7, and 1.9 used
• Applicability is supported
• Stand-alone and client/server
• A must for for successful result
  – Close cooperation between all parties, Government and Contractors, are mandatory for success
  – Working group with user participation from day one
• Our pilot project resulted in submittal of a series CPFs to 1000D consortium, which have been implemented
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Thirteen Years of S1000D Work on AWACS – USAF S1000D

Brian Johnson, AWCS Logistics Senior Manager
Boeing
Why We Chose S1000D?

- Commercial-Off-The-Shelf COTS H/W
  - Very short procurement life
  - Multiple configurations of H/W
  - Multiple configurations of aircraft
  - Multiple configurations of technical data

- Improved Fault Isolation
  - Legacy AWACS FI based on 30 year old technology
  - S1000D provides organizational tools to automate FI
  - SNS Part of Mission Computing Fault Codes

- Integration of Logistics Products
  - Logistics Maintenance Information / Logistics Support Analysis
  - Technical Publications
  - Training Courseware

Commonality with NATO
What We Put in S1000D (1st round)

- Air Vehicle
- Legacy MS/SE/TE
- Flight

Mil-STD

- New Training Systems
- New Support Equip
- New Ground Systems
- New Mission Systems

S1000D

- Wiring

Intelligent Viewer

Integration in viewer

- IPB

Database
Conversions (What & Why)

2.0
Little data to convert

2.2

Biggest Issue Info Codes:
3.0 - Not Given, NOT GIVEN
4.0 – Available for program use
4.0.1 – Not available for program use

CM, XML

3.0

AF Std

4.0

Experience: Good
(BR+, DM+++)

S1000D

International Specification for Technical Publications
Utilizing a Common Source Database

S1000D

International specification for technical publications
Utilizing a common source database

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International Specification for Technical Publications
Utilizing a Common Source Database

S1000D

International specification for technical publications
Utilizing a common source database
Configuration management

COTS Equipment

Tail # Unique Data

Content Management System

S1000D Viewer

S1000D
Collaboration Tools

- Viewer / collaboration tool to allow reviewers to see context
- Web enabled
- Database of comments

Viewers

- COTS Viewer
- No deviations/waivers from spec
- Boeing demonstrates within selected viewer
- Customer integrates into their viewer if not same as Boeing’s
Boeing/USAF Coordination

- Internal Boeing coordination / collaboration to provide common offering to customers
  - Legacy Air Force Platforms
  - New(er) Air Force Platforms
  - Other Military Platforms
  - Boeing Commercial
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Thirteen Years of S1000D Work on AWACS – Where are we going from here
Robert Volkmar, Senior Maintenance Engineer
Boeing
Future Planning

- E-3 AWACS modernization to extend service life
  - More upgrade modifications are planned
  - Technical Manuals are currently a mixture of S1000D and MIL-STD-38784 (ETMs and paper)
Study to Convert Legacy Paper into S1000D

- Conducted study to convert remaining Organizational Maintenance Technical Manuals
  - Goal: Remaining paper books replaced by one laptop viewer
  - Books to convert:
    - Remaining System Maintenance
    - Illustrated Parts Breakdown
    - Corrosion Prevention
    - Non-Destructive Inspection
    - Structural Repair
    - Inspection Requirements
    - Work Cards

Photograph courtesy of NATO
The Need for S1000D

- Air Vehicle Upgrade
  - Instruments
  - Air Vehicle Avionics

Photograph courtesy of NATO

- Mid-Life Upgrades

Future Modification Programs require a common authoring standard!
Books Outside of S1000D

- Flight Manuals
- Wiring Diagram Manuals
Advantages and Challenges

ADVANTAGES

• Configuration Management
• Hyperlinking
  – Hyperlink from Maintenance DM to IPD DM that opens in separate window
  – Hyperlink from Inspection Requirement (or Work Card to Maintenance DM)
• Inclusion of Training Material (SCORM)

CHALLENGES

• Common Publication
  – Customers own the publication
  – Individual Customer Requirements
• CSDB vs. ITAR
• Packaging
Putting All Organizational Maintenance T.O.s into S1000D

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Questions?