Allowable Service Life Extension Determinations

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Presented by:
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CAD/PAD Life

• Cartridge Actuated Devices (CAD) and Propellant Actuated Devices (PAD) begin their lives in manufacturing → Packaging
  o Complete manufacturing starts “shelf” life
  o Open package starts “install” life
CAD/PAD Evaluation

- CADs & PADs perform various functions in all critical military egress aircraft systems
  - CADs & PADs performance changes with time
  - The Ordnance Assessment (OA) Group assesses change using
    - OA/Quality Evaluation/Surveillance Test
    - Lot Acceptance Test
    - Qualification Test
The latest approved Ordnance Evaluation Indian Head Technical Report determines current:

- Allowed Shelf Life
- Allowed Install Life
- Life limiting issues include:
  - Test Failure(s)
  - In-service Failure(s)
  - Out of specification with age
  - Lack of long term data
Fleet Availability

• The fleet tries to schedule their deployment/maintenance cycles to accommodate unit replacement before they become overaged.

• Frequently, these deployment/maintenance cycles conflict with shelf/installed life predictions or stock availability. The choices are:
  - Deploy at risk,
  - Ground the aircraft, or
  - Deploy under a granted service life extension.
Request Service Life Extension

• The least risk to Aircrew Safety and Aircraft Availability is to operate under an approved Service Life Extension (SLE) request.

• SLE requests are submitted to the Virtual Fleet Support (VFS) SLE request module.

• VFS provides two types of data to evaluate SLEs:
   Unit Identification and
   Unit Shelf & Installed Age
VFS SLE Data

Unit Identification

- Assigned SLE Request No.
- Department Of Defense Identification Code (DODIC)
- Lot No.
- Part No.
- Part Serial No.
- Installed Aircraft Type
- Installed Aircraft Tail No. (BUNO)
VFS SLE Data

Unit Shelf & Installed Age

- Ordnance Evaluation Initial Life
- Latest Life Extension
- Current Life Requested Extension
A VFS Feature allows SLE Download

- Ordnance Evaluator (OE) downloads VFS data into an Excel® spreadsheet
- OE sorts data by the earliest expiration date
  - Determines the highest priority + LMS requests
- OE filters data by assignment aircraft
- OE populates data in a separate spreadsheet with one or more DODIC(s) *New*
# Ordnance Evaluation Spreadsheet

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Ordnance Evaluation Spreadsheet

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<tr>
<td>ShelfInstall (Original)</td>
<td>ShelfInstall (Current Extended)</td>
<td>Current Expiration Date</td>
<td>ShelfInstall (As of Today)</td>
<td>ShelfInstall (Requested)</td>
<td>Requested Expiration Date</td>
<td>Order Status From One Year Ago to Today</td>
<td>Ordnance Evaluation Recommended</td>
<td>Recommended Expiration Date</td>
<td>Senior Engineer Concurrence Or Non-Concurrence</td>
<td>Comments</td>
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</tbody>
</table>

- The current ShelfInstalled life is ????. (Full Tech Report ????/?? params)
- Stock Qty ??? Condition and Purpose Code A
- General Note
- Units on Order Status
- Code A Stock

- Reference Unit Life Determination Technical Report Document
- VFS params give allowed extra shelf and installed life
SLE Ordnance Evaluator’s Role

- The **Ordnance Evaluator**’s role is to recommend a service life and an install life that minimizes risk to the aircrew and aircraft.

- The Ordnance Evaluator’s role *isn’t* to maximize aircraft availability.
SLE LMS’s Role

- The Logistics Management Specialist (LMS)’s role is to maximize aircraft availability by managing CAD/PADs supplied to aircrafts as need if available.

- The LMS’s role *isn’t* to evaluate a service life’s affect on aircrew or aircraft safety.
SLE Senior Engineer’s Role

• The **Senior Engineer**’s role is to concur or not concur with the Ordnance Evaluator’s recommended allowable service life and install life.

• If non-concurrence, the **Senior Engineer**’s recommends a service life and install life that minimizes risk to the aircrew, aircraft and aircraft availability to the Ordnance Evaluator.

• The Program Office ultimately dictates what service life and install life the **Senior Engineer** may allow.
Ordnance Evaluator’s SLE Recommendation

Ordnance Evaluator’s SLE Recommendation

Ordnance Assessment

- Previous Determinations (Precedence)
- Ordnance Evaluations

Lot Analysis

Aircraft Temperature History

OE

Device Analysis

Spreadsheet Recommend Allowable Service Life to Senior Engineer
SLE Determination Data Flow

OE Recommended Service Life

LMS Recommendations

Unpublished Test Data

Populates OE’s Spreadsheet With Determinations

Senior Engineer

Aircraft Availability

Aircrew Safety

Ordnance Evaluation

Concurrence / Non-Concurrence

Program Desk

SLE Request Limited Approval

• Limits Shelf Life and/or Install Life
  ➢ Shelf life limits are based on unit deterioration/uncertainty in storage and in an aircraft
  ➢ Install Life limits are based on unit deterioration/uncertainty in an aircraft
SLE Spreadsheet Determinations

SLE Request Bottom Line

- Denial
- Approval
- Limited Approval
- Approval Beyond

VFS Email Verification
FMS Engineering Evaluation
Ordnance Evaluator
VFS
FMS LMS
Fleet Field Maintainer

Same DODIC ≠ Same Life

• The same DODIC may have difference extension lives
  ➢ Some devices have stabilizer depleted by heat influenced by its aircraft ambient temperature history
  ➢ DODICs produced with performance near or far from its limits have life determinations based how long it takes to exceed those limits.
  ➢ Some producer make units with better aging performance than others.
SLE Determination Tools

• Ordnance Assessment
  o Unit’s test performance changes with time
  o Linear trends with tolerance bands
    ➢ Where there is a 90% confidence that 99% of the inventory population will perform within those bands.
    ➢ Projection of curves
• Device analysis
• Rates of aging *New*
• Precedence
SLE Determination Tools

Project of Curves

Device Analysis

• Shear Pin Force = Initiation force – Back Pressure force
• Back Pressure force increases with increased O-ring leakage
• Aged Nitrile O-rings tend to shrink
• O-ring on shear pin hole may damage O-ring → leakage
An Uninstalled DODIC Can Fail

Failure to Output

Uninstalled Units

What’s the Difference?

- Maximum Allowable Ave Slope
- OA Data
- Maximum Slope
- Ave. LAT
- Max. Value
- Target Time Value

OA Rates of Aging

- Exception
- Failure to output
- Mid Spec
- Maximum Allowable Aging Rate
- Neutral Slope

Calculated worse case service life based on aging rate

SLE Data Uncertainty

• Test results may falsely indicate less life due to excessive bending/damage during uninstalling, packaging or testing:
  ➢ Mild Detonating Cord Sets (MDCS)
  ➢ Thin Layer Explosive lines (TLX)
  ➢ Mild Detonating Cords (MDC)
  ➢ Flexible Linear Shape Charges (FLSC)

• Excessive bending may cause charge separation or excessive compression and large variations in propagation velocities.
SLE Data Uncertainty

- Ballistic ordnance assessment testing may show successful testing; however, false positives may happen because
  - Long out of conditioning times bring the unit closer to ambient
  - Some uninsulated units reach ambient temperature quickly out of conditioning
  - Fixture can bring a unit to its temperature
  - An inadequately cleaned closed bomb volume decreases with each test
  - Inadequate or unmeasured stabilizer
SLE Data Uncertainty

• Qualification may not simulate aging
  o Current temperature extreme cycling may not adequately simulate long term aging
  o Real aging requires multiple cycles that simulate day and night exposures
    ▪ In storage and
    ▪ In its appropriate aircraft
Conclusions

Predicting allowable service life accurately requires:

1. A well understood installed/storage environment and its impact on performance
2. Representative unit ballistic testing performance
3. Measuring chemical/mechanical changes that correlate well with performance
4. An accurate performance analysis of trend data with sufficient data at the requested age
Acknowledgements

- Ordnance Assessment/Logistics Branch