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Smarter choices: Raise asset availability *and* reduce operating costs

New analytics techniques can help companies keep more of their assets working more of the time, while reducing inventory levels and lifecycle costs.

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Maintenance activities, and the associated spare parts, are a big supply-chain challenge in asset-intensive industries. Take air travel, for example. Every year, the world's airlines spend an estimated $70 billion on maintenance—twice as much as they make in profit. Collectively, they hold some $50 billion in spares and inventory, yet are still plagued by technical problems and poor availability, with the average aircraft operating for only 10.5 hours a day.

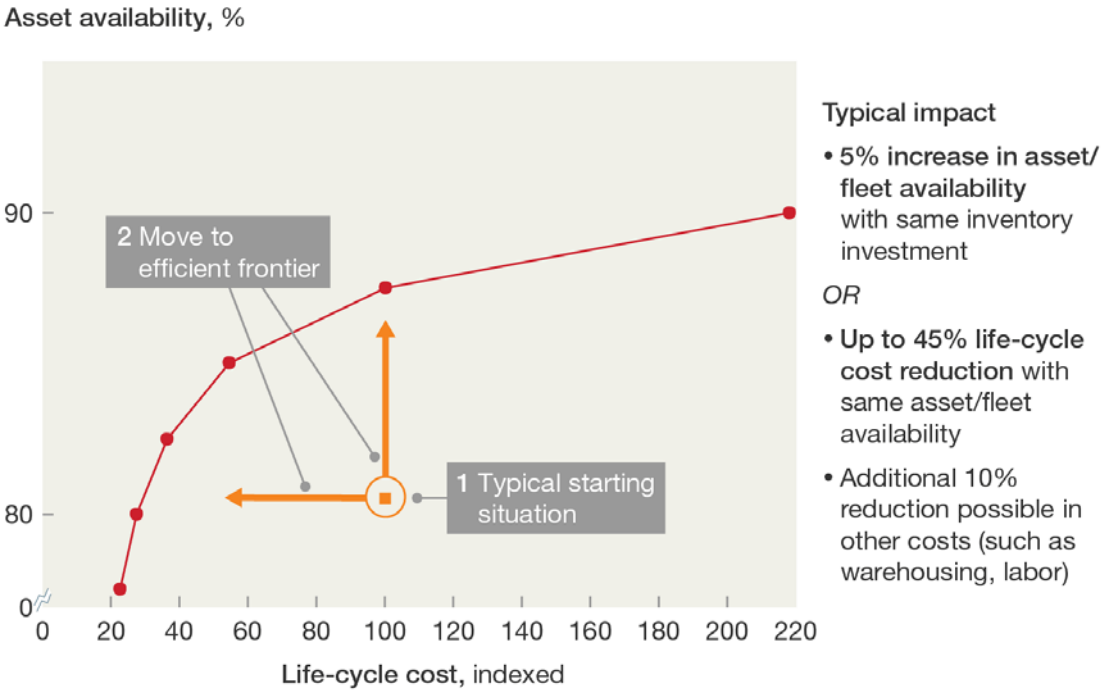
Aviation isn't an outlier. Plenty of other industries, including rail and marine operators, utilities, telecommunications, and IT companies are also wrestling with large spares inventories, high maintenance costs, and poor asset availability.

The conventional view is that companies can either keep costs and inventories down or availability up. But that turns out to be a false choice. A McKinsey cross-industry study of over 100 companies around the world found that 10 percent were in the top third of performers on both measures.

A more nuanced analysis shows that there is indeed a trade-off between spend and asset availability, but its effect only emerges once an organization has the right people, parts, and tools in the right place at the right time. For a given fleet of assets, supported by a given network of service facilities and parts storage locations, optimal allocation decisions lie along the "efficient frontier"—the red curve in Exhibit 1. If companies get allocation right, they can balance inventory and other investments against the resulting availability.

Exhibit 1

Most companies remain far from the efficient frontier between asset availability and life-cycle cost.



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Most companies are currently operating well away from this efficient frontier, as shown by the orange marker. Bringing their performance closer to the curve would allow them either to maintain cost while increasing availability (by moving up along the Y axis), or to maintain current availability at lower cost (by moving left along the X axis).

But how? Modeling and advanced-analytics approaches offer a solution to some of the most difficult questions in MRO optimization, such as:

- Which of my assets or sites present the biggest risks to my profitability due to downtime?
- Given my current network design, what is the optimal inventory arrangement to maximize asset uptime while minimizing my costs?
- What network design will minimize cost and downtime?
- Are my downtime and cost challenges driven primarily by reliability issues, maintainability issues, or supply issues?

The answers to these questions help determine which moves will have the greatest impact. In our experience, pursue the first option typically improve availability by 5 percent. Those that seek the second typically cut lifecycle cost by up to 45 percent. In practice, many companies aim for combination of these benefits, boosting availability and profit, while reducing inventory costs.

The long trail to the frontier

The efficient frontier is hard to reach. Many companies still struggle to understand which parts they hold at which locations in their service networks. Others are still building robust part-demand forecasts based on historical supply chain performance, asset usage, and known failure patterns. And even high-performing organizations face formidable challenges as they seek to make the maintenance and inventory decisions that will best improve fleet wide availability and reduce cost.

Those challenges arise from the sheer complexity of maintenance and repair operations (MRO). Individual assets may comprise thousands of parts, and fleets may comprise many different types of assets or platforms. Across a fleet, even assets of the same make and model may differ significantly at the bill-of-materials level, with limited interchangeability between parts from different production runs, for example. Failure rates will vary by part and by asset usage. Parts also vary in their importance to operations: some are critical, so that without the part, the entire operation shuts down, others are semicritical, affecting the system's efficiency or throughput, for example. Demand for parts, and ordering strategies, will vary accordingly. Fleet schedules may be highly variable, and fleet composition will change over time as different asset types are phased in and phased out.

Using advanced analytics to fix MRO investments

Companies often begin addressing their asset inventory, cost, and availability challenges by undertaking traditional supply-chain improvement initiatives, such as creating end-to-end inventory visibility and introducing tighter process controls. The complexity of supply chains for heavy assets, however, means many companies still fall short of the efficient frontier.

Today, that situation is changing. The emergence of a new generation of data processing, analysis, and visualization tools is starting help organizations get maintenance planning under control, and take their operations to the efficient frontier. These tools can automate the construction of detailed models, extracting and blending data from sources ranging from enterprise-resource-planning (ERP) and warehouse-management systems (WMS) to in-house planning tools unstructured spreadsheets.

An accurate, granular model that captures the real-world complexity of MRO networks, fleet characteristics, and historical demand transforms an organization's ability to manage its maintenance lifecycle costs. Instead of working part by part, managers can apply advanced optimization and simulation techniques, together with predictive analytics, to optimize inventory across the entire system or network. Rather than just seeking to minimize short-term maintenance expenditures, the company can optimize the lifetime cost of its assets. Such systems allow companies to identify the elusive efficient frontier, and determine the repair and spares inventory strategies that will take them to that frontier.

Significantly, these powerful tools are no longer the sole preserve of data scientists and operations-research specialists. The best of today's systems offer flexible, user-friendly graphical interfaces that provide clear answers to essential MRO questions, such as deciding how many

of which parts to store at specific inventory locations, and the likely impact of those decisions on asset availability and downtime.

Advancing the efficient frontier

These models' true power for MRO goes beyond the optimization of existing processes and networks to help companies unlock opportunities for significant performance improvements. Models can identify the parts or repair processes that are the biggest causes of downtime, for example, allowing companies to address those issues through condition monitoring, changes to operating procedures, or design modifications. Predictive analytics also enables companies to run what-if analyses to explore the likely impact of changes to their MRO networks and capabilities. By testing multiple scenarios, they can find ways to move the efficient frontier, providing higher asset availability at a given cost.

A national defense organization used this approach to understand the effect that changes to its budgets, operating hours, and maintenance schedules would have on the readiness of its fleet of aircraft. Combining data from its own records with those of contractors and suppliers, it built a detailed model that included data on component cost, reliability, and maintainability, together with the time and cost of transport and maintenance activities and the productivity and skill levels of the available maintenance workforce.

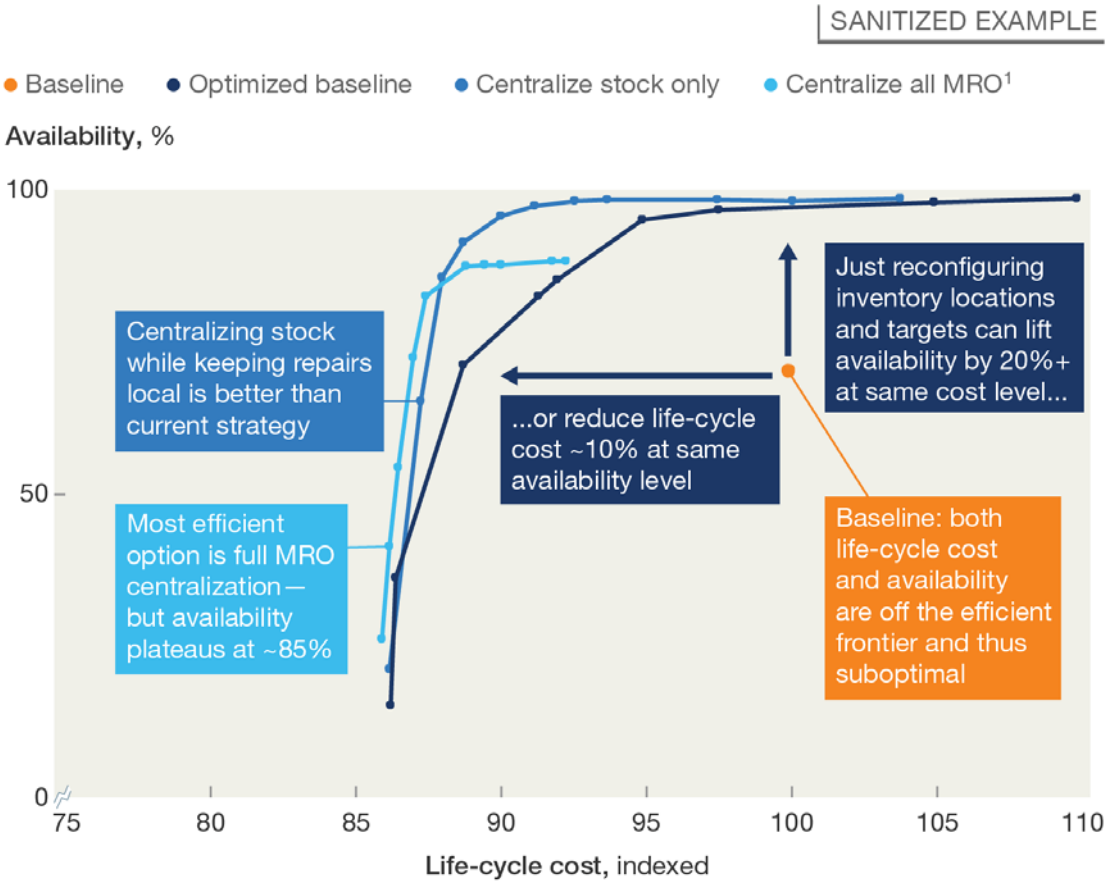
The new model revealed precisely how proposed changes would affect fleet readiness. For example, increasing planned flight hours by 20 percent would reduce availability by around 5 percent under the current supply-chain plan, while changing maintenance shift patterns from 24 hours per day, seven days a week to twelve hours a day on weekdays only would reduce readiness by 11 percent. By exploring multiple possible changes, the organization was able to identify a number of changes that allowed it to increase overall readiness while reducing costs.

Similar modeling by a major airline revealed significant opportunities to improve the performance of its current MRO operations. Reaching the efficient frontier could increase aircraft availability by more than 10 percent at the same cost, or allow the company to reduce MRO inventory by more than $40 million with no loss of availability.

The airline then ran a series of what-if analyses to explore the impact of different repair and inventory strategies. As Exhibit 2 shows, it discovered that centralizing both spare parts inventories and repair activities offered the biggest lifetime cost benefits, but the additional travel time required to bring all aircraft back to base for repair meant that fleet availability would reach a plateau. An alternative approach, in which spare parts inventories were centralized, but repairs distributed across its network, offered both higher availability and lower costs than its existing fully decentralized strategy.

Exhibit 2

Advanced strategies can reshape the efficient frontier.



[1]Maintenance, repair, and operations.

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Across a range of industries and assets, companies can now identify and eliminate waste in their maintenance operations and spare-parts inventories through fact-based discussions about the real trade-offs between support costs and asset availability. Across a range of industries and assets, we've seen these approaches capture significant cost and inventory reductions and availability improvements.

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