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Creating the Equation for Growth

Global Commercial Aero Turbofan Engine Market, Supply Chain and Opportunities: 2011 - 2017

Lucintel Brief

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Lucintel

1320 Greenway Dr., Suite 870, Irving, TX 75038, USA.

Tel: +1-972-636-5056, E-mail: helpdesk@lucintel.com

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Executive Summary

- **Commercial aero turbofan engine on new airframe deliveries totaled 1,862 units in 2011. Turbofan engine deliveries realized 1% CAGR during the 2006-2011 time frame. Engine market was US $16.7 billion in 2006 and reached $21.2 billion with CAGR of 5% during 2006-2011.**
- **CFM International is the leading turbofan engine manufacturer in the narrow body aircraft market, capturing 62% market share of the active fleet. GE dominates in wide body aircraft with 48% share.**
- **Major drivers of this industry include growth in air traffic, environmental regulation, the need for economization to enhance airline profitability/competitiveness, and the replacement of aging fleet.**
- **Commercial aero turbofan engine on new airframe deliveries in terms of units is expected to growth with CAGR of 5% during the 2012-2017 time frame.**
- **Some of the emerging trends in aero engine market include: (1) use of second-generation biofuels, (2) lower maintenance cost, and (3) design & development of fuel-efficient and light weight aero engines**
- **Titanium, nickel, and steels are the dominating materials in aero engine design – with an increasing interest in composites.**
- **Aero engines to be qualified and released during the forecast period include the CFM LeapX and the PW1000G Geared Turbofan. The manufacturers of these engine cite the following advantages: (1) Enhanced fuel efficiency over current market offering, (2) Reduced emission of NOx and CO_2 (3) Lighter weight**
- **China Commercial aircraft COMAC C919 will be launch with CFM LeapX engine but in future China has plan to manufacture engines for the airframe domestically.**

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Global Commercial Aero Turbofan Engine Market Overview

- An aircraft engine is the primary component of the propulsion system for an aircraft that generates mechanical and in-flight electrical power.
- This market is dominated three major manufacturers: GE Aviation (a subsidiary of General Electric, based in Evendale, Ohio, US); Pratt & Whitney, (a subsidiary of United Tech-nologies Corporation, based in Hartford, Connecticut, US); and Rolls-Royce (Derby, UK).
- The industry is also characterized by consortiums: International Aero Engine (Pratt & Whitney, Rolls-Royce, and MTU); CFM International (GE and Snecma); and Engine Alliance (GE and Pratt & Whitney).
- Revenue-sharing partnerships play an important role in how the industry operates. Several suppliers are involved in this type of relationship with engine OEMs, including Volvo Aero, IHI, KHI, MHI, and Avio SPA.
- The Trent 1000 and GEnx are the newest engines in the fleet, soon to be followed by the CFM Leap-X and PW1000G Geared Turbofan.

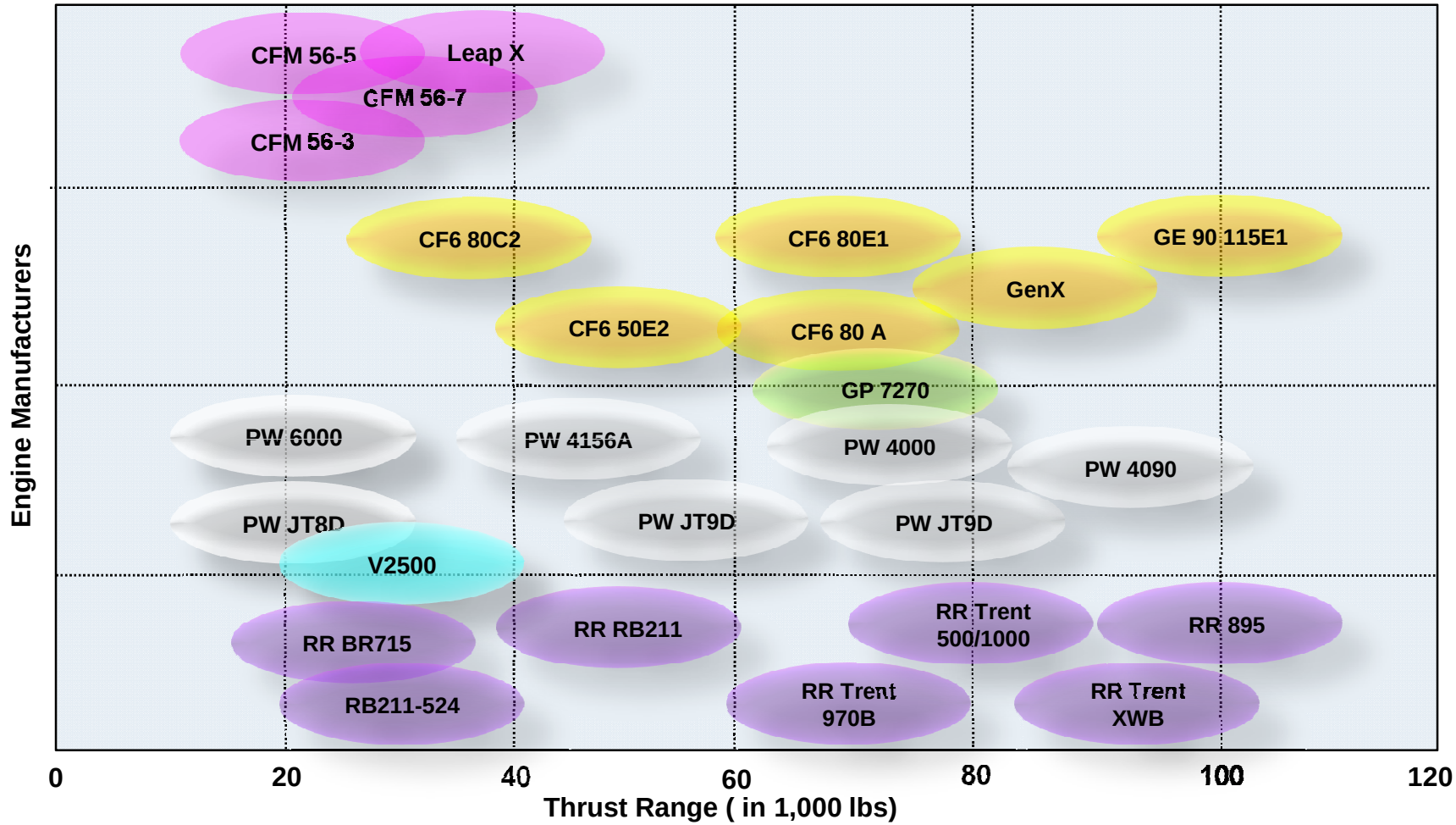
Commercial Turbofan Engine OEMs on Wide Body Aircraft (Engines with Thrust Range of 60-90 K Lbs.)

Aircraft	Rolls-Royce	Pratt & Whitney	General Electric	CFM (JV: Snecma & GE)	International Aero Engines (JV: PW, RR,MTU)	Engine Alliance (JV: GE & PW)
A310		●	●			
A330	●	●	●			
A340	●			●		
A350	●					
A380	●					●
B767		●	●			
B777	●	●	●			
B787	●		●			
B747	●	●	●			

Commercial Turbofan Engine OEMs on Narrow Body Aircraft (Engines with Thrust Range of 20-40 K Lbs.)

Aircraft	Rolls-Royce	Pratt & Whitney	General Electric	CFM (JV: Snecma & GE)	International Aero Engines (JV: PW, RR, MTU)	Engine Alliance (JV: GE & PW)
A318		●		●		
A319/320/321				●	●	
A 320 Neo				●		
B737				●		
B757	●	●				
B737 Neo				●		
Comac C919				●		

Portfolio of Commercial Turbofan Engines for Wide & Narrow Body Aircraft



GE Engines | RR Engines | PW Engines | JV: GE & PW | CFM Engines | JV: PW, MTU & Japanese Aero engine

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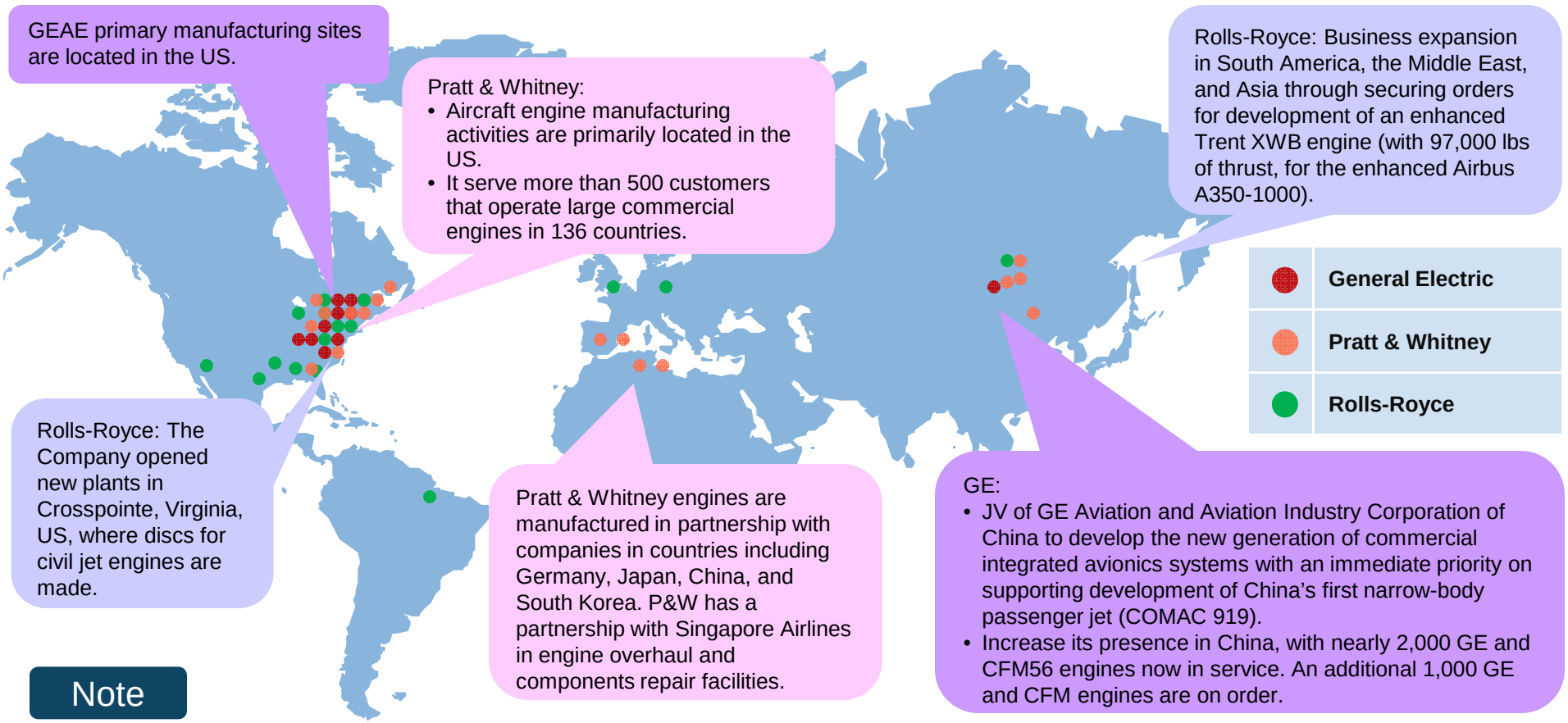
Geographical Footprint: Commercial Turbofan Engine Manufacturers

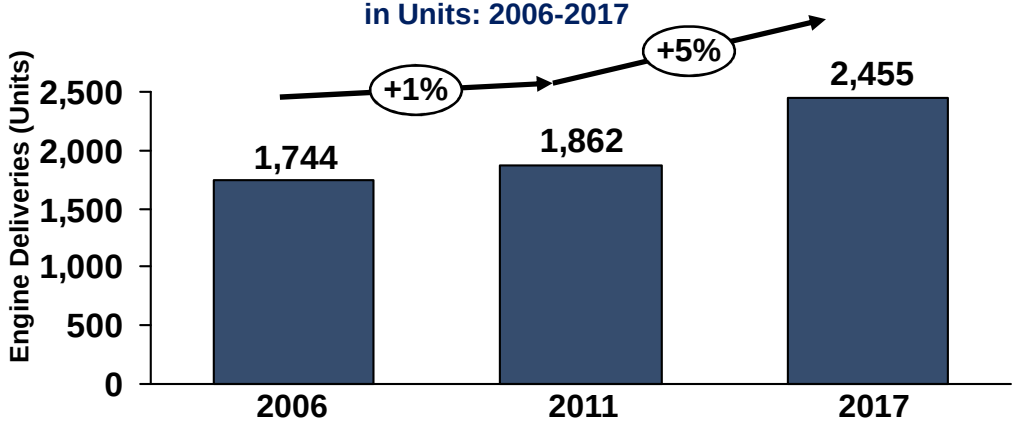


Note

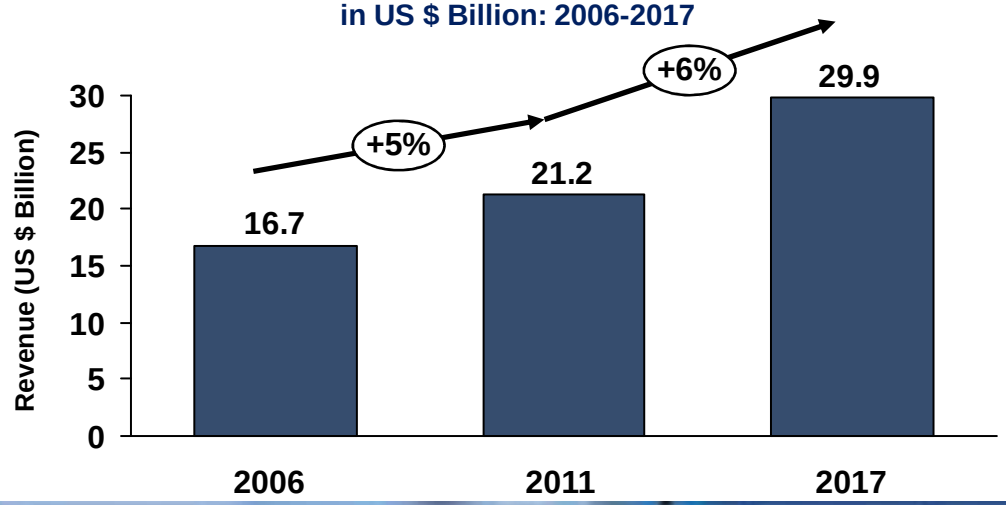
- CFM International is a joint venture between GE Aviation, a division of US-based General Electric and Snecma, a division of Safran of France, with manufacturing of engines in their respective facilities.
- IAE International Aero Engines AG is a joint venture between Pratt & Whitney of the United States and MTU Aero Engines of Germany, with manufacturing of engines in their respective facilities.
- Engine Alliance, a 50/50 joint venture between General Electric and Pratt & Whitney, with manufacturing facilities mentioned above.

Global Commercial Turbofan Engine Market Trend and Forecast: 2006-2017

Global Commercial Turbofan Engine Trend and Forecast in Units: 2006-2017



Global Commercial Turbofan Engine Trend and Forecast in US $ Billion: 2006-2017

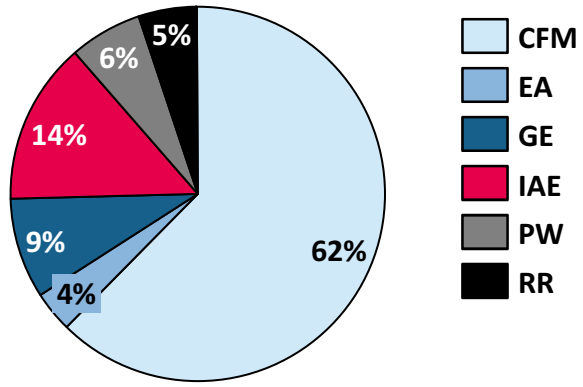


Key Insights

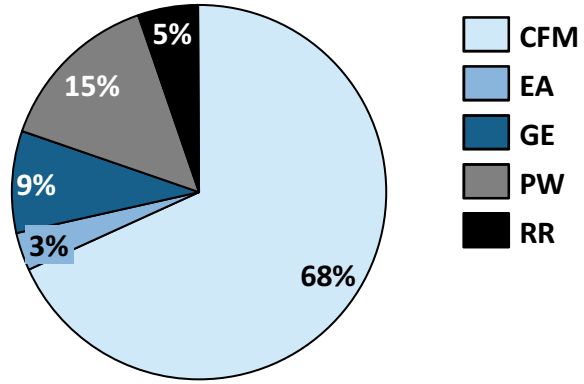
- Global commercial aero engine shipments totaled 1,744 units in 2006 and grew at a CAGR of 1%, reaching 1,862 in 2011
  - CFM International and IAE are the major players driving the market.
- The industry realized revenues of $16.7 billion in 2006, growing to $21.2 billion by 2011, at a CAGR of 5%
  - Engines for narrow body aircraft made up 81% of the market on a volume basis, and led industry growth with a CAGR of 20%.
- Commercial aero engine market is expected to reach $29.9 billion by 2017 with a CAGR of 6% from 2012-2017
  - CFM and PW are expected to be the dominant engine manufacturers for next-generation narrow body aircraft.

Global Commercial Turbofan Engine Market by Manufacturer: 2006-2017

Global Commercial Turbofan Engine Market Share 2011
1,862 Units Delivered



Global Commercial Turbofan Engine Market Share 2017
2,455 Units Delivered



Key Insights

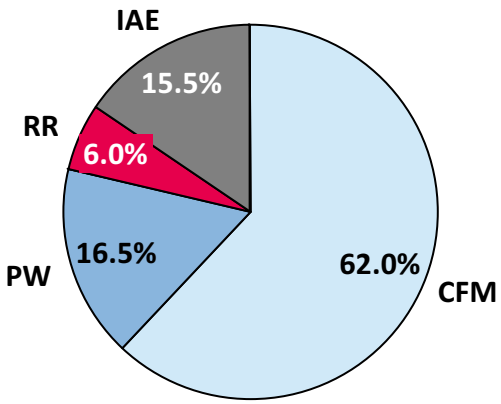
- Highly consolidated industry, with top 3 major players controlling 85% of the total market
- The market is dominated by CFM, accounting for 62% of the market in 2011, followed by IAE.
- CFM International, a 50-50 joint venture between Snecma and GE, manufactures the CFM56, one of the most fuel-efficient aero-engines in the market.
  - New CFM engines reduce NO_X emission by 25%, and are powering several aircraft, including A319, A320, A321. and B737.
  - With its new Geared Turbo Fan engine, PW share is expected to grow at the expense of IAE and, to a smaller extent, CFM.

CFM dominates narrow body turbofan engine fleet with 62% market share
GE dominates wide body turbofan engine fleet with 48% market share in 2011

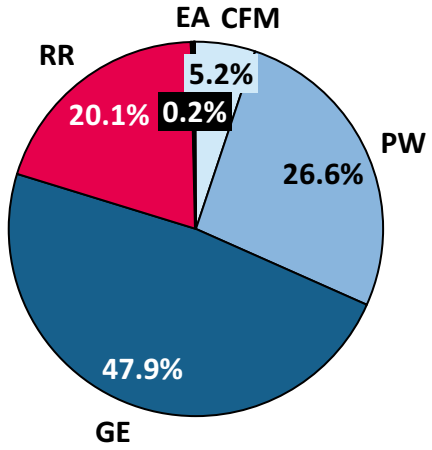
Aircraft Type	PW	GE	RR	CFM	IAE	EA
Narrow Body	◔	○	◔	◕	◔	○
Wide Body	◑	◑	◔	○	○	○
		●	◕	◑	◔	○
Range		76%-100%	51%-75%	26%-50%	6%-25%	0%-5%

World Aircraft Active Fleet Market Share by Engine Manufacturer 2011

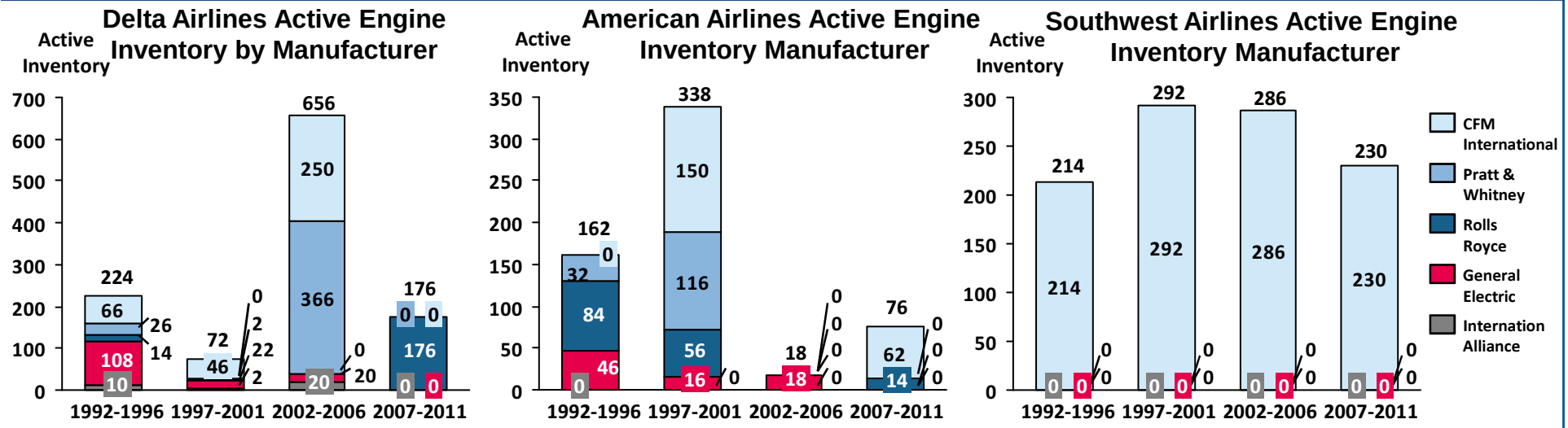
Narrow Body Active Fleet
Total Fleet in 2011:11,576

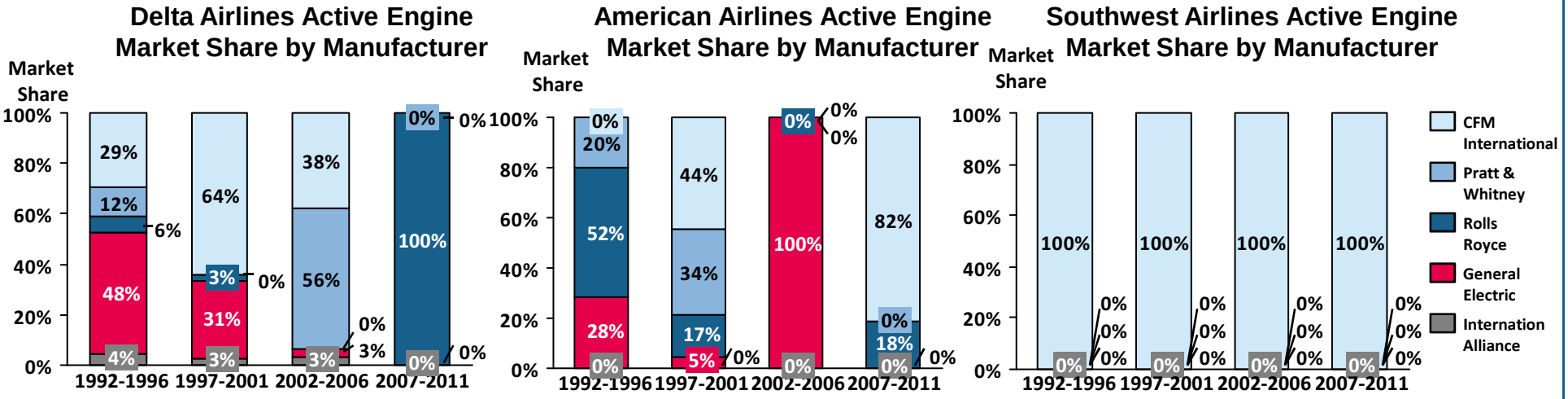


Wide Body Active Fleet
Total Fleet in 2011: 4,317



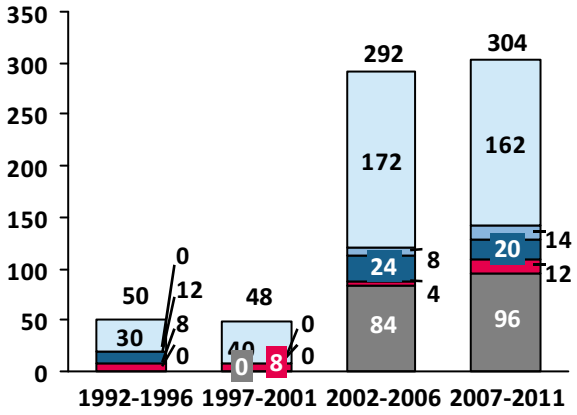
Top 6 Airlines: Turbofan Engine Inventory by Age and Manufacturer



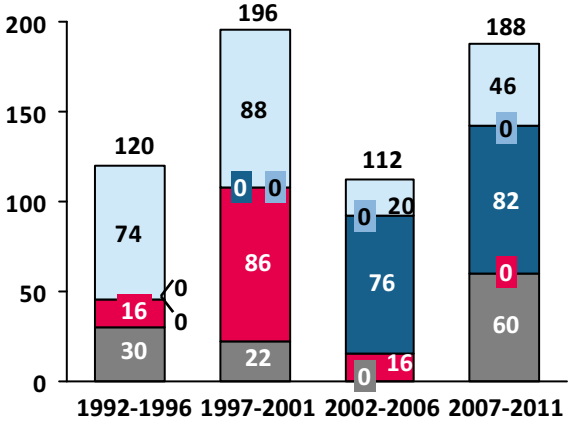


Top 6 Airlines: Turbofan Engine Inventory by Age and Manufacturer

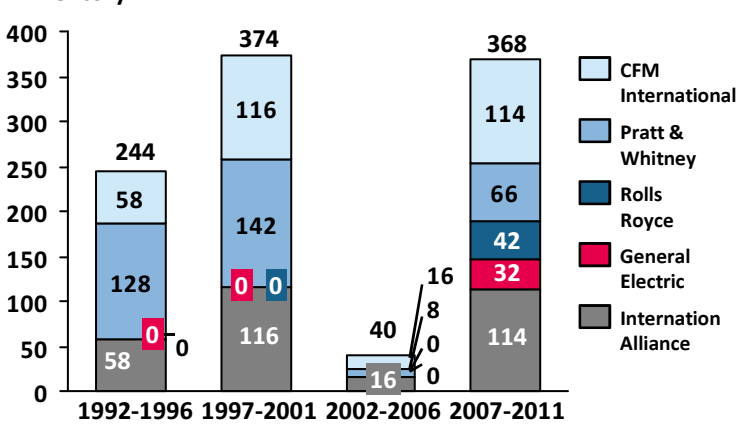
China Southwest Active Engine Inventory by Manufacturer



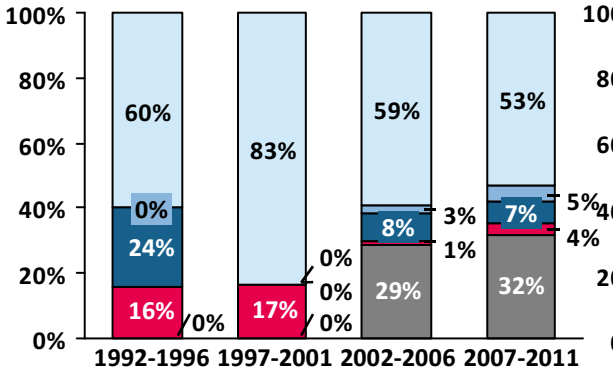
Lufthansa Airlines Active Engine Inventory by Manufacturer



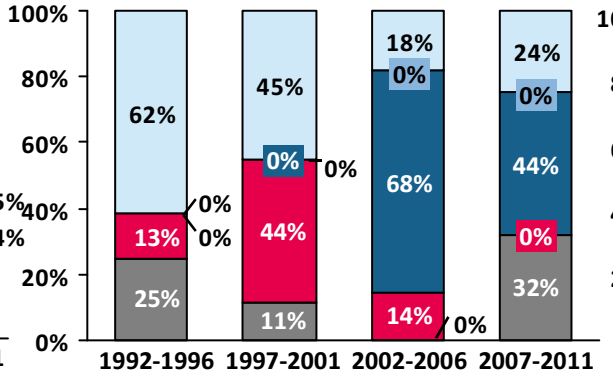
United Airlines Active Engine Inventory by Manufacturer



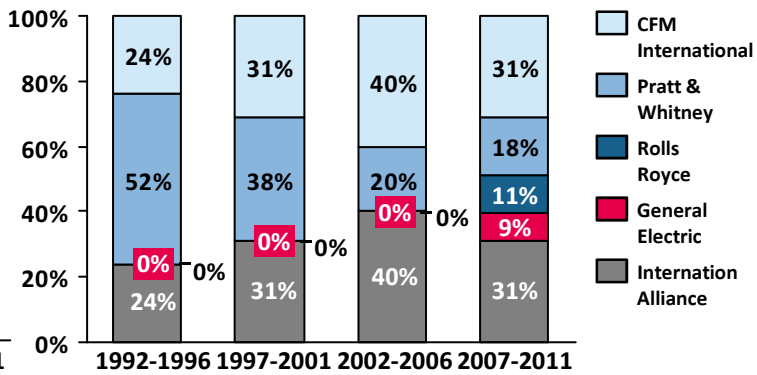
China Southwest Active Engine Market Share by Manufacturer



Lufthansa Airlines Active Engine Market Share by Manufacturer

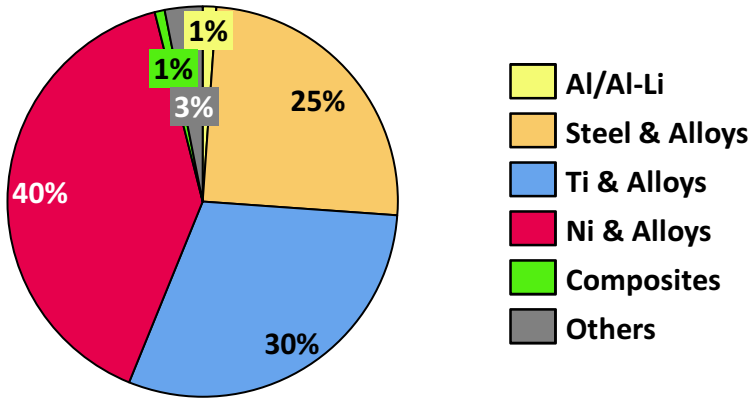


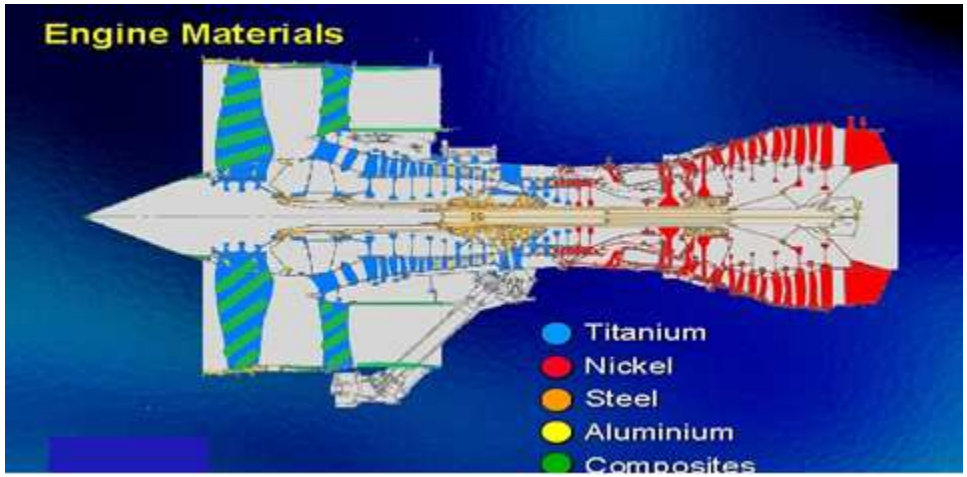
United Airlines Active Engine Market Share by Manufacturer



Material Composition in Turbofan Engines

Material Composition in Turbofan Engines by Total Weight of Engine





Source: Rolls Royce

Key Insight

- Titanium, nickel and steels are the dominating materials in aero engine design – with increasing interest in composites.
- Industry-wide requirements for enhanced fuel efficiency is driving the need for lightweight engines.
- Environmental regulators are requiring reductions in both noise and carbon emissions.
- Fans made of woven carbon fibers rather than titanium have been demonstrated to enhance fuel efficiency by up to 15%
- Sophisticated airfoil design, advanced nickel-based super alloys, and thermal barrier coatings have allowed for hotter, more complete combustor burn, thus reducing carbon emissions and affording designers greater thrust options.

China Aero Engine Industry

- Chinese players will bring major changes to aerospace industry dynamics in the coming years by launching its new commercial aircraft and engine in international market
- The country's aerospace industry is developing under the Chinese government's five year plan with the following goals:
  - Development of COMAC C919 narrow body aircraft
  - Initially C919 will be launch with CFM LEAP X engine
  - Longer term engine for C919 to be manufactured domestically
  - Five year plan clearly states the development of civil aircraft and engine, engines in pipeline by China aero engine manufacturers are
    - CJ-1000A
    - CJ-1000AX
    - CJ-1000B ER
- MTU Aero Engines of Germany and the Chinese engine manufacturer AVIC Commercial Aircraft Engine Co. Ltd. (ACAE) have signed an agreement on key terms for a possible cooperation on the future CJ1000 engine

Upcoming China Aero Engines

CJ-1000A

- Launching Year: 2016
- Application: C919 Basic
- Specific Fuel Consumption: 0.53 kg/(kgf.h)

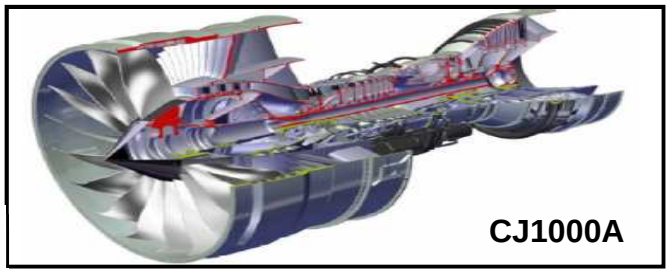
CJ-1000AX

- Launching Year: 2022
- Take-off Thrust:~12800kgf
- Specific Fuel Consumption:~ 0.53 kg/(kgf.h)

CJ-1000B ER

- Launching Year: 2026
- Take-off Thrust:13400kgf
- Specific Fuel Consumption 0.52 kg/(kgf.h)

The CJ-1000 Engine Family



- China Jet CJ-1000A is the domestic engine designed and built for C919 150-seater commercial aircraft
- Initially C919 will be launch with CFM LeapX engine
- In the longer term, the C919 will be powered by a domestically produced engine
- Certified and into-production by 2020
- Demonstrator engine to be produced by 2016
- Take-off thrust: ~14000 kgf
- SPF: ~0.52 kg/kgf.h
- Bypass Ratio: >9
- OPR: ~40
- HPC Pressure Ratio: ~20

Drivers and Challenges of Commercial Turbofan Engine Market

Drivers

- **Increasing Traffic Forecast**
  - Traffic growth on the existing route network where it is more efficient to add capacity than frequency
  - Some 1,300 very large aircraft to meet passenger demand are required in future years; increasing population; urbanization and increasing world disposable income is leading to demand for new aircraft
- **Demand for Light Aircraft and Low-Cost Carriers**
  - Soaring fuel prices has pushed the demand & need for lighter aircrafts among airliners to leverage their shrinking bottom-lines
  - Continued growth of LCCs, especially in Asia
- **Retro-fitting of New Engines in Existing Aircraft**
  - Retro-fitting of new engines in aircraft-Leap X in A320neo family of aircraft
  - Leap-1B in B737 Max
- **Fuel-Efficient Engines**
  - Manufacturing fuel-efficient engines that can emit less CO_2 and NOX
  - Emerging regulatory requirement to reduce greenhouse gas emission

Challenges

- **Increase in Prices**
  - Increase in material pricing such as the price of titanium
  - Cost of fuel also affects the engine market
- **Tough Regulations and Certification Process**
  - Stringent certification process discourages market entry
  - Market requirement for 20% improvement in operating economies to launch next-generation narrow body
- **Meeting Technological Changes and other Challenges**
  - Technological changes taking place over time
  - Capacity issues, difficulties in hiring skilled and less expensive labor
  - Challenges in adding production facilities are major constraints for engine manufacturers

Factors Shaping the Outlook for the Commercial Turbofan Engine Market

Usage of Composites, Ceramics & Super Alloys

Advanced Material usage such as increase in use of composites, ceramics , and super alloys in aeroengines. These materials offer several key advantages in engine design:

- Lower maintenance cost
- Lower weight
- Ability to integrate structures
- Better hi-temperature performance
- Improve fuel efficiency
- Satisfy safety standards

Increasing Use of Biofuels & Green Aero Engines

More efficient "**Green Aero Engines**" are now a market imperative. Factors that facilitate green aero engines:

- Emerging regulatory requirement to reduce greenhouse gas emission

Biofuels are the primary means of reducing the carbon footprints, key advantages of biofuels are:

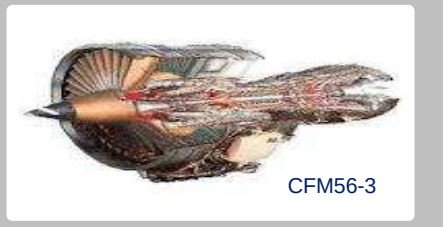
- Improves efficiency
- Reduces emission from aviation
- Reduce dependence on fossil fuels

Increasing Air Traffic, Market Liberation & Developing Infrastructure

All these are pushing global aerospace engine market toward growth

- Traffic growth on the existing route network where it is more efficient to add capacity than frequency
- Increasing population; urbanization & increasing world disposable income is leading to demand for new aircraft
- Increase in new airline networks due to turning global cities & new routes are leading to new aircraft procurement

Prognostics and Diagnostics & Escalating PMA Parts



Growing use off **Prognostics & Diagnostics** have become a core element of engine OEM value proposition

- New generation aircraft designs feature heavy use of prognostics, diagnostics, and health monitoring systems

Escalating PMA parts trends beneficially affecting commercial aerospace suppliers

- Rising PMA parts could reshape the MRO market
- PMA parts currently 2% to 3% of total parts consumption by value

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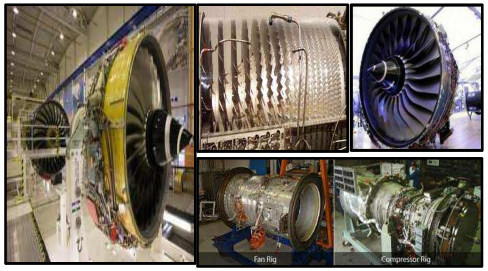
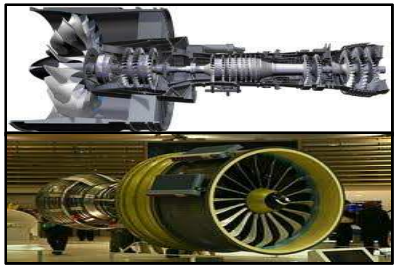
Supply Chain: Global Commercial Turbofan Engine Market





Raw Material Suppliers

- Hexcel
- Alcoa
- Hadco
- RMI Titanium
- VSMPO
- ASM
- Allegheny Technologies
- Compos Flex, Inc.
- Others

Aero engine Component (Tier I & II) Suppliers

- Precision Castparts
- Alcoa Howmet
- Blades Technology Intl.
- Carmel Forge
- Aerospace Industrial Development Corp.
- Xian Aero Engine
- Turbocam International
- Twigg Corporation
- Barnes Aero
- SIFCO Industries
- Avio S.p.A.
- IHI
- KHI
- MHI
- Volvo Aero
- Others

Engine Manufacturer

- Rolls Royce
- Pratt & Whitney
- General Electric
- CFM International
- IAE
- Engine Alliance
- Others

Customers

- Delta Airlines
- American Airlines
- China Southern Airlines
- Air China
- United Airlines
- Boeing
- Airbus
- Others

Global Commercial Turbofan Engine Manufacturing Decision Process

Process Driver
Influencer
Follower

Decision Process

Product Design & Development	Material Selection	Prototyping & Testing
• Parameters • Specifications • Lifecycle Needs	• Type of material selection	• Testing • Gap Analysis • Improve as needed

Commercial Aero engine

Role of Airline (End User)			
Role of Airframe OEMs			
Role of Aero engine OEMs			

Key Insights

- In life cycle of engines, the engine OEMs are responsible for the following activities:
  - Marketing & Design: Preliminary design studies & market studies, definition of engine with new technology concepts
  - Development Stage: Program launch, engine design, manufacture of first development parts & assembly of development engines
  - Production and Distribution: Parts sent to assembly shop, engine assembly , start of full engine & flight tests
  - Sales and Support: Marketing, sales, and contract negotiations (vendors and customer support)
  - Maintenance, Repair, and Overhaul (MRO): Troubleshooting, repair or restoration, re-assembly, test & reinstallation
  - Spare parts: Forecast customer needs, component delivery, customer-oriented service

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Technology Roadmap of Turbofan Engines

Specific Fuel Consumption

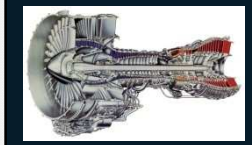
11%

JT8D-200

- SPF- 0.65 lbs/hr
- BPR- 2
- OPR- 15.4
- Thrust- 21700 lbf
- CO2 Emission- 0.8g/kg
- NOx Emission- 22.8 g.kg

14%

PW 2037



- SPF- 0.58 lbs/hr
- BPR- 4
- OPR- 29.4
- Thrust- 41067 lbf
- CO2 Emission- 0.33g/kg
- NOx Emission- 29.41 g.kg

8%

CFM 56-7B

- SPF- 0.5 lbs/hr
- BPR- 5.5
- OPR- 32.8
- Thrust- 23400 lbf
- CO2 Emission- 0.54g/kg
- NOx Emission- 20.81 g.kg

4%

RR Trent 900

- SPF- 0.46 lbs/hr
- BPR- 10
- OPR- 36.3
- Thrust- 75000 lbf
- CO2 Emission- 0.54g/kg
- NOx Emission- 20.7 g.kg

4.5%

GE GenX

- SPF- 0.44 lbs/hr
- BPR- 9.5
- OPR- 40
- Thrust- 67400 lbf
- CO2 Emission- 0.17g/kg
- NOx Emission- 18.9 g.kg

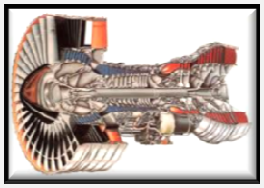
CFM LeapX

- SPF- 0.42 lbs/hr
- BPR- 10.5
- OPR- 40
- Thrust- 18000- 35000 lbf
- CO2 Emission- 16% lower (CFM56)
- NOx Emission- NOx emissions by 50 percent compared to current CAEP/6 regulations

1960 1970 1980 1990 2000 2010 2020

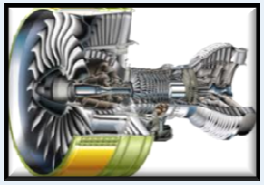
Front Runner Turbofan Engines

PW4000



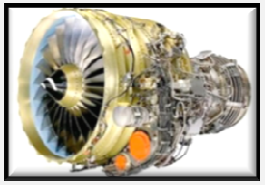
- Fan tip diameter of 100 inches
- Take-off thrust: 64,000 - 68,000 lbs.
- Bypass ratio: 5:1
- Overall pressure ratio: 32
- Fan pressure ratio: 1.75
- Four-stage low pressure compressor (LPC) and a four-stage low pressure turbine (LPT)

GP7000



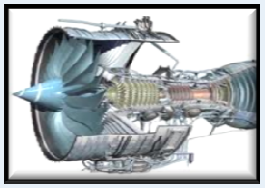
- Two-spool high-bypass turbofan engine
- Single annular combustor
- Two-stage high pressure turbine, boltless architecture, single crystal blades, split blade cooling and thermal barrier coatings, axial flow; six-stage low-pressure axial flow
- Overall pressure ratio: 43.9

CFM 56



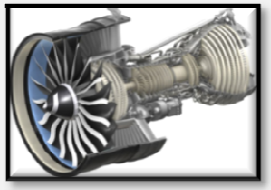
- Double-annular combustor. Instead of having just one combustion zone [Reduced nitrogen oxides (NOx) and carbon dioxide (CO_2)]
- Nine-stage high pressure compressor
- Single-stage fan, and most variants have a three-stage booster on the low-pressure shaft, with four stages in the 5B and 5C variants

Trent 1000



- Trent 1000 is three-shaft high bypass ratio (11-10.8:1) turbofan engine
- Trent 1000 has OPR of 52
- Single stage LP, eight-stage IP, six-stage HP compressor
- Single-stage HP turbine, single-stage IP turbine, six-stage LP turbine

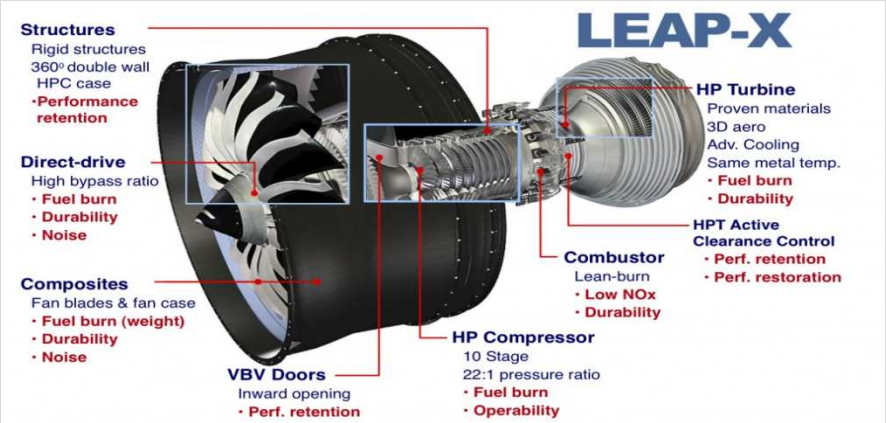
GenX Engine



- Successor to CF6
- Major Applications: Boeing 747-8 Boeing 787 Dreamliner
- Composite fan blades with titanium leading edges
- Fan bypass ratio of 19:2, which also helps reduce noise
- Titanium aluminide stage 6 and 7 low pressure turbine blade

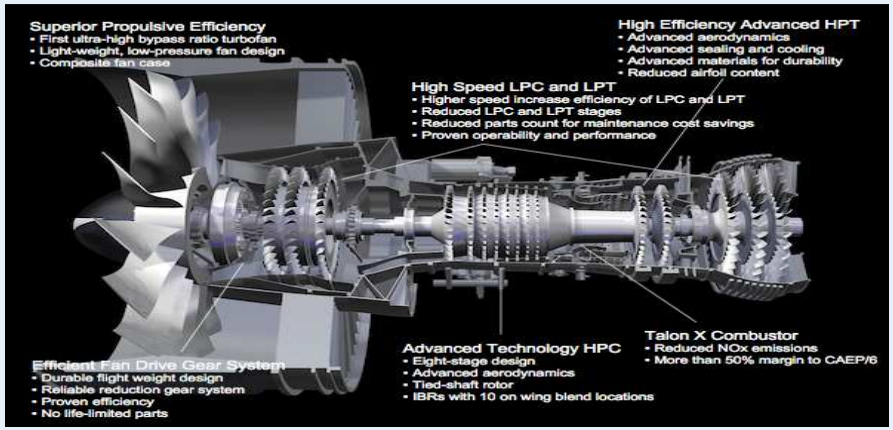
Future Technology: CFM LeapX Engine Vs PW1000G Engine

CFM LEAP-X



- CFM LeapX designed to have significantly lower deterioration rates, has an additional 1.4% fuel burn advantage
- Single-stage fan, 3-stage low pressure compressor, 10-stage high pressure compressor
- 3-D woven RTM technology for 18-blade composite fan
- 15% better fuel efficiency
- 50% Lower NOx emission
- 75% reduce reduction of noise foot print
- Maximum thrust: 18,000-35,000 lbf., ca. 25,000-30,000lbf. for C919
- Overall pressure ratio: 40:1
- Bypass ratio: 10:1
- Applications: A320neo, B737 Max, C919
- Reduced weight, fuel burn and noise
- Better maintenance cost

PW1000G



- Compressor: Axial flow, 1-stage geared fan, 2-3 stage LP, 8 stage HP
- Combustors: Annular combustion chamber
- Turbine: Axial, 2-stage HP, 3-stage LP
- Maximum thrust: 14,000–23,000 lbf (62–100 kN)
- By pass ratio: 12:1
- Applications: A320neo, Bombardier CSeries, Mitsubishi Regional Jet, Irkut MS-21
- Talon X combustor is a third-generation combustor that reduces NOx emission by 50% to CAEP/6 standards

Comparison: CFM LeapX and PW1000G

Parameters	CFM LeapX	PW1000G (GTF)	Comparison
Fan section	18 blade composite fan	18 blade bi-metallic fan	• **LeapX:** Foreign-object damage (FOD) reduction technology, lower maintenance cost ↑ • **GTF:** Translating sleeve, lower maintenance cost ↑
Gearbox	No gearbox	Yes	• **LeapX:** No Maintenance ↑ • **GTF:** Maintenance cost for gearbox ↓
Low pressure compressor	3 stage LPC	3 stage LPC	• **LeapX:** Moderate maintenance cost ↑ • **GTF:** Moderate maintenance cost ↑
High pressure compressor	10 stages	8 stages	• **LeapX:** More airfoils than GTF ↓ • **GTF:** one-third fewer airfoils than the LEAP ↑
Combustor	TAPS combustor	Third-generation Talon combustor	• **LeapX:** New Technology ↑ • **GTF**: New Technology ↑
Low pressure turbine	4 to 7 stages (application dependant)	3 stages	• **LeapX:** 7 stages ↓ • **GTF:** Two-thirds fewer airfoils for GTF than LEAP ↑
High pressure turbine	2 stages	2 stages	• **LeapX:** Minimize fuel burn ↑ • **GTF:** Low maintenance ↑

Research & Development Activities in Aero Engine Industry

Vision 2020 (January 2001)
• Responding to the Society needs
• Securing global leadership to Europe

ACARE
October 2002: The Strategic Research Agenda (SRA 1): 5 Challenges

Quality & Affordability	Environment	Safety	Air Transport System Efficiency	Security

October 2004: The SRA 2: 6 High Level Target Concepts

Very Low Cost ATS	Ultra Green ATS	Highly Customer Oriented ATS	Highly Time-efficient ATS	Ultra Secure ATS

The Advisory Council of Aeronautical Research in Europe (ACARE) identified the research needs for the aeronautics industry for 2020. The engine has to contribute to the overall ACARE targets with a 20% reduction in CO_2 emissions per passenger-kilometer, 10 dB noise reduction per certification point and a 80% reduction in NOx emissions.

Source: NEWAC

Key Insight

- Large investments have already been made in Europe and the US through R&D programs and collaborations to reduce the negative environmental effects of aircraft use
- ICAO, under the CAEP process, has undertaken an effort to establish medium and long-term environmental goals relating to three types of technologies – noise, NOx, and fuel burn:
  - **Medium Term Goal (2016):** CAEP/6 levels – 45%, ±2.5% (of CAEP/6) at an overall pressure ratio of 30
  - **Long Term Goal (2026):** CAEP/6 levels – 60%, ±5% (of CAEP/6) at an overall pressure ratio of 30

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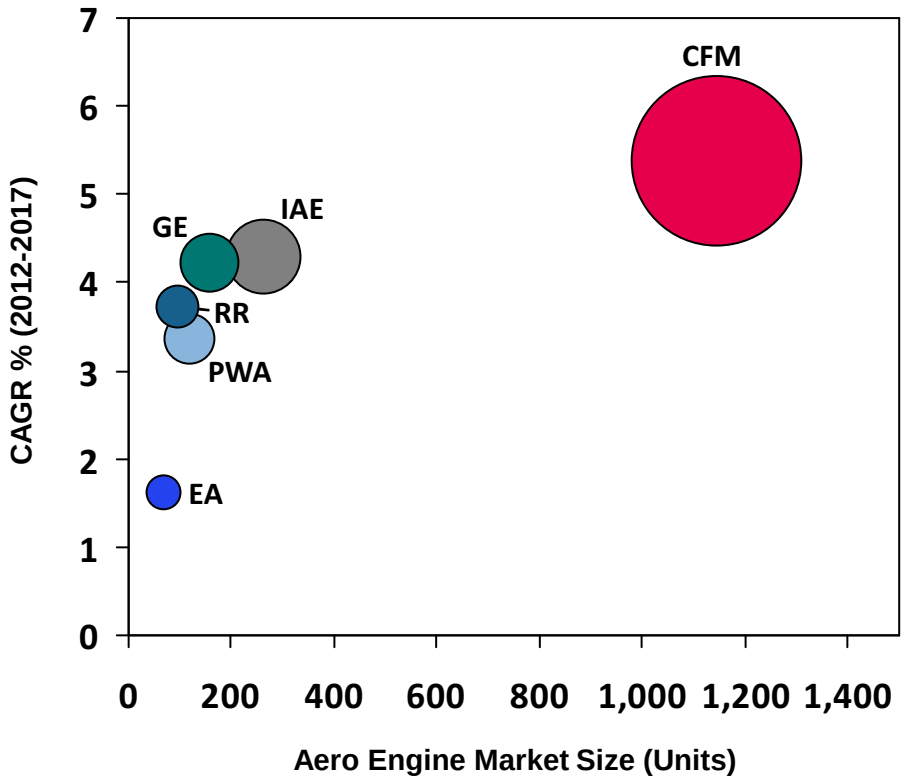
Growth Opportunity of Commercial Turbofan Engine Market

Growth Opportunities in Global Commercial Aero Engine Market (2012-2017)



* **Bubble size indicates 2017 aero engine market size.**

Key Insights

- In 2017, the global aero engine market is expected to approach 2,500 units with a CAGR of 5% for 2012-2017
- The global aero engine market is poised for robust growth with the following opportunities:
  - New material development, which will drive the aero engine market in coming years
  - New future technologies such as woven resin transfer molding technique, driving weight reduction
- Next-generation narrow body aircraft with upgraded engines are expected to drive the market in coming years
- CFM engines are forecast to drive the aero engine market with over 1,500 units in 2017

Emerging Trends in Global Commercial Turbofan Engine Market

Emerging Trends in Aero Engine Market

Fuel-efficient and light weight aero engines

- The CFM International LEAP-X is a high-bypass turbofan engine
- Use of composites on fan blades and other components could reduce the weight of engine to 1,000 pounds

Less CO_2 and NOx emitting engines

- The PurePower PW1000G series engines use an advanced gear system allowing the engine's fan to operate at a different speed than the low-pressure compressor & turbine
- This engines will have 50% reduction in NOx & 50% reduction in engine noise

Retro-fitting of new engines

- Airbus is working on offering a new engine for the A320 known as the *New Engine Option (NEO)*
- The new engine will burn 16% less fuel and will have 20% lower maintenance cost

Use of second- generation biofuels

- Air transport's contribution to climate change represents 2% of man-made CO_2 emissions and this could reach 3% by 2050, according to the Intergovernmental Panel on Climate Change (IPC). Thus, introduction of biofuel will drive the future aero engine market

Lower Maintenance cost

- The GenX engines offers 30% reduction in the maintenance cost
- Some of the GE engines predict elapsed time between inherent failures of a system during operation

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About Lucintel

- Lucintel is the leading global management consulting and market research firm.
- Lucintel creates the equation for growth and is committed to actionable results that deliver significant value and long-term growth to its clients.
- Lucintel has been creating measurable value for more than 14 years and for thousands of clients in 70+ countries worldwide.
- Visit http://www.lucintel.com/imovie/for a short 3.5-minute movie on Lucintel solutions.

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Composite Materials

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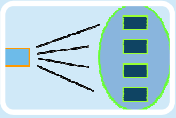
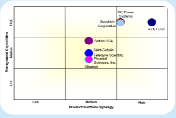
Benchmarking

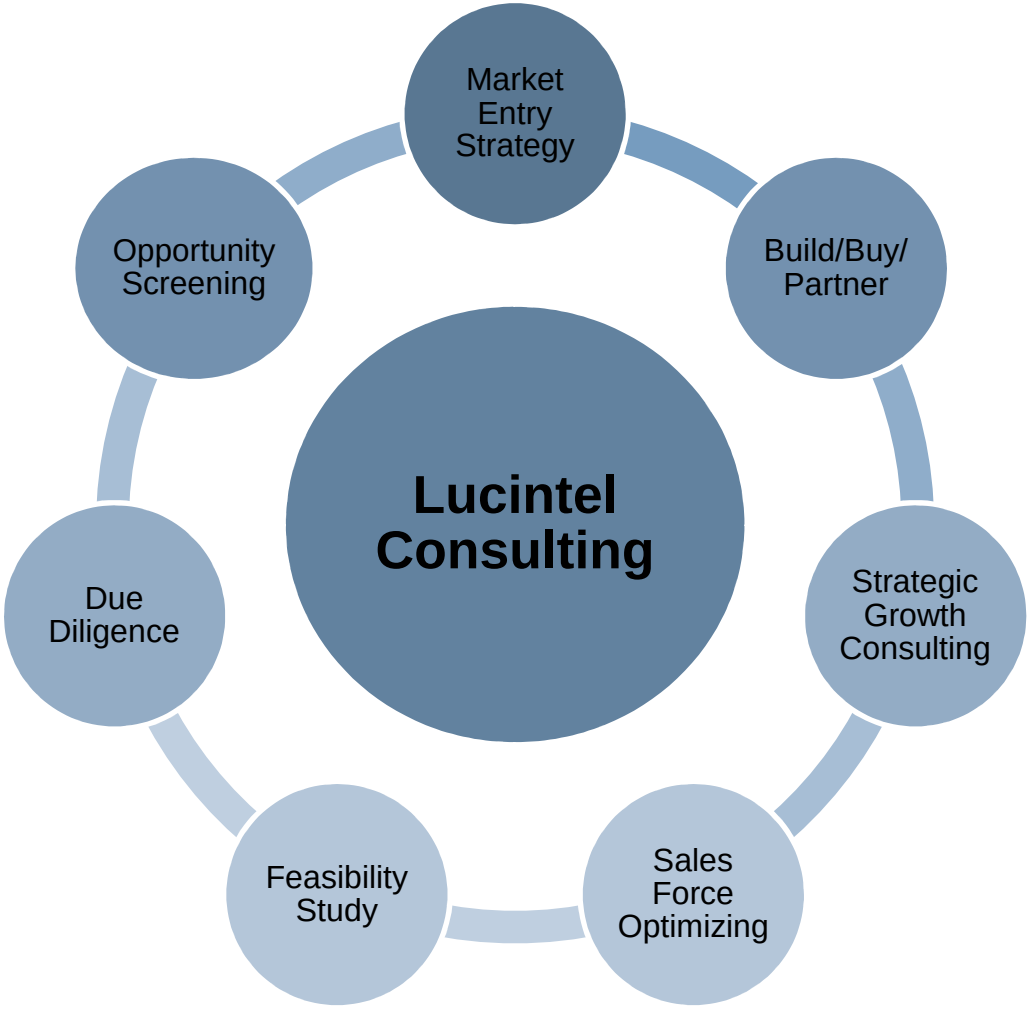

Opportunity Screening


Partner Search and Evaluation


Due Diligence and M&A


Market Entry Strategy

Lucintel has an extensive toolkit to address key strategic questions for increasing your company's profitability and market presence



Key Questions

- **Is market space/opportunity of current product offerings sufficiently robust?**
- **Markets are focus for many: how can my company profitably differentiate?**
- **Based on our core skills, where should we focus?**
- **Should we build or buy? Is build even an option?**
- **What game changer actions exist and/or is a more incremental approach best?**
- **What is the order sequence of market entry segments/products?**

Clients Around the World Value Lucintel's Services

Creating the Equation for Growth

Lucintel

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Joseph E. Fritz, MBA
VP, Research and Operations,USA
Email: joseph.fritz@lucintel.com
Tel: +1 520 638 8866

Steve Parker
Vice President Sales, USA
Email: steve.parker@lucintel.com
Tel: +1 972 636 5056

Roy Almaguer
Sales Manager, USA
Email:roy.almaguer@lucintel.com
Tel. : +1 210 878 7693