The Future of MRO

Executive Summary

Today, unscheduled aircraft maintenance costs airlines $10,000 for every hour spent on the ground performing maintenance, repair, and overhaul (MRO). Beyond that, the cumulative losses associated with the loss of customer experience and the loss of revenue quickly add up. From a macro outlook, the MRO industry is also undergoing a transformational change. The business changes from market consolidation, fleet turnover, and new aircraft technology coupled with the dramatic changes in IT technology is heralding a new era. By 2020, virtual reality, artificial intelligence, mobile, wearables, Big Data in the cloud and 3D printing would have a significant impact on the MRO industry. The industry is expected to top USD 80 Billion by 2022.

Some of the most significant changes are already happening. A study conducted by Boeing Research and Technology concluded that augmented reality technology increased MRO service professional performance by 30% on speed and 90% on accuracy compared to a PDF document. IFS flight logs have leveraged smart phones to eliminate paper use. Several airlines, such as Virgin America, Endeavor Air and WestJet, have embraced cloud computing systems for managing aircraft maintenance records. Boeing has been using the 3D technology to produce hinges, while Rolls-Royce and GE have started to incorporate this technology to produce lighter engines.

With these all-round structural changes, the question that remains is: How is your organization positioned for continued success in the future?
Introduction

A foundational transformation is reverberating throughout global aviation. This shift results from a combination of multiple, massive airline industry changes occurring concurrently. Market consolidation, fleet turnover, changing business economics, and new aircraft technology are some of the priority areas for the MRO industry. Experts project the world airliner fleet to grow from approximately 23,000 today to 44,500 by 2033. Over the previous decade, airlines have increased their fleets by an additional 5,172 aircraft and those fleets are expected to grow by an additional 3.1% compounded annual growth rate (CAGR) over the next decade. This growth in the number, variety, and maintenance requirements of the worldwide fleet presents a tremendous challenge and a huge opportunity for companies who have already jumped on the MRO bandwagon. It is estimated that there will be a 4.1% CAGR in MRO spending. The 2017 MRO market is worth $61 billion, a $15 billion increase since 2007. The value of the MRO market is expected to top $80 Billion by 2022.

As the global commercial aviation sector grows, it continues to struggle with issues of cost, profitability and changing customer expectations. New aircraft types will have longer planned maintenance intervals, while the existing fleet will stay in service for up to 20 to 25 years. That is where MRO providers have a huge role to play. According to the findings of Oliver Wyman, the average cost of maintenance is now more than US$1,200 per flight hour for a commercial aircraft. Even a 1% improvement in the efficiency of engine maintenance alone will save the airline US$250 M. The key is to focus on the four areas of MRO – airframe, engine, component and line.

The following sections highlight the software technological advances and trends as it relates to MRO.
MRO and Virtual Reality

Virtual reality today is still in its creative infancy and is hailed as the new multi-billion technology. The future of Virtual Reality is expected to generate much higher momentum in the upcoming years. Today, flight simulators are used for time and cost effective training without using any real aircraft. Virtual reality (VR) and Augmented reality (AR) technology applications are slowly becoming more common across aircraft hangars worldwide because of the increasing popularity of wearable consumer tech such as Google Glass and Oculus Rift headsets.

A study conducted by Boeing Research and Technology on AR technology revealed a sharp contrast in output among trainees that used a PDF on a computer compared to another group that was given a tablet loaded with AR technology applications. The study concluded that the AR technology helped the group perform 30% faster and 90% more accurately than the other group.

Virtual reality’s most significant benefit is its ability to make the participant feel present in any location or time. This prime benefit is especially beneficial for the airline industry because it helps create a perfect environment by creating training scenarios anywhere in the virtual world’s airports. Therefore, investing in its future potential for cutting costs on maintenance and repair would position the company to maintain a competitive edge.

MRO and Mobile

The pervasiveness of mobile technology for practical applications in the aviation industry cannot be undermined. As mobile technology has permeated every facet of our life, it presents unexplored and tremendous opportunities for activities that span the entire MRO space. It raises the magnitude of convenience by providing a breadth of accuracy and support, be it remotely or at the point of execution. This helps maximize time and streamline operations in MRO. The ability to view stock availability, check history of past repairs and approve work orders at the touch of a button is in sharp contrast to the heavily paper-reliant aviation industry.

An example would be the EmpowerMX flight logs which enable key operational data to be recorded on smartphones or tablets and which can then be transmitted back in real-time into the applications system. The main advantage includes elimination of paper records and long processes by providing a full flight log of all events including flight plans, disruptions, faults, crew, and past inspections.
Wearables offer expertise on demand remotely. They have become essential to MRO because of the need to service a vast number of aircraft. Today, wearables such as Pebble Watch and Google Glass, have brought speed and efficiency to the forefront. Wearables prove to be a highly effective solution in aircraft maintenance because they have the potential to automatically identify the spare part required by a field engineer. The information and task required can then be fed to the engineer’s wearable device. This is particularly useful in difficult maintenance environments where movement is limited such as the underbelly of an aircraft. The benefits of wearables include replicating and supporting the location of faulty wires or equipment on a grounded aircraft, notifying workers about areas that are currently being worked on, reducing time, increasing autonomy, and context-aware computing thereby leading the way for overall MRO efficiency.

EasyJet and Japan Airlines have experimented with using augmented reality glasses for their ground engineers. Working around aircraft on the tarmac, they are able to send images to maintenance specialists for assessment who then feed any issues they see back to the engineer on the ground.

Presently, some airlines are now training with smart glasses to equip their mechanics with an amplified view of their surroundings, uncovering meta-content to their wearers and providing the promise of hands-free maintenance. Considering the pace at which the aviation industry has been developing over the last years, wearable technology has massive potential to reinvent its working processes.

Big data can be mined for the right information that can be used to better drive maintenance operations, safety, efficiency, and decision making. The main issue stems from the fact that airlines don’t use their diverse data, which is typically stored in silo systems. Predictive maintenance is expected to be embraced by more aviation companies in the coming decade, substituting the industry’s proclivity for reactive and preventative maintenance methods. This can be used to aid prediction of part failure, thereby reducing the total cost of parts.

In its 2015 MRO Survey, Oliver Wyman recognized that the compilation, collection, storage and analysis of data will be key factors in aircraft health monitoring and predictive maintenance. Also, performance data about a particular aircraft allows operators to customize heavy-check maintenance for that specific tail number. Virgin America, Endeavor Air, and WestJet are examples of airlines that have embraced cloud computing systems for managing aircraft maintenance records. Another example would be Pratt & Whitney, which collaborated with technology company IBM to analyze big data from 4,000 aircraft engines to help predict faults.

Data analytics can significantly lower unplanned line maintenance by optimizing management of inventory and allocation, lowering failure, and tracking incident issues that need to be resolved quickly.
According to a new study by consulting firm Oliver Wyman, a whole wave of disruptive technology is about to hit the aviation MRO sector. More than half, or 52.8% of U.S. manufacturers believe that in the next 3-5 years, 3D Printing will be more useful in producing after-market parts or products. This is primarily because 3D printing makes it possible to order a replacement part after identifying the issue. This changes the speed and course of supply chains and alters the relationship between OEM’s and customers. In recent years, 3D printing has become a technology of great interest among manufacturers, with the likes of Airbus, Boeing and CFM International embracing it in their day-to-day operations.

3D printing and manufacturing allows civil aviation enterprises to manufacture the required part quickly, cost-efficiently and on-site. While Boeing has been using 3D technology to produce hinges, Rolls-Royce and GE have started to incorporate this technology to produce lighter engines. A recent study of 3D printing adoption by Price Waterhouse Cooper estimates the MRO market stands to save $3.4bn annually in material and logistical costs alone. The accuracy of manufacturing with 3D printing, the time saved when out in the field, as well as the potential cost savings, cannot be ignored.

3D printing is especially useful in areas where several constituent parts for an aircraft engine need to be pieced together. Another example is the creation of a metal jet engine bracket. With the help of a little crowdsourcing and 3D technology, GE and GrabCAD was able to redesign a metal jet engine bracket, making it 30 percent lighter while preserving its integrity and mechanical properties like stiffness. The impact and scope of 3D printing on MRO products is just beginning.
Conclusion

Aviation’s core elements are undergoing a wave of technological change. According to Oliver Wyman’s 2015 MRO Survey, “the use of big data in the aviation industry will become pervasive, with the rise of aircraft health monitoring and predictive maintenance systems. The way MROs touch the aircraft will change with wearable and other new repair technologies and additive manufacturing (3D printing).” Digital manufacturing technology is poised to embrace innovation to solve challenges like reducing weight and cutting down on emissions. All these advances bode well for the MRO industry of 2020.

Most travelers today only think about airline maintenance when their flight is delayed. More than an inconvenience for the passengers on board, the unscheduled aircraft maintenance also costs airlines $10,000 for every hour spent on the ground performing MRO. The airlines have to recover these costs through the checked baggage fees and pay-as-you-use fees that further aggravate the traveling public. The latest generation of aircraft produces several terabytes of data on a single transatlantic flight—which could be used to streamline maintenance operations, decrease fuel consumption, improve safety, and increase customer satisfaction.

Increases in MRO costs that go beyond maintenance costs significantly add up – rush charges for repairs and replacement parts, subsequent delays throughout the airline’s network, aircraft substitutions and many more. To avoid unscheduled maintenance issues, many airlines are evaluating MRO software that helps them manage the process across their fleets in real time. That need is spawning a lot of innovations. The numerous examples cited in this whitepaper are the latest adoption trends in the MRO space.

The question that remains is: How is your organization positioned for continued success in the future?

About EmpowerMX

EmpowerMX is a world leader in providing intelligent maintenance solutions for today’s aircraft. We are a global software company that creates innovative aviation maintenance solutions.

Our FleetCycle® software solutions with its modules enables customers to significantly improve their entire maintenance operation.

Headquartered in Frisco, Texas, with offices in Europe and Far East, EmpowerMX is uniquely focused on the aircraft maintenance industry and is managed by aviation maintenance experts.

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