

MRO SURVEY 2016

MRO BIG DATA – A LION OR A LAMB?

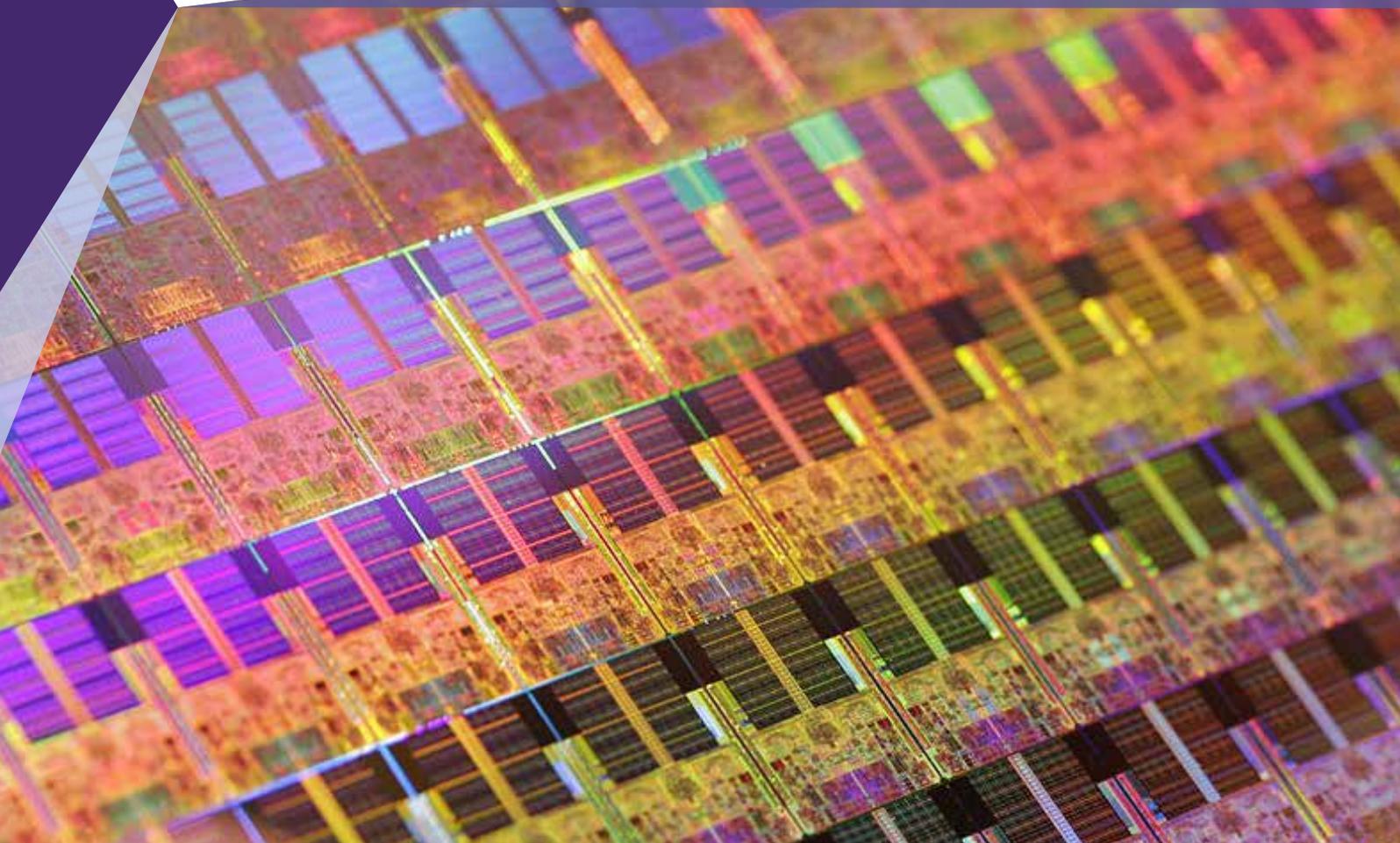
INNOVATION AND ADOPTION IN AVIATION MRO

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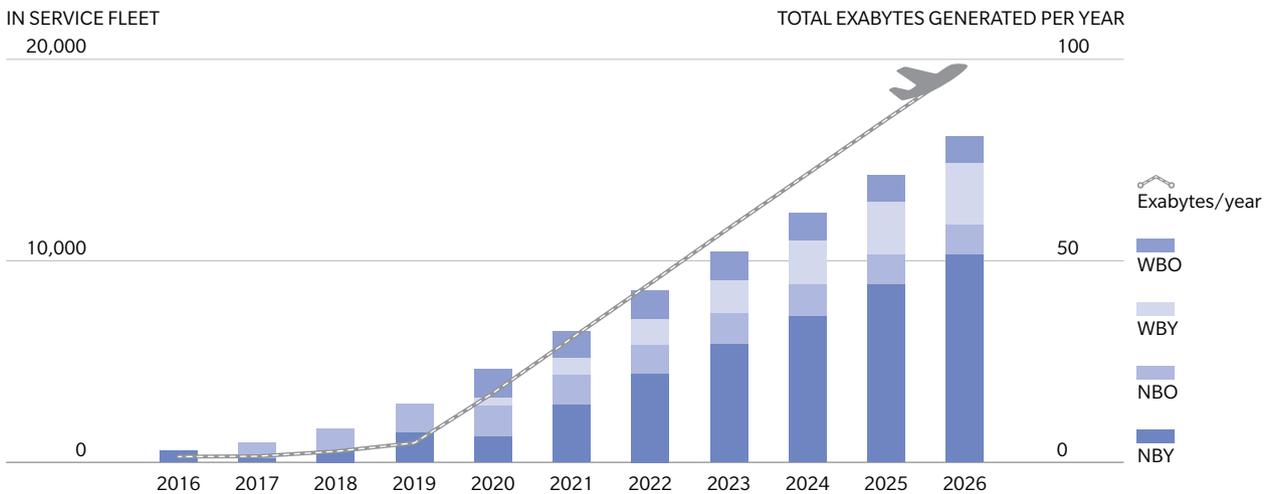
terabytes of data by 2026.

EXECUTIVE SUMMARY

Thanks to cost reductions spurred by a sharp decline in fuel prices, industry consolidation in some regions, and general capacity discipline, many carriers are enjoying improved margins and ramping up investments in next-generation aircraft and supporting technology infrastructure.

The latest aircraft designs now entering fleets are equipped with technologies that can deliver unprecedented collection and transmission of data at the system and part level. By our estimates, the global fleet could generate upwards of 98 million terabytes of data by 2026. (See Exhibit 1). This surge of data, in the hands of a new breed of data scientists and innovative management teams, could lead to major changes in how modern aircraft are cared for and perform.

Exhibit 1: Data generated from projected global fleet
 In 2026, the global fleet will generate 98 exabytes of data (That’s 98 million terabytes or 98 billion gigabytes)



Source: Oliver Wyman Fleet & MRO Forecast, www.planestats.com/betterinsight

In Oliver Wyman’s 2016 MRO Survey, we examine a variety of technology and innovation themes, including how operators, MROs, and OEMs are adopting, utilizing, and investing in big data capabilities – particularly relating to aircraft health monitoring (AHM) and predictive maintenance (PM) systems. According to survey respondents, big data in commercial aviation already has moved past the early adopter phase for some applications, with a majority reporting implementation of AHM and PM on at least a modest scale. We also discovered that airlines and MROs are beginning to see the first tangible impacts of these initiatives: measurable gains in reliability and reduced maintenance costs, particularly on engines – where OEMs lead the industry in development and deployment of these technologies.

The survey findings do not, however, support the notion of an imminent big data revolution in aviation MRO. Several obstacles could slow the scaling of these technologies within individual operators and across the industry, suggesting evolutionary progress over the next several years. In particular, ongoing legacy IT system upgrades at several carriers, unresolved industry issues regarding data standards and ownership, and still unproven business cases are moderating the pace and depth of adoption.

With commercial aviation experiencing an up-cycle, many airlines are allocating resources to large-scale MRO and enterprise IT infrastructure projects once delayed due to unprofitability. And from an industry perspective, lack of a common data standard is emerging as an impediment to more rapid acceptance.

Meanwhile, OEMs are investing aggressively in these solutions, and current adoption hurdles could mean near-term development efforts outpace operator readiness, thereby slowing the critical user feedback cycle needed to upgrade capabilities that will unlock the maximum level of return from these developing technologies.

For MROs, rising global flying capacity is providing a reprieve from a forecasted maintenance down-cycle. This may provide them with a limited window to invest in developing complementary services needed to maintain relevance, as data proliferation enables a gradual shift from diagnostic to prognostic maintenance. For more insights into fleet evolution and its impact on the aftermarket, see the Oliver Wyman 2015–2016 Fleet and MRO Forecast.

BIG DATA IS HERE – WITH A ROAR OR A WHIMPER?

Our survey shows adoption of AHM and PM is growing; although, sophistication at the user level remains nascent. Despite promising initial benefits, the nature, scope and scale of long-term effects are still to be defined.

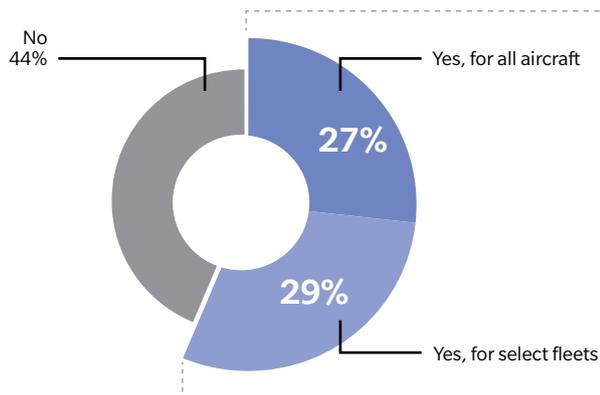
NEW TECHNOLOGIES GAINING TRACTION

Next-generation aircraft bring an array of new data collection features, and acceptance of AHM has moved beyond the early adopter stage. Of respondents, 56 percent utilize AHM for some or all of their aircraft. (See Exhibit 2). The most common application of AHM is engine condition monitoring (ECM), a long-established OEM offering. Use is less widespread within airframe and component maintenance applications, areas in which third-party or captive MROs are more common primary providers.

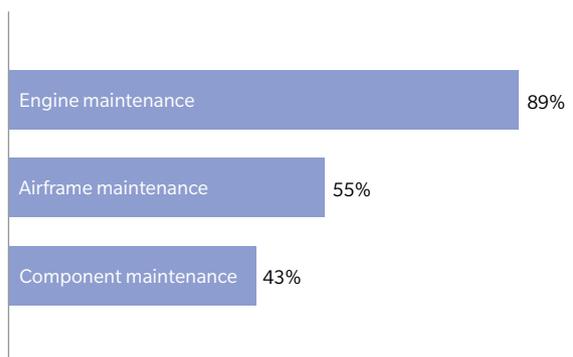
Predictive maintenance adoption lags that of AHM at only 44 percent uptake, with less than half of those respondents applying PM to all aircraft. (See Exhibit 3).

Exhibit 2: Aircraft Health Monitoring

DO YOU CURRENTLY RELY ON AIRCRAFT HEALTH MONITORING SYSTEMS TO MANAGE YOUR FLEET?^{*1}



WHERE DO YOU APPLY AIRCRAFT HEALTH MONITORING?^{*2}



*1 Percent of all respondents

*2 Multiple selections possible

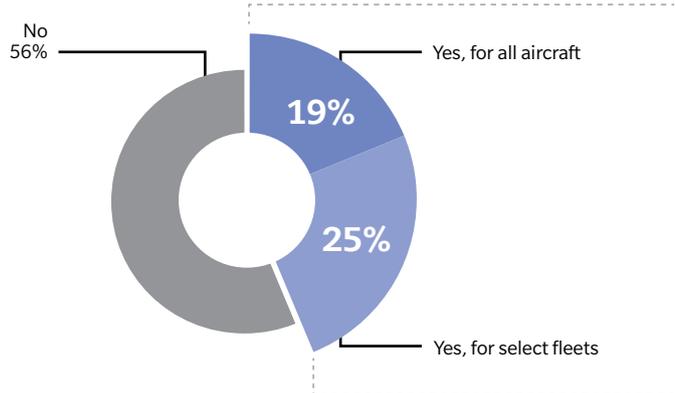
Source: Oliver Wyman MRO Survey 2016

As with AHM, engines are the primary focal point and engine OEMs again appear to be leading the way in the use of PM technologies. However, component maintenance receives more attention for PM, relative to engine maintenance, than for AHM.

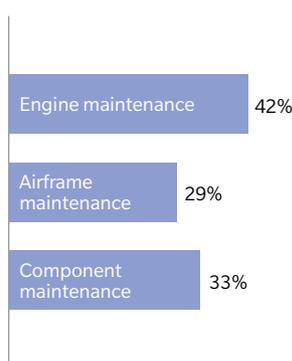
This finding is reminiscent of the defining aviation aftermarket trend of the past decade – aggressive actions first by engine OEMs and then by large component OEMs to protect intellectual property and blunt development of PMA material by independents. This trend likely foreshadows competitive efforts by OEMs to stake ownership claims on data generated by on-aircraft systems, further girding their aftermarket services offerings with data advantages that independents will struggle to match alone.

Exhibit 3: Predictive Maintenance Systems

DO YOU RELY ON PREDICTIVE MAINTENANCE SYSTEMS TO MANAGE YOUR FLEETS?^{*1}



WHERE DO YOU APPLY PREDICTIVE MAINTENANCE SYSTEMS?^{*2}



*1 Percent of all respondents

*2 Multiple selections possible

Source: Oliver Wyman MRO Survey 2016

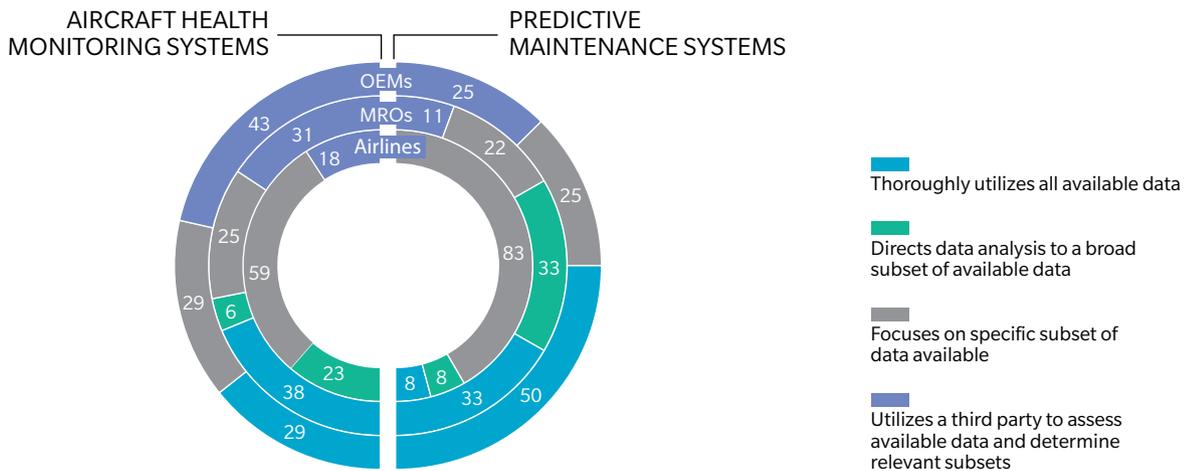
TAMING THE BEAST: MAKING BIG DATA MANAGEABLE

On-board data systems of newly designed aircraft capture reams of data not available from previous-generation aircraft, creating new storage, organization, and application challenges. As a result, many operators report modest big data programs, reflecting limited readiness for these new challenges. Fifty-nine percent of airline respondents plan to restrict AHM use to small subsets of data, either directly or through a third party, rather than pursuing a broad or comprehensive approach. For those using PM, 83 percent focus on narrow subsets, while only one in five expect to apply predictive techniques to all available data. (See Exhibit 4).

This suggests most operators are either entering big data judiciously, selecting the highest-impact and most manageable datasets upon which to build their initial analytics programs, or have not dedicated resources sufficient to manage the full volume of data available.

Without a clear plan for its collection and fruitful application, big data can bring distractions for resource-constrained operators, leading to squandered efforts or, more endemically, abandoned intentions to integrate advanced analytics into long-term maintenance strategy and technical operations. The pathway to a high-impact, productive big data platform will begin with targeted successes on modest improvement initiatives, such as statistical reliability analysis of high-failure parts, then expand to progressively larger and more structural shifts, such as artificial intelligence, to diagnose issues, signal supply chain requirements, and schedule maintenance – all before operation disrupting failures occur. Here, providers have an opportunity to collaborate with willing but unready operators to map a successful big data strategy and deepen ties as the technology proliferates.

Exhibit 4: Based on the volume of data collected by a system, our organization...^{*1}



*1 Single response only
 Note: Data in percentage
 Source: Oliver Wyman MRO Survey 2016

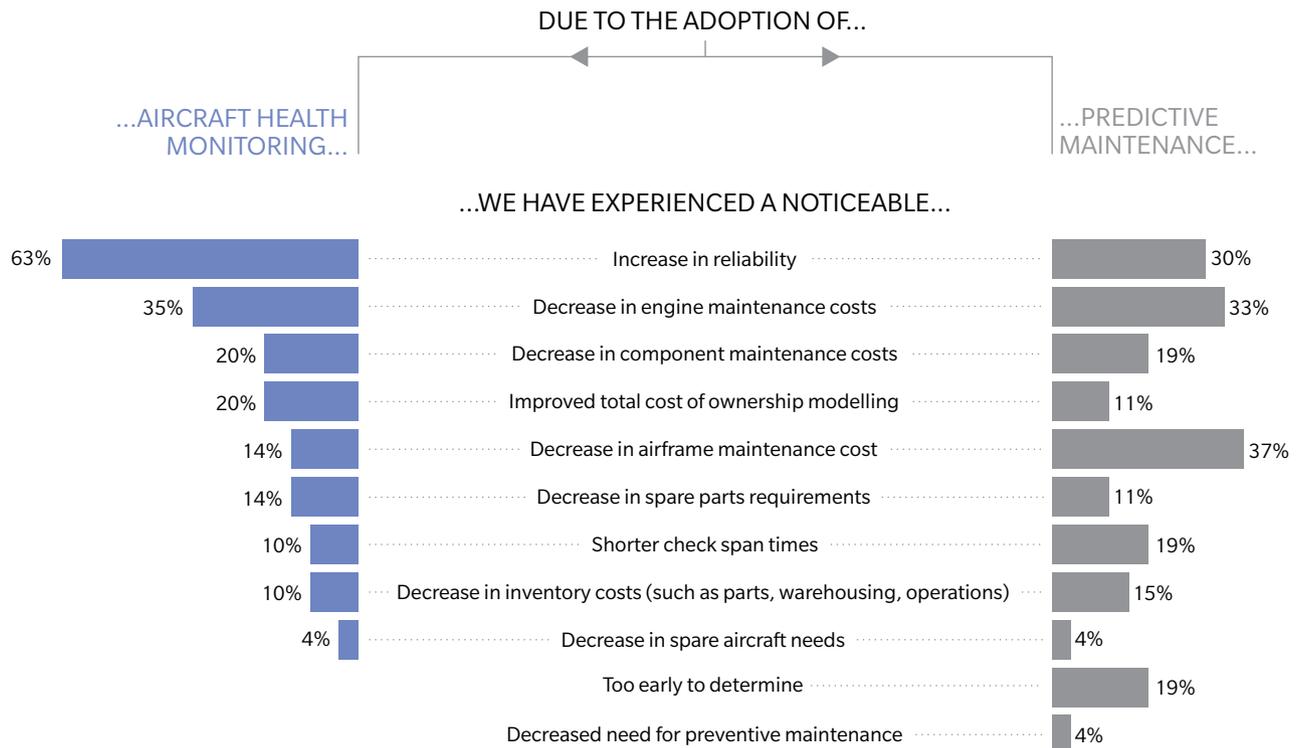
WHAT'S THE BUSINESS CASE?

To date, the business case for a wide-scale roll-out of big data solutions remains elusive for many respondents. Responding carriers using AHM, and to a lesser extent PM, are seeing improvements in reliability, but evidence of other benefits is less pervasive. (See Exhibit 5). And even if these benefits materialize, the pathway for OEMs and MROs to successfully commercialize the offering is unclear.

Outcomes like reliability gains and cost savings are tangible benefits operators can point to in justifying further investment in analytics – hardware, software, and people. And yet, other sources of value traditionally required in investment cases (such as spare parts reductions, shorter turn times) are less commonly experienced, suggesting significant work remains to tap the full potential big data technologies offer.

Even so, attitudes surrounding these technologies remain optimistic and plenty of headroom for growth exists. A large majority of respondents are “confident” or possess “growing confidence” in the value of AHM systems, while over half hold the same views regarding PM. (See Exhibit 6).

Exhibit 5: Tangible benefits measured*1



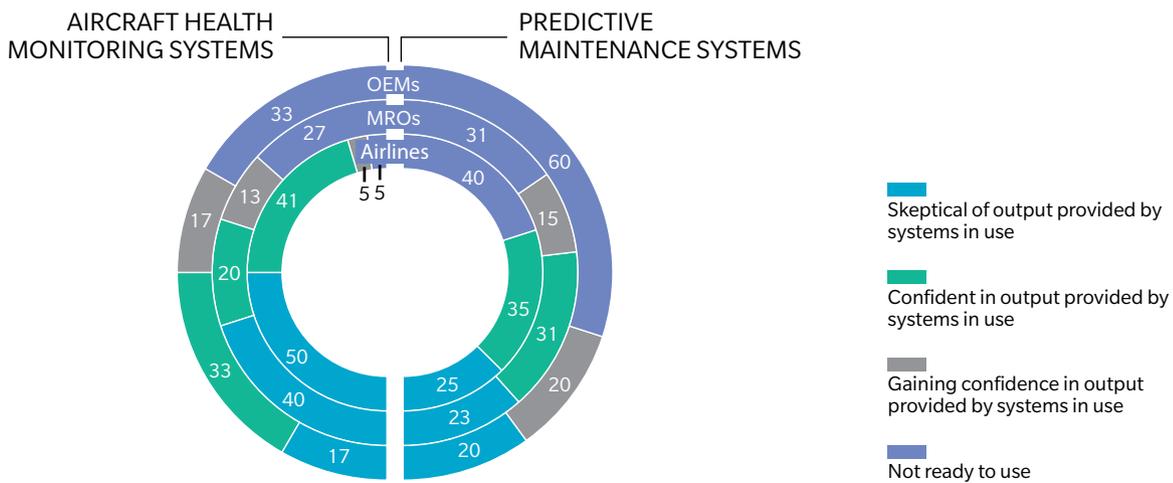
*1 Multiple selections possible

Source: Oliver Wyman MRO Survey 2016

Further, while only 8 percent of respondents said AHM has reached the level of sophistication and utility ultimately expected, 59 percent see AHM evolving into a core decision support tool. (See Exhibit 7).

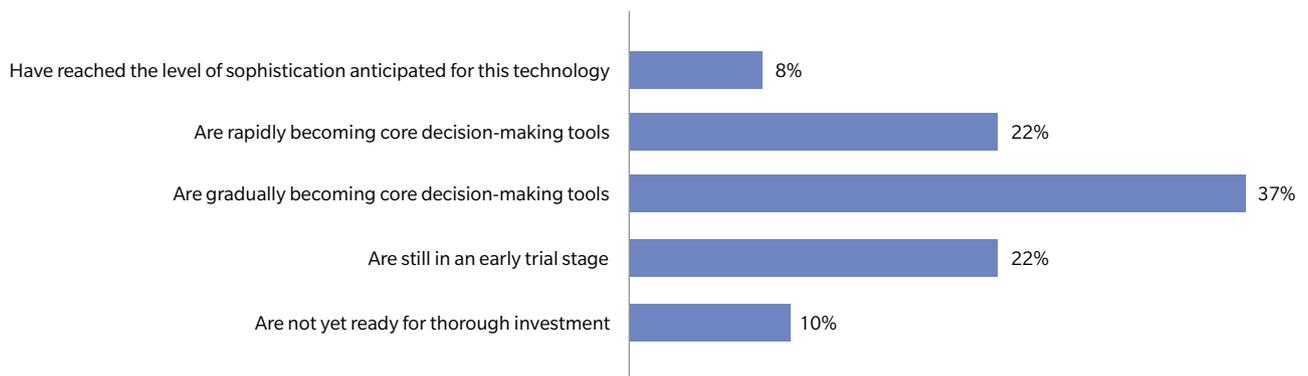
As a result, we expect investment will continue as users integrate these technologies further into airline technical and MRO organizations, possibly even ahead of an established history of tangible benefits. Tellingly, half of respondents (53 percent) said they plan to invest further in AHM over the next three years.

Exhibit 6: Management at our organization is...^{*1}



*1 Single response only
 Note: Data in percentage
 Source: Oliver Wyman MRO Survey 2016

Exhibit 7: My organization believes Aircraft Health Monitoring products...^{*1}



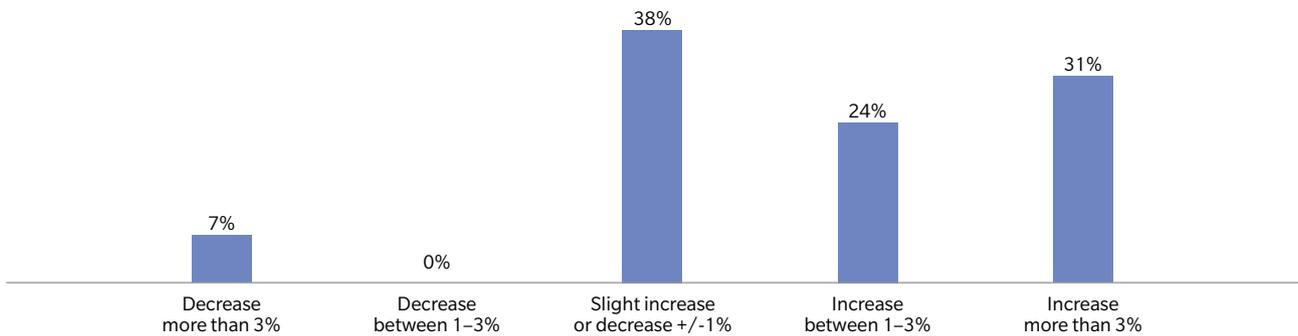
*1 Single response only
 Source: Oliver Wyman MRO Survey 2016

FIRST THINGS FIRST

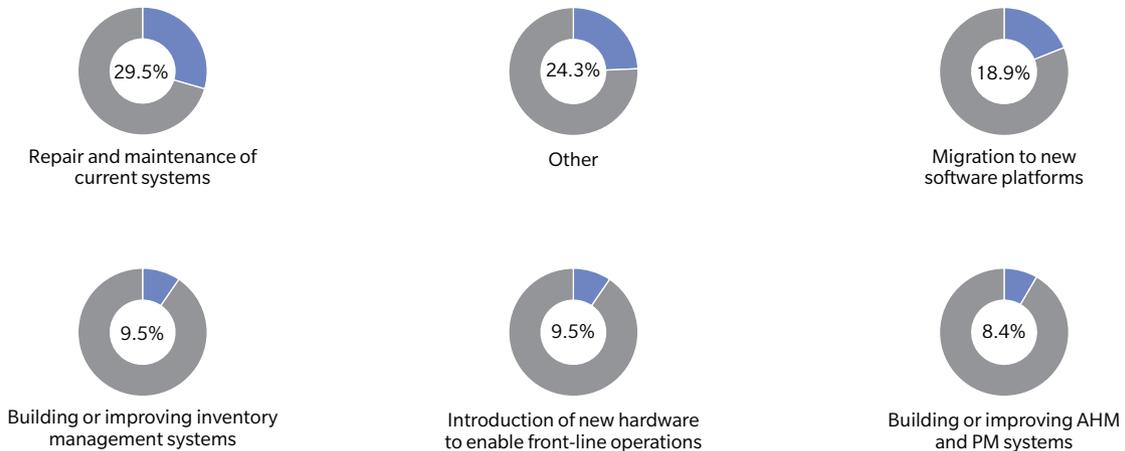
While OEMs may assume carriers are in step with their ambitions to grow AHM and PM, the airlines may not be ready to fall in line. Competing with these emerging technologies for limited IT resources and discretionary spend are investments in traditional enterprise and maintenance IT systems. Over half of our airline respondents cited plans to increase spending in this area, while investments in advanced technologies were outranked by undertakings to stabilize and improve current systems. (See Exhibit 8).

Exhibit 8: Investments in IT continue for most respondents, but airlines largely focus on current systems

RELATIVE TO 2015, OUR 2016 IT BUDGET WILL... (ALL RESPONDENTS)



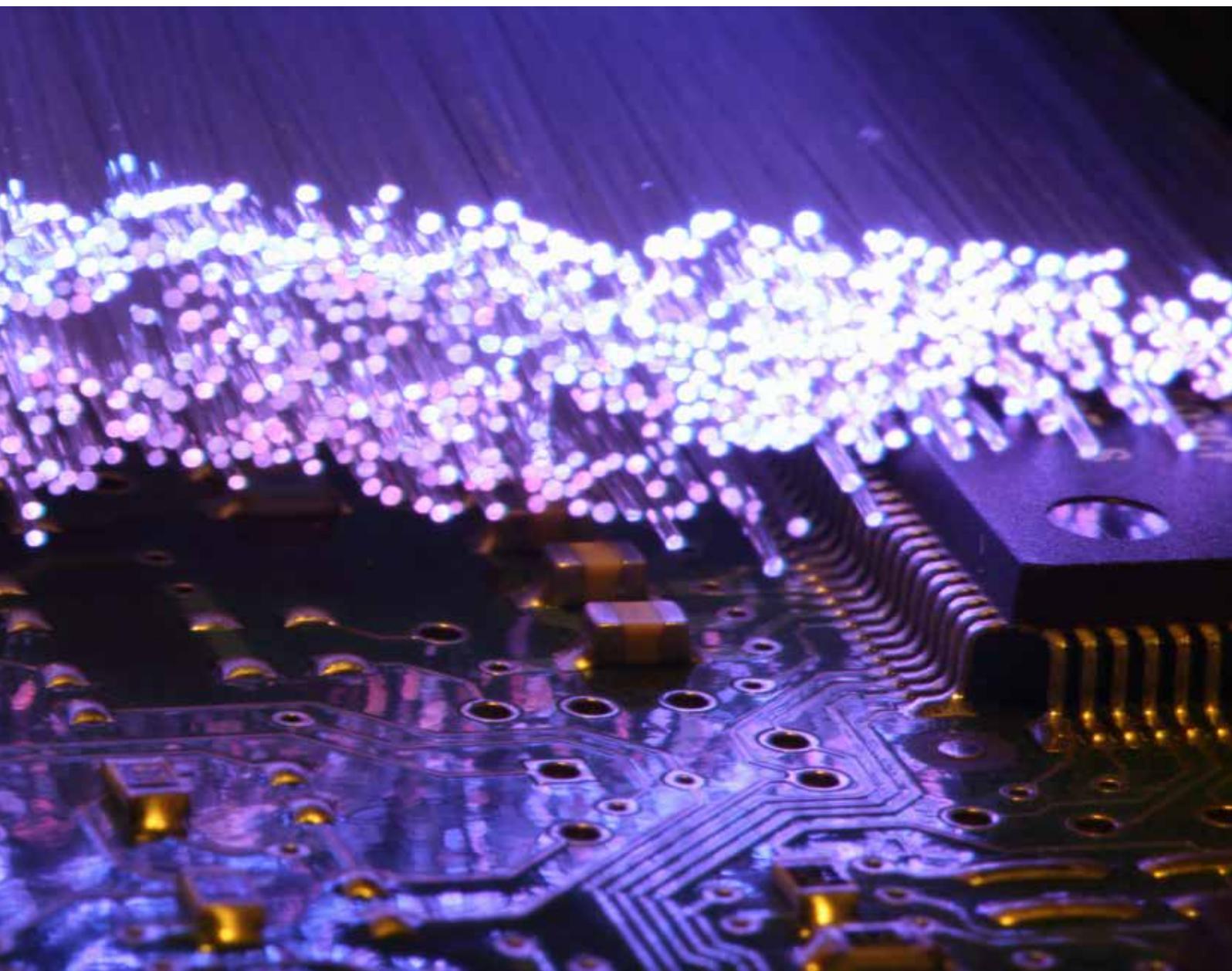
AIRLINE SPENDING BY TYPE OF TECHNOLOGY (AIRLINE RESPONDENTS ONLY)



Source: Oliver Wyman MRO Survey 2016

In addition to upgrading legacy IT systems at an operator level, accelerating the possibilities of AHM and PM technologies will be hamstrung without a data standard at the industry level. To function seamlessly across manufacturers, fleets, logistics systems, and aftermarket partners, an agreed aircraft data standard is necessary. Efforts to promote adoption of ATA SPEC2000 and iSPEC2200 standards are underway, but widespread acceptance is not yet assured. The aviation industry has calibrated itself in the past through trade associations and must do so again to preserve the momentum propelling adoption of big data strategies.

Finally, to bring the full promise of big data to bear, carriers must preserve full rights to their data, including the ability to share it with maintenance providers. If OEMs are able to deprive third parties of this data, as they have done with repair and engineering intellectual property over the past decade, third parties will struggle to develop data-centric solutions, giving OEMs a clear new advantage.



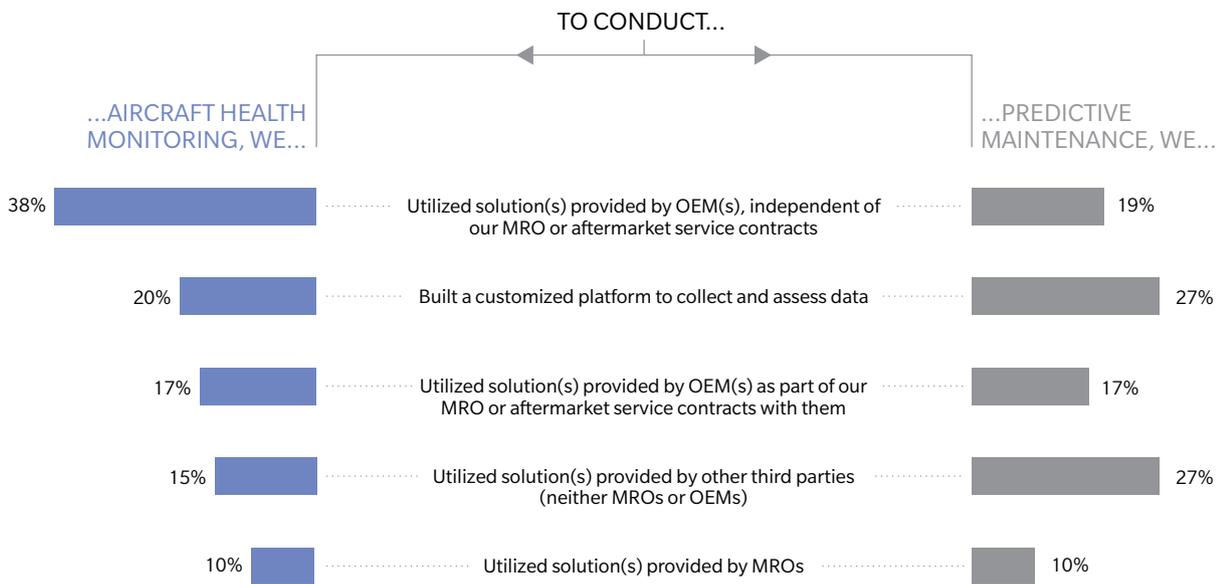
ANOTHER FRAGMENTED AFTERMARKET

Adopters are seeking various routes to build AHM and PM platforms. Leading offerings, particularly in the engine space, are driven by OEMs, but MRO, third-party, and in-house developers also have entered the fray. (See Exhibit 9).

For PM, end users are relying less on OEMs and MROs to supply packaged solutions and pursuing customized platforms or looking outside the industry for bespoke offerings.

Although OEMs, particularly for engines, have a head start in generating, parsing, and evaluating data, their focus is narrow. As with the traditional parts-and-service aftermarket, their interest is unlikely to extend beyond their own equipment. As a result, there remains room for in-house departments, third-party maintenance providers, consulting firms, IT companies, and unknown new entrants to discover value-adding niches.

Exhibit 9: A fragmented market



Source: Oliver Wyman MRO Survey 2016

WHO PLAYS WHERE

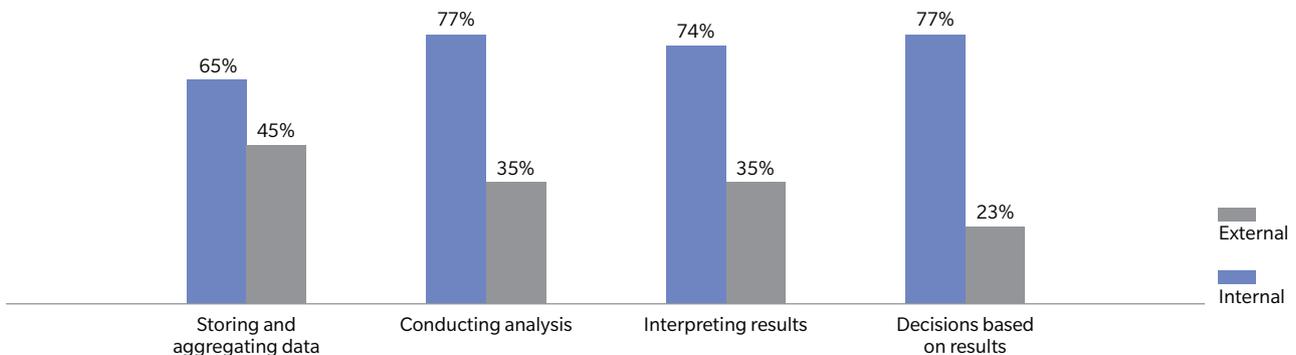
With operator sophistication lagging the pace of development, OEMs that have invested heavily in big data technology do not yet have a clear path to an associated material revenue stream. We expect OEMs to continue to press adoption, investing additional resources in promoting understanding of the technology’s potential, and advancing usage at airlines. Their path to monetizing the technology may include bundling analytics services with their aftermarket offerings or employing the data to embody performance improvements in their delivered and new-build equipment, seeking to demonstrate performance superiority to win an outsized share at the point of aircraft selection.

We expect carriers to become more purposeful and outcome oriented in their big data programs, engage a cross-section of stakeholders to understand and prioritize available data, and develop more robust business cases supporting greater adoption. They will make investments in new forms of human capital, driving demand for data scientists who can derive insights and operations analysts who can optimize and operationalize those insights. Long term, these efforts will lead airlines from static, backward-looking reliability and maintenance programs to preventive, probability-based approaches.

Other providers, including MROs, consultancies, and IT firms, will search for sustainable niches in the value chain surrounding big data. This may include partnering or building in-house capability to package data-centric services – collection, analysis, reporting, decision support, and compliance – with traditional touch maintenance. This would relieve operators of the expense of building and sustaining an in-house function while potentially accelerating adoption.

Unfortunately for these providers, respondents appear more willing to engage outside support for storage and aggregation of data than for analysis and interpretation of results. (See Exhibit 10). These downstream capabilities are more likely to become the high-value services in the big data paradigm and aspiring providers will have to overcome resistance to avoid being relegated to commodity tasks that are unlikely to generate sustainable margins.

Exhibit 10: How does your organization manage data from predictive maintenance systems?



Source: Oliver Wyman MRO Survey 2016

CONCLUSION

The advent of big data technologies will bring airlines unprecedented transparency into the condition of their aircraft. As the global fleet transitions from previous-generation to next-generation aircraft, the volume and predictive power of this big data will enable operators and providers of maintenance to better forecast, plan, and deploy aircraft assets. Players of all stripes have piled into the aftermarket, seeking to define a profitable niche, even as airlines themselves take a measured, modest approach to adoption. OEMs have captured an early advantage in deploying analytics to better manage their equipment, particularly engines. However, the market will not concede this ground easily. With major industry-level issues to resolve, such as standards and ownership rights for the new data, the eventual shape and size of this growing slice of the aviation aftermarket will not be known for several years.

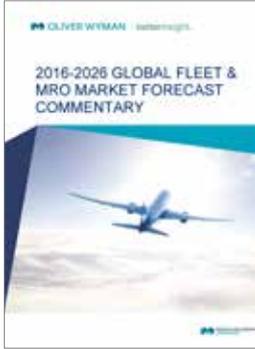
ABOUT THE SURVEY

The annual MRO survey produced by Oliver Wyman is an industry standard for information about changing trends in the MRO sector. The survey queries leaders across the MRO industry, including top executives from airline operations, procurement and engineering departments, captive and independent maintenance providers, OEM aftermarket divisions, and financing and leasing professionals. Our respondents are overwhelmingly in C-suite and senior executive positions and represent a global cross section of the industry.

The MRO Survey findings also include forecast data from our 2016–2026 Fleet and MRO Market Forecast (<http://www.PlaneStats.com/betterinsight> for more information about the forecast data).

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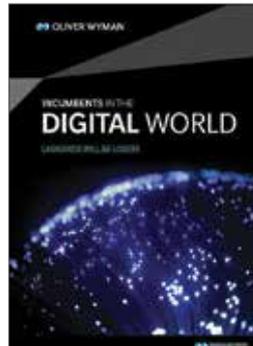
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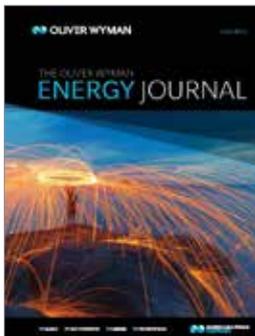
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