



LEAN AVIATION MRO

THE SUCCESS OF AN AIRLINE OR OTHER FLEET OPERATOR SUCH AS THE MILITARY REQUIRES HAVING AS MANY PLANES AS POSSIBLE IN FULL OPERATION. A PLANE GROUNDED FOR REPAIR IS A PLANE THAT'S NOT BRINGING IN MONEY – AND A PLANE THAT'S TAKING UP SPACE IN A HANGAR OR REPAIR FACILITY. WITH MRO OPERATIONS ACCOUNTING FOR 15 TO 18 PERCENT OF AN AIRLINE'S TOTAL OPERATING COSTS, PROFITABILITY IS DIRECTLY AFFECTED BY REPAIR AND MAINTENANCE COSTS, SO CONTROLLING THIS EXPENSE IS OF PARAMOUNT IMPORTANCE. FOR THESE REASONS, AIRLINES AND OTHER FLEET OPERATORS ARE TURNING A CRITICAL EYE ON THEIR MAINTENANCE AND REPAIR OPERATIONS, LOOKING FOR WAYS TO CUT COSTS WHILE GETTING PLANES BACK IN THE AIR FASTER AND MORE SAFELY.

This is the highly competitive landscape in which aviation Maintenance Repair Overhaul (MRO) operators find themselves today, and in which they must seek transformational solutions to remain competitive. "Airlines are increasingly seeking ways to mitigate economic fluctuations by reducing operating costs across the entire aircraft maintenance cycle," says Patrick Wiebusch, Co-Founder and Managing Partner at Four Principles. "Lean can optimize aviation MROs to achieve the dramatic performance improvements necessary to win in this game."

Today's Challenges in Aviation MRO

Thanks to increasing global competition and the challenges faced by the travel industry in the wake of the COVID-19 pandemic, aviation MRO organizations are feeling intense pressure to streamline and improve business operations and boost profit margins. The result is that aviation MRO organizations need to speed aircraft turn-around times (TAT,) reduce overall maintenance costs, streamline supply pipelines, and meet higher demands in customer service and business standards.

In addition, the global MRO market is in flux as MROs based in Asia, Latin America, and the Middle East compete for business with established North American and European aviation MROs. As reported in Aviation Week's [2021 Commercial Fleet & MRO Forecast](#), MRO demand in the Middle East is projected to grow by 5.3 percent, well ahead of the global average of 3.6 percent growth. The report projects that the Middle East region will generate \$94 billion in MRO demand over the next decade. Of this, \$47 billion will relate to engine maintenance.

The difference in costs is such that general cost-cutting measures won't achieve the necessary reductions. Rather, MROs that wish to stay competitive will need to make much more fundamental and systemic operational changes to compete.

Defining Lean Aviation MRO

With its roots in the automotive industry as pioneered by Toyota, Lean MRO is ideally suited to achieve the performance improvements, increased efficiencies, and cost reductions needed in today's aviation MRO industry. As a tested and proven means to organizational transformation, Lean can help aviation MROs make the drastic changes necessary to maintain their competitive advantage.

One key concept underlying all of Lean is the reduction of waste. Anything that does not add value to the product is removed from the process. Another underlying value is continuous flow, which means a steady, constant movement of the product through the production cycle without roadblocks or waiting times so that it reaches the customer with the exact amount of resources needed along the way. Lean production follows 5 key steps:

1. Identify Value – Identify the product needed by the consumer and the exact steps needed to produce it.
2. Map the Value Stream – Design a process in a sequence of necessary steps, eliminating waste.
3. Create Flow – Ensure a seamless process without interruptions.
4. Establish Pull – Create demand-driven production, working backwards from the final product or service and its consumer.
5. Seek Perfection – Implement a process of continuous improvement.

When Lean MRO organizations are evaluated in comparison with traditional manufacturing and production, Lean organizations are found to design, make and service products with less effort and less capital investment. Speed and agility are the watchwords, with key processes requiring less time and involving greater innovation, but this does not mean a reduction in quality. In fact, it's quite the opposite - Lean manufacturers produce goods with fewer defects and have lower incidence of employee injury. Companies following Lean MRO practices need fewer suppliers and require less inventory at each step.

Lean philosophy, when fully implemented, becomes a discipline that aviation MROs can use to become more lightweight, nimble, and competitive. Implementing an iterative system of improvement can help aviation MROs cope with the unpredictability of the landscape in which they operate. Lean MRO helps aviation service providers avoid delays and service disruptions, which cause serious problems for airlines. Lean's "pull" system, in which work flows backward from customer demand, basically eliminates the need for stockpiling when fully and implemented. By following the principles of just-in-time (JIT) production, Lean MRO slashes inventory and decreases reliance on working capital.

Applying Lean to the Aviation MRO Industry

Servicing and repairing aircraft is a complex business that requires a fool-proof system of inspection, detection and quality control. Tasked with returning aircraft to a state at which they can perform their original function, Aviation MROs therefore may be seen as more in the business of remanufacturing than manufacturing. MROs are responsible for making modifications, repairing and restoring parts, and obtaining replacement parts, making supply and inventory primary concerns. The repair and restoration process may occur as scheduled or unscheduled maintenance, increasing unpredictability.

In the aviation industry, MRO involves a series of processes:

- Communication and inspection of the problem
- Disassembly of the plane or part, partial or complete
- Inspection of the components
- Repair, replacement, or modification of the parts at fault
- Reassembly
- Testing and inspection of the reassembled plane
- QA of the repair process

Lean can be applied to these core processes to improve turnaround time (TAT) and cut costs. An illustration of this can be seen in a Lean initiative conducted by Fed Ex in its LAX facility, which radically redesigned the complex process for conducting a maintenance C-check, a major inspection and overhaul.

In a typical work structure, a C-check is organized according to a check 'work pack' and then into a set of 'task cards' giving the instructions for the aircraft maintenance personnel to carry out the different tasks on the aircraft. A major C- or D-check may have as many as 5000–10,000 task cards, each containing a description of the task and information pertaining to the type of aircraft, referring to the aircraft manufacturer's maintenance manuals. The task card is also a legal document that when properly executed provides 'proof' of work accomplishment and it exacts accountability from the AME/inspector signing off the card.

At Fed Ex, components of a C-check included overhauling the aircraft's cargo loading system, cockpit seats, and the large flaps on the rear the main wings. As part of its Lean redesign, Fed Ex used kaizen to streamline the maintenance process for the cargo loading system maintenance, reducing the time required from 30 days to 18, then made similar improvements to the flap overhaul/replacement process.

Using Value Stream Mapping, the lean teams analyzed the standard work of a C-check, identifying 68 milestones, or key aspects of the process. They planned each C-check by the mechanical time required, breaking it into four-hour increments. By understanding each four-hour block of mechanics' time, they created a flow that allowed one mechanic to pick up a task where the previous mechanic left off, eliminating wasted time and movement during transitions. Value Stream Mapping was also used to eliminate bottlenecks. Prior to the lean initiative, mechanics typically waited 15 minutes or more to obtain needed components from the stock room. Reorganization of the use of space placed pallets of special tools and airplane parts within reach on the hangar floor.

Both the parts staff and maintenance technicians worked together in a kaizen to identify the parts most likely to be needed during each stage of a C-check operations and created a moveable parts cart that could be placed close to the plane. This reduced setup time from four hours to less than two. For less commonly needed parts, the facility located four terminals on the hangar floor where mechanics look up the specific parts they need. Kaizen was used again to determine the best sets of tools for each particular repair or maintenance operation in a C-check and establish a relevant toolkit for the task. A 5S operation was used to redesign the workspace with each maintenance worker's wheeled toolbox parked in an assigned location.

In six months, Fed Ex's LAX Lean initiative reduced the time needed to perform a C-check from 32,715 man-hours to 21,535 man-hours, resulting in a savings of \$2 million per C-check, excluding parts, and enabling the facility to handle more work. After extending the Lean transformation to its Memphis and Indianapolis facilities, Fed Ex saved an estimated \$18 million in the first fiscal year.

Unique Challenges of the Aviation MRO Industry

The challenges of aviation MRO are somewhat different than those of traditional manufacturing because of the complexity of scope of work and the unpredictability of demand. Forecasting is particularly difficult in the aviation MRO industry because of the variability and unpredictability of repair work. Technology also changes rapidly in the aviation industry, with systems becoming outdated more quickly than in some industries and manufacturers discontinuing parts and even whole model lines.

In addition to production, Aviation MROs also follow the model of the service industry, since they answer to the airlines that contract for their services. For this reason, Aviation MROs must pay attention to customer relations, focusing not just on internal operating efficiency but on satisfying the end customer – the airline.

To address this variability, Lean can be applied with mixed modeling for greater flexibility. To achieve full Lean transformation, aviation MROs must identify product family patterns and reorganize MRO shops according to these groupings. Production, manufacturing and service systems can be redesigned according to a cellular system for greater adaptability. Kanban-based management can help achieve the desired flexibility and flow.

Lean Aviation MRO Reaps the Rewards

Hard data on the successful implementation of Lean to aviation MROs is not as widely available as in some other industries, [as noted by researchers](#) seeking to evaluate Lean success. However, the researchers conclude, “There is little doubt that the correct application of Lean principles in the service sector represents an opportunity for improvements in competitiveness.”

Additionally, a survey of 22 aviation MROs found that those organizations that had implemented or partially implemented Lean reported its value and applicability. Evaluating the impact of Lean in 11 different areas, the authors found that Lean has been valuable and influential in the areas of performance measurement, process and technology, Human Resources (HR), and quality control. Lean was also reported by managers and leaders to have value in the area of planning and control, leading to more strategic business decision-making.

“What we are seeing is that there has been a significant increase in the adoption of Lean tools and techniques by aviation MROs,” says Seif Shieshakly, Co-founder and Managing Partner at Four Principles. “However, many MROs have yet to achieve the systemic change and paradigm shift that can occur with Lean. Here at Four Principles, we help MROs introduce Lean principles and practices that can bring about this transformation.”

Successes in Lean Aviation MRO: Case Studies

One example of Lean success is FL Technics, a global aviation MRO with 1,200 employees working in hangars based in Lithuania, Indonesia and elsewhere, which services 27 airlines, including Swiss Air, Luxair, and Pegasus.

In 2017, FL Technics underwent a [Lean transformation](#) to which CEO Zilvinas Lapinskas attributed that year's \$6,650,000 profit. Zilvinas announced in 2018 that reorganizing according to Lean principles and practices had allowed FL Technics attract new top-tier European airlines. Investing in mechanical training, dedicating teams of workers to each aircraft in a Bay system, and implementing OASES aviation maintenance software, allowed FL Technics to expand and open 8 new service lines in Germany, Spain, Russia, the UK and Latvia.

AFI KLM E&M, an MRO subsidiary of KLM and Air France, is an even greater Lean/Agile success story, repeatedly recognized by Aviation Week magazine as aviation MRO of the year. The company, which goes by the full name of Air France Industries KLM Engineering & Maintenance (AFI KLM E&M), ranks number two globally in multi-product MROs with third-party revenues of around \$1.4 billion. In 2019, Aviation Week's [award announcement](#) specifically cited the company's "commitment to adaptiveness" and track record of innovation, both hallmarks of Lean transformation.

Pratt & Whitney, one of the world's largest airline manufacturers and MROs, [implemented Lean practices](#) more than 15 years ago and has seen remarkable results that have contributed to its recent rapid growth. The company first introduced a Lean-based program of continuous improvement, Achieving Competitive Excellence (ACE) in 2005, and in 2009 introduced Set-Based Concurrent Engineering (SBCE) and other Lean systems to support value streams and reduce product development time.

In 2020 [the company announced](#) it had expanded its global network of MRO facilities, including Delta TechOPS in the US and locations in Poland and India, and was also expanding its North Berwick facility to service new modules. The company estimates it has achieved a 64- to 88-percent return on investment with the application of Lean thinking, and its achievements earned it a place in the book Lean Product Development Best Practices.

"We can see the benefits many aviation MROs have achieved through the application of Lean thinking, and many more aviation MROs should be able to share these advances," says Mehdi Chelhi, Principal at Four Principles.

If you are interested in undergoing a Lean Aviation MRO transformation, Four Principles offers expertise, experience and effective techniques to achieve tangible results that can be sustained over time. Please contact us at info@fourprinciples.com or call our Dubai office at +971 4 368 2124 or our Riyadh office at +966 11 297 8016 to find out how we can help take your business to the next level.

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