FRONT-END ANALYSIS:
CORNERSTONE OF LOGISTICS

Presenter: Paul J. Nager, CPL
United Space Alliance
8 August 2000
New Orleans, LA
FRONT-END LOGISTICS SUPPORT ANALYSIS

OVERVIEW

• WHAT IS 'FRONT-END LOGISTICS SUPPORT ANALYSIS'?
• WHEN SHOULD IT BE PERFORMED?
• WHAT ARE THE BENEFITS OF PERFORMING FELSA AND WHY SHOULD IT BE DONE?
• HOW IS FELSA CONDUCTED?
• EXAMPLES
FRONT-END LOGISTICS SUPPORT ANALYSIS

DISCLAIMER NOTE: ALL HARDWARE ITEMS AND COST OR OTHER FIGURES ASSOCIATED WITH THEM IN THIS PRESENTATION ARE FICTIONAL AND ARE USED FOR ILLUSTRATIVE PURPOSES ONLY.
FRONT-END LOGISTICS SUPPORT ANALYSIS

2 DEFINITIONS OF LSA:

- LSA is an iterative analytical process by which the logistic support necessary for a new system is identified and evaluated. (Blanchard)

- LSA is the selective application of scientific and engineering efforts undertaken during the acquisition process, as part of the system engineering and design process, to assist in complying with supportability and other ILS objectives. (Jones)

- Front-End LSA

- Logistics Support Analysis Record (LSAR)
FRONT-END LOGISTICS SUPPORT ANALYSIS

LSA GOALS AND OBJECTIVES

1. CAUSE LOGISTICS SUPPORT CONSIDERATIONS TO INFLUENCE DESIGN

2. IDENTIFY SUPPORT PROBLEMS & COST DRIVERS EARLY

3. IDENTIFY LOGISTIC SUPPORT RESOURCE REQUIREMENTS FOR SYSTEM LIFE

4. DEVELOP A SINGLE LOGISTICS SUPPORT DATABASE
FRONT-END LOGISTICS SUPPORT ANALYSIS

HOW THESE GOALS AND OBJECTIVES ARE ATTAINED

1. **INFLUENCE DESIGN**
   - IDENTIFY THE QUANTITATIVE CHARACTERISTICS
     - DEFINE PERTINENT QUANTITATIVE OPERATIONAL PARAMETERS
     - ESTIMATE THE SYSTEM/EQUIPMENT LIFE CYCLE COST (LCC)
   - OPTIMIZE THE SYSTEM/EQUIPMENT OPERATION AND SUPPORT (O&S) COST
     - EVALUATE ALTERNATIVE OPERATIONAL, MAINTENANCE, AND SUPPORT CONCEPTS (SIMPLIFY WHERE POSSIBLE)
     - PROVIDE QUANTITATIVE MODELING SUPPORT FOR DESIGN TRADE-OFFS
     - CONDUCT FORCE STRUCTURE/MANPOWER IMPACT ANALYSIS
FRONT-END LOGISTICS SUPPORT ANALYSIS

1. INFLUENCE DESIGN (CONT.)
   - OPTIMIZE THE SYSTEM/EQUIPMENT O&S COST
     • IDENTIFY & DOCUMENT THE OPTIMUM SYSTEM SUPPORT CONCEPT
       - ESTABLISH THE SYSTEM, SUBSYSTEM & ASSEMBLY MAINT. CONCEPT
         » MAINTENANCE SIGNIFICANT ITEMS LIST
         » LEVELS OF MAINTENANCE AND REPAIR VS DISCARD POLICY
         » DIAGNOSTIC CONCEPT (TESTABILITY REQUIREMENTS)

2. IDENTIFY SUPPORT PROBLEMS AND COST DRIVERS EARLY
   - DETERMINE SUPPORTABILITY, COST AND READINESS DRIVERS
   - CONDUCT SUPPORTABILITY RISK ASSESSMENT (SENSITIVITY ANALYSIS)
   - IDENTIFY LOGISTIC SUPPORT RESOURCE CONSTRAINTS
   - DETERMINE AVAILABILITY OF EXISTING SUPPORT RESOURCES
3. **IDENTIFY LOGISTIC SUPPORT RESOURCE REQUIREMENTS FOR SYSTEM LIFE**

- ESTIMATE THE MANPOWER & PERSONNEL REQUIREMENTS
- DEFINE TRAINING REQUIREMENTS
- DEFINE TRANSPORTABILITY REQUIREMENTS
- DEFINE FACILITY REQUIREMENTS
- IDENTIFY AND DOCUMENT NEW OR CRITICAL LOGISTICS SUPPORT RESOURCES
  - PECULIAR TOOLS AND SUPPORT/TEST EQUIPMENT
  - TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT
  - COMMON TOOLS AND TEST EQUIPMENT
FRONT-END LOGISTICS SUPPORT ANALYSIS

FROM

- Design the System
- Design the Support
- Combine System and Support

SEQUENTIAL ENGINEERING

TO

- Design the System
- Design the Support

CONCURRENT ENGINEERING (INTEGRATED)

{analysis} {redesign} {update}
FRONT-END LOGISTICS SUPPORT ANALYSIS

By End of Concept Studies
70%

By End of System Definition
85%

By End of Full-scale Development
90%

Decision Affecting Cost

System Life Cycle

Years
FRONT-END LOGISTICS SUPPORT ANALYSIS

FRONT-END LSA IN SUPPORT OF ACQUISITION MILESTONES AND PHASES

- **DETERMINATION OF MISSION NEED**
- **PHASE 0**
  - CONCEPT EXPLORATION AND DEFINITION
- **PHASE I**
  - DEMONSTRATION AND VALIDATION
- **PHASE II**
  - ENGINEERING AND MANUFACTURING DEVELOPMENT
- **PHASE III**
  - PRODUCTION AND DEPLOYMENT
- **PHASE IV**
  - OPERATIONS AND SUPPORT PHASE V

- **MILESTONE 0**
  - CONCEPT STUDIES APPROVAL
- **MILESTONE I**
  - CONCEPT DEMONSTRATION APPROVAL
- **MILESTONE II**
  - DEVELOPMENT APPROVAL
- **MILESTONE III**
  - PRODUCTION APPROVAL
- **MILESTONE IV**
  - MAJOR MODIFICATION APPROVAL

PDR CDR

FRONT-END LSA

ECP ONLY

FRONT-END LSA
FRONT-END LOGISTICS SUPPORT ANALYSIS

HOW FRONT-END LSA IS PERFORMED

• FRONT-END ACTIVITIES AND PRODUCTS
  - PARTICIPATE IN USE STUDY
  - FORM BASELINE COMPARISON SYSTEM (BCS)
  - DATA GATHERING
  - ASSIST IN FORMING THE MAINTENANCE CONCEPT
  - EVALUATE ALTERNATIVES
  - CONDUCT REPAIR LEVEL ANALYSIS
  - PERFORM SENSITIVITY ANALYSIS
  - TRADE STUDIES/COMPARATIVE ANALYSIS
  - ESTIMATE MANPOWER & FORCE STRUCTURE IMPACTS
  - ESTIMATE LCC AND O&S COSTS
  - IDENTIFICATION OF COST AND SUPPORT DRIVERS
FRONT-END LOGISTICS SUPPORT ANALYSIS

REMEMBER,
THIS IS AN

ITERATIVE

PROCESS!

– MOST/MANY OF THESE ACTIVITIES AND PRODUCTS MUST BE REPEATED OR UPDATED AS THE DESIGN MATURES AND DATA IMPROVES

• THE BETTER THE DATA, THE BETTER THE ESTIMATES
FRONT-END LOGISTICS SUPPORT ANALYSIS

EXAMPLE
SUPPORTABILITY, COST, & READINESS DRIVERS

RELIABILITY DRIVERS:

<table>
<thead>
<tr>
<th>LINE REPLACEABLE UNIT</th>
<th>FAIL/OP LIFE</th>
<th>%/SYSTEM FAILURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER SUPPLY</td>
<td>651</td>
<td>17.02%</td>
</tr>
<tr>
<td>RELAY CARD ASSEMBLY</td>
<td>616</td>
<td>16.66%</td>
</tr>
<tr>
<td>DC/DC CONVERTER</td>
<td>369</td>
<td>9.83%</td>
</tr>
</tbody>
</table>

COST DRIVERS:

<table>
<thead>
<tr>
<th>LRU</th>
<th>UNIT COST</th>
<th>COST/OP LIFE</th>
<th>%/SYSTEM COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROCESSOR ASSY</td>
<td>$32,150</td>
<td>$17,182,000</td>
<td>18.37%</td>
</tr>
<tr>
<td>POWER SUPPLY</td>
<td>$ 3,680</td>
<td>$18,957,000</td>
<td>17.58%</td>
</tr>
<tr>
<td>AFT MODULE</td>
<td>$ 7,265</td>
<td>$ 9,235,000</td>
<td>6.34%</td>
</tr>
</tbody>
</table>
FRONT-END LOGISTICS SUPPORT ANALYSIS

EXAMPLE: SUPPORTABILITY TRADE-OFF

Alternative Maintenance Concepts (System Level):

1. Two-Level: Organizational: Remove/replace LRUs at failure
   Depot: Repair LRUs

2. Three-Level: Org: R/R LRUs
   Intermediate: Screen LRUs/Discard selected failed LRUs
   Depot: Repair selected LRUs

3. Contractor Repair: Org: R/R LRUs
   Contractor: Repair LRUs
FRONT-END LOGISTICS SUPPORT ANALYSIS

EXAMPLE: ALTERNATIVE MAINTENANCE CONCEPTS OPERATIONS & SUPPORT COST SUMMARY (SYSTEM LEVEL)

1. TWO-LEVEL = $18,783,800
2. THREE-LEVEL = $22,326,100
3. CONTRACTOR REPAIR = $35,155,600
**FRONT-END LOGISTICS SUPPORT ANALYSIS**

**EXAMPLE:**  LEVEL OF REPAIR ANALYSIS (LORA)  

**COST SUMMARY ($,000)**

<table>
<thead>
<tr>
<th>LRU</th>
<th>CONTRACTOR</th>
<th>DEPOT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>REPAIR</td>
<td>REPAIR</td>
</tr>
<tr>
<td>PROC. CCA</td>
<td>920</td>
<td>937</td>
</tr>
<tr>
<td>INTERFACE CCA</td>
<td>876</td>
<td>859</td>
</tr>
<tr>
<td>HIGH SPD PROC</td>
<td>925</td>
<td>908</td>
</tr>
<tr>
<td>CABLE ASSY</td>
<td>767</td>
<td>815</td>
</tr>
<tr>
<td>POWER SUPPLY</td>
<td>1,895</td>
<td>1,950</td>
</tr>
</tbody>
</table>
EXAMPLE:  SENSITIVITY ANALYSIS

![Bar chart showing unit cost sensitivity analysis with three bars labeled Baseline, .90, and .80. The y-axis represents life cycle cost in millions, ranging from 0 to 100. The bars are divided into two sections: investment costs and operational and support costs. The investment costs are shaded in dark gray, and the operational and support costs are shaded in light gray.](image-url)
EXAMPLE: SENSITIVITY ANALYSIS

---

MTBF  AOH  UNIT COST

---

FRONT-END LOGISTICS SUPPORT ANALYSIS
FRONT-END LOGISTICS SUPPORT ANALYSIS

SUMMARY

- MUST BEGIN “UP FRONT”
- MAKES OTHER LOGISTICS ACTIVITIES MORE WORTHWHILE
- AN ITERATIVE PROCESS
- VERY DYNAMIC AND ALLOWS FOR CREATIVITY
- ANSWERS MANY QUESTIONS:
  - WHICH DESIGN IS MORE SUPPORTABLE?
  - HOW WILL THIS IMPACT MY MANPOWER/FORCE STRUC?
  - FORECAST SPARING QUANTITIES AND LOCATIONS
  - ESTIMATE OF LCC AND O&S COSTS
  - IS THE REPAIR CONCEPT SENSITIVE TO _____ (VARIABLE)?
  - WHAT ARE MY COST AND SUPPORTABILITY DRIVERS?
- TRULY A “VALUE-ADDED” FUNCTION