



Mission Critical Metallics®

# Titanium Demand and Trends in the Jet Engine Market

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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, 2012.



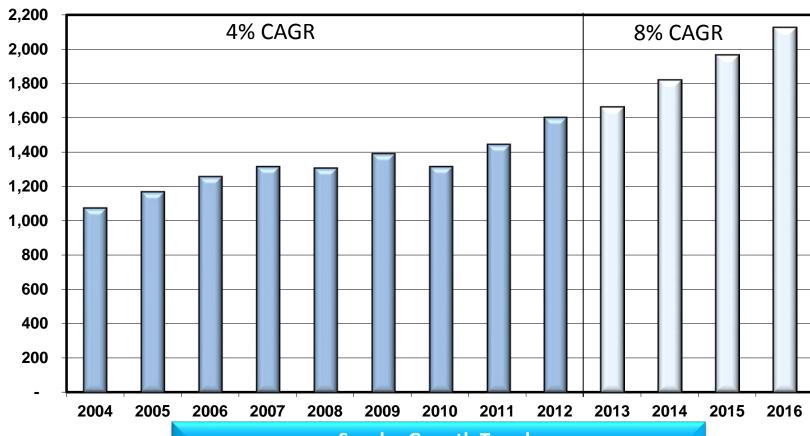
# **Commercial Aerospace Market Drivers**

	Change	Specialty Metals Market Impact
Traffic (RPMs)	1	+
Capacity (ASMs)	1	-
Airline Profitability	1	+
Fuel Costs		+
International Carriers		-
Growth of Low-Cost Carriers	1	-



# New Commercial & Military Jet Aircraft Build Rate

**History and Forecast** 



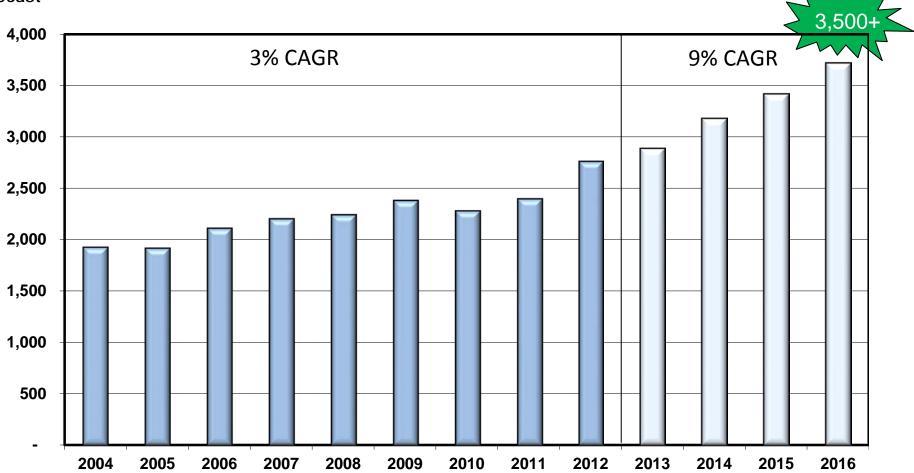
Sources: Airline Monitor, Forecast International

Secular Growth Trends
Titanium intensive airplanes
Fuel efficient hotter burning engines



# **New Commercial Airplane Engine Builds**

**History and Forecast** 

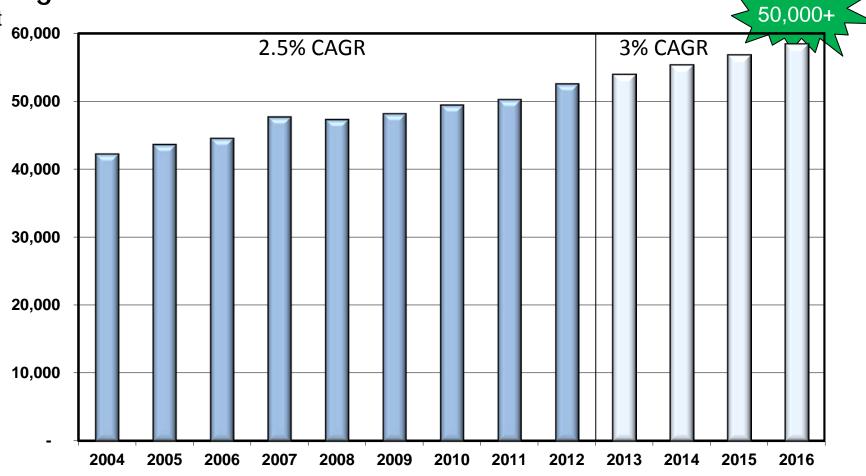


Source: Airline Monitor



# **Commercial Engines in Service**

History and Forecast

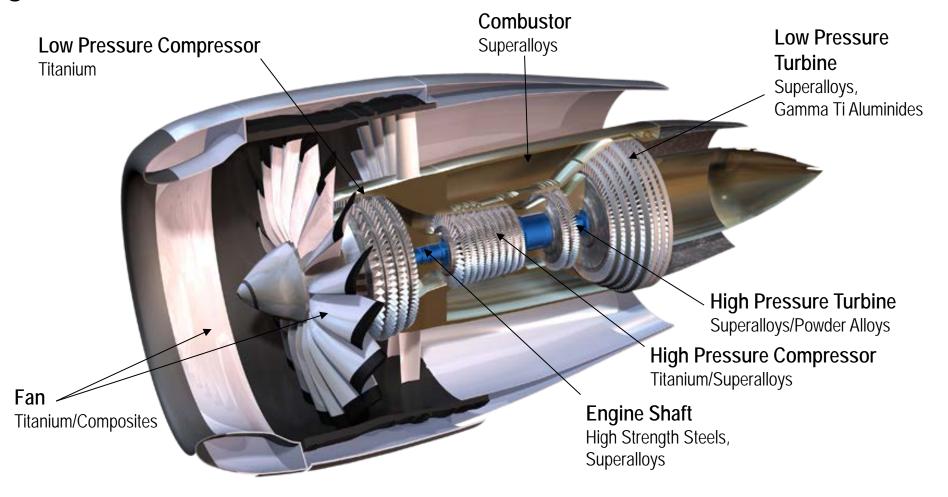


The larger the fleet, the greater the demand for spare parts.

Source: Airline Monitor



# **Jet Engine Materials**



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# **ATI Alloys in Jet Engines**

**Fasteners** Titanium

ATI 6-4™

Stainless & Specialty Steel

ATI A286™

Nickel & Cobalt-Based & Superalloys

- ATI 718™
- ATI 718Plus®

#### Niobium

ATI Ti45Nb™

#### Bellows Honeycomb.

#### insulation & Tubing

#### Titanium

- ATI 3-2.5™
- ATI 425® ATI 6-2-4-2™
- ATI 6-4™
- ATI 6-4 ELI™

#### Stainless & Specialty Steel

- AM 350®
- ATI 15-7™
- ATI 219™ (21-6-9)
- ATI A286™

#### Nickel & Cobalt-Based & Superalloys

- ATI 600™
- ATI 625™
- ATI 718™
- ATI 718Plus®
- ATI HX™

#### **APU Disks**

Nickel & Cobalt-Based & Superalloys

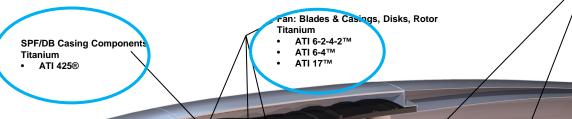
- ATI 720 PM™
- Low Carbon Astroloy

Bearings, Gears & Shafts Stainless & Specialty Steel

- ATI 1014™
- ATI HCM3™
- ATI HCM5™
- ATI RBD™
- ATI Vascomax® C-250™

Nickel & Cobalt-Based & Superalloys

ATI 718™



Compressor a Turbine: Disks, Rotors, Blades & Vanes

#### Titanium ATI 6-2-4-2™

- - ATI 6-2-4-6™ ATI 6-4™
- ATI 8-1-1™
- **ATI 17™**

#### Gamma Ti Aluminiae Stainless & Specialty Steel

#### ATI A286™

ATI FV448™

Casings & Rings

Stainless & Specialty Steel ATI A286<sup>™</sup> Steel

Nickel & Cobalt-Based

ATI 263™ Nickel

ATI 625™ Nickel

ATI 718™ Nickel

ATI HX™ Nickel

ATI 718Plus® Nickel

ATI GTD-222™ Nickel

ATI Waspaloy<sup>1</sup> Nickel

ATI X-750™ Nickel

- ATI FV535™
- ATI Jethete™ M152

#### Nickel & Cobalt-Based & Superalloys

- ATI 718™
- ATI 718Plus®
- ATI 720™ ATI 901™
- ATI HX™
- **ATI Powder Superalloys**
- Rene 65™
- ATI Rene 95™
- ATI Waspaloy<sup>1</sup>



- ATI 617™
- ATI 625™
- ATI 718™
- ATI 718Plus®
- ATI HX™

#### Niobium

ATI C-103™

Combustors & Liners Nickel & Cobalt-Based ATI 188™

- ATI 718™ ATI 718Plus®
- ATI HX™
- ATI L-605™

<sup>1</sup> Trademark of Pratt & Whitney





# **Titanium Applications in Jet Engines**

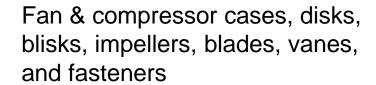












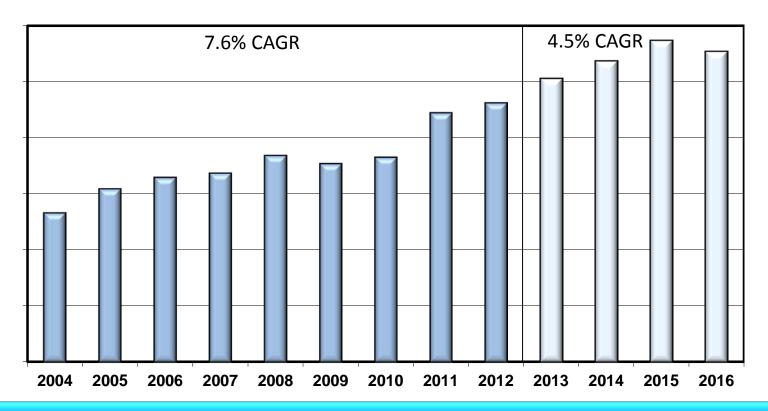






### Titanium Demand for New Engine Builds

**History and Forecast** 



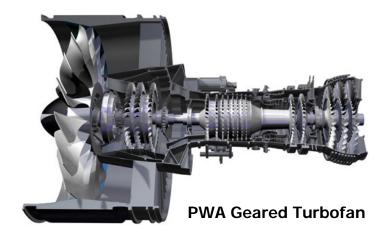
- Fundamental drivers & backlogs remain strong.
- Large commercial engines driving titanium demand.
- Near-term shipments impacted by lower demand for spares and inventory reduction throughout supply chain in 2012 and 1H 2013

Source: Airline Monitor; ATI Estimates



### **Engine Development Trends**

- Demand for "Green" engines
   Reduced noise
   Reduced emissions (SO<sub>2</sub>, CO<sub>2</sub>, NO<sub>2</sub>)
- 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
- 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







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