Global Engine Fleet and Market Forecast 2015-2025

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Engine Fleet Forecast
The global air transport jet and turboprop engine fleet will grow by more than 20,000 net new engines by 2025.

2015-2015 Engine Fleet Forecast by Engine Manufacturer

<table>
<thead>
<tr>
<th>Engine Manufacturer</th>
<th>2015</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFM Int'l</td>
<td>5,000</td>
<td>10,630</td>
</tr>
<tr>
<td>GE</td>
<td>10,630</td>
<td>12,119</td>
</tr>
<tr>
<td>Pratt &amp; Whitney</td>
<td>5,898</td>
<td>9,214</td>
</tr>
<tr>
<td>Rolls-Royce</td>
<td>5,072</td>
<td>13,772</td>
</tr>
<tr>
<td>IAE</td>
<td>5,082</td>
<td>7,078</td>
</tr>
<tr>
<td>Honeywell</td>
<td>806</td>
<td>116</td>
</tr>
<tr>
<td>P&amp;W Alliance</td>
<td>292</td>
<td>744</td>
</tr>
<tr>
<td>Power Jet</td>
<td>546</td>
<td>256</td>
</tr>
<tr>
<td>New TP Engine</td>
<td>0</td>
<td>480</td>
</tr>
<tr>
<td>Aviadvigel</td>
<td>74</td>
<td>74</td>
</tr>
</tbody>
</table>

Key Fleet Forecast Highlights

- Global engine fleet will grow on average 3.4% over the full forecast period.
- Today, the top 3 engine manufacturers are CFM Int'l, GE, and Pratt & Whitney.
- CFM International's fleet has the greatest market share (36.7%)
  - More than 15 points larger than the next largest fleet
  - CFMI's installed base will widen the gap by 2025
- Pratt and Whitney also makes large gains over the next ten years, increasing their fleet size by nearly 50%.

The growth outlook, however, varies widely from region to region.
A 5 pt. spread in regional growth rates leads to a significant share shift over the decade ahead

<table>
<thead>
<tr>
<th>Region</th>
<th>2025 Engine Fleet Size</th>
<th>10YR CAGR</th>
<th>2015-2025 Absolute Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>16,504</td>
<td>0.8%</td>
<td>1,247</td>
</tr>
<tr>
<td>Europe</td>
<td>16,685</td>
<td>2.4%</td>
<td>3,506</td>
</tr>
<tr>
<td>Latin America &amp; the Caribbean</td>
<td>5,445</td>
<td>4.4%</td>
<td>1,906</td>
</tr>
<tr>
<td>Africa / Middle East</td>
<td>7,987</td>
<td>5.0%</td>
<td>3,084</td>
</tr>
<tr>
<td>Asia Pacific / China / India</td>
<td>23,942</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The mature North American and Western European markets will continue to undergo significant re-fleeting during the next 10 years
Fleet growth and systematic replacement of older aircraft with new technology aircraft will drive significant change in the engine MRO business.

2015 Engine Fleet Forecast
by Engine Model

2025 Engine Fleet Forecast
by Engine Model

Next generation engines will comprise 30% of the fleet by 2025.
Engine MRO Market Forecast
The engine MRO grows to nearly $47 billion by 2025

2015-2015 Global MRO Market Forecast by MRO Segment

2015-2015 Engine MRO Market Forecast by Engine OEM

**OEM** | **2015** | **2020** | **2025** | **CAGR 2015-2025**
---|---|---|---|---
GE Aviation | $8.2 | $10.2 | $11.5 | 3.5%
CFM Int'l | $5.3 | $7.8 | $14.0 | 10.3%
Rolls-Royce | $5.2 | $7.3 | $8.9 | 5.6%
IAE | $4.8 | $7.4 | $6.1 | 2.5%
Pratt & Whitney | $4.3 | $3.4 | $5.0 | 1.4%
GE - P&W Alliance | $0.2 | $1.0 | $1.2 | 20.9%
Honeywell | $0.1 | $0.0 | $0.0 | -26.9%
Grand Total | $27.9 | $37.1 | $46.8 | 5.3%

Engine on-wing times growing; shop visits more expensive.
New technology engines are forecast to make up an increasing share of the market over the period

2015-2025 Global Engine Fleet Forecast
Legacy vs New Generation

2015-2025 Global Engine MRO Market Forecast
Legacy vs New Generation

Largest MRO growth through 2025 for new technology engines
With 78% of the new aircraft deliveries forecast to replace older aircraft, the North American engine MRO forecast is virtually flat.

**2015-2025 North American Engine Fleet Forecast**

<table>
<thead>
<tr>
<th>Year</th>
<th>Legacy</th>
<th>New Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>15,257</td>
<td>1,768</td>
</tr>
<tr>
<td>2015-2020 CAGRS</td>
<td>17.6%</td>
<td>-2.2%</td>
</tr>
<tr>
<td>2020</td>
<td>16,027</td>
<td>3,972</td>
</tr>
<tr>
<td>2020-2025 CAGRS</td>
<td>12.8%</td>
<td>-5.2%</td>
</tr>
<tr>
<td>2025</td>
<td>16,504</td>
<td>7,258</td>
</tr>
</tbody>
</table>

**2015-2025 North American Engine MRO Forecast**

<table>
<thead>
<tr>
<th>Year</th>
<th>Legacy</th>
<th>New Generation</th>
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</thead>
<tbody>
<tr>
<td>2015</td>
<td>$8.2</td>
<td>$0.9</td>
</tr>
<tr>
<td>2015-2020 CAGRS</td>
<td>1.9%</td>
<td>-1.1%</td>
</tr>
<tr>
<td>2020</td>
<td>$7.9</td>
<td>$1.0</td>
</tr>
<tr>
<td>2020-2025 CAGRS</td>
<td>28.9%</td>
<td>-4.0%</td>
</tr>
<tr>
<td>2025</td>
<td>$9.3</td>
<td>$3.7</td>
</tr>
</tbody>
</table>

Honeymoon periods for new engines will impact the market in the near term; long term trend towards OEM engine MRO will accelerate.
With aggressive fleet renewal, interesting to consider how engine management practices change over time

Engine management practices over engine life cycle

- **Strong MRO market**
  - PBTH
  - T&M
  - New material
  - Cost/hour is key metric

- **Strong Asset Management market**
  - Exchanges
  - Leases
  - Short life builds
  - Repairs/Used material/DER/PMA
  - Cost/SV is key metric

Asset management will be very active in current/coming fleet renewal cycle
3 Divining the Future
Trends and Challenges

• Big changes underway
  – Strong world growth
  – Re-fleeting for North America
  – New technology engines as growing share of fleet

• Fuel efficiency dominates operating economics
  – Operators expect maintenance costs to be flat relative to current models

• Operators more sophisticated and demanding
  – More consideration of maintenance at the time of equipment purchase/lease
  – With fewer and more expensive shop visits, look for creative solutions at each SV opportunity

• New generation of engines are being designed by OEMs with expectation that they will control MRO over the life of the engine
  – Life cycle and roll of lessors increasingly important
  – Challenge for independent engine MRO to maintain share
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