MRO EUROPE 2018
FORECAST & KEY TRENDS

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David Stewart, Partner
Amsterdam
Oliver Wyman’s Aviation, Aerospace & Defense practice is the largest and most capable consulting team dedicated to the industry. 

**OUR EXPERIENCE**

~250 professionals across Europe, North America, and the Middle East

Deep aviation knowledge and capabilities allow the practice to deliver data-driven solutions and provide strategic, operational, and organizational advice.

Increased technical aviation expertise in Europe from 2017 acquisition of UK based AVISA Aviation Safety Systems.

**OUR CLIENTS**

We have worked with many of the industry’s Fortune 500 companies, including:

- Leading airlines, MROs, OEMs, and independent parts manufacturers in the Americas, Europe, ME, and Asia
- Dominant aerospace and defense firms
- Regulatory bodies and Governments

**OUR APPROACH**

**Data-driven**: unbiased benchmarking and forecasting tools to establish problems and identify solutions.

**Innovative**: ideas that are forward-thinking.

**Actionable**: results-oriented recommendations.

**Collaborative**: an emphasis on working with our clients, alongside executives, management, and support teams.
This presentation incorporates Oliver Wyman’s 2018–2028 Global Fleet and MRO Market Forecast and 2018 MRO Survey, both of which are available at oliverwyman.com
1 Industry Overview
Global performance remains strong with European operators continuing to deliver strong financial performance

In spite of rising fuel prices and political uncertainty, European operators financial performance continues to improve.

Source: IATA
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As oil prices rebound, operators will face new cost pressures, particularly with the older generation widebody aircraft.

**Crude Oil and Jet Fuel Spot Prices per Gallon**
*By year/US$ BN*

- **New gen widebody aircraft are more profitable than current gen**
- **New gen narrowbody aircraft are more profitable than current gen**

Source: U.S. Energy Information Administration, Oliver Wyman Analysis
Over the past year, status changes to ~3,600 aircraft have led the global active fleet to grow by 940 aircraft, a 3.7% annual growth rate.

Year Over Year Changes to the Global Commercial Air Transport In-Service Fleet

By Transaction Type

25,368 2017 In-Service Fleet
- (1,337) Aircraft Removals
  - Storage for conversion into a freighter (8)
  - Transferred to a non-commercial operator (15)
  - Involved in an accident (16)
  - Formally retired (113)
  - Sent to storage (1,185)

2,276 Aircraft Additions
- Transferred to commercial operator (3)
- Completed freighter conversion (30)
- Unknown prior exclusion (6)
- Removed from storage (608)
- New aircraft delivery (1,629)

26,307 2018 In-Service Fleet

Translating the changing fleet dynamics into MRO, the 2018 market is estimated at $77.4 BN, with engine MRO continuing to be the driver.

2018 Global Commercial Air Transport MRO Market Forecast

By MRO Segment

- $19.0 BN Airframe & Modifications
- $32.7 BN Engine
- $12.9 BN Component
- $12.8 BN Line

Source: Oliver Wyman Analysis; Fleet & MRO Forecast 2018-2028
Though the global fleet & MRO market are expected to increase by nearly 50% by 2028, increasing costs (e.g., oil prices) and external market factors (e.g., interest rates) create considerable uncertainty.

A trade dispute between the US and large trading partners such as China could likely drive the forecasts to the lower bounds and shave several years of growth off the industry’s potential.

Source: Oliver Wyman Analysis; Fleet & MRO Forecast 2018-2028
The global fleet is forecast to grow 3.7% per annum, while the MRO market is forecast to grow at 4.5%

Global Commercial Air Transport Fleet Forecast
By Aircraft Class/number of Aircraft

Global Commercial Air Transport MRO Forecast
By MRO Segment/US$ BN

Narrow body aircraft will dominate the global fleet growth, while expensive engine shop visits associated with newer technologies will drive MRO growth

Source: Oliver Wyman Analysis; Fleet & MRO Forecast 2018-2028
Western Europe is expected to show moderate annual fleet growth of 2.8%, reaching a fleet size of nearly 6,800 aircraft by 2028.

**Western Europe Commercial Air Transport Fleet Forecast**
*By Aircraft Class/number of Aircraft*

<table>
<thead>
<tr>
<th>Year</th>
<th>Narrow-body</th>
<th>Wide-body</th>
<th>Regional Jet</th>
<th>Turbo-prop</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>2,962</td>
<td>5,178</td>
<td>6,195</td>
<td>215</td>
</tr>
<tr>
<td>'18–’23 CAGR</td>
<td>3.5%</td>
<td>-1.5%</td>
<td>2.8%</td>
<td>4.9%</td>
</tr>
<tr>
<td>'23–’28 CAGR</td>
<td>-1.8%</td>
<td>-3.5%</td>
<td>2.2%</td>
<td>-0.8%</td>
</tr>
<tr>
<td>2028</td>
<td>2,587</td>
<td>6,138</td>
<td>6,798</td>
<td>197</td>
</tr>
<tr>
<td>'18–’28 CAGR</td>
<td>-1.6%</td>
<td>-2.1%</td>
<td>2.5%</td>
<td>2.8%</td>
</tr>
</tbody>
</table>

**Western Europe Commercial Air Transport MRO Forecast**
*By MRO Segment/US$ BN*

<table>
<thead>
<tr>
<th>Year</th>
<th>Airframe &amp; Mods</th>
<th>Engine</th>
<th>Component</th>
<th>Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>$16.2</td>
<td>$18.5</td>
<td>$18.5</td>
<td>$21.7</td>
</tr>
<tr>
<td>'18–’23 CAGR</td>
<td>2.7%</td>
<td>3.0%</td>
<td>3.0%</td>
<td>3.2%</td>
</tr>
<tr>
<td>'23–’28 CAGR</td>
<td>4.3%</td>
<td>5.4%</td>
<td>5.4%</td>
<td>3.0%</td>
</tr>
<tr>
<td>2028</td>
<td>$21.7</td>
<td>$25.3</td>
<td>$25.3</td>
<td>$25.3</td>
</tr>
<tr>
<td>'18–’28 CAGR</td>
<td>3.9%</td>
<td>4.9%</td>
<td>4.9%</td>
<td>3.0%</td>
</tr>
</tbody>
</table>

Western Europe MRO spend is expected to increase 3.0% annually, driven by Engine MRO which will make up over 40% of total spend by 2028.
The industry’s OEM preoccupation
Survey respondents are still overwhelmingly concerned about increasing OEM presence in the aftermarket.

Will OEMs’ increasing presence in the aftermarket fundamentally change your market?

Distribution of total responses

- Yes: 71%
- No: 29%

Segment deep dive

Distribution of responses for each segment

- MROs
  - Yes: 64%
  - No: 36%
- Operators
  - Yes: 70%
  - No: 30%
- OEMs
  - Yes: 56%
  - No: 44%
- Other
  - Yes: 14%
  - No: 86%

Interestingly, OEMs themselves are less convinced about their impact in fundamentally changing the aftermarket.
75%+ of this year’s survey respondents see OEMs as credible in their ambitions and expect them to gain market share over the next three years.

Do you think OEMs’ growth targets for their aftermarket business’ are achievable?

- **Yes**: 12%
- **No, but they will come close**: 63%
- **No, they will miss their goal by a wide margin**: 24%

Compared to the market growth, OEMs’ share of the aftermarket over the next 3 years will...

- **Increase significantly more rapidly**: 38%
- **Increase slightly more rapidly**: 40%
- **Increase about the same**: 7%
- **Increase slightly less rapidly**: 10%
- **Increase significantly less rapidly**: 5%

Source: Oliver Wyman Analysis; MRO Survey 2018
OEMs are expected to leverage the strength of their IP positions to increase their share of the aftermarket in the near term.

How will OEM grow their presence in the aftermarket?

**Weighted average of rankings (highest to lowest ranking, scale of 1–3)**

- **Usage restrictions on existing IP and licensing**: 2.1
- **Joint ventures with existing MROs and suppliers**: 1.7
- **M&A**: 1.5
- **New internal startups**: 0.2
- **Other**: 0.2

Who is the (majority) owner of the IP your current aftermarket service offering depends on?

**Distribution of total responses**

- **A non-OEM company owns the IP**: 6%
- **My company owns the IP**: 24%
- **An OEM owns the IP**: 70%
- **Other**: 23%

Source: Oliver Wyman Analysis; MRO Survey 2018
And only the OEMs are comfortable with their IP ownership position; third party MROs clearly feel the most vulnerable.

Do you own enough of the IP or OEM authorized licensing to continue to be successful if an OEM restricts use of the IP they own or licenses they provide?

Distribution of responses

Segment deep dive

*Distribution of responses for each segment*

© Oliver Wyman

Source: Oliver Wyman Analysis; MRO Survey 2018
2b Dealing with rising costs
Almost all respondents report experiencing increasing material costs; not surprisingly, MROs and operators overwhelmingly attribute their material cost increases to OEM actions.

**Have you experienced an increase in material costs?**

**Distribution of responses**

- **Yes**: 97%
- **No**: 3%

**Main drivers of material cost increases (for yes responses)**

**Weighted average of rankings (highest to lowest ranking, scale of 1–5)**

- **Annual OEM material price increases**: 3.8
- **OEMs restricting the direct sale of OEM designed parts**: 2.6
- **Next generation aircraft**: 1.7
- **Lack of availability of USM**: 1.5
- **Supply chain failures/issues**: 1.2
- **Other**: 0.2

Source: Oliver Wyman Analysis; MRO Survey 2018
Though respondents have no single strategy to combat rising costs, many non-OEM respondents have included leveraging partnerships, USM or technology in their strategic plans.

What strategy or strategies have you adopted or are you considering to combat rising material costs?

% of respondents who selected each response (for top 5 strategies only)

- Partner with OEM to secure discounts: 60%
- Leverage data analytics, aircraft health monitoring and predictive maintenance to reduce material usage: 51%
- Increase overall usage of USM parts from any source: 50%
- Implement policy to use own USM rather than purchasing parts when able: 47%
- Implement policy to use alternative parts rather than purchasing OEM parts when able: 41%

Source: Oliver Wyman Analysis; MRO Survey 2018
An increase in USM from a small base is expected; however, lack of supply and lack of a clear sourcing strategy are big inhibitors.

### How will your USM change over the next 5 years?

**Distribution of total responses**

- **Increase rapidly**: 29%
- **Increase slightly**: 47%
- **Remain the same**: 22%
- **Decrease slightly**: 1%
- **Decrease rapidly**: 0%

### Is your use of USM inhibited?

**Distribution of total responses**

- **Yes**: 85%
- **No**: 15%

### Main factors inhibiting use of USM

**Weighted average of rankings (highest to lowest ranking, scale of 1–3) (amongst yes responses)**

- **Lack of availability**: 1.5
- **Material sourcing strategy**: 1.1
- **Lessors/financiers**: 0.8
- **Other**: 0.4

Source: Oliver Wyman Analysis; MRO Survey 2018
On the labour front, not surprisingly, W Europe is the highest technician pay rate region; E Europe and N America are on par; all other regions are substantially lower.  

1. Average estimate of current prevailing technician billed airframe rates for heavy airframe maintenance by region (in US$)  

Source: Oliver Wyman Analysis; MRO Survey 2018
And globally, respondents overwhelmingly indicate that a lack of labour supply is the primary driver of wage increases by a factor of two.

Have you experienced any upward technician wage pressure?

Main drivers of technician wage pressure (for yes responses)

Distribution of total responses

Technician retirements and a lack of new technician creation continue to squeeze both ends of the workforce spectrum – a trend that is unlikely to be resolved soon.

Source: Oliver Wyman Analysis; MRO Survey 2018
Approaches to combating rising labour costs differ; operators view outsourcing/right-shoring and data analytics as major levers, whereas, MROs and OEMs are more focused on productivity improvements.

What strategy or strategies have you adopted or are you considering to combat rising labour costs?

<table>
<thead>
<tr>
<th>Strategy</th>
<th>% of respondents who selected each response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implement job sharing, lean, and other internal productivity and efficiency strategies</td>
<td>59%</td>
</tr>
<tr>
<td>Leverage data analytics, aircraft health monitoring, and predictive maintenance to reduce labor demand</td>
<td>59%</td>
</tr>
<tr>
<td>Increase the use of technology (i.e., automation, drones and robots) to reduce labor demand</td>
<td>57%</td>
</tr>
<tr>
<td>Establish an internal maintenance technician training program (e.g., Part 147) or partner with an existing program to combat labor supply issues</td>
<td>47%</td>
</tr>
<tr>
<td>Outsource work to lower cost facilities and/or regions</td>
<td>44%</td>
</tr>
<tr>
<td>Leverage engineering capabilities by developing DER repairs and modified work scopes</td>
<td>39%</td>
</tr>
</tbody>
</table>

Source: Oliver Wyman Analysis; MRO Survey 2018
Finally, although training programmes are seen as a key to improving labour productivity, there is a large gap between importance and satisfaction across key indicators.

**Difference between average importance ranking vs. average satisfaction ranking**

*Rankings on a scale of 0 to 10; rankings of importance and satisfaction made separately*

**Improved internal training programmes may include aligning to Part 145 & 147 regulations**

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Source: Oliver Wyman Analysis; MRO Survey 2018
2c  Cybersecurity
Every day and across every facet of life, hackers are increasingly bolstering capabilities to launch cyberattacks and disrupt industries.

Nature of cyber threats has evolved drastically over just the past decade.

Experts place the number of expert, professional hackers at over 300,000 globally.

Hackers use a variety of means to achieve a number of ends.

Global counter-hacking efforts and actual damages are estimated at half a trillion US$ annually – a sum that has been increasing every year.
67% of respondents indicate they believe that their companies are prepared, yet less than half had conducted a review of cybersecurity risk in operations and maintenance in 2017.

**Is your company well prepared to handle cybersecurity threats related to operations and maintenance?**

**Has your company conducted a review of your cybersecurity risk in operations and maintenance in 2017?**

*Source: Oliver Wyman Analysis; MRO Survey 2018*
A chain is only as strong as its weakest link; stolen credentials have led to multiple significant breaches

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Details</th>
</tr>
</thead>
</table>
| **Target (2013)**                      | • Hackers used stolen credentials of a Target vendor to penetrate Target’s network  
  • Planted malware and stole **personal data of 70 MM customers** and **information on 40 MM payment cards**  
  • Cost to Target: $300 MM |
| **Third-party vendor (2014)**         | • Hackers stole log-on credentials – used to steal data from $56 MM credit and debit cards and $53 MM customer emails  
  • Cost to vendor: $180 MM+ |
| **Global Infrastructure attack (2017)**| • Hackers attacked the Ukraine with wiper malware (*NotPetya*)  
  – Wiped out data and disrupted operations across industries (banking, transportation, energy)  
  • Spread to computer systems around the world after computers at the Danish shipping conglomerate Maersk were infected (**cost to Maersk: $300 MM**))  
  • Led to serious delays in major ports (e.g. Rotterdam, Mumbai, Port of New York and New Jersey); temporary shutdown largest terminal at the port of Los Angeles |
The MRO industry has not yet had a major Target or Equifax level cyber-attack – are we next?
Oliver Wyman believes certain factors make the MRO industry a candidate for a major cyber attack

<table>
<thead>
<tr>
<th>1</th>
<th>Industry players have access to the networks of world’s airlines and OEMs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Any business in this supply chain becomes target</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>MRO providers operate across the globe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• MRO companies more vulnerable to regional disparities in security</td>
</tr>
<tr>
<td></td>
<td>• Attractive for hackers looking to cause maximum, cross-border disruption</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Industry is becoming increasingly digitized</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• More interconnectivity, more access points (e.g. Internet of Things), more direct third-party participation</td>
</tr>
<tr>
<td></td>
<td>• Difficult to control for all the hands that can come in contact with multitude of processes, systems and data</td>
</tr>
</tbody>
</table>
While the majority of companies show an appropriately elevated level of concern, our survey reveals considerable variability in levels of preparedness, creating potential for weak links in the supply chain.

Which cybersecurity safeguards has your company implemented?

% of total respondents who selected each response for each segment

<table>
<thead>
<tr>
<th>Category</th>
<th>Overall</th>
<th>MROs</th>
<th>OEMs</th>
<th>Operators</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall cybersecurity strategy for the company</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee cybersecurity training program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security standards for third party vendors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cybersecurity threat assessment</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active monitoring of cybersecurity intelligence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cybersecurity hardening of communication networks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Oliver Wyman Analysis; MRO Survey 2018
To achieve a comprehensive, unified cybersecurity and risk management approach for the industry, MRO providers should consider a comprehensive approach.

1. Evaluate current state cyber security programmes to identify areas of improvement.
2. Develop a clear framework for mitigating and managing cyber risks.
3. Fortify information technology systems and create a security-minded culture across companies.
4. Build and enhance a security minded culture and be fully prepared for when a major cyber incident happens.

While no solution is guaranteed to avert all attacks, developing a shared, holistic approach to cybersecurity risk management may give companies a material advantage.
3 Conclusions
Conclusions

The global MRO business is currently valued at $77 BN and is anticipated to reach $115 BN by 2028.

OEMs are expected to continue their push into MRO services and anticipated to hit or come close to meeting their growth ambitions.

At the same time, MROs continue to battle higher material and labour costs:
- There are no easy answers. MROs will need to use a number of countermeasures to become more efficient.

Cyber threats are mounting and causing increasing disruption across industries:
- The MRO industry has significant work to do to ensure they are well-prepared to mitigate and manage cyber risks.
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