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Smarter MRO

5 strategies for increasing speed, improving reliability, and reducing costs – all at the same time

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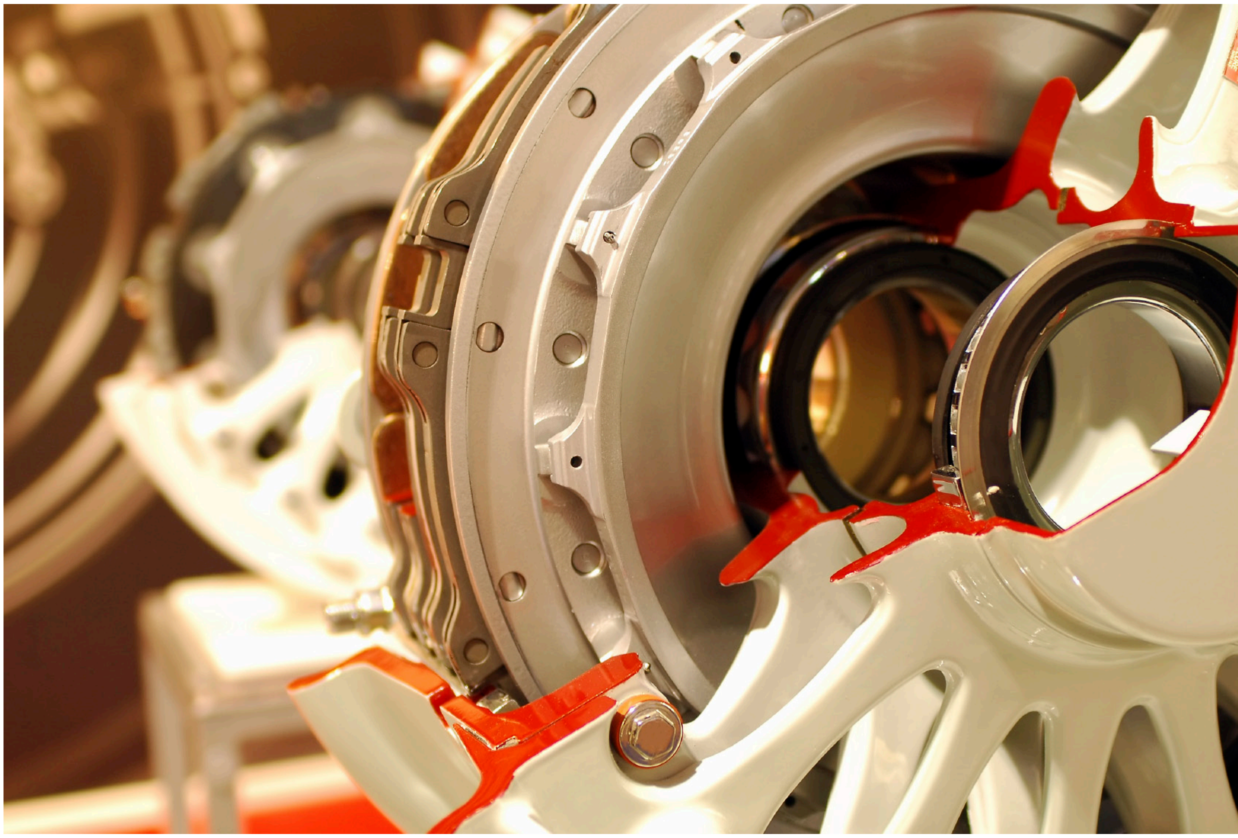


A few leading airlines and MRO companies have figured out how to exploit opportunities to reduce the cost of maintenance, repair, and overhaul (MRO) operations by 8-15 percent. What do they know that their competitors don't?

It's tougher than ever to perform MRO operations efficiently and effectively. From outside, material costs are rising. From inside, siloed processes, disparate systems, and data overload make it hard to coordinate the whole MRO process, from scheduling and forecasting to inventory management and replenishment. Only a few airframe, engine and component MRO companies have an approach that enables simplification, standardization, speed, and "do it right the first time" quality. But those that do are reducing total costs by 8-15 percent initially and achieving a sustainable competitive advantage with continuous improvement.

The end state: An integrated approach to MRO

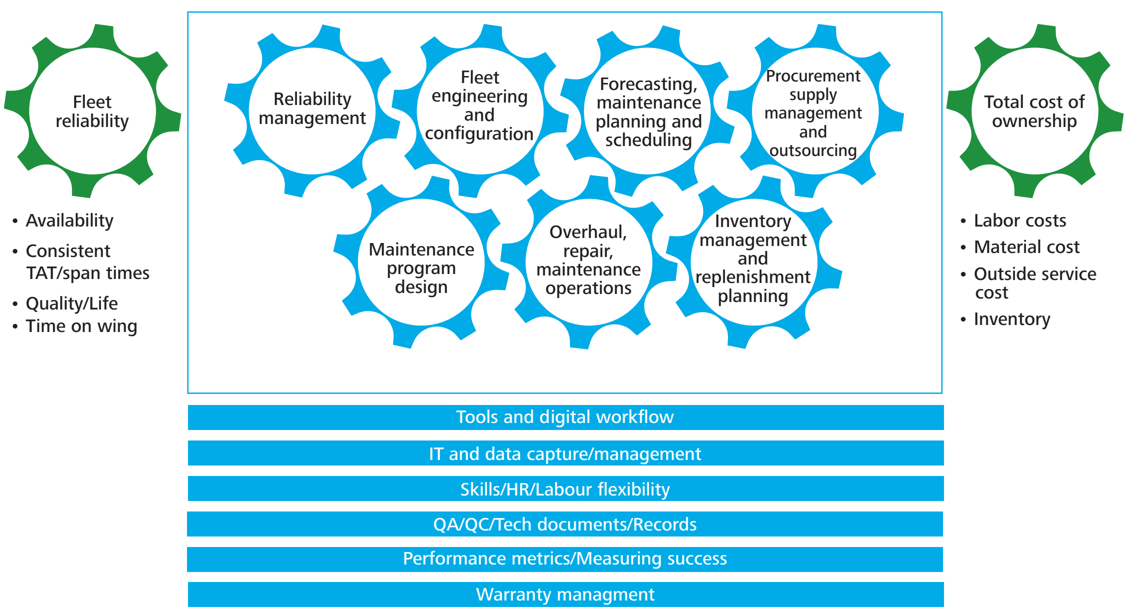
Sometimes, it's best to begin at the end. What's the ideal state for maintenance, repair, and overhaul operations? An appropriate answer is an integrated approach in which processes, people (including OEMs, third-party providers, and vendors), and technology are connected, each component of the whole process finely tuned and coordinated to achieve optimal reliability for the lowest possible cost (chart A).

In such a process a few advantages are apparent: 1) processes are designed for the most rational flow of materials, tools, and ground support equipment (GSE) with the least possible human intervention; 2) people collaborate to ensure that each one's actions are appropriate for the greater good, which is fleet reliability at competitive costs and consistent turnaround time; and 3) data is used analytically to enhance the flows of material and information.

Integration is so important because MRO is such a complex process: a small mistake in a single activity will likely carry through from A to Z, impacting each subsequent activity and creating costly delays. If forecasting is off, the required material won't be available down the line. If material management is poor, inventory isn't in the right place at the right time (and it's more likely to become obsolete). If work scopes aren't standard, every job is a potential one-off. If engine induction is incomplete or inaccurate, final assembly will be late. Just a few missteps can lead to an unreliable fleet, and every day that a plane is grounded cuts into profit.

Implementing the following five strategies can help MRO organizations in their efforts to become more efficient and effective.

Chart A. An integrated MRO process



Source: Deloitte Analysis

1. Achieve short and consistent turnaround time (TAT) using a combination of lean, Six Sigma, theory of constraints, and information

While MRO differs by product/service (component, engine, or airframe), one truth is universal: analytics and process improvements can reduce cycle time.

Collaborate to find win-win solutions

In an engine overhaul, the benefits of collaboration are apparent when customers, sales, and engineering work together to define an optimal work scope based on insights about repair issues, configuration, and "time on wing." Looking at data patterns, stakeholders in the process can ask: What is the best way to perform maintenance on the engine? Which parts are worth repairing and which are not? Are some parts not repairable at all? Should we consider PMAs? Do we perform "on condition" or on time and cycles? How much EGT (exhaust gas temperature) margin is expected or acceptable?

The goal of collaboration is a common agenda necessary to standardize the work scope and, in this way, take costly variability out of the process. In a typical case, engineers want a lot of detail, making each work order different; operations want repeatability; OEMs (original equipment manufacturers) want nothing to do with PMAs (parts manufacturing authority) and have an ideal, albeit costly, work scope in mind: these different agendas are hard to arbitrate on the fly.

In heavy airframe maintenance, collaborative planning between materials and maintenance management supports the development of standard work cards consistent with better TAT. The ideal here is to identify at least 90 percent of non-routine items within the first 10 percent of the planned time of the check, so that these exceptions can be re-scheduled effectively to meet TAT goals. Work should be allocated in two- four- or eight-hour increments consistent with a shift and planning routines; high-risk items should be addressed early in the process. All these steps increase both speed (because of standardization) and flexibility (because of exception processing) as well as overall schedule adherrence. Software can help if it embeds leading practices in planning. Additionally, the incorporation of service bulletins (SBs), airworthiness directives (ADs), and modifications can be planned in advance with the customer, sometimes as part of line maintenance or short duration checks.

Other opportunities for collaboration include third-party service providers and OEMs: how can their capabilities be leveraged for better TAT? For example, a "time slicing" strategy can reserve capacity for special processing, such as heat treat, special coatings, and shot peening. The concept is simple: a reservation system allocates a specific period in the week for a process; if the material is on time and properly prepared, it is serviced immediately, thereby eliminating queue time and ensuring material availability. As for OEMs, making inventory visible electronically would help ensure part availability, while sharing fleet performance data could help predict spare part demand patterns.

Serve the mechanic as a customer

If the mechanic is the center of the process, several lean techniques can make his job easier (which means more productive). Here, all kinds of options come into play — such as point-of-use tools and fixtures and pre-positioned GSE; digital technical manuals and mobile devices (for a "no effort" management of information); and the proper kitting of all parts in sequence for each repair and assembly operation. We want ultimately all work, tools, and instructions to be served to the mechanic, eliminating unnecessary effort and time.

Effective background support could encompass material management and planning, including new/repair/ PMA tradeoff decision tools, "beyond economic repair" modeling, rapid-response engineering for non-routine issues, detailed standard work cards consistent with takt time, repair float management, and Kanban/vendor managed inventory for consumables. These support function processes and tools are critical to ensure material, tool, and document availability, as well as clear work instructions.

In many — maybe most — airlines and MRO companies, mechanics spend more than half their time on non-productive (that is, non-value-added) activities, such as manually processing paper work, performing re-work or work-arounds because of a lack of parts, looking for tooling and spares, searching for engineering drawings or waiting for engineering instructions/feedback, and moving to the back office to find reference material and advice. An integrated MRO process, enabled by advanced analytics, is fundamental for the better planning and processes that lead to long-run productivity.

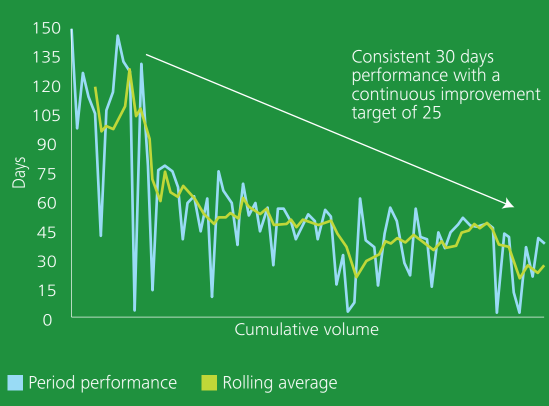
Close the loop for improved accountability

A well-defined monitoring and feedback system — including actual versus-planned time, costs, and quality by tail number, engine serial number, and work package — is essential for spotting improvements and training requirements.

Few MRO entities have the analytical power and data management skills to support the systematic translation of raw data into the actionable productivity metrics needed for continuous improvement. Having that capability, an MRO organization can measure and compare performance by mechanic and by work package, allowing leading practices to be shared and effective remedial training to be targeted. Time-based data can support better sequencing of work, especially non-routine tasks. Rather than simply reacting, management can discover variations early on and develop corrective actions.

Another leading practice in closed-loop process design is making back-end assembly accountable for induction. Mistakes made on "day one" of engine or component induction — including late repair identification, unworkable repairs requiring new parts late in the process, and incomplete BOMs — typically carry through to the end, delaying final assembly and testing. By having a supervisor leading both ends, the loop is closed, thereby promoting accountability.

Chart B. Improving TAT performance for engine overhaul



Source: Client disguised data, Deloitte Analysis

Achieving short and consistent TAT in engine overhaul

The best performing engine overhaul centers are achieving short and consistent turnaround times by using a combination of lean/Six Sigma, theory of constraints, and technology. Here is one example of a third-party overhaul center's journey from average to excellent.

The initial effort was focused on lean/Six Sigma initiatives for work scopes, materials management, and work flow, including:

- A joint customer-sales-engineering process redesign that promoted standard work scopes, the release of early data to help repair forecasts, and the determination of ideal "time on wing."
- Better material flow in the repair cells, effective rotable pool management, FIFO repair operations, Kanban for consumables, and assembly/repair kits organized by shift.
- An induction process upgrade, starting with a complete BOM, historic data on repairs, and data feedback on actual-versus-estimated work. Additionally, the induction process was "owned" by the final assembly supervisor, thus improving end-to-end accountability.
- A small "quick response" cell to address one-off issues and unexpected events.
- A supplier management process that included on-time delivery commitments with penalty provisions.

While the lean/ Six Sigma efforts clearly had positive results, they did not address typical constraints caused by operations bottlenecks and outside services (for heat treat, shot peening, and coatings). To tackle these problems, three new techniques were applied:

- Strategic cross-training — if one engine module is ahead of scheduled, labor resources could be moved to lagging modules.
- Rolling-block/dynamic scheduling — advanced scheduling techniques, with corresponding metrics of schedule adherence and compliance, were used to synchronize the shop, identify constraints and bottlenecks, and prevent a nervous MRP.
- Time-slicing — for external service providers and internal operations (such as cleaning and heat treatment), time-slicing helped overcome long queues. In effect, it's a reservation system that dedicates capacity at a specific time in the week.

The final improvement strategy was the incorporation of information technology, including tools that rely on accurate data such as a "beyond economic repair" tool, a material availability tool, and a master scheduling and capacity planning tool. To improve mechanics' performance, mobile devices were incorporated into the work cells to display standard work, quality specifications, and general research.

The end result was a consistent 30-day TAT performance, as shown in chart B. Furthermore, as part of a continuous improvement program, a new target of 25 days was set based on actual data feedback and the identification of the next level of constraints to overcome.

2. Improve the design and planning of maintenance

When processes are poorly designed and information systems are disparate, complexity (from hand-offs, rework, and redundancy) is inevitable. Stand-alone MRO solutions can help, but they won't be up to the task if the process has not been reengineered and if the software is not integrated with enterprise systems.

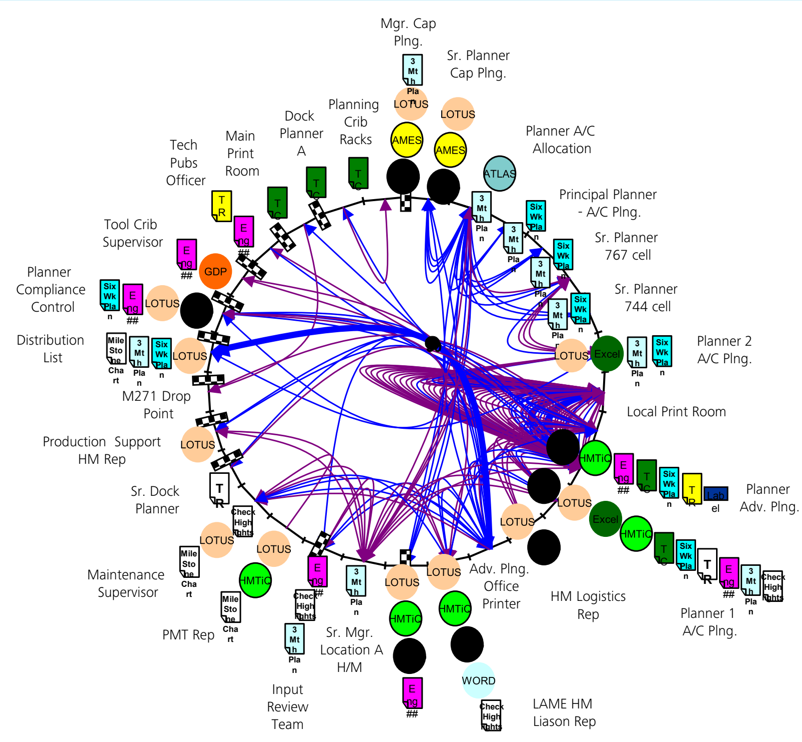
To improve TAT, MRO management should understand and differentiate routine and non-routine processes and costs. Over time, MRO should create a data base of its own leading practices: "this approach worked well, this one did not work well." Clearly, performance data — gathered, organized, and analyzed — is fundamental to better planning. By collaborating with operations and finance, MRO can get consistent data, in a usable form, to the appropriate planner in a timely manner.

Another level for improvement is the design of the maintenance checks themselves. Which work cards should be incorporated in the check? How should they be effectively sequenced and re-sequenced as issues are uncovered? Should some of the work be done prior to checks or during online maintenance? Should some work be on condition only?

In one Asian airline company, the heavy maintenance planning process included 11 systems; of the 210 information transactions, half were paper-based. The distance traveled by a single work order was more than 15 km. Check planning required significant time and effort time, while the excessive hardcopy handoffs triggered multiple trips to the planning print room. Using lean methods, an MRO redesign team traced the travel of people and information across multiple departments (illustrated in chart C). This analysis helped convince planners and management of the need for change.

Chart C. Complex and labor-intensive planning processes

Pre aircraft check input planning



Statistics

Total systems employed: 11

Total info transactions: 210

- Paper-based trans: 105
- Systems-based trans: 105

Information pathway distance

- Intra-site: 12.5 km
- Inter-site: 4.2 km

Paper information flow

Electronic information flow

Source: Client disguised data, Deloitte Analysis

During a management consensus meeting, a new MRO planning vision was agreed to, based on leading MRO planning practices and an initial "to be" value stream for each critical process. Resources were allocated to recast the overall planning process into four areas: configuration management, planning and scheduling, quality, and post-visit analytics (chart D). Expected improvements, both financial and operational, were quantified to track progress.

As a result of these changes — which represented a fundamental transformation of the MRO planning process — the company reinforced its capabilities in scheduling, parts forecasting, aircraft real-time data, standard and non-routine work package development, workforce management, and documentation. The measurable impact was an improvement in the TAT "C" check performance from a highly, variable 30-plus days to a consistent 15-21 days. Additionally, the company gained the capability to integrate additional work and service bulletins in overnight line maintenance work and short duration checks.

Chart D. Lean engineering and heavy maintenance planning process redesign

	Configuration management & Maintenance engineering	Maintenance planning and scheduling	Quality assurance	Post-visit analysis & support
Core processes	• Maintain configuration from initial aircraft Induction through configuration in as-maintained status • Establish and maintain a unique aircraft scheduled maintenance program • Extend configuration managements to cross-referencing part numbers to Illustrated Parts Catalogue (IPC) to General Maintenance manual (GMM) • Assure warranty and other performance guarantee information is traceable to parts	• Perform long-range planning for inventory, human resources, capacity, and visit planning • Provide notice to materials planning for special programs/ ADs/SBs • Conduct short term planning (internal and external) to prepare visit packages and ensure manpower, parts, hangar capacity, facilities availability, and tools/equipment will be available – Establish capability for non-routine work – Create efficiently sequenced work orders – Reserve resources – Provide detailed resource planning and capacity constraint management information – Schedule work cards at the optimal maintenance level	• Execute a quality management processes including performance monitoring and analysis of causes of non-conformance/ costs of non-quality throughout the organization. Some specific MRO activities include – Audit configuration model for accuracy and completeness – Audit maintenance review board findings against changes in the scheduled maintenance program for consistency with established procedures and approval granted by the FAA – Audit part numbers in the parts catalogue to IPC and engineering documents to validate parts catalogue numbers are approved for use	• Conduct analysis of planned versus actual for manpower and materials at work package/ work order level as well as the visit duration level • Identify and analyze unscheduled work • Perform closure on material management open items • Execute billings • Measure performance and trends
Process improvement results	• Fewer Removal/Installation (R/I) exceptions (improves work order close-out) • Better linkage to PO delivery/ asset maintenance requirements/ events tracking/ Minimum Equipment List (MEL) & Configuration Deviation List (CDL) standards • Established a closed loop feedback improvement capability	• Reduced overhead costs through improved planning fidelity and efficiency and minimization of non-routine work and expedites • Improved direct labor productivity through better sequencing of better work packages, improved parts availability and integration of third party support • Improved inventory turnover through better forecasting of inventory requirements • Improved asset utilization through improved turnaround times	• Program and management structure that effectively reduces cost of non-quality • Improved reliability and proper documentation of maintenance program changes through consistent use of policy and procedures outlined in the MRB program • Improved compliance and operational performance through proper installation of approved parts • Reduced mechanic research time and adherence to Federal Air Regulations (FAR's) through accurate and approved IPC and Parts Catalogue information	• Improved understanding of variances to plan with corrective action plans • Acceleration of billings and capture of non-standard or out-of-scope activities • Implementation of closed looped process to improve planning process • Implementation of performance measurements and continuous improvements

Source: Deloitte Analysis

3. Reduce inventory, while increasing service levels

The signs of an inventory problem are readily apparent: high inventory turns (based on our benchmarking visits the worst players in the industry can have inventory turns around one; the best have an inventory turn of five with higher parts availability); poor or no measurement of fill rates and service levels; and on-going inventory excesses and obsolescence.

How can these problems be fixed? Consider the following five ways:

Part segmentation and replenishment strategies

Consider the target inventory and replenishment process in chart E. A lean inventory balance can be reached by deciding for each part the ease of forecasting, the procurement lead time, and the desired service level. Parts are segmented by value and demand volatility: those of high-value and somewhat level (easy-to-forecast) demand can be included in a consumption-driven replenishment scheme. High-value parts with high volatility, such as major housings and cases, can be replenished by "use one-buy one" strategies or pooling. On the other extreme, low-value "C" parts can be best served by a combination of min-max, vendor-managed, and Kanban strategies.

Chart E. Part segmentation and replenishment strategies

Segmentation strategy

Value (based on COGS): High → Low

		X	Y	Z
A[1]	Total Parts	10	11	4
	Inventory	$2.9 M	$3.5 M	$2.8 M
	Opportunity[1]	($0.3 M)	($0.2 M)	($1.2 M)
A	Total Parts	135	195	93
	Inventory	$5.8 M	$10.7 M	$10.8 M
	Opportunity[1]	($1.9 M)	($3.3 M)	($2.8 M)
B	Total Parts	153	476	298
	Inventory	$1.9 M	$6.3 M	$8.9 M
	Opportunity[1]	($1.1 M)	($2.5 M)	($4.4 M)
C	Total Parts	104	355	905
	Inventory	$0.2 M	$1.4 M	$8.1 M
	Opportunity[1]	($0.1 M)	($0.7 M)	($6.4 M)

- Actively managed
- Use one, Buy one MRP planned
- Level load comsumption-based
- Min/Max MRP planned
- MRP planned comsumption-based
- Min/Max Vendor manged

Common replenishment strategies

- **Actively managed** - Optimal where cost and criticality justifies active oversight. Frequent manual review is used to manage high-risk factors involved (high cost , volume, and/or uncertainty)
- **Consumption-based** - Optimal where near-term uncertainty justifies periodic reassessment. Manual replenishment is used until credible part history is established and part is transitioned to a more permanent strategy (one among those below)
- **Level load** - Optimal when demand is consistent with low volatility. Also ideal for high cost or capacity-limited demand with long lead times
- **MRP planned** - Optimal when demand is rare, intermittent, or highly variable. Also ideal for variable, high-cost demand with long lead times
- **Use one, buy one** - Appropriate for low, infrequent demand. Units are ordered as they are used. Safety stock may be kept in inventory to accommodate lead time or forecast uncertainty
- **Min/Max** - Appropriate for items with low value demand. Cost-optimized level of stock is held to cover demand and supplier variability. MRP will order the economic order quantity (EOQ) after the minimum has been reached

Note 1: Opperunity represents inventory reductions that are possible with appropriate replenishment strategies.

Source: Client aftermarket disguised data, Deloitte Analysis

Plan for every part (PFEP)

In addition to applying part segmentation and replenishment strategies, leading companies develop a “plan for every part,” thereby preventing a “one size fits all” strategy for very different part dynamics. Each part plan has explicit inventory targets, supplier management instructions, and part metrics. A sample PFEP is shown in chart F.

Chart F. Plan for every part example

Plan for every part-bearing assembly	
Internal part number	65951-11563-045
Part descriprtion	BEARING ASSY
Part attributes	
Segment	AX
Unit cost	$23,185
Make/Buy	Buy
Lead time	728 days
Last supplier	XXX
Part metrics	
Forecast error	83%
Forecast bias	7%
Supplier on-time delivery	50%

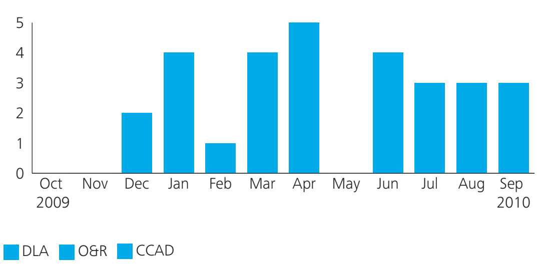
Demand				
Demand	DIST.	O&R1	O&R2	Total
LTM forecast	-	30	1	31
LTM orders	-	27	2	29
2011 forecast	-	30	3	33

Modeled inventory	
Replenishment strategy	MRP level load
Target service level	66%
Cycle stock	2 units ($46.4 K)
Safety stock	13 units ($301.4 K)
Total inventory	15 units ($347.8 K)
Current inventory	34 units ($788.3 K)
Recommended decrease/increase	-19 units ($-440.5 K)

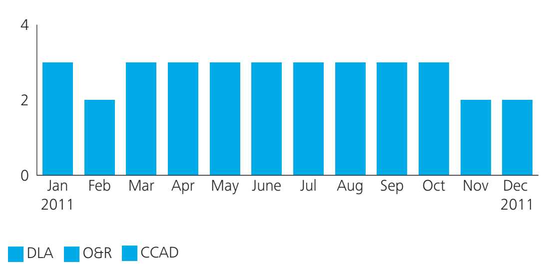
Part plan

- Level-load orders at 3/month (cycle stock of 1.5) based upon expected consumption pattern, beginning when excess is depleted
- Leverage penalties for poor on-time performance to improve delivery
- Support investment in raw materials or offer guaranteed buys to shorten lead time
- Plan for safety stock of 11 units given supply improvements
- Ensure outstanding orders are pushed out past when burn down is completed

Order history (LTM, ending Sep 2010)



2011 forecast



Target Inventory = 12.5 units ($289.8 K) → Reduction = -21.5 units (-$498.5 K)

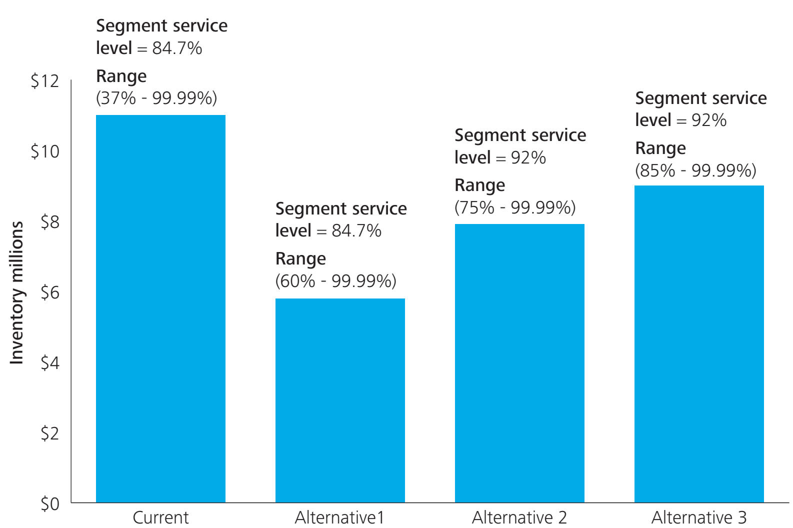
Source: Client disguised data, Deloitte Analysis

Demand forecasting

Often an MRO organization relies on the history of "average part demand" as a forecast of future demand. But the past can be a poor predictor of future demand since it cannot address all sources of variability. "What if" simulations and robust off-the-shelve, automated tools (such as MCA Solutions, Sevigistics, and Oracle Demantra) can be effective. As shown in chart G, improvements in forecasting move the inventory-service level curve.

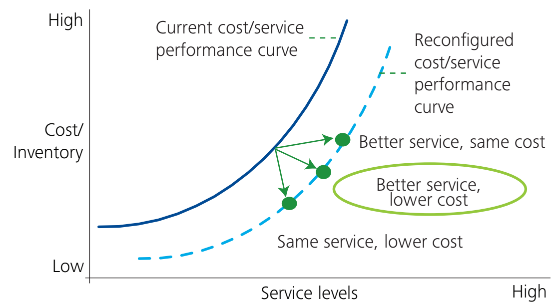
When one engine OEM used advanced tools to perform simple simulations for a spare part family, the company discovered that its inventory/service level performance was both expensive and inconsistent in availability. Then, a simulation tool (output illustrated in chart H) with advanced forecasting algorithms demonstrated three possibilities for solving the problem: 1) keep the same service level, but cut inventories in half; 2) simultaneously improve service levels and inventories; and 3) reduce inventories incrementally, while driving consistent and high service levels.

Chart H. Spare parts simulations



Source: Client disguised data, MCA Solutions and Deloitte Analysis

Chart G. Simultaneous improvement of service level and inventory



Source: Deloitte Analysis

Sourcing and supplier management

Many airline and MRO companies have achieved significant cost reductions by developing sourcing strategies for direct, indirect, and commodity spend categories. But sourcing and supplier management requires constant vigilance. Answering these questions, can help a company's supply chain leadership in its efforts to identify new opportunities for improvement:

- Is there a sourcing strategy for 95 percent of your spend?
- Can you aggregate spend totals by part family?
- How well do you track supplier performance? On time delivery? Lead times?
- Are 75 percent or more of your suppliers under long-term agreements?
- Do you share accurate forecasts with your suppliers? Measure on-time delivery and quality performance?
- Are your suppliers selected by using only pricing history?
- Are you using exchange pools, vendor-managed inventory, volume/mix flexibility in contracts, and other advanced methods?
- Have you secured OEM discounts?
- Have you incorporated PMA/DER (parts manufacturing authority/designated engineering representative) and advanced repair development in your material strategies?
- Have you performed joint process improvements and supplier development with critical/red suppliers?

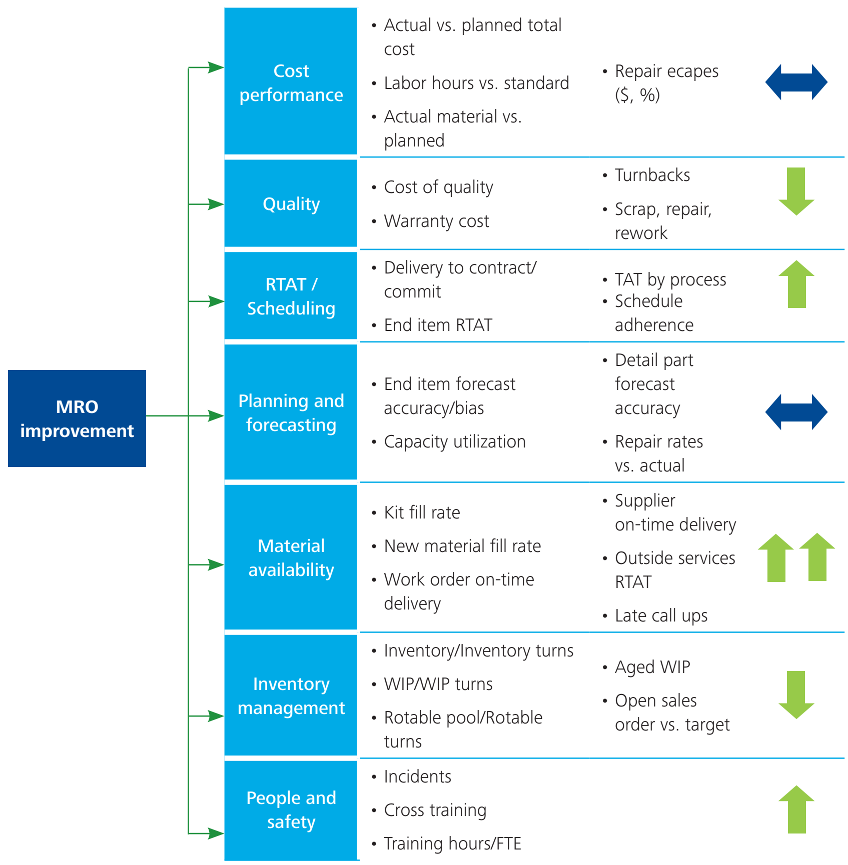
Metrics

Performance metrics can help MRO organizations improve continuously.

One North American airline used three simple, top-management level metrics: forecast accuracy, fill rates to measure service levels, and inventory per aircraft. In less than two years (after the incorporation of better part segmentation, supplier management, and demand forecasting tools), forecasting accuracy improved from 45 percent on average to 70 percent on a part basis. Likewise, fill rates improved from a solid 92 percent to an even better, industry-leading 97 percent. Perhaps most important, total inventory dropped from almost $1M to $600K per aircraft.

A more balanced scorecard used by an MRO provider of helicopter transmissions is detailed in chart I. The company measures not only cost, quality, TAT, and safety, but also planning and forecasting, material availability, and inventory. Additionally, targets are set and tracked weekly. The biggest short-term improvement areas are material availability, especially kit fill rates, late call ups (usually due to incomplete induction), and repair supplier on-time delivery.

Chart I. Set of cascading metrics for transparency



Source: Deloitte Analysis

4. Select the right MRO IT solution and extract value from that investment

Replacing or upgrading MRO IT can be complicated, costly, and difficult — it requires significant change management involving many stakeholders, including internal departments and functions, external partners, and customers. In addition, safety and regulatory factors have to be taken into account, and existing data has to be cleaned and converted.

Yet, not acting has a price, as legacy systems are getting more expensive to support and even more expensive to adapt for mobility devices, wireless connections to modern aircraft, and sensors that support on-condition maintenance. Adding niche software to legacy systems, and then integrating the mix of software to an ERP system, is an exceedingly difficult challenge. For example, an assessment of a North American airline with a complex MRO profile — including a combination of legacy systems, excel spread sheets, a customized, ERP-based MRO partial solution, and another custom ERP system for back-office processes — exposed a number of pain points and integration challenges, including excessive manual work-arounds (better known as human middleware), an inability to link MRO software to critical financial and procurement systems, and poor data integrity. Unfortunately, this situation is not unique.

Another challenge in deciding to replace or upgrade MRO IT is choosing from many alternative solutions, including at least two dozen pure MRO solutions, a half a dozen ERP-based solutions, and more than 50 niche applications (such as spares demand forecasting and repair/rotable pool management).

Given all these variables, three strategic choices emerge: add niche solutions to existing legacy architecture to gain advanced capabilities, adopt a "best of breed" new solution, or install an ERP-based MRO solution. In any case, all three choices are expensive and time-consuming. Before making a choice, answer these questions:

- Is my MRO organization prepared to change?
- How will we extract value from that IT investment?
- What leaders (or executives) are accountable for realizing value from the IT investment?

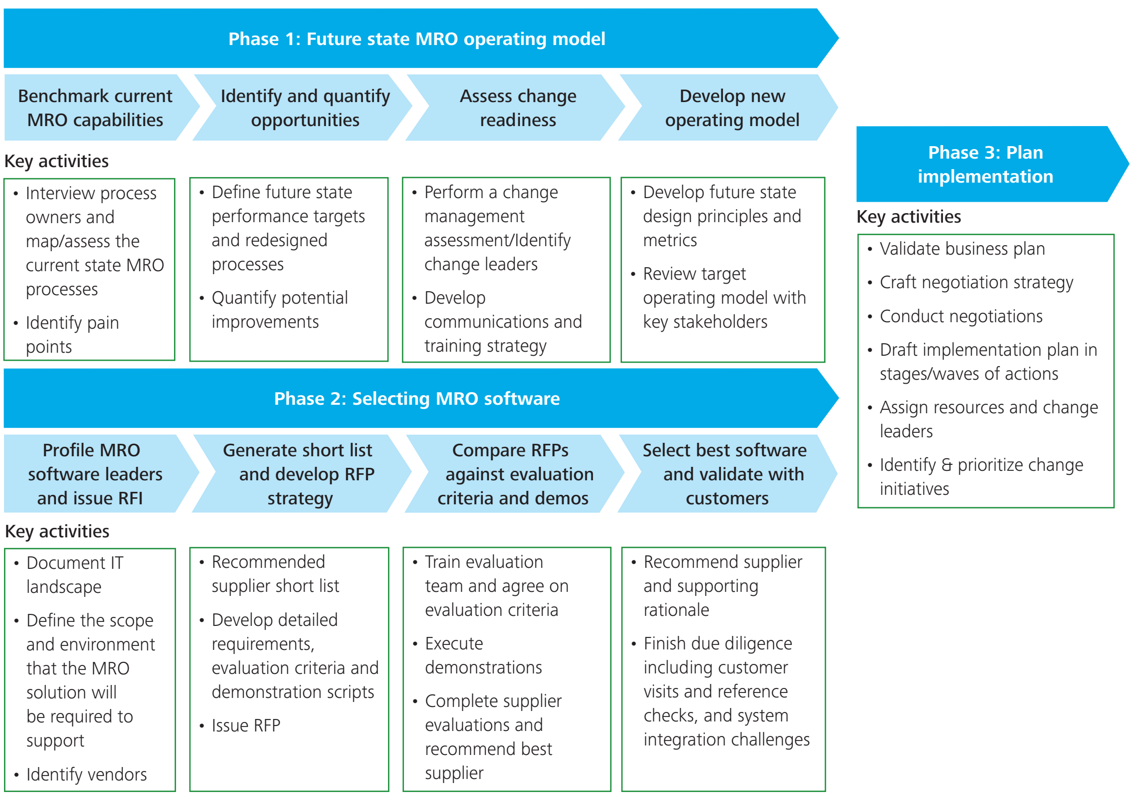
The answers to these questions should be considered before software selection and revisited throughout implementation. In particular, if the answer to the last question is somewhat nebulous — that is, if executives are not on the hook for achieving benefits — then the answer to the first question is probably "no" as well.

Use a systematic process to select an MRO IT solution

In most cases, software selection starts with a profiling of vendors through RFI and RFP processes. But a better starting point may be an assessment of current MRO processes and capabilities and a change management audit (phase 1, chart J). An upfront diagnostic confirms the vision of the new MRO organization, documents the expected benefits of the change, and details the process redesign and new tools required to change behaviors and move away from the "as is" way of doing business.

Then, software selection should follow a systematic RFP process (phase 2 and 3, chart J) that tests functionality with demonstrations and visits to existing customers. Although both phase 1 and 2 can start at the same time, phase 1 should be completed prior to any software recommendation.

Chart J. Three phase approach for preparing an organization for next generation software



Source: Deloitte Analysis

The "ten commandments" of an MRO IT implementation

Following these "rules" (similar to lessons learned in any ERP upgrade) could help a company in its efforts to achieve desired functionality within a reasonable budget.

1) Clean and migrate data (note: when legacy data is on paper, that's an additional challenge). Should everything be changed? Should some processes be cherry-picked for automation? How do legacy systems fit in the big picture? How will MRO integrate with enterprise systems?

2) Allocate significant time and effort for business user participation in all project phases. Collaboration makes for greater buy-in and a better product in the end.

3) Minimize or avoid customization. Do not jeopardize the savings that come from easy-to-upgrade software; if customization is unavoidable, reserve it for critical, differentiating processes (five, not 25, percent of the total).

4) Avoid scope creep — it will cost the project dearly.

5) Pay attention to interfaces, especially between ERP systems and other applications, so there will be seamless functionality with correct data inputs.

6) Perform detailed testing to determine quality and conformance to safety and regulatory requirements. Do not skip or reduce the scope of this step.

7) Stage the transition: phase 1 could cover back office, engineering, planning, records and documentation; phase 2 could cover mechanics and heavy maintenance; and phase 3 could cover the rest of the supply chain.

8) Rationalize application systems as much as possible: avoid overlapping functionality and reduce the total number of applications. Keeping legacy applications and excel spreadsheets could require customization and make interfaces to the main ERP system problematic.

9) Do not underestimate the need for change management strategies, communication, and training. A new system changes people's day-to-day work significantly, and many people will want to replicate the "as is" way of doing business. To follow that path would likely add complexity and cost without benefit.

10) Be aware of future requirements (especially with the onboard software loads of the B787), so that the solution is flexible for adaptation and growth.

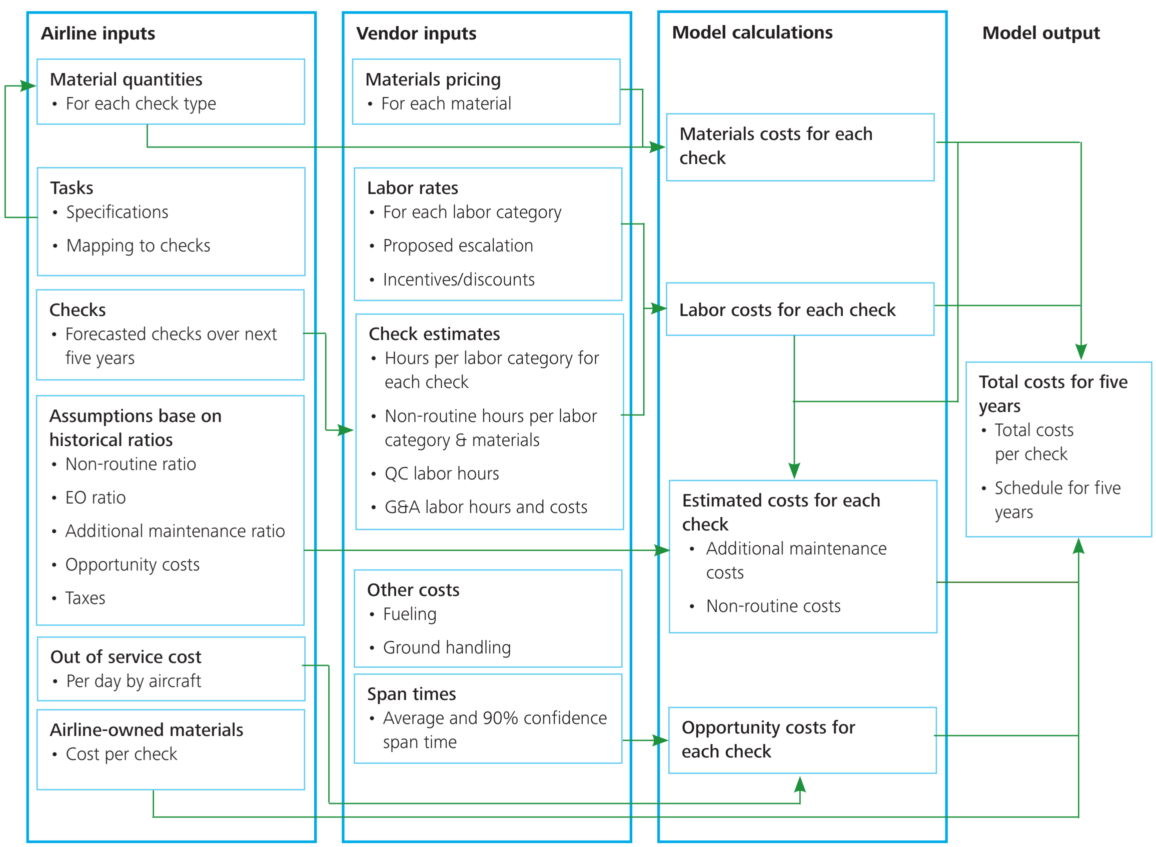
5. Craft a fact-based outsourcing strategy

Assuming they have a proper make-buy decision making process and significant analytical capability, companies deciding to outsource MRO activities (whether a lot, such as engine overhaul and C and D checks, or a little, such as component repair) could gain real cost and service advantages. But, once again, making effective choices requires significant data inputs and advanced analytical modeling. An example of the modeling structure required for outsourcing major checks/heaving maintenance is depicted in chart K.

Historical data and planning inputs are critical to get a true picture of total cost of ownership. The MRO organization should quantify the total cost of each bid and each contract item, taking into consideration the type of contract, the length of contract, and vendor performance metrics/targets.

To put the outsourcing process in better perspective, consider the case study of a North American legacy carrier that was ready to renew an engine overhaul power-by-the-hour contract with the OEM at a price somewhat higher than that of the expired contract. Top management decided to get help in setting up a competitive process to see if better terms could be negotiated.

Chart K. Analytics for airframe heavy maintenance outsourcing

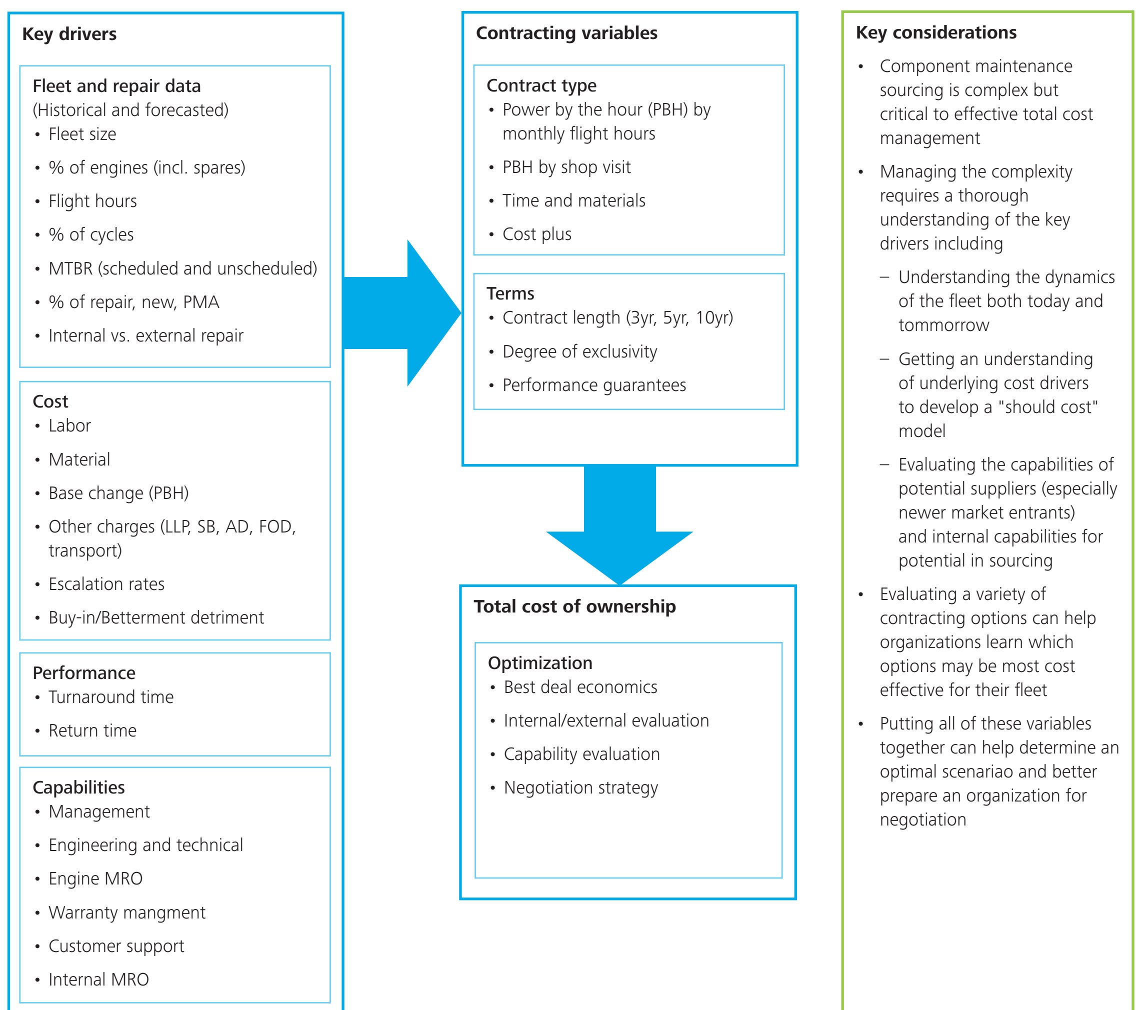


Source: Deloitte Modeling

The first step was to develop a "total cost of ownership" model (chart L) by contract type. Which was preferable? Time-and-material or power-by-the-hour? Specific data was analyzed and assumptions for fleet size, age, and mix, removal rates, and baseline spend were made.

A fact-finding RFI to 70 potential suppliers — OEMs, third-party shops, and specialty repair providers — was developed and distributed. The research exposed plenty of available capacity and a wide range of performance in cost, EGT margin, TAT, and TAT reliability. The field was reduced to eight service providers, including two OEMs. The resulting RFP covered two broad areas — technical qualifications and "total cost of ownership" data — as required inputs to the analytical model. Comparing the responses in the context of different contract and timing structures — along with different scenarios of removal rates, fleet composition, and escalation factors — the company made an initial selection of the three best service providers.

Chart L. Total cost of ownership modeling for engine overhaul



Source: Deloitte Modeling

The last phase was critical in upping the competitive intensity of the marketplace. For three finalists, the company proposed a three-year, time-and-material contract for the new fleet and a 10-year, power-by-the-hour contract for the older standard fleet. Additionally, each finalist received specific scores (advantaged/disadvantage/neutral) on base charges, LLP, and SB/AD/FOD charges, spare engine economics, material strategies (PMA incorporation, % used/serviceable, material fees and markups), labor rates, warranty provisions, and escalation rates.

The final result: the airline achieved an annual savings of $12-15M annually with better TAT, rather than the cost increase initially proposed by the incumbent service provider.

Conclusion

The five strategies for achieving smarter MRO result in increased speed, improved reliability, and reduced costs — all at the same time. Although each of the five strategies has different impacts (chart M), when combined they affect the efficiency and effectiveness of the whole MRO function. Excellence in these five strategies represent nothing more than a fundamental transformation of capabilities.

We have observed that, within 18 months of implementing the five strategies, an MRO organization can achieve cost improvements in the order of 8-15 percent. Even more important, continuous annual improvements can move from 2-3 percent to 4-5 percent. On the balance sheet, inventory turns may double, depending on the starting point. Obviously, a company could be motivated to take such cost reductions to the bottom line. Alternatively, a portion of the savings could be re-invested — in advanced repair development, inventory pooling across customers, next-generation technology, and alternative material solutions — to help make the MRO business a distinctive performer.

Chart M. Typical benefits realized

	Consistent TAT	Maintenance planning	Inventory management	MRO IT	Outsourcing	Potential reduction
Overhead costs	Minor impact	Major impact		Major impact		8 - 17%
Outside services	Minor impact		Minor impact		Major impact	7 - 10%
Materials		Minor impact	Major impact	Minor impact	Minor impact	5 - 8%
Direct labor	Major impact	Minor impact		Minor impact	Minor impact	5 - 20%
Total cost savings of MRO 8 - 15%						

Minor impact Major impact

Source: Deloitte Benchmarking

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