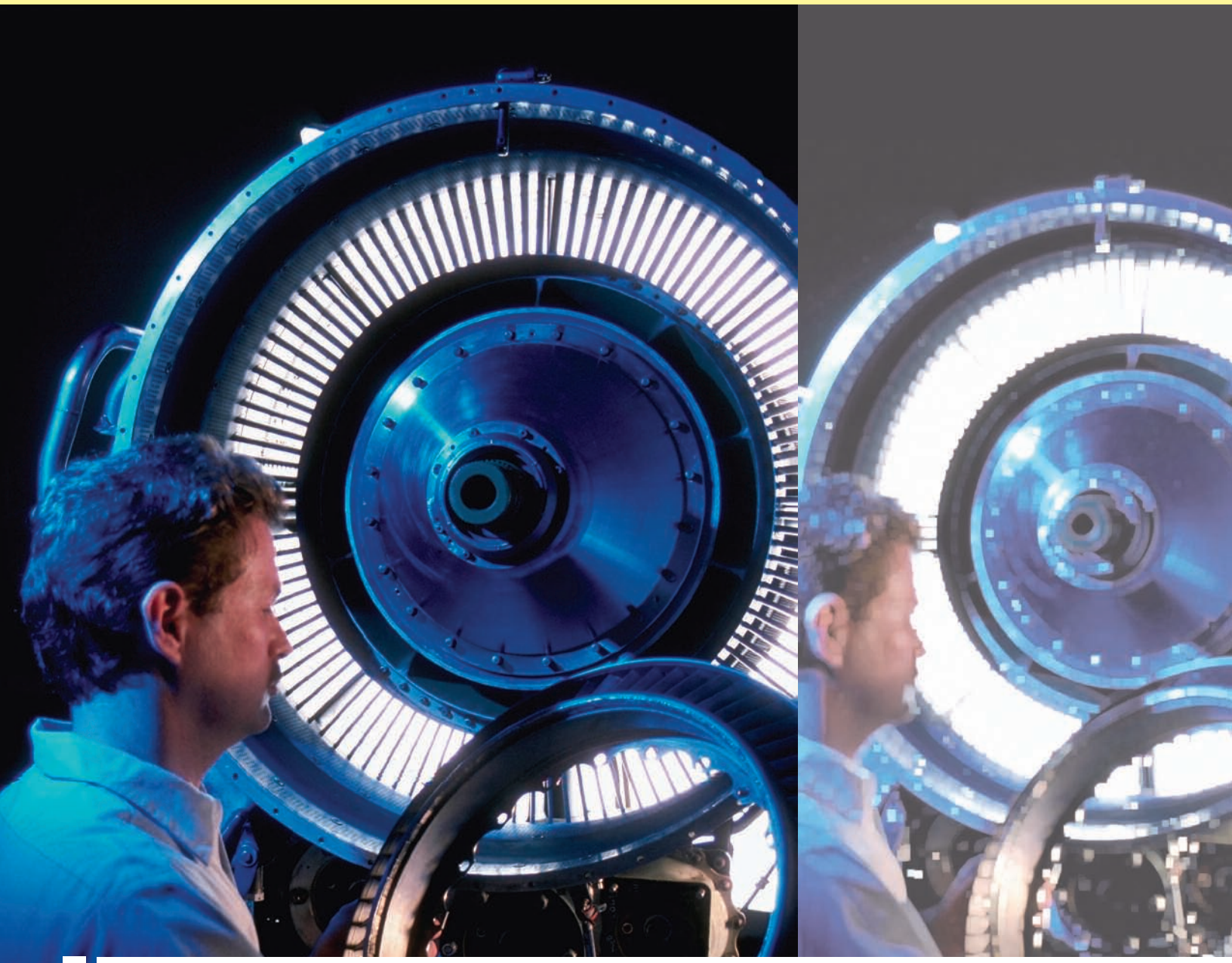
Powering maintenance, repair and overhaul for aerospace and defense

Executive brief



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Powering maintenance, repair and overhaul

The numbers are staggering.

The global commercial aviation fleet includes more than 17,600 active aircraft whose 2007 operating budget for maintenance, repair and overhaul (MRO) exceeds $41 billion and whose inventory of spare parts is valued at $50 billion.[1]

The U.S. Air Force budgets $60 billion for MRO and $600 billion in property, plant and equipment to manage more than 374,000 operational assets and subsystems with a maintenance force of over 680,000 people.[2] In 2007 the active military fleet of aircraft totaled nearly 39,000.[13]

Just as importantly, future MRO spending is projected to grow substantially in both aviation sectors. The worldwide commercial aviation fleet is expected to experience steady growth at 4.5 percent CAGR over the next ten years with the fleet exceeding 27,450 active aircraft by 2017[3]. While new generation aircraft and lower labor costs will produce a decline in MRO unit costs, these advantages will be offset by regional jet expansion and the advent of higher thrust engines that require exotic alloys, single crystal casting configurations and more difficult repair techniques.[4]

The net-net: commercial aviation is expected to face MRO costs that will grow from $41 billion in 2007 to nearly $51 billion in 2012 and over $62.5 billion by 2017[5]. Faced with heavy capital investment and a cash-flow sensitive business, commercial operators have few alternatives other than trying to control their MRO expenditures.

U.S. military aviation also faces cost pressures. An aging fleet, modernization initiatives, supplier consolidation and outsourcing limitations produce a different mix of issues with equally pressing cost-containment demands. Both the U.S. Air Force and Department of Defense want to reduce the cost of maintenance so that more money can be spent on new aircraft and new systems.

With this in mind, the Department of Defense is looking for ways to trim $12 billion a year that it spends on MRO – but without compromising the readiness and performance of its active fleet.[6] For example, the U.S. Air Force has developed MRO-related goals for a variety of initiatives at the next operational level, including objectives for depot maintenance and transformation, purchasing and supply chain management and its product support campaign.[7]

Converging MRO trends

The upshot of these MRO cost pressures has caused commercial aviation operators, the U.S. Air Force and other defense services and agencies that maintain complex operational assets (such as ships, tanks and other weapons systems, platforms and supporting infrastructures) to examine each other's MRO initiatives to look for common solutions. The objective of all of these enterprises is remarkably similar: to turn their fixed MRO costs into variable costs that can be effectively managed under cyclical conditions. Equally important, enterprises want to increase the utilization of these fixed cost investments.

U.S. Air Force Material Command Initiatives[8]

Initiative	*Objectives*
Depot maintenance transformation	25 percent decrease in flow days 100 percent on-line delivery 10 percent decrease in costs 20 percent increase in aircraft availability
Purchasing and management	50 percent drop in sourcing cycle chain supply time 20 percent increase in supply material availability 20 percent decrease in purchase and repair dollars
Product support (draft)	10 percent decrease in lifecycle campaign costs Actual project lifecycle cost within 10 percent of bids 20 percent increase in weapon systems availability

For global commercial aviation operators, the goal is to control their operating costs across a "complete business cycle" that includes both good and bad economic fluctuations[9]. For the U.S. Air Force, the goal is to "keep warfighters in the air" during both "up-and-down cycles" in a way that balances the military's most extraordinary mission-critical needs with a cost-effective inventory.[10]

The end result is a convergence of MRO objectives with both commercial and military operators looking to four key MRO initiatives:

- Long-term MRO contracts that incorporate performance-based logistics
- Total asset management
- Lean MRO processes
- Knowledge-based MRO enterprise transformation

Performance-based logistics contracts have become prominent in both civilian and military aviation because they enable operators to offload investments in spares and other MRO capabilities. In essence, an operator contracts with a supplier on a long-term basis to deliver a particular kind of service-related performance.

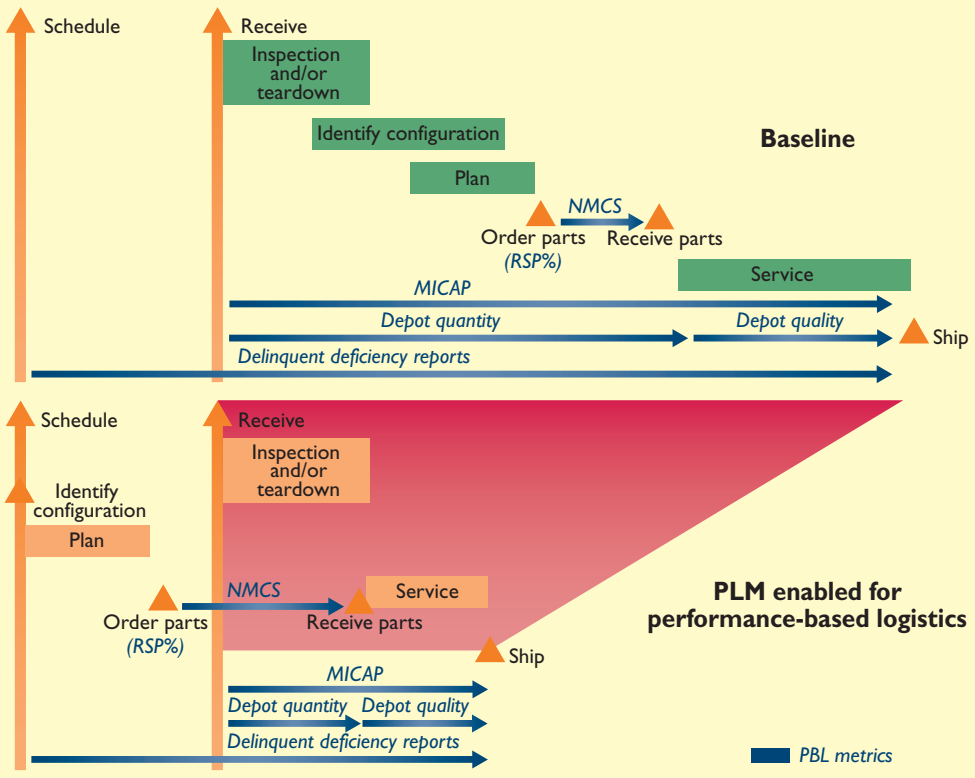
Sometimes, the contract takes the form of a per-hour maintenance cost or a specific reliability guarantee. Suppliers might deliver a level of readiness that the U.S. Air Force requires or a cost-per-landings guarantee that a civilian operator requires.[11]

In all instances, the challenge is for the supplier to determine what service personnel and equipment resources are needed to fulfill the contract, as well as to deal with the fluctuations in workload that rise or fall as either the economy or the world situation changes.

Total asset management enables owners and operators to understand their capital assets and the related parts, tools and equipment inventories that sustain these assets as they evolve across a lifecycle that extends from acquisition to disposal. The ability to access and accurately understand the configuration and location of these assets, inventories and tools enables organizations to operate, support and service these resources on a more cost effective basis.

Total asset management also helps organizations understand how specific parts, tools and equipment are used by various service teams. The goal is to allow enterprises to optimize their working capital by predicting future material needs, align inventory levels with tangible maintenance requirements and understand the optimum time when given parts should be replaced.

At another level, the analysis of asset design and performance enables organizations to improve reliability and readiness in



Configuration-driven MRO facilitates cycle time reduction by optimizing the MRO process, removing/reducing unnecessary tasks and ensuring that the service process is ready and able to support the adoption of performance-based logistics contracts.

conjunction with Six Sigma objectives. Along these lines, the U.S. Air Force has leveraged this kind of analysis in working with engine manufacturers to increase mean time between repair (MTBR) from 200 to 2000 hours per engine while simultaneously reducing the Air Force's inventory spares requirements.

Lean MRO enables service organizations to eliminate non-productive tasks from the MRO process, improve service team performance and increase the yield of scheduled maintenance. Lean MRO targets all aspects of waste – from enabling service teams to execute best-practice MRO processes to productivity improvements that target both service team managers and service technicians.

Typical lean initiatives enable service organizations to remove unnecessary tasks from the service event's critical path, as well as allowing service teams to maximize information re-use, manage the complexity that arises from asset variation and reduce the time spent performing tangential tasks, such as information searches and data downloads.

Knowledge-based MRO enterprise transformation allows service teams, service managers and service technicians to reduce MRO cycle time, improve first-time fix rates, eliminate repeated corrective service visits and increase wrench time. The key to this improvement is providing service team members with highly accurate product and asset knowledge for planning purposes, as well as delivering service knowledge at the point of maintenance in a format directly related to the service task at hand.

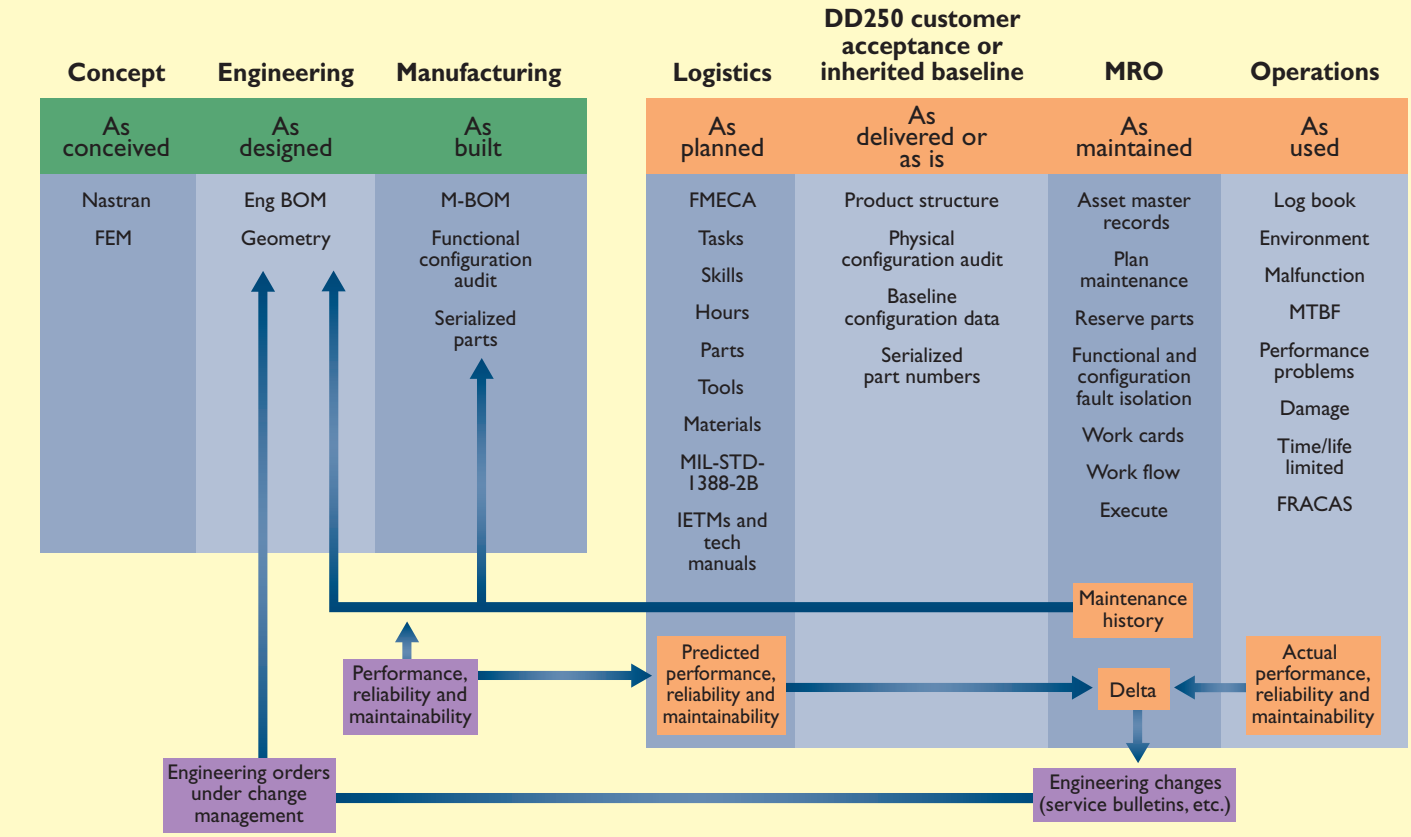
The goal of these improvements is to increase the throughput of the MRO process by optimizing the utilization of an enterprise's capital resources and improving their related return on investment. Reduced MRO cycle times result as organizations optimize their service plans – including eliminating unnecessary steps from the MRO process' critical path before the asset arrives at the service depot.

Today's newest IT solution – configuration-driven MRO

As you might expect, all of these MRO initiatives – performance-based logistics, total asset management, lean MRO and knowledge-based MRO enterprise transformation – involve the use of information technology.

Ray Valeika, senior vice president of Delta Airlines' Technical Operations Division, sums it up nicely. "The future of maintenance is not about turning wrenches; it's about information" and how it is used.[12]

One of the newest and most comprehensive IT approaches to MRO improvement is called configuration-driven MRO – and interestingly enough, it can be used by owners and operators, third-party MRO suppliers and OEMs (looking to enter the MRO business) as a solution for implementing all four major MRO initiatives.



Configuration-driven MRO is the logical extension of the OEM product lifecycle – providing crucial technology for all enterprises that are responsible for supporting complex operational assets across lengthy life spans.

Basically, *configuration-driven MRO* is an integral component in product lifecycle management that enables service organizations to capture, manage and access a comprehensive and highly accurate set of information about individual and aggregate capital assets within an MRO-related context. Once this information is collected, it provides enterprises with core knowledge that they can use for decision support across their entire product lifecycle. This knowledge also can be leveraged in workflow-driven processes that can be tightly focused to deliver metrics-driven lean and Six Sigma MRO objectives.

While configuration-driven MRO can be discussed from many perspectives, five key attributes establish it as a crucial solution for driving MRO improvement.

- Configuration-driven MRO is a *lifecycle* solution. It enables service organizations to address MRO over long periods of time. Both commercial and military operators need to deal with fluctuations. Configuration-driven MRO can be closely integrated with change processes that require the service organization to account for change on a systematic and repeatable basis that runs from initial deployment to asset retirement.
- Configuration-driven MRO is a *metrics-based* solution that can easily measure and account for service performance. Organizations that expect to provide performance-based logistics contracts have to understand what resources are needed to fulfill the contract, as well as how to deal with fluctuating workloads.

- Configuration-driven MRO provides a *historical record* that service organizations can analyze to predict their material needs and manage their inventory effectively. Managing inventory is crucial to today's civilian and military operators. Configuration-driven MRO enables organizations to understand their maintenance requirements and align these requirements on a fine-grain basis for the purpose of optimizing inventory levels. Equally important, configuration-driven MRO lets service teams understand what the optimum time is for replacing given parts, thereby maximizing an asset's readiness and uptime, as well as enhancing platform/fleet availability.
- Configuration-driven MRO is a *best-practice tool* that facilitates lean MRO. Service teams can establish MRO processes with compressed workflows, continuously monitor service visits and analyze accumulated service experiences with an eye to studying and then implementing alternate flows if and when these alternatives demonstrate real business value. In essence, configuration-driven MRO enables organizations to capture and re-use both knowledge and best practices for new programs, as well as for upgrades and enhancements.
- Configuration-driven MRO is *geared for speed*. Point-of-service knowledge delivery – including wireless mobility at the point of maintenance – is central to configuration-driven MRO's mission. The delivery of accurate, up-to-date and highly tailored asset knowledge enables the service team to understand, plan and rapidly execute the service visit. Configuration-driven MRO ensures that the right parts and skill sets are on hand before the technician begins the service visit. Configuration-driven MRO makes certain that the correct information is available for any asset under service, including inspection requirements, service procedures, allowable configurations and life limit cycles. The result: first-time fix rates rise and repetitive customer visits plummet.

To put all of this in perspective, consider one more factor. Configuration-driven MRO is a systematic and repeatable approach intended for companies and government services/agencies whose central mission is to sustain their enterprise's capital assets in a cost effective manner that ensures both readiness and reliability. Configuration-driven MRO is adept at reducing MRO turnaround time (TAT) and overhaul cycle time.

Configuration-driven MRO is a natural outgrowth of product lifecycle management. As such, it plays an integrated and seamless role in digital lifecycle management from requirements to retirements, thereby providing enterprises with the ultimate-force multiplier. Configuration-driven MRO's heritage provides tools and capabilities that have their roots in a time-tested, mission-critical technology. Configuration-driven MRO can be adopted by commercial operators looking to adopt service lifecycle management (SLM), as well as by defense services/agencies that implement integrated digital environments (IDEs) to improve sustainment within the standards-based Defense Acquisition Management Framework.

1 2007 World MRO Forecast, Team SAI, April 2007.

2 Aviation Week Executive Roundtable, General G.S. Martin, April 2005.

3 2007 World MRO Forecast, Team SAI, April 2007.

4 Ibid.

5 Ibid.

6 Aviation Week Executive Roundtable, presentation by General G.S. Martin, 2005

7 "Fleet Readiness and Performance-based Logistics Summit," Carole Richard Hedden, Aviation Week Executive Roundtable, April 18, 2005

8 Ibid.

9 Aircraft Technology: Engineering & Maintenance, Aviation Industry Group, February-March 2005

10 "Government MRO Goes Lean with Industry Help", Aviation Today, June 09, 2005

11 Ibid.

12 "MRO Moving Toward Strategic Alliances," Edward H. Phillips, Aviation Week & Space Technology, April 2004

13 "Leveling Off: An Overview of the Global Military Aircraft MRO Market," Hal Chrisman, AeroStrategy, April 2007

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