Titanium Demand and Trends in the Jet Engine Market

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ATI Specialty Materials
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Forward Looking Statements

This presentation contains forward-looking statements. Actual results may differ materially from results anticipated in the forward-looking statements. These and additional risk factors are described from time to time in the Company’s filings with the Securities and Exchange Commission, including its Annual Report on Form 10-K for the year ended December 31, 2013.
## Commercial Aerospace Market Drivers

<table>
<thead>
<tr>
<th>Factor</th>
<th>Change</th>
<th>Specialty Metals Market Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic (RPMs)</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>Capacity (ASMs)</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>Airline Profitability</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>Fuel Costs</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>International Carriers</td>
<td>🟢</td>
<td>🟢</td>
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<tr>
<td>Growth of Low-Cost Carriers</td>
<td>🟢</td>
<td>🟢</td>
</tr>
</tbody>
</table>

(Sources: Airline Monitor, IATA press releases)
**Commercial Aircraft Engine Build Rates**

Sources: Airline Monitor, July 2014 & ATI

Build rates of Next Generation Aircraft & Engines Accelerating
### Major Engine Programs - Firm Order Book (July 31, 2014)

<table>
<thead>
<tr>
<th>Engine Program</th>
<th>Firm Order Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFM56 - 5B</td>
<td>1,446</td>
</tr>
<tr>
<td>CFM56 – 7B</td>
<td>3,588</td>
</tr>
<tr>
<td>V2500</td>
<td>1,130</td>
</tr>
<tr>
<td>CFM LEAP</td>
<td>7,170</td>
</tr>
<tr>
<td>PW 1000G</td>
<td>2,502</td>
</tr>
<tr>
<td>GEnx</td>
<td>1,062</td>
</tr>
<tr>
<td>Trent 1000</td>
<td>502</td>
</tr>
<tr>
<td>Trent XWB</td>
<td>1,484</td>
</tr>
<tr>
<td>Trent 7000</td>
<td></td>
</tr>
<tr>
<td>GE 90</td>
<td>562</td>
</tr>
<tr>
<td>GE 9X</td>
<td>572</td>
</tr>
</tbody>
</table>

Source: Aero Engine News Sept 2014

Legacy Single Aisle 6,164 (Boeing 737, Airbus A320)
Future-Gen Single Aisle 9,672 (737 Max, A320Neo)
Boeing 787
Airbus A350XWB
Airbus A330neo – just launched

Large Commercial Engine Backlog over 20,000. 2/3 are Next Generation!
The larger the fleet, the greater the demand for spare parts.

Source: Airline Monitor

Commercial Engines in Service
History and Forecast

70,000+
3.3% CAGR
Jet Engine Materials

- **Low Pressure Compressor**: Titanium
- **Combustor**: Superalloys
- **High Pressure Compressor**: Titanium/Superalloys
- **Low Pressure Turbine**: Superalloys/Powder Alloys, Gamma Ti Aluminides
- **High Pressure Turbine**: Superalloys/Powder Alloys
- **Fan**: Titanium/Composites
- **Engine Shaft**: High Strength Steels, Superalloys
Titanium Applications in Jet Engines

Fan & compressor cases, disks, blisks, impellers, blades, vanes, and fasteners
Engine Development Trends

- Demand for “Green” engines
  - Reduced noise
  - Reduced emissions ($SO_2$, $CO_2$, $NO_2$)
- Improved fuel efficiency
  - Higher operating temperatures
    - Higher temperature capable materials
  - Lighter materials
- Lower operating costs for airlines
  - Reduced maintenance intervals
  - Reduced part count
Changes in Jet Engine Design

- Limited introduction of composites
- Larger thrust engines
  - Consume more nickel-based and titanium alloys per engine
- Higher engine temperatures
  - Nickel-based alloy content in compressor growing
  - High temp powder/cast & wrought alloys
- New titanium-based materials
  - Gamma TiAl
- Advanced Manufacturing
- Additive Manufacturing
Titanium in Jet Engines

Demand Drivers

- Higher build rates
- Larger engines
- Larger global fleet for spare parts
- New engine designs
- Fuel efficient hotter burning engines