CYCLE TIME TASK GROUP

Final Report
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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

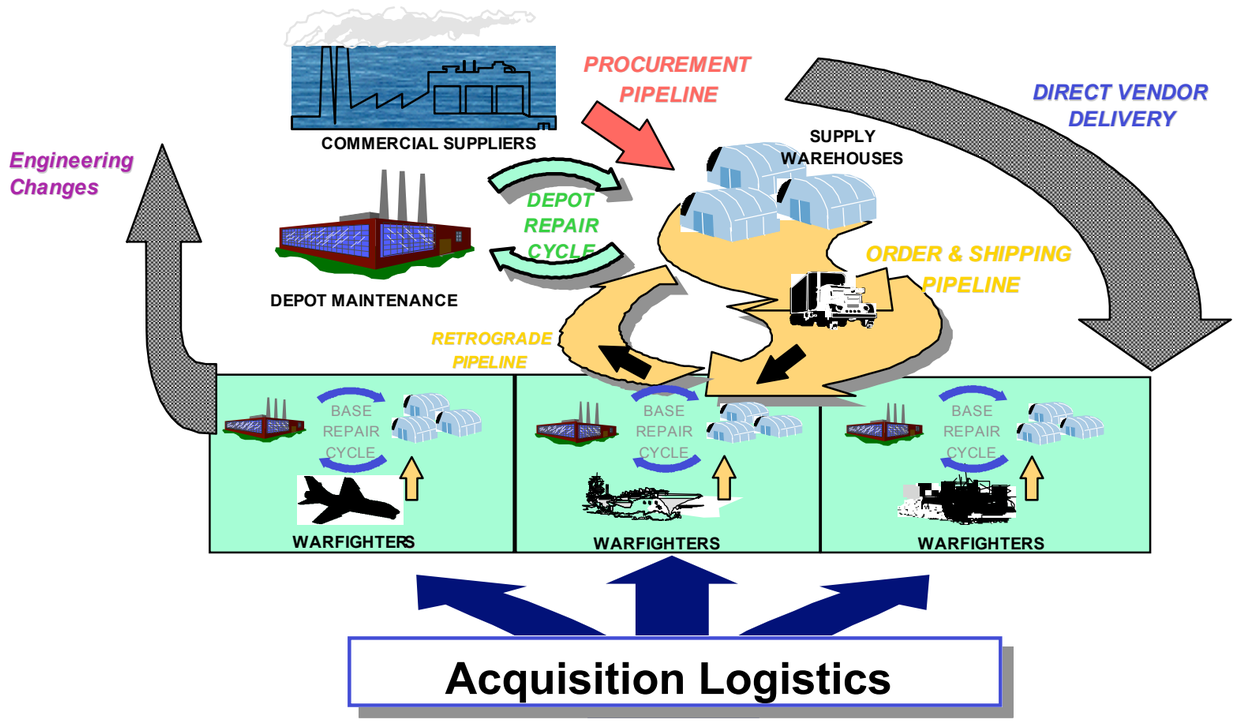
3. Benchmark best-in-class commercial operators to understand how they have addressed these cycle time issues;

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:

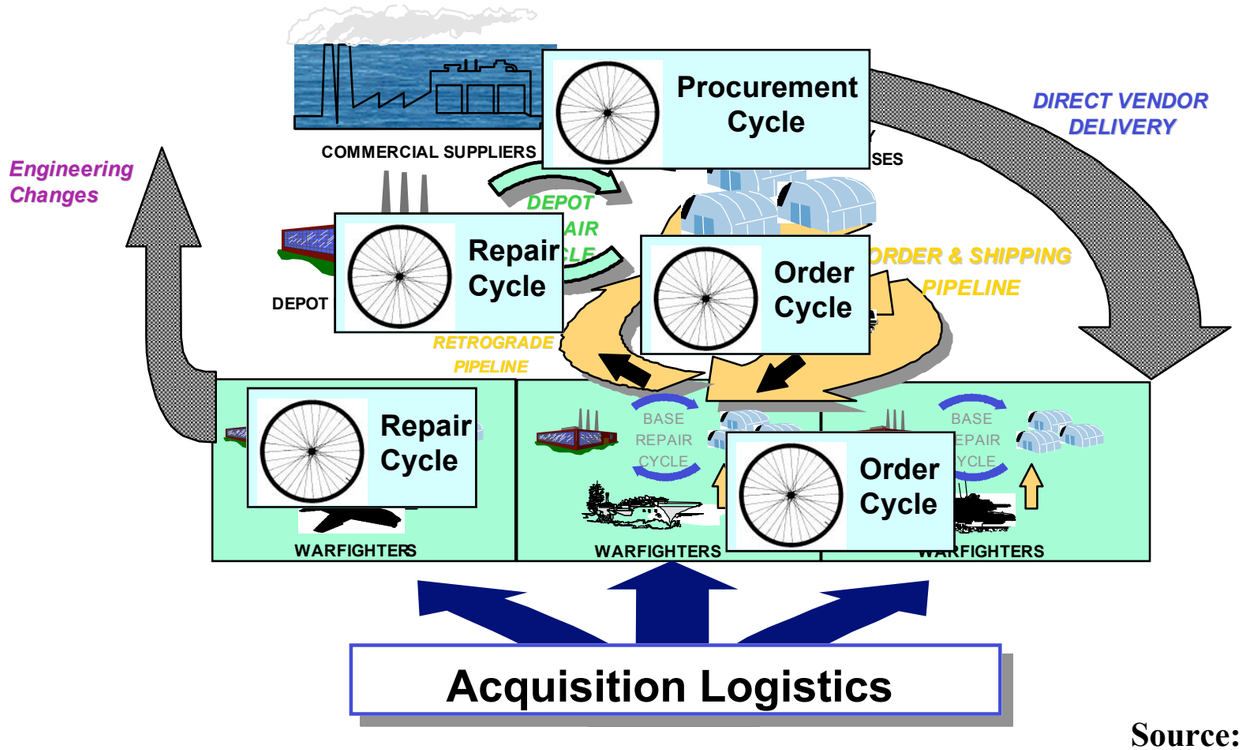
- Interviews with DoD Supply Chain Integration team
- Review of Previous Studies (Logistics Management Institute)
- Industry Best Practice Interviews:
  - Delta Air Lines
  - FedEx
  - UPS
  - Southwest Airlines
- DoD operational site visits to aircraft maintenance/supply facilities:
  - Naval Air Station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

OSD/LMI Studies Provided to Task Group	Assessment			Categorizing findings
	Order cycle	Repair cycle	Procurement cycle	
OST study	Yes	Not mentioned	Not mentioned	Benefits of reducing order cycle time
Independent study	Yes	Not mentioned	Not mentioned	Readiness impact of not having parts.
Cannibalization study	Yes	Not mentioned	Not mentioned	Impacts of parts delay on readiness
AWP study	Yes	Yes	Yes	Depot parts delays, causes, and potential solutions
Backorder analysis	Yes	Yes	Yes	Reasons for backorders

Source: LMI

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.

Source: LMI

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.

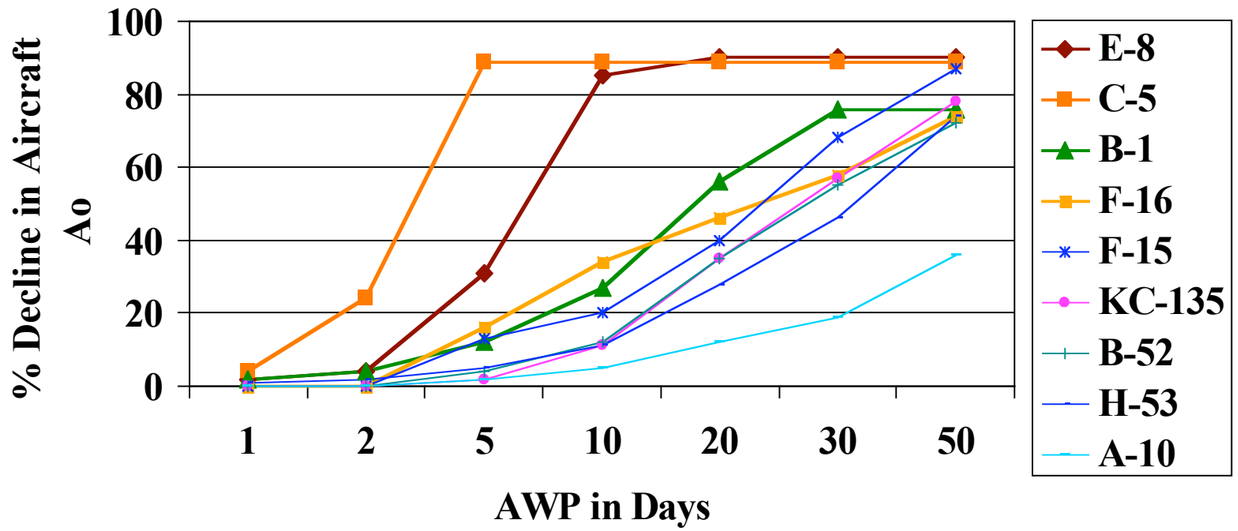
Source: LMI

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.

Awaiting Parts

Simulated Impact of Parts Delay



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

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:**

Problem with	% of Most	% of Oldest
Unforecasted demand	23.1	9.9
Increased lead times	42.7	31.2
Problem with item	20.7	39.5
Problem with contractor	7.6	11.4
Problem with demand	4.3	5.8
Asset problem	1.6	2.3

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

Source: LMI

Progress at Depots

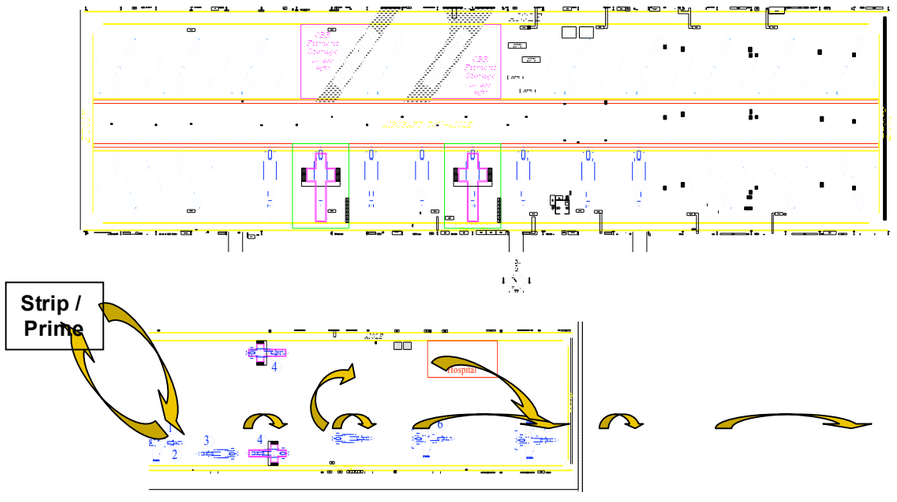
- **Naval Air Depots (Navy) and Air Logistics Centers (Air Force) are making progress addressing cycle time issues through:**

  - 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/rotable 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

CATEGORY 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

CATEGORY 2: LONG-TERM ACQUISTION 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