CYCLE TIME TASK GROUP

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Original Terms of Reference Objectives:

1. Set Goals for DoD Supply Chain CWT and LRT Cycle Times that are achievable for DoD;

2. Review causes of CWT and LRT cycle time variability and make recommendations for reduction;

3. Quantify the improvement in readiness and reduced inventory from reduced CWT and LRT cycle time;

4. A summary recommendation including a cost/benefit analysis and identification of the significant management initiatives, including potential legislative changes, required for implementation and execution of a program to reduce CWT and LRT cycle times.
Revised Focus/Objectives:

1. Examine cycle time delays for both Customer Wait Time (CWT) and Logistics Response Time (LRT) within the Aviation repair process:
   - High value of inventory
   - High impact on readiness

2. Focus on delays related to backordered parts and unplanned direct vendor delivery (DVD) parts:
   - Longest cycle times
   - Biggest variability in cycle times

3. Benchmark best-in-class commercial operators to understand how they have addressed these cycle time issues;

4. Delivers summary recommendations including a cost/benefit analysis where appropriate that identifies the significant management initiatives, including potential legislative changes, required for implementation and execution of a program to reduce cycle times for backordered and DVD parts.
## Process:

- Interviews with DoD Supply Chain Integration team
- Review of Previous Studies (Logistics Management Institute)
- Industry Best Practice Interviews:
  - Delta Air Lines
  - FedEx
  - UPS
  - Southwest Airlines
- DoD operational site visits to aircraft maintenance/supply facilities:
  - Naval Air Station Patuxent River
  - Naval Air Station Jacksonville
  - Warner Robins Air Logistics Center
DoD Supply Chain - Processes

Source: LMI
Where Cycle Times Fit In

Source: LMI
## Cycle Time Studies and Analyses

<table>
<thead>
<tr>
<th>OSD/LMI Studies Provided to Task Group</th>
<th>Assessment</th>
<th>Categorizing findings</th>
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</thead>
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<tr>
<td></td>
<td>Order cycle</td>
<td>Repair cycle</td>
</tr>
<tr>
<td>OST study</td>
<td>Yes</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Independent study</td>
<td>Yes</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Cannibalization study</td>
<td>Yes</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>AWP study</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Backorder analysis</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: LMI

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OST Study (September 1997)

- **OST** - the time between when a retail supply activity initiates a replenishment requisition and when it receives the requisitioned materiel (order cycle time between DoD wholesale and retail).

- **Findings**
  - Over 30 different types of retail supply activities.
  - Fixed and actual OST used to compute retail inventory levels.
  - Reducing OST would produce 1-time savings in materiel costs and recurring savings in repair costs.

- **Applicable Conclusions**
  - 1-time savings estimated to be between $24.8 and $40.1 million for a 1-day reduction in OST (in 1997, between $26.8 and $43.3 million in 2004 dollars).
  - Recurring savings estimated to be between $3.2 and $5.9 million ($3.5 to $6.4 in 2004 dollars).
  - If OST included in stockage decision, larger savings possible.

Source: LMI
Independent Study (July 2001)

- **Question** – are parts shortages adversely affecting readiness?
- **Findings**
  - As inventories declined during the 90s so did weapon system readiness rates.
  - While wholesale response times have improved, the number of critical parts demands has increased at a higher rate; thereby, causing more high priority demands to be in the system.
- **Applicable Conclusions**
  - Reductions in cycle times may not be effective in improving readiness if they are overtaken by increases in the demand for critical parts.
Cannibalization Study (July 2002)

- Cannibalization - the removal of serviceable parts from one item of equipment in order to install them on another item of equipment.

Findings
- Causes for cannibalization include:
  - Insufficient stockage at the inventory level supporting maintainers (1/3 of parts cannibalized not authorized for stockage)
  - Untimely resupply
  - Delays in local repair due to awaiting parts problems.
- Without cannibalization, mission capable rates would drop an average of 17 percentage points.

Applicable Conclusions
- Cycle time delays could significantly reduce readiness rates if not countered by workarounds like cannibalization.

Source: LMI
Awaiting Parts Study (July 2002)

• AWP Delay – occurs when a maintainer encounters a time delay in obtaining a repair part needed to complete the repair or overhaul of an end item.

• Findings
  – AWP a major inhibitor to depot maintenance adding between 18 and 24 days to the average repair cycle time.
  – AWP delays stem from poor local parts availability and low wholesale performance for depot requisitions.

• Applicable Conclusions
  – Local availability could be improved by including order cycle time in stockage decisions.
  – Wholesale availability could be improved by (1) implementing head start reorder points, corporate contracting with multiple sourcing, and greater emphasis on performance in contracting (2) adopting a new algorithm for low demand items and a revised process for special program requirements (SPRs), and (3) keeping item management codes current.

Source: LMI
Awaiting Parts

Simulated Impact of Parts Delay

Actual awaiting parts delays add 18 to 24 days to average repair cycle time.

Source: LMI

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Backorder Analysis

- Looked at the top 100 items with the most backorders and the top 100 items with the oldest backorders to determine causes of backorders.
- Findings:

<table>
<thead>
<tr>
<th>Problem with</th>
<th>% of Most</th>
<th>% of Oldest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unforecasted demand</td>
<td>23.1</td>
<td>9.9</td>
</tr>
<tr>
<td>Increased lead times</td>
<td>42.7</td>
<td>31.2</td>
</tr>
<tr>
<td>Problem with item</td>
<td>20.7</td>
<td>39.5</td>
</tr>
<tr>
<td>Problem with contractor</td>
<td>7.6</td>
<td>11.4</td>
</tr>
<tr>
<td>Problem with demand</td>
<td>4.3</td>
<td>5.8</td>
</tr>
<tr>
<td>Asset problem</td>
<td>1.6</td>
<td>2.3</td>
</tr>
</tbody>
</table>

- Applicable Conclusion
  - The reasons for backorders are varied and many.

Source: LMI
Progress at Depots

- Naval Air Depots (Navy) and Air Logistics Centers (Air Force) are making progress addressing cycle time issues through:

  - Performance-based logistics
    - Manages inventory, storage and transportation
    - Increases produce availability and reliability
    - Manages obsolescence
    - Enables cost-wise readiness
    - Enables focus on artisan strengths (core competencies)

  - LEAN manufacturing principles
    - Creates inventory "pull" system
    - Reduces Work in Process (WIP) inventory requirements
    - Reduces wasteful labor processes
Progress at Depots

- “LEAN” Transformation Example—F-18 Overhaul Line

Before:
- Total WIP: 22 Aircraft
- Turnaround Time: 275 Days
- Output: One aircraft every 12.5 days

After:
- Total WIP: 10 Aircraft
- Turnaround Time: 125 Days
- Output: One aircraft every 12.5 days

- Same output, but significant reduction in inventory requirements and more aircraft available to the Fleet
Summary

- Delays in the order cycle times for components/parts can adversely affect readiness and disrupt depot repair and overhaul programs.
- Reducing cycle times can save money and may improve weapon system support, if not countered by increased demand for critical parts.
- There are numerous causes of cycle delays ranging from increased demand exhausting available stocks to problems in replenishing inventories.
Interviews with commercial aviation operators:

**Multiple Aircraft Types/Hybrid Maintenance**
- FedEx
- UPS

**Multiple Aircraft Types/In-house Maintenance**
- Delta Air Lines

**Single Aircraft Type/Outsourced Maintenance**
- Southwest Airlines
Commercial Aviation Parts Management

3 Primary Categories of Best Practices:

1. Business Model, Core Competencies, and Values
2. Internal Operations Strategy
3. Vendor Management Strategy
Business Model, Core Competencies, and Values

**Best Practices:**

- Most dominant practice is that best-in-class airlines **focus on what they do best**, and allow others to perform non-core functions.
- In some cases, certain levels of maintenance are considered to be core while others are not. The level of **outsourced maintenance is dependent upon the company’s view of what it can be good at**:
  - Delta views line, accessory, and engine overhaul as core competencies—continue to perform in-house and leverage internal capabilities by serving other customers while still maintaining low costs.
  - FedEx, UPS, and Southwest are focused on the core mission of moving passengers and packages and, as a result, limit their internal maintenance operations to what they do best: quick turnaround at the line and light base maintenance level.
  - UPS expertise in supply chain operations is not a core capability of UPS airline, but rather housed in a separate corporate entity.
Understanding of Business Model, Core Competencies and Values

**Best Practices (continued):**

- Well-communicated strategy and understanding of corporate values permeates operating philosophy of maintenance/supply chain operations:
  - FedEx- sense of urgency drives a rapid response mentality that moves to quickly resolve maintenance issues
  - UPS- prides itself on supply chain integration expertise; have a very active management of stock inventory with close integration to operational requirements
  - Southwest- keep costs low so they can offer low priced tickets to customers; does not invest in costly inventory, but rather pushes that to OEMs and other vendors
  - Delta-safety is paramount, therefore maintaining quality and control of maintenance is critical to them in addition to providing dedicated service to the airline
Internal Operations Strategy

**Best Practices:**

- **Control configuration wherever practical**
  - Southwest (single aircraft type) 59% of parts in inventory can be used on more than one model 737 in their fleet
  - Operators with multiple types and configurations—approximately 80% of parts in inventory are unique to specific models

- **Integrate maintenance and parts supply operations**
  - Solving “parts” issues in a vacuum without an understanding of the operational and financial impact on the overall maintenance organization is a mistake

- **Integrate information systems**
  - Link to flight schedule, vendor base, operating base inventory requirements, current stocking levels, etc.
Internal Operations Strategy

*Best Practices (continued):*

- **Automate data entry where practical**
  - Decrease human error in data entry and generation of repair orders for vendors
  - Hand held devices bring data closer to the mechanics at the aircraft

- **Provide total asset visibility to the organization**
  - Real time information on inventory levels/requirements/rotatable parts status and locations

- **Simplify internal processes and adopt LEAN manufacturing concepts**
  - Highlights supply chain issues quickly; allows for corrective action

- **Understand what parts shortages are critical and which ones are not.**
  - Focus on availability for parts that cause operational delays
Internal Operations Strategy

Best Practices (continued):

- Establish clear and visible metrics
  - Maintenance and supply chain organizations focused on key internal metrics on turntimes in the repair cycles AND overall operational metrics related to the airline mission

- Link supply chain/parts procurement to the finance organization
  - Organizational balance between financial constraints and the tendency to overstock selected items to ensure 100% availability

- Create a knowledge-based organization
  - Best companies have invested in recruiting, developing and retaining deep industry and technical expertise related to fleet types and vendor base

- Create dedicated team to manage critical parts shortages that impact mission capability (aircraft on the ground)
Vendor Management

**Best Practices:**

- **Objective process for vendor selection**
  - Remove subjective decisionmaking based on relationships; focus on value and best interest of the airline
  - Value/reliability is more important criteria than cost

- **Performance-based contracting**
  - Fixed-price contracts with meaningful “out” clauses
  - Hold vendors to performance standards
  - Power by the hour/landing/cycle arrangements
  - Reward excellent performance
    - Price increases and/or future work
  - **Penalize poor performance**
    - Cash penalties and/or loss of future work
## Vendor Management

### Best Practices:

- **Active vendor management**
  - Vendor scorecards tied to incentives
  - “Kitting” of parts in advance of work to ensure availability to vendor

- **Foster close relationship with OEMs for aftermarket support**
  - Airframe
  - Engine
  - Critical accessories
Recommendations
CATEGORIES 1: IMMEDIATE ACTIONS

• Align performance goals of various entities within the supply chain (eliminate “sub-optimization”). Develop “integrated operation” to focus supply chain on critical parts that impact aircraft availability and readiness:
  – Quantify/communicate the “cost” of aircraft non-availability
  – Assign ownership for parts that have direct impact on mission capability
  – Focus supply chain on responding to critical requirements
  – Reduce need for cannibalization

• Actively push “LEAN” and Six Sigma operating principles at the Depot level:
  – Reward/provide incentives for continued progress
  – Share best practices across Services
**CATEGORY 1: IMMEDIATE ACTIONS (continued)**

- **Improve Measurement**
  - Correct disconnects between actual response times and expectations of the logistics models currently in use
  - Measure costs of delayed cycle times and/or cannibalization

- **Active Vendor Management and Enforcement:**
  - Scorecard/communicate vendor performance
  - Mix of positive and negative incentives to ensure timely delivery
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**CATEGORY 2: LONG-TERM ACQUISITION POLICY**

- **Continue to Advance Performance-Based Logistics:**
  - Enlist vendor base in improving cycle time management
  - Airline best practice for those employing extensive outsourcing of the maintenance functions
  - Look for “big PBL wins” like complete engine support that demand extensive parts management

- **Leverage DoD-wide Aircraft Parts Supply Where Possible**
  - Total asset visibility and needs prioritization should drive business rules that allow cross-Service access to common parts

- **Leverage Common Aircraft Platforms**
  - Future acquisition policy should consider commonality/interoperability of airframe and components where practical