

Mastering military maintenance

Maximizing asset availability without increasing costs will be a critical priority for armed forces in the years to come. We have found that armed forces can improve both the efficiency and the effectiveness of their maintenance, repair, and overhaul (MRO) function by as much as 60 percent, but doing so requires fundamental changes to organization, processes, and mind-sets.

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As militaries around the globe strive to do more without increasing their costs, one critical area for improving performance is equipment maintenance, repair, and overhaul (MRO). Performance in MRO has an important effect on the availability of equipment: in many armed forces, one-third to half of the total capability of key asset classes is out of action for maintenance at any time. Furthermore, in a typical armed service, MRO accounts for more than 10 percent of the total defense budget and as much as 70 percent of all aircraft-related costs.

Our experience, based on our work with defense organizations across the globe, shows that armed services can typically improve the quality and

productivity of their maintenance processes by between 40 percent and 60 percent, and they can increase the consistent availability of critical assets to more than 95 percent. Delivering these kinds of improvements requires armed services to take three fundamental steps. First, they must do maintenance work only when needed, eliminating unnecessary work by reevaluating MRO protocols. Second, they must do it where it counts—that is, they must ensure that their MRO infrastructure meets the requirements of current operations. Third, they must do it as efficiently as possible, which often means adopting best-practice techniques for productivity improvement—techniques pioneered by the manufacturing industry but equally applicable in MRO environments.



By taking these steps, armed services can maximize availability without having to make any trade-offs; the improvements come about even as MRO costs remain the same. In this article, we examine these steps in greater detail and discuss three elements vital to sustaining productivity and quality in MRO processes: smart labor planning, effective information management, and strong operations management.

Do it only when needed

In recent years, companies in various industries—including oil and gas, automotive, and commercial aviation—have reduced maintenance work to the minimum possible level, whether by switching from time-based to condition-based maintenance scheduling, implementing in-service equipment monitoring, or building a detailed understanding of the root causes of equipment failure. In so doing, companies not only cut maintenance costs and increase equipment availability but also reduce the significant risk of introducing new problems during maintenance procedures.

Leading armed services are using some of the same approaches. Typically, they begin with a critical look at current MRO protocols: were the protocols designed for operating conditions that have since changed? Could a simpler inspection or diagnostic test replace a costly and time-consuming intervention? Is the MRO requirement of a few critical parts dictating a larger overhaul? One of the world's ten largest air forces, for example, undertook a review that revealed that the manufacturer requirement for a major overhaul of one aircraft type every 200 flying hours was driven by the likelihood of failure in a few key engine components. By separating engine and airframe maintenance schedules, the air force was able to dramatically increase the time between interventions for the majority of the

aircraft while keeping engine reliability under close scrutiny.

In the United States, one armed service replaced conservative, time-based maintenance intervals specified by manufacturers with a reliability-centered approach, thereby extending the time between major overhauls of some large assets from 5 years to 15. Key to the success of this approach has been the development of a comprehensive evidence base that covers the performance of equipment in service. Detailed recording of incidents of equipment failure allows MRO staff to perform maintenance only when needed; parts that do not wear out in normal service remain untouched during overhaul.

Do it where it counts

Many military MRO organizations were designed in an environment very different from that in which they operate today. In Europe, for example, many armed services established their current MRO infrastructure during the Cold War, when the next conflict was expected to take place at or near home and MRO structures needed to be robust in the event of a direct attack. Changing military doctrine brings these structures into question. Are multiple MRO facilities at home necessary when the expeditionary force needs critical capability thousands of miles away? Should resources be reallocated from the maintenance of tanks to aircraft, given that aircraft sees much higher levels of utilization in theater? By better matching their MRO organizations to current need—that is, collapsing processes onto strategic locations and making common MRO services available closer to the front line—armed forces can reduce redundancy, minimize transportation requirements, maximize economies of scale, and improve asset availability.

In the United Kingdom, maintenance work on Harrier vertical takeoff fighter aircraft took place at two separate bases, each with engine-overhaul facilities located nearby. Consolidating these facilities into one site has produced annual savings of £250 million and allowed the introduction of more efficient and flexible maintenance processes. In Australia, a program is under way to consolidate submarine maintenance at a single base, with key suppliers located adjacent to the repair docks. (We note that consolidation of facilities makes sense only for nations without an immediate threat from a neighboring country.)

Moves like these can be challenging to implement. Military commanders tend to be reluctant to close facilities that have received substantial investment, and loss or movement of large numbers of jobs is obviously politically sensitive. To be successful in these kinds of efforts, armed forces must convincingly demonstrate both the operational and financial case for consolidation.

Do it as efficiently as possible

Maintenance personnel take pride in their flexibility and ability to cope with unexpected “emergent” work discovered during maintenance activities. While these skills are important in MRO, they are often accompanied by a failure to recognize that the majority of maintenance work is highly predictable and therefore likely to benefit from the same productivity-improvement techniques that have transformed the efficiency of manufacturing industries around the world. These best-practice techniques eliminate waste and root out unnecessarily nonstandard work practices, unbalanced maintenance loads, and highly variable team structures that have hampered efficient and effective delivery, and that many defense personnel have traditionally—and mistakenly—viewed as unavoidable.

More open-minded leaders of MRO units have delivered dramatic quality and productivity improvements by emulating the processes of modern production facilities. One UK army unit, for instance, halved the man-hours required to refurbish each armored vehicle by moving from a fixed-station approach—in which one team worked on a single vehicle from beginning to end—to a flow-line approach (long used in mass production but only recently proven valuable in military MRO) in which vehicles move through the facility from station to station, with a team at each station focused on a specific task. Teams have thus developed deep expertise in their particular tasks, performing them faster and more effectively. The flow-line approach has delivered other benefits as well: a reduced need for duplicated tools and equipment, and fewer training requirements because individuals have to develop proficiency in only a few tasks.

The same unit also changed its approach to shorter-cycle maintenance processes for bringing vehicles back into full operational order between missions. It used a pit-stop approach inspired by motor-sport processes—that is, rather than working on each vehicle when it arrives, teams do as much preparatory work as possible before a vehicle comes in from the field, ensuring they have the right parts, tools, and people in place to work on damage reported by crews. The pit-stop approach has enabled the unit to do repairs in the field that would previously have required vehicles to be sent to a dedicated maintenance facility. Damaged vehicles are often made ready for use again during the same mission—something that had been rare under the previous system. Since adopting the approach, the unit has reduced by 67 percent the time taken to complete work on each vehicle.

Some MRO staff fear that the rigor inherent in standardized best-practice techniques will

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hamper their ability to “flex” capacity in response to spikes in demand. However, MRO personnel often find that these techniques actually improve flexibility—both by reducing the time required to complete common tasks and by making it easier to allocate tasks across available labor resources.

Achieving continuous improvement

Once they have designed and implemented efficient MRO processes, military organizations must adhere to those processes and seek to improve them in the face of emerging knowledge and changing demand. To do this, they must have excellent capabilities in labor planning, information management, and operations management.

Labor planning

Leading manufacturing companies use production leveling—a technique that aims to keep the volume and mix of work as constant as possible—to achieve extremely high efficiency. Similarly, labor planners and schedulers must strike the right balance between maximizing the availability of individual assets and increasing the efficiency of the system as a whole. It may be better, for example, to bring forward the scheduled overhaul of a vessel if dock capacity is available than to ensure it completes all its operating hours.

Planning for labor availability can make a big difference in MRO performance. It is common for crews to be assigned to maintenance activities when their vessels or vehicles are not in service, but pressure on this time is particularly intense, as personnel are often required to participate in

training activities or are keen to spend the time with their families. Even if they are theoretically available for work, other aspects of military life can limit their actual working hours to as little as 20 percent of the available time.

If MRO organizations are effectively paying five times their standard hourly rate for military personnel, it may be more cost-effective to employ civilian staff for MRO roles. Australia, for example, has outsourced maintenance work on military transport aircraft to the technical organization of Qantas Airways, thus freeing up key military personnel for other tasks. Furthermore, the civilian personnel have applied sophisticated approaches developed for airliner maintenance and thus achieved higher productivity than their military counterparts.

Outsourcing maintenance activities is not without risks, however. If civilian contractors are required in theater, the cost and complexity of providing appropriate protection can be significant. Also, the loss of MRO skills among military personnel could threaten a service’s ability to keep key equipment operational in the field; some services have minimized this risk by rotating military personnel into contractor work teams.

Information management

Effective management of information is equally important to sustaining high performance. For example, to optimize scheduling and work allocation, planners need accurate data on how long MRO tasks take. In one military facility,

the shortest time allocated to any task was four hours, even though many tasks took considerably less time. The result: long MRO cycles and an underutilized workforce. MRO organizations can overcome this simply by monitoring how long it takes for experienced staff to complete certain tasks over a few MRO cycles, making these data easy to record and access, and using them as benchmarks for planning and work allocation.

In other military MRO activities, tedious record-keeping places a burden on staff. Excessive paperwork, in fact, is one factor that eats into “wrench time”—the working hours that maintenance staff spend on their assigned tasks (exhibit). Some armed services, for example, require pilots to keep handwritten records of aircraft defects in a log kept in each aircraft. Their notes are then copied into a duplicate log kept at the base, and MRO personnel create

a job card for each maintenance task. Once they complete the tasks, they are required to sign off on the cards and in both logs.

MRO organizations must implement information-management processes and systems that allow relevant personnel to enter, access, and analyze data easily and in real time. In one air force, pilots key details of incidents into a computer terminal when their mission is complete, enabling automatic creation of work orders and real-time review of the frequency of incidents by all relevant personnel. This system allows the service to constantly refine its maintenance policies.

Operations management

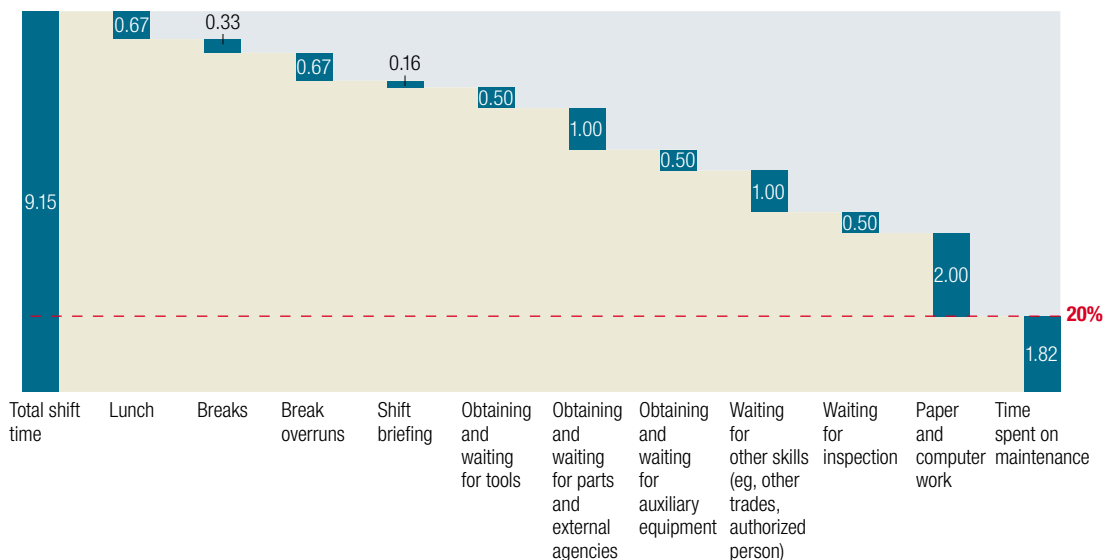
One might think that introducing operational changes is relatively straightforward in the military environment, since presumably it can be done by order and maintained as a function of

Exhibit

Time for tasks

When “wrench time” is low, there is a major opportunity for productivity improvement.

Average hours (based on standard hours for Monday through Thursday)



Source: On-site observations and interviews with maintainers and supervisors at a European military facility

military discipline. The reality is that the management of MRO is at least as challenging in the military as in civilian life—but the challenges can be overcome with smart operations management.

One challenge is that while military operations can produce pockets of extremely good practice, these practices are far from universal. Aircraft-maintenance personnel, for example, are trained to avoid the risk of foreign-object damage in part by ensuring that tools are returned to their allocated place after each use; a byproduct of these excellent tool-control practices is that an aircraft-maintenance staff never wastes time searching for tools. Yet ground-vehicle MRO units rarely adopt these practices. The most effective MRO leaders establish mechanisms for best-practice sharing and learning.

Another challenge is that best practices in operations can run counter to good practices in other military activities. For instance, many military personnel excel at finding fast and creative solutions to problems on the line. One air force suffered frequent failures of the hydraulic power units used to support aircraft on the ground, and instead of investigating the cause of the failures right away, MRO staff quickly became adept at repairing the units. Only much later, when use was studied in the field, did it become clear that operators were circumventing the unit's time-consuming shutdown procedure by activating the emergency stop, which placed

internal components under great strain and frequently resulted in damage. MRO managers must ensure that they train their staff to engage in root-cause problem solving rather than going for quick fixes.

A third management challenge in military MRO is capturing the “hearts and minds” of personnel. After all, few military personnel envisage working in a factory environment when they embark on their careers; furthermore, the connection between improved shop-floor productivity and battlefield success is not obvious. Emphasizing that link through frequent and careful communication can become a vital motivator. The leaders of one air force MRO facility, for example, explained to personnel that savings achieved on the overhaul of an existing aircraft fleet would allow the force to acquire an additional squadron of new-generation fighter aircraft.



As with any transformation program, the support and commitment of top management is vital to the sustainability of MRO improvement efforts. The explicit and implicit signals that leaders send their subordinates have a direct effect on how well new techniques “stick.” Leaders must persist even when MRO staff initially appear resistant to new ways of doing things. Our experience has shown that once military personnel see the benefits of best-practice approaches, they typically become extremely enthusiastic adopters. ○