Titanium Demand and Trends in the Jet Engine Market

Hunter Dalton - ATI
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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, 2009.
## Commercial Airframe Market

### Market Drivers

<table>
<thead>
<tr>
<th>Traffic (RPMs)</th>
<th>Capacity (ASMs)</th>
<th>Airline profitability</th>
<th>Fuel costs</th>
<th>International carriers</th>
<th>Growth of low-cost carriers</th>
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(Sources: Airline Monitor, IATA press releases)
Commercial Airframe Market
2003–2013 Build Rate History & Forecast

(Source: Airline Monitor)
Commercial Jet Engines & Aero-derivative Gas Turbines

2003–2013 Build Rate History & Forecast

(Sources: Airline Monitor, Forecast International)

SPARES NOT INCLUDED
Jet Engine Materials

- Fan: Titanium/Composites
- Low Pressure Compressor: Titanium
- Combustor: Superalloys
- Combustor: Superalloys
- High Pressure Compressor: Titanium/Superalloys
- High Pressure Turbine: Superalloys
- Low Pressure Turbine: Superalloys
- High Pressure Turbine: Superalloys
- High Pressure Turbine: Superalloys/Powder Alloys
- High Pressure Compressor: Titanium/Superalloys
- Engine Shaft: High Strength Steels
Titanium Consumption in Commercial Jet Engines

Applications

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

Sources: Airline Monitor, Forecast International, ATI database
SPARES NOT INCLUDED
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
New Engines

- GEnx 787/747-8
- LeapX C919
- HF120 HondaJet
- GE38 CH-53K
- Trent XWB A350-XWB
- Trent 1000 787
- RB282 TBD
- RB262 TBD
- RB285 TBD
- PB 2011 TBD
- PW GTF C-series, MRJ, MS-21

Not a complete list of new engines or engines in development.

Growth & Competition
Changes in Jet Engine Design

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

Evolutionary Change
Titanium in Jet Engines

Demand Drivers

– Higher build rates
– Larger engines
– Spares returning
– Unique characteristics driving usage
– Challenges from new materials