At the 2008 MRO Americas Conference, consultancy AeroStrategy offered a vision for MRO in the year 2018

- AeroStrategy was an MRO-focused consultancy which provided market forecasts at MRO events

- At the 2008 MRO Americas in Ft Lauderdale, it offered a vision of what MRO would like in 2018

- AeroStrategy was acquired by ICF International in 2012

**HOW ACCURATE WERE THE PREDICTIONS?**
AeroStrategy predicted a 4% fleet expansion...

- The installed base of 18,935 was projected to grow 4% per annum
- At the time, there were 7,300 firm orders
- Some 4,000 retirements were anticipated over the 2007 – 2017 timeframe
…and the fleet prediction of 28K aircraft was very accurate

- Actual 2018 fleet = 28,924 vs prediction of 28,000
- Distribution is spot-on
  - 737: 25%
  - A320: 25%
  - 777: 5%
  - EMB 170/190: 5%

Sources: AeroStrategy, AeroDynamic Advisory, Alton Aviation
Asia grew faster than expected; Europe had slower growth

- **North America**
  - Predicted: 9,000
  - Actual: 8,438

- **Europe**
  - Predicted: 7,600
  - Actual: 6,600

- **Asia**
  - Predicted: 7,100
  - Actual: 8,400

- **Rest of world**
  - Predicted: 5,200
  - Actual: 5,400
  - Underestimated

**Middle East**

**Disparities in Asia and Europe**

Sources: AeroStrategy, AeroDynamic Advisory, Alton Aviation
Predictions for aircraft models was accurate but the anticipated order book was much too low

- Actual order book 2X greater than forecasted – 15K aircraft
- Accurately projected replacements for single aisles in 2014 – 2016 and 777/A330 in late 2010s (but not re-engining)
- Predicted 787/A350 XWB order book of 1,242 vs 1,370 actual
- Actual order book more skewed to single aisles than projected

Sources: AeroStrategy, AeroDynamic analysis
Predictions for the Americas and the Middle East were mostly accurate...

- Correctly forecasted consolidation to four majors and the rise of “green aviation”
- One US MRO integrator (Delta TechOps) emerged rather than two
- Anticipated the growth of Latin America in aircraft heavy maintenance
- Africa did not become a major MRO base although Morocco plays a stronger role

Sources: AeroStrategy, AeroDynamic analysis
Low cost carriers did consolidate and their growth led to more maintenance outsourcing in Europe

Missed several predictions in Europe including open skies and spin-out of AF/KLM

Eastern Europe grew MRO, but not CIS

Predictions about Asia were mostly correct, although Korea is not a major MRO player

-mostly accurate
The 2017 MRO market prediction was very accurate

The 2017 MRO Market is $61B...

2017 MRO Market $62.0B (in 2007 $)

Within 2% - not bad!
MRO outsourcing was predicted to increase significantly...
...and significant outsourcing did occur

The predicted outsourcing wave generally came to fruition

Engine predictions were spot on

Component outsourcing and airframe heavy maintenance was less than expected

Accurate on engines but overestimated outsourcing on components & AHM

Source: AeroDynamic Advisory
Aircraft OEMs did not secure significant integrated MRO contracts on new single aisles due to reengining

- New “white sheet” single aisles didn’t happen – reengining took the industry by surprise
- The high degree of component commonality killed the business case for aircraft OEM integrated MRO programs
- Boeing and Airbus have minimal penetration on the A320 neo and 737 MAX

Sources: AeroStrategy, AeroDynamic analysis
In 2008, the PMA parts phenomenon was in full swing

- Pratt & Whitney, which appeared to be exiting the engine business, targeted CFM56-3 PMAs
- Delta and Chromalloy pursued PMA LLPs on the CFM56

AeroStrategy believed that one or more lessors would accept PMAs...this did not happen

Current penetration is 2.5 – 3 %

Significantly overestimated PMA penetration
MRO macrotrend predictions were very accurate

- Licensed PMA grew as OEMs sought solutions for sunset aircraft
- Green upgrades also surged – winglets, engine modifications, and lightweight interiors
- Aircraft health monitoring grew as predicted and is a hot topic today
- Distributors consolidated as predicted
- Lessors did not offer wet-leases with maintenance

Several Other Changes Have Shaped The MRO Market In The Last Decade

2018 MRO Market Trends

<table>
<thead>
<tr>
<th>MRO Market Trend</th>
<th>Why It Happened</th>
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<tbody>
<tr>
<td>Growth of licensed PMA</td>
<td>• Significant increase in 30+ old aircraft</td>
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<tr>
<td></td>
<td>• OEM focus on core competencies</td>
</tr>
<tr>
<td></td>
<td>• Threat of competitive PMA</td>
</tr>
<tr>
<td>Surge in green upgrades</td>
<td>• Carbon taxes implemented in early 2010s</td>
</tr>
<tr>
<td></td>
<td>• Focus on fuel cost reduction</td>
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<tr>
<td></td>
<td>• OEM defensive tactics versus PMA</td>
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<tr>
<td>Greater use of advanced aircraft/engine health</td>
<td>• Need for reduced maintenance costs and greater dispatch availability</td>
</tr>
<tr>
<td>management systems</td>
<td>• Advancement of technology / algorithms</td>
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<tr>
<td>Lessors offer wet leases that include MRO</td>
<td>• Lessors pursuing competitive differentiation</td>
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<tr>
<td>Consolidation of distributors</td>
<td>• Increased OEM demand from distributors for service parts logistics</td>
</tr>
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<td></td>
<td>• Supply base of 2000s was too fragmented; consolidation was inevitable</td>
</tr>
</tbody>
</table>

Source: Secondary Research