

U.S. ARMY MATERIEL COMMAND
LOGSA
SUPPORTING WARFIGHTERS GLOBALLY

LORA and COMPASS

21 July 2011



SUSTAINING THE ARMY THROUGH THE MATERIEL LENS...



COMPASS



Application Overview

Computerized Optimization Model for Predicting and Analyzing Support Structures (COMPASS) is a PC-based computer model designed to assist in conducting a Level of Repair Analysis (LORA) study.

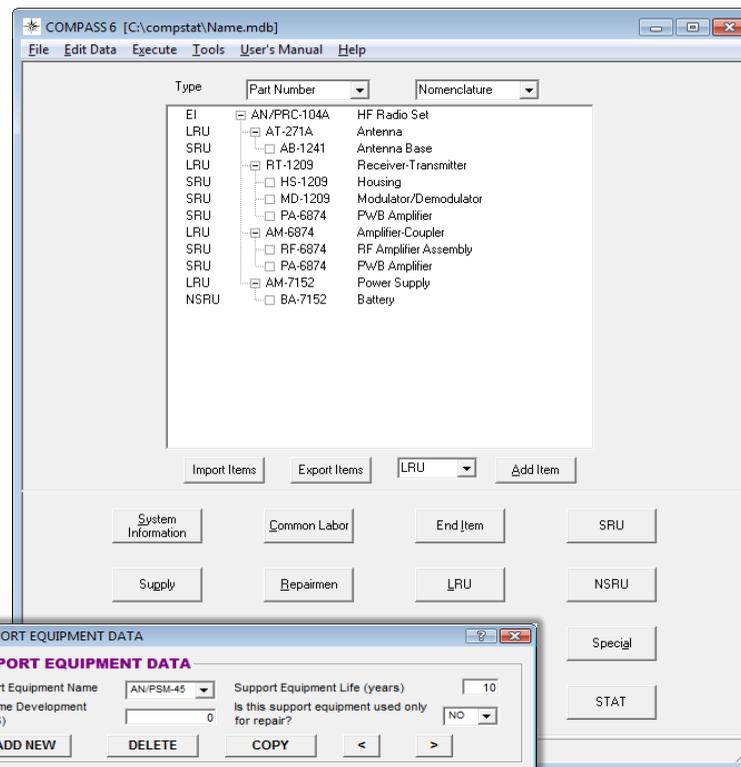
Benefits

- Level of Repair Analysis (LORA)
- Calculates Least Cost Maintenance Alternative
- Force Structure Evaluation
- Sparing/Stockage Optimization
- Sensitivity Analysis
- Repair vs. Discard

Decision Support for Leadership

COMPASS is designed to assist project managers in analyzing various maintenance concepts for their system and related equipment.

COMPASS is used to simultaneously optimize maintenance and supply functions, while achieving a desired operational availability goal.



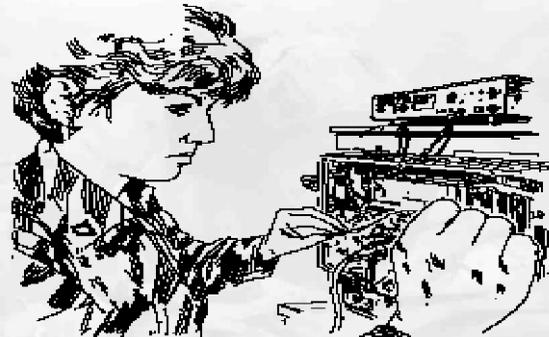


LORA - What?



Level of Repair Analysis (LORA)

A methodology used to establish the maintenance levels at which items will be removed and replaced to meet operational readiness requirements in an optimal, least cost fashion.





LORA - What?



LORA Output Products

- **Maintenance Policy/Concept** - Determines the maintenance levels where items should be removed and replaced; repaired or discarded
 - Leads to formulation of Maintenance Allocation Chart (MAC)
- Allocation and cost of repair resources (repairmen/support equipment) and spares needed to support a given maintenance policy
- Overall costs associated with transportation, cataloging, requisition, technical manuals, etc.



LORA - When?



Department of Defense Instruction 5000.02

"Life-cycle sustainment planning shall be considered during Materiel Solution Analysis, and shall mature throughout Technology Development. A LCSP shall be prepared for Milestone B."

"The LCSP shall be updated and executed during Production and Deployment and Operations and Support."





LORA - When?



Army Materiel Maintenance Policy (AR 750-1)

"As part of the post deployment evaluation, the LORA will be rerun no earlier than 1 year and no later than 3 years from first unit equipped date (FUED) using actual reliability data from fielded equipment. The LORA will be rerun every 5 years throughout the equipment life cycle."





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Features/Highlights

- **Army's standard LORA model (per AR 700-127)**
 - Also used widely by Navy, Marines, Air Force, and NASA
- **Considers up to 4 levels of organic maintenance**
 - Supports two level maintenance (2LM), plus contractor
- **Provides optimal, least cost maintenance policy**
 - Allocates spares and repair resources
 - User may also input a pre-defined policy
- **Sensitivity Analysis**



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Features/Highlights (Cont'd)

- Current version STAT (6.2.0) released 30 Jan 11
- **Optimizer**
 - Uses mixed integer programming (MIP)
 - Optimizes maintenance policies on cost and availability
 - Determines optimum allocation of resources and spares
- **Evaluator**
 - Determines life cycle maintenance, resources, spares, etc. associated with a user-defined maintenance policy

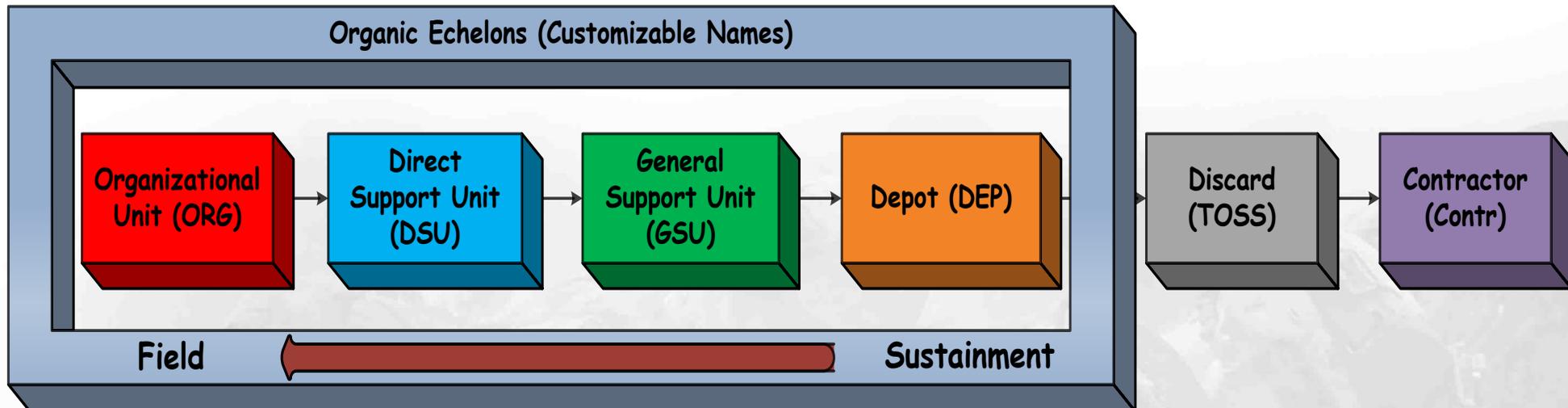


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Modeling Perspective

- Six possibilities for maintenance
 - Up to four levels of organic maintenance
 - Default echelon names: ORG, DSU, GSU, DEPOT
 - Names may be customized to service (i.e. AVUM \equiv ORG)
 - Discard (TOSS) of the item
 - Contractor repair of the item





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Output Reports

- **Front End Analysis Report (FEA)**
 - Report which contains all input data supplied by the user
 - Copy of this report should be provided in all LORA reports
- **Optimizer/Evaluator Report (OPT/EVA)**
 - Lists maintenance policy (optimized or user-defined)
 - Identifies quantity of repairmen, support equipment, and spares required at each maintenance level
 - Lists all life cycle maintenance and support costs associated with the maintenance policy

Note: All reports can be exported to Excel or Word



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Sensitivity and Trend Analysis Tool (STAT)

- Provides capability to automatically adjust logistics parameters over a defined range, monitoring results
- Sensitivity Parameters
 - MTBF, MTTR, Unit Price, Availability, Operating Hours, Repairmen, Support Equipment, **Turn Around Time***, **Density***, **Weight***
- Results saved to Excel tracking selected output variable
 - Changes from baseline execution are highlighted
 - Chart showing output response to sensitivity

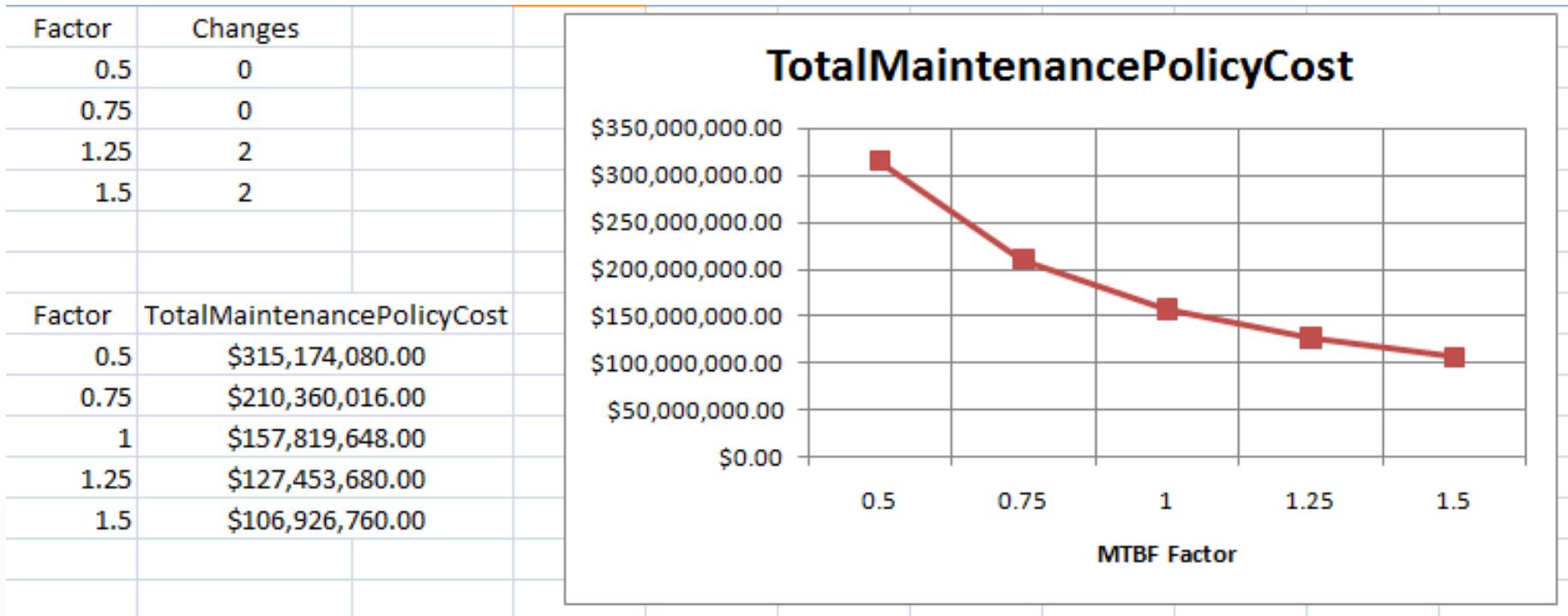
* New sensitivity parameters in COMPASS STAT 6.0.0



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STAT Excel Output



Example: $\pm 50\%$ MTBF, tracking Maintenance Policy changes and charting Total Maintenance Policy Cost



COMPASS



Item Importer

- Item data can be collected in Excel spreadsheet(s)
 - Allows for utilization of multiple data sources
 - Template available for required column headers
- Imports items (LRU/NLRU/SRU/NSRU) into input database
- Reduces data entry time, traditionally done through GUI

Item Exporter

- Item data can be exported to Excel spreadsheet
 - Exports to same template used for import
 - Allows for combining of multiple COMPASS files



COMPASS



Summary

- COMPASS is the Army's standard system level LORA model; also used by Navy, Marines, Air Force, and NASA
- Main function is to assist analyst in determining where items should be removed and replaced; and repaired or discarded
- COMPASS can select least cost maintenance alternative, or analyst can evaluate costs associated with a user defined maintenance policy

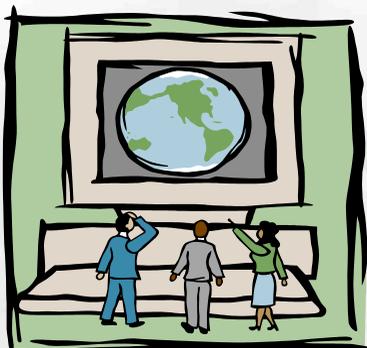


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LOGISTICS ENGINEERING CENTER LOGISTICS ENGINEERING DIVISION

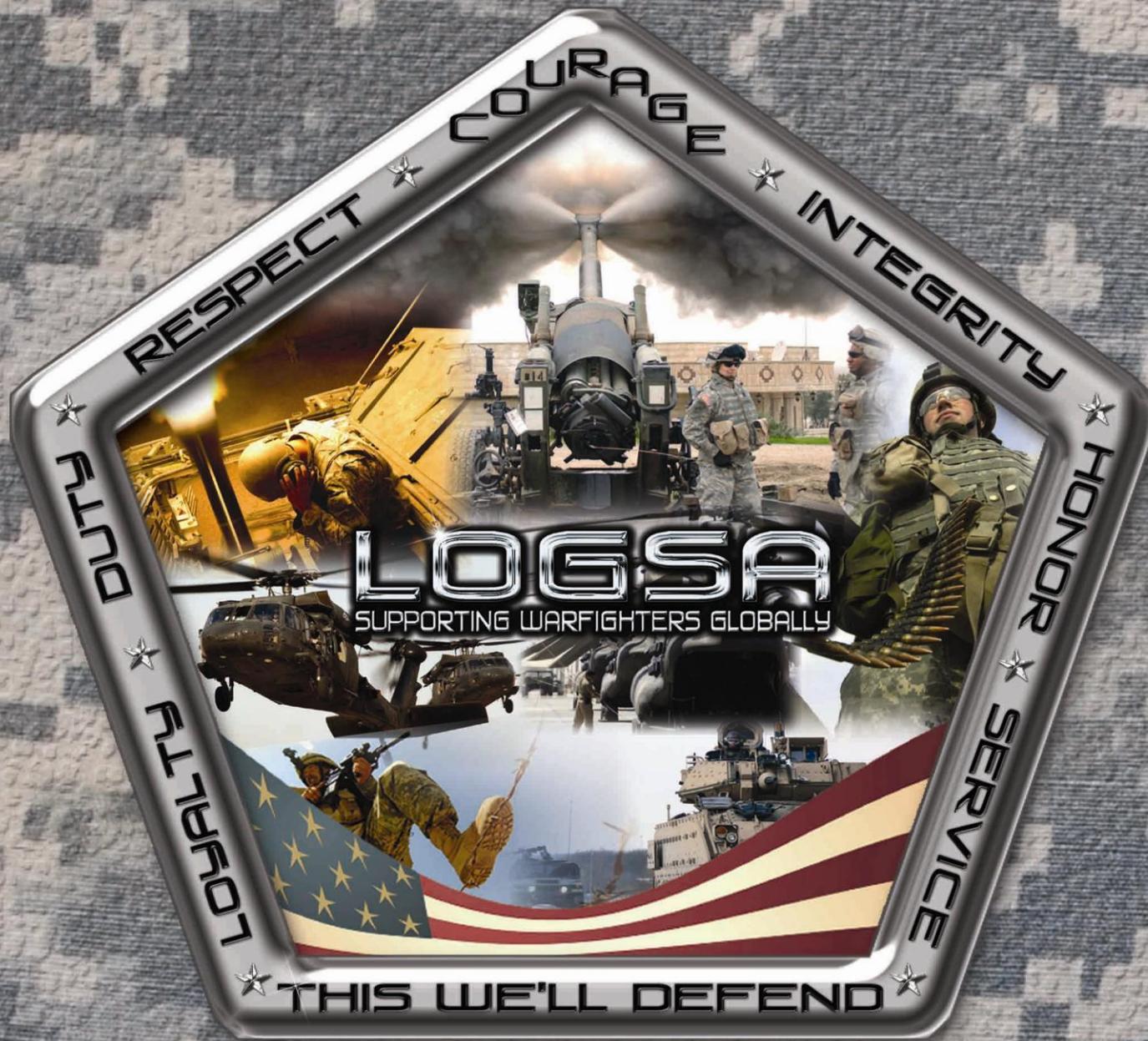
NEED ASSISTANCE or ADDITIONAL INFO?



Product Websites

<https://www.logsa.army.mil/lec/compass>

<https://www.logsa.army.mil/lec/compass-lite>



[HTTPS://WWW.LOGSA.ARMY.MIL](https://www.logsa.army.mil)



Backup Slides



Backup Slides



LORA



LORA Related Documents (www.army.mil/usapa)

- AR 750-1 - Army Materiel Maintenance Policy
- AR 700-127 - Integrated Logistics Support (ILS)
- AR 70-1 - Army Acquisition Policy
- AMC-R 700-27 - Level of Repair Analysis
- PAM 700-56 - Logistics Supportability Planning and Procedures in Army Acquisition

Coming Soon...

- LOGPAM 750-1 - Level of Repair Analysis (LORA) Guide



LORA - How?



Potential Data Sources

Acquisition Phase

- Contractor/Vendor Estimates
- Reliability, Availability, Maintainability (RAM) Report
- Logistics Management Information (LMI)/Logistics Support Analysis Record (LSAR)
- Predecessor System
- AMCOS (MOS rates)

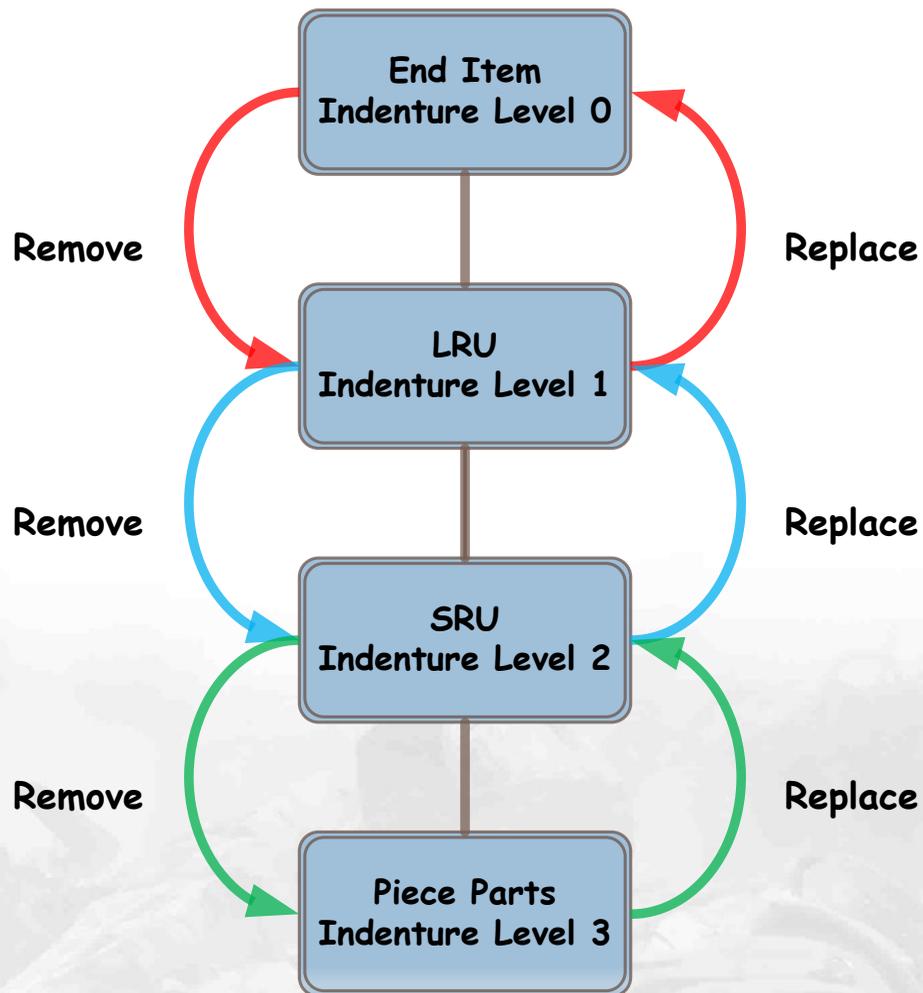
Post Fielding Phase

- Previous LORA
- Previous LCC study
- LMI/LSAR
- Post Fielding Support Analysis (PFSA)
- Technical Manual (ETM/IETM)
- Provisioning Master Record (PMR)



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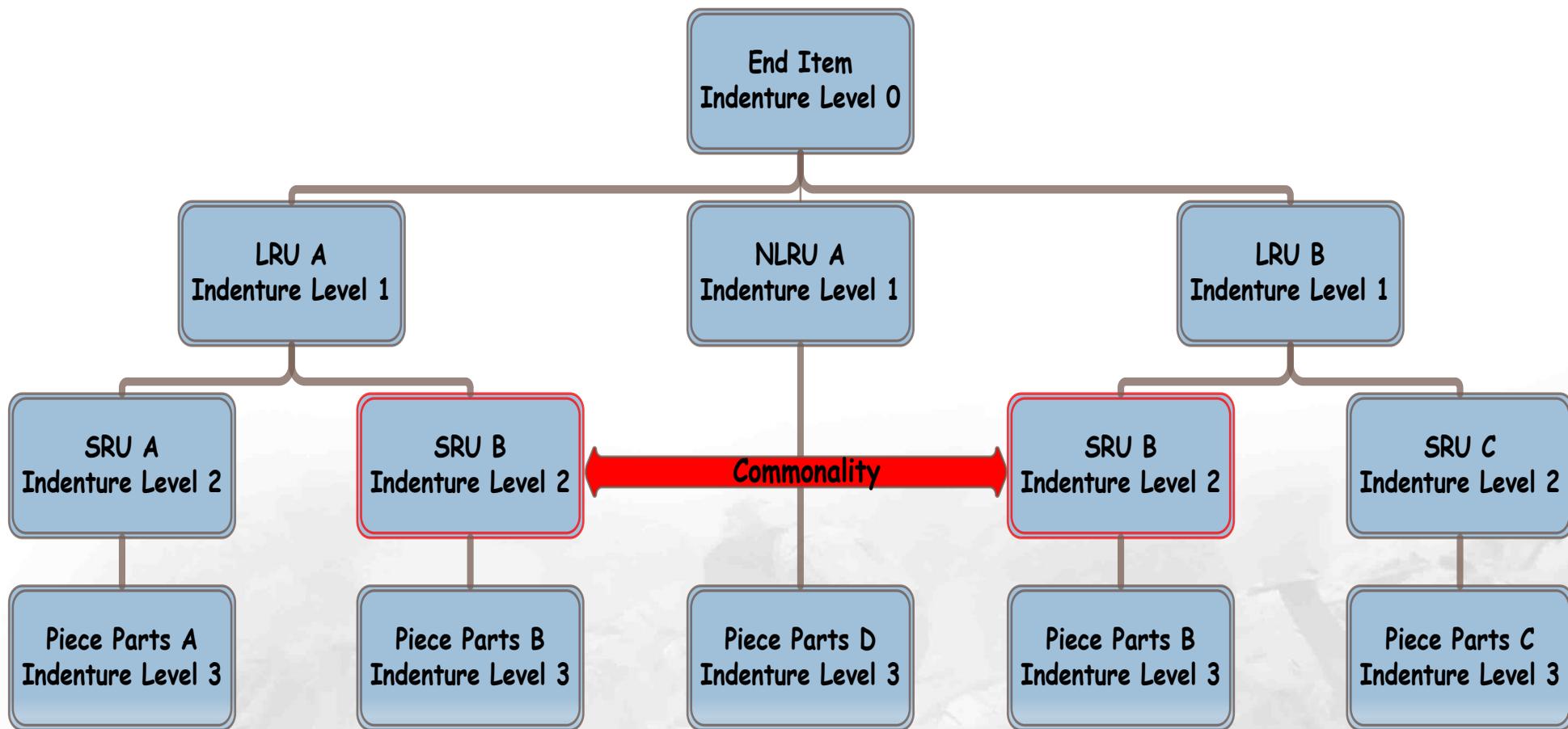
Failure Scenario





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System Breakdown





COMPASS 7 Origins



Rewrite Purpose

- Original algorithms over 25 years old (written in FORTRAN)
 - Updated to modern programming language (Visual C#)
- Difficult to manage legacy code (insufficient documentation)
- Limitations in capabilities
 - Army focused terminology (e.g. echelon and level of indenture names)
 - Maximum number of items (currently 801)

Rewrite Progress

- Project initiated with operations research (Nov 07 - Apr 08)
- Algorithm and GUI rewrite (Apr 08 - Present)
 - Expected test version to be released early 2011



COMPASS 7 Features



Enhanced User Interface

- Reduced data input screens
 - New Version: 4 input screens, Old Versions: 12 input screens
- Improved data integrity checks
 - Real-time control of valid inputs (e.g. $0 < A_o < 1$, Unit Price > 0)
- Item data and system breakdown managed separately
 - Allows for inputting all item data at once
 - Ability to create multiple system breakdowns from same item list

Service Oriented

- Allows for customization of maintenance levels, indenture levels, input parameters, etc.



COMPASS 7 Features



Advanced Capabilities

- Lone Item Evaluator (LITE)
 - Previously available as COMPASS LITE software
- Sensitivity and Trend Analysis Tool (STAT)
- Preset LORA scenarios
 - Two Level Maintenance, Organic vs. Contractor, Repair vs. Discard

Tool Interoperability

- New XML schema allows for full data exchange between other XML based software tools
- Import/Export through XML or spreadsheet
- Full backward compatibility with old versions of COMPASS