

Introducing Aero-Engine Business

November 17, 2014

IHI Corporation
Aero-Engine & Space Operations

Board Director and Managing Executive Officer,
President of Aero-Engine & Space Operations
Tsugio Mitsuoka

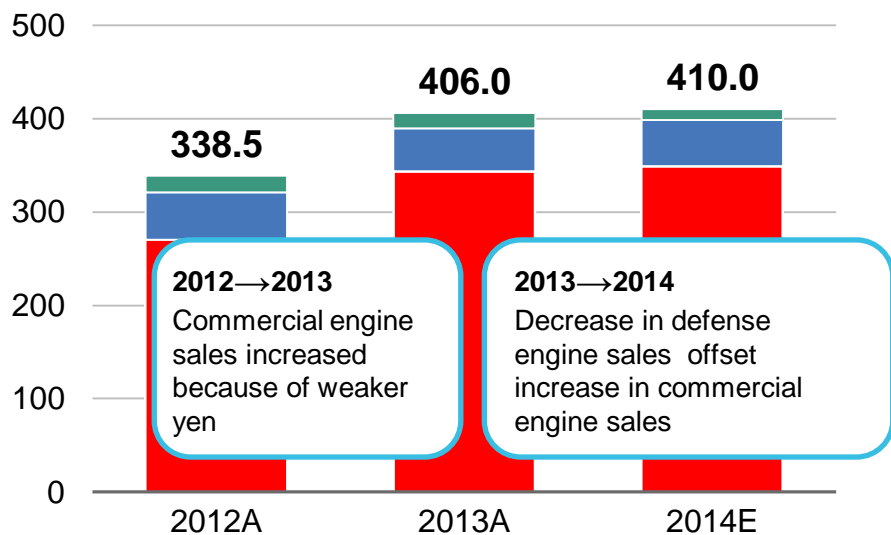
Aero-Engine & Space Business Overview

Aero-Engine, Space and Defense Segment

- Aero-Engines
 - Defense
 - Commercial
- Defense Systems
- Rocket Systems/Space Utilization

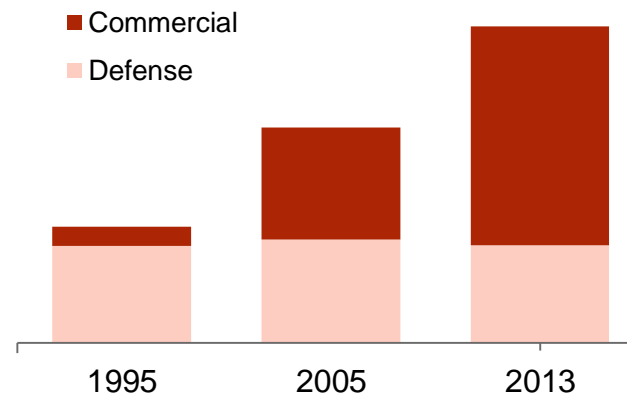
Head of Operations	Tsugio Mitsuoka Director and Managing Executive Officer
Employees (nonconsolidated)	3,255 (as of April 2014)
Office	1,259
Mizuho Works	796
Kure No.2 Works	412
Soma No.1 Works	255
Soma No.2 Works	533

(Billions of Yen) Consolidated Sales



Aero-Engine Sales Breakdown

Sales composed of stable engine business for Ministry of Defense and growing commercial engine business

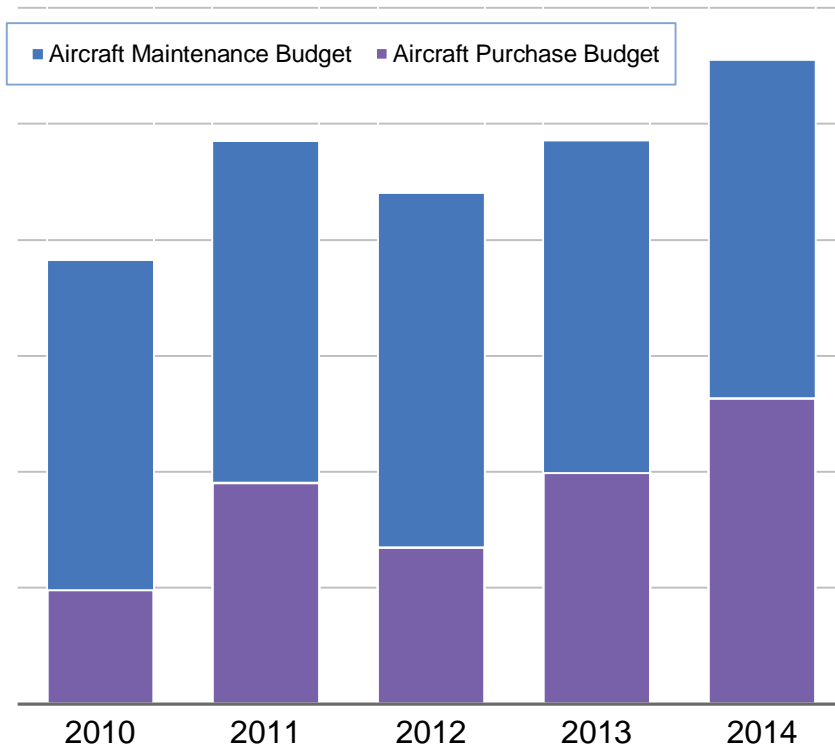


■ Defense Systems ■ Rocket Systems/Space Utilization ■ Aero-Engine

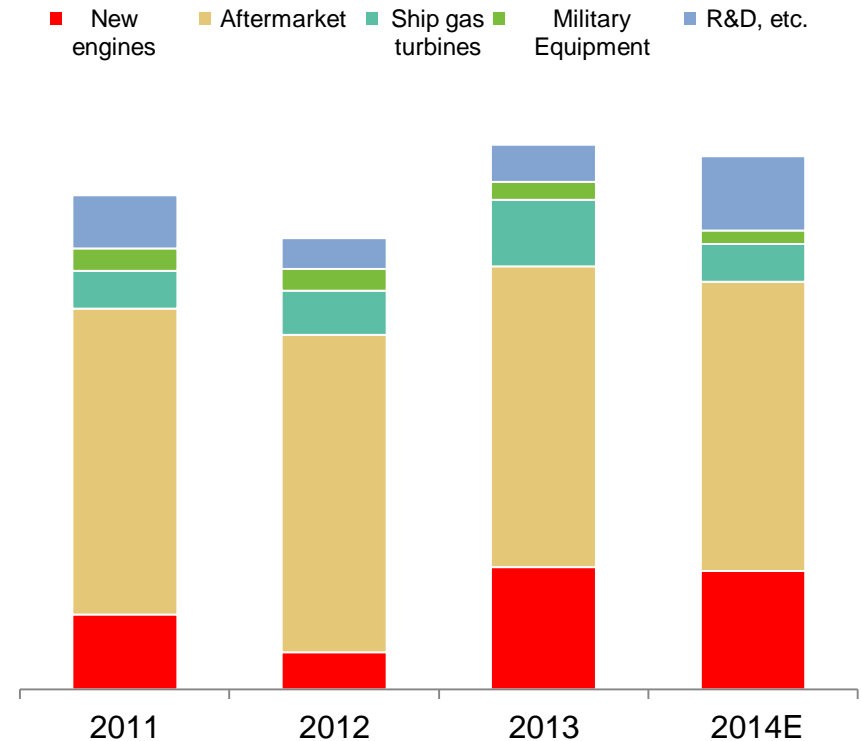
Note: Foreign exchange rate of ¥100/USD for 2014E

Defense Systems Business

Aircraft Defense Budgets



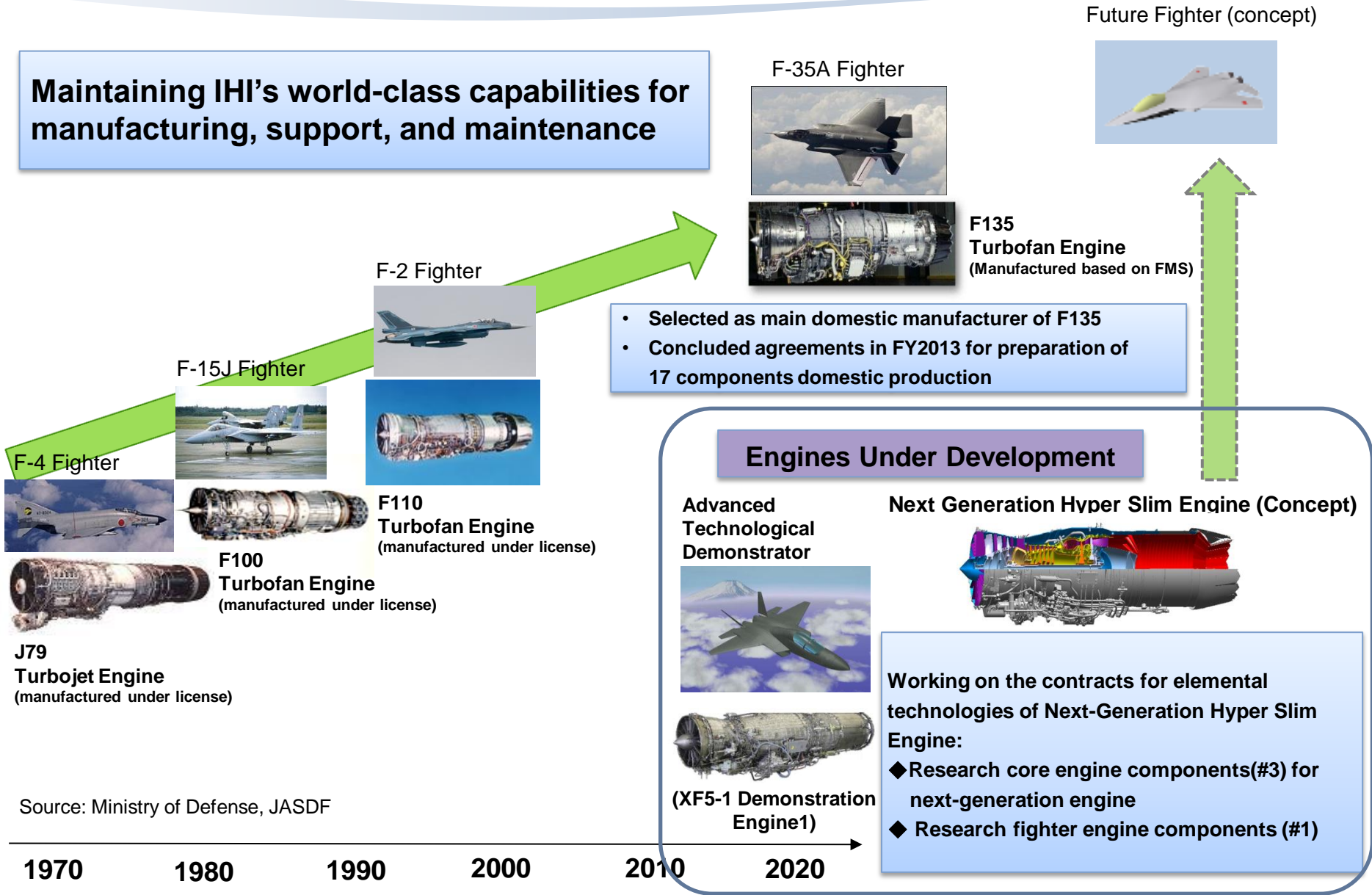
Defense Systems Orders



- Aircraft budgets have risen with national security requirement
- Orders have remained stable throughout the years because of expanding demand for new engines, such as the F135, and a steady aftermarket business

Defense Engine Business for Ministry of Defense

Maintaining IHI's world-class capabilities for manufacturing, support, and maintenance



Commercial Aero-Engines Business

Aircraft market growth

- Aircraft demand should increase steadily with passenger traffic growth in emerging markets
- Demand should increase in various categories, particularly mid-sized models for low-cost carriers on the rise

Global player with world-class technological expertise

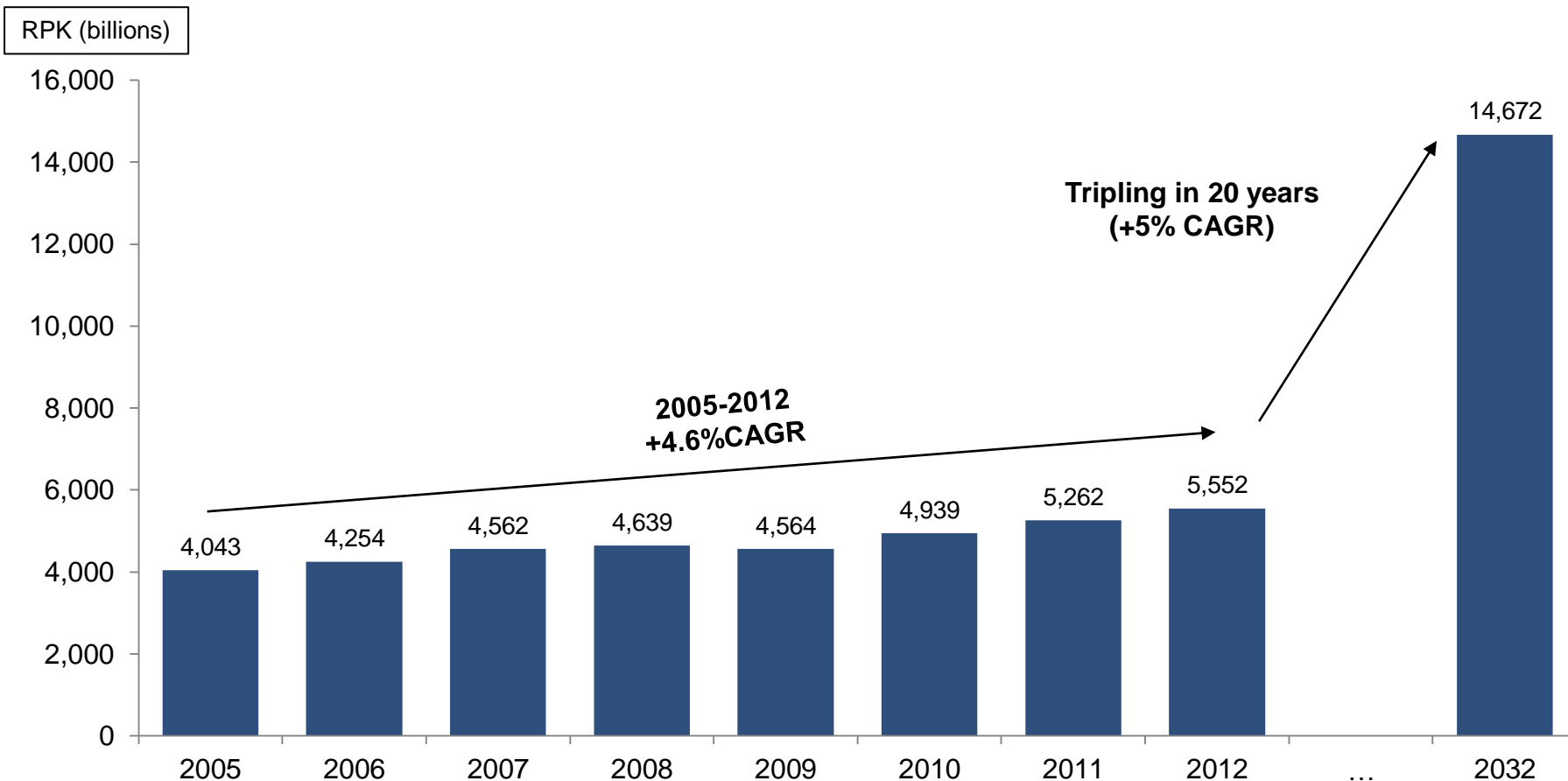
- IHI is a global player, participating in many engine development programs so that its line-up fully covers all aircraft segments
- Development and start-up costs for second-cycle programs should increase for foreseeable future
- Vital to keep investing in advanced technologies

Increasing aftermarket ratio

- Unit numbers and service hours of IHI's engines are on the increase
- Aftermarket ratio should rise as more programs enter investment payback phase

Passenger Traffic Continuing to Grow

Global RPKs (Revenue Passenger Kilometers): 2005 to 2032



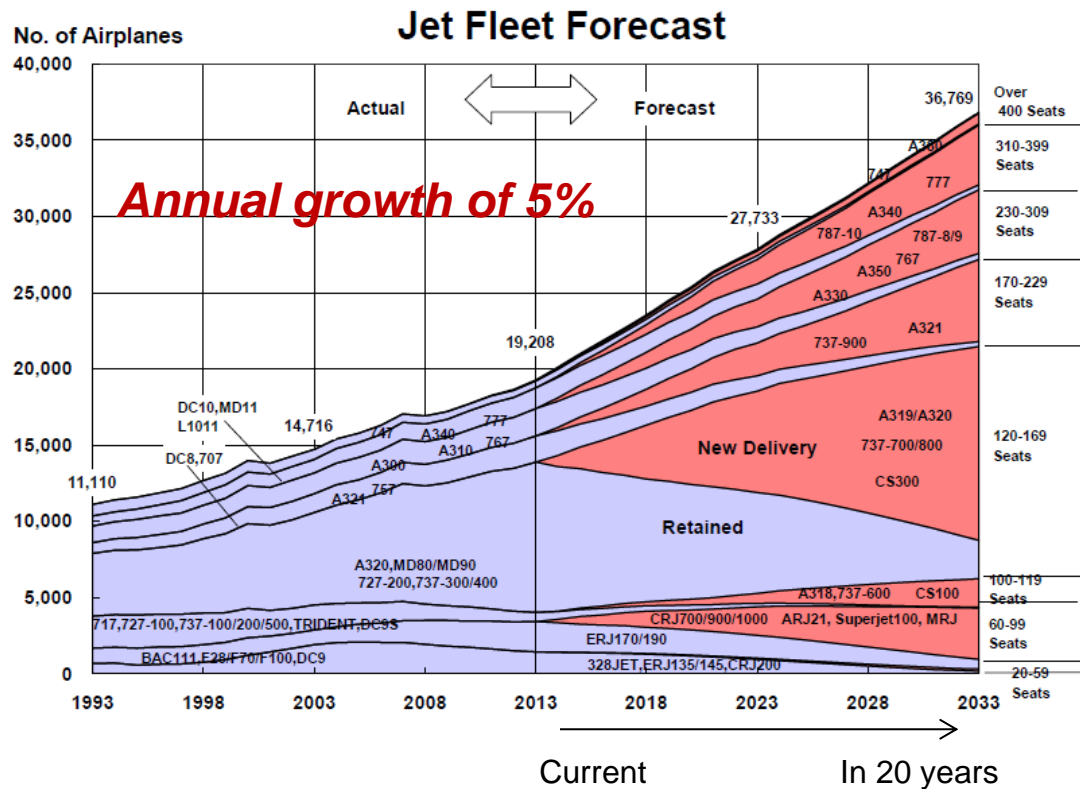
Passenger traffic continuing to grow amid economic and population growth in emerging markets

Source: Boeing

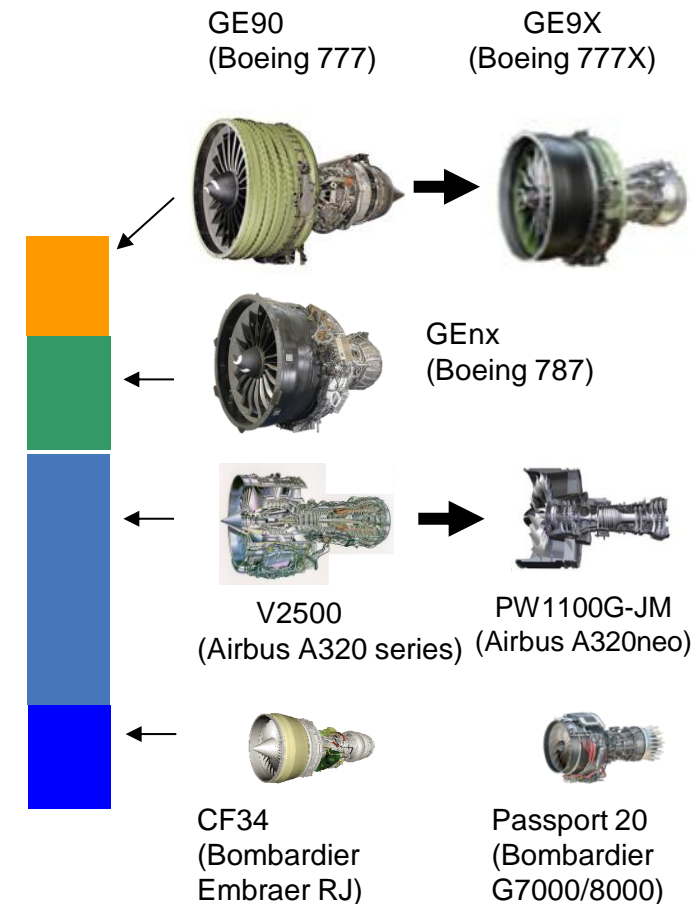
➤ Development Program and International Partnerships

- Commercial engine development requires a considerable amount of time and capital, so it is usually performed by international best partnerships formed of best players
- Partners disperse business risks by sharing overall development costs based on partnership stakes
- Partners address the following issues to develop long-term strategic relationships:
 - Manufacturing
 - Technological development
 - Product support
 - Aftermarket services (spare parts and engine maintenance services)
- Each partner supplies certain engine components according to strengths

IHI's Participation in Commercial Engine Programs



Source: Japan Aircraft Development Corporation



➤ In light of increasing global aircraft demand, IHI continues to participate in best-seller aircraft engine development and production businesses covering all segments in terms of aircraft size → Entering second cycle

IHI's Engine Portfolio

Engine Program	Aircraft (Type)	Main Partners	Unit Sales	Status				
				'80	'90	'00	'10	'20
			(As of Sep. 2014)					
V2500 	A320, MD-90 (Single Aisle)	Pratt & Whitney JAEC (Japanese Aero Engines Corporation) (IHI ∙∙14%) MTU	6,231	Started development in 1984				
GE90 	777 (Medium Widebody)	General Electric IHI ∙∙9% Safran	1,923	Joined GE's development program in 1990				
CF34 	Bombardier CRJ (Regional Jets)	General Electric JAEC (IHI ∙∙27%)	3,984	Joined GE's development program in 1996				
GE9x 	787 and 747 (Small Widebody)	General Electric JAEC (IHI ∙∙15%) Safran MTU	620	<ul style="list-style-type: none"> • Development: 2004~ • Shipment: 2011~ 				
PW1100G-JM 	A320neo (Single Aisle)	Pratt & Whitney JAEC (IHI ∙∙15%) MTU	-	<ul style="list-style-type: none"> • Development: 2011~ • Shipment: 2014~ 				
Passport20 	Bombardier Global 7000/8000 (Business Jets)	General Electric JAEC (IHI ∙∙27%)	-	<ul style="list-style-type: none"> • Development: 2012~ • Shipment: 2015~ 				
GE9X 	777X (Medium Widebody)	General Electric JAEC (IHI ∙∙10~12% (To be decided)) Safran MTU	-	<ul style="list-style-type: none"> • Development: 2014~ • Shipment: 2019~ 				

Development
 Initial Production
 Commercial Production
 Spare Parts / MRO

Aircraft

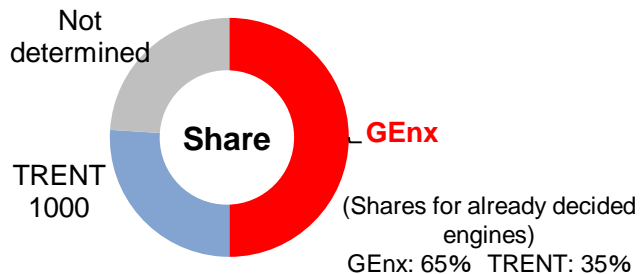
Boeing 787



Engine Overview



✓ **Unit Orders: 1,054** (as of September 2014)



✓ **Around 15% better fuel economy than previous model**

✓ **IHI supplies rotating parts for low-pressure turbine and high-pressure compressor airfoils**

- **Top share in engines for Boeing 787 program expected to be on the rise**
- **Engine addresses environmental concerns and helps airlines save operating costs**

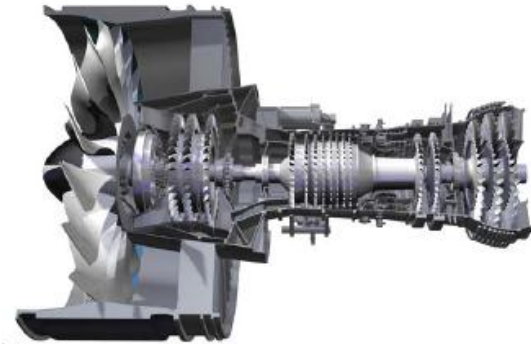
New Engine Program (PW1100G-JM)

Aircraft

A320NEO



Engine Overview



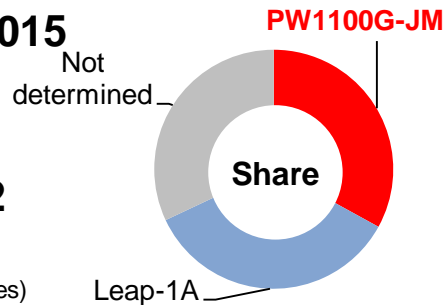
- ✓ **To start operating commercially in 2015**

(made maiden flight in September 2014)

- ✓ **Unit Orders: 3,272**

(as of September 2014)

(Share for already decided engines)
PW1100G representing about 50%



- ✓ **Around 16% better fuel economy than V2500**

- ✓ **IHI will supply fan modules incorporating light-weight fiber-reinforced plastics**

➤ **Single-aisle model of the segment most in demand with high growth potential from Airbus**

➤ **Our advanced latest technologies and composites have helped to significantly enhance fuel efficiency and reduce exhaust and noise levels**

New Engine Program (GE9X)

Aircraft

Boeing 777X

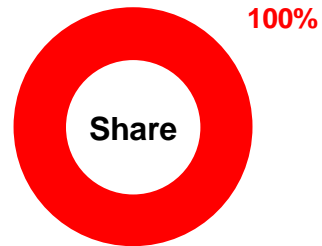


Engine Overview



✓ **Should start operating commercially from 2020**

✓ **Unit Orders: 300**
(as of September 2014)



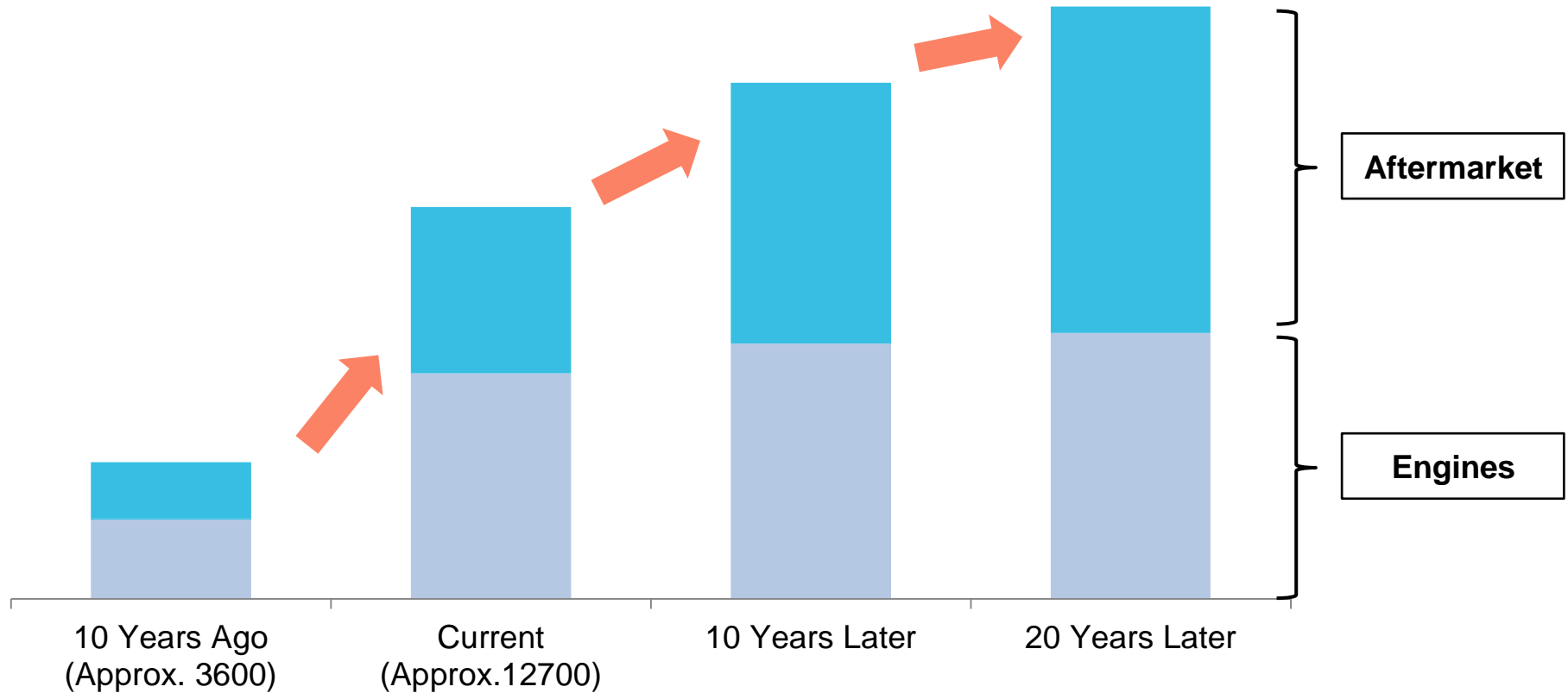
✓ **Exclusive engine for 777X (successor to GE90-115B)**

✓ **Approximately 10% better fuel economy than GE90-115B**

✓ **IHI will supply low-pressure turbine parts and shaft**

➤ **Participating in GE9X engine program for Boeing's next generation 777X widebody jet**

Commercial Engine and Aftermarket Revenue Ratios

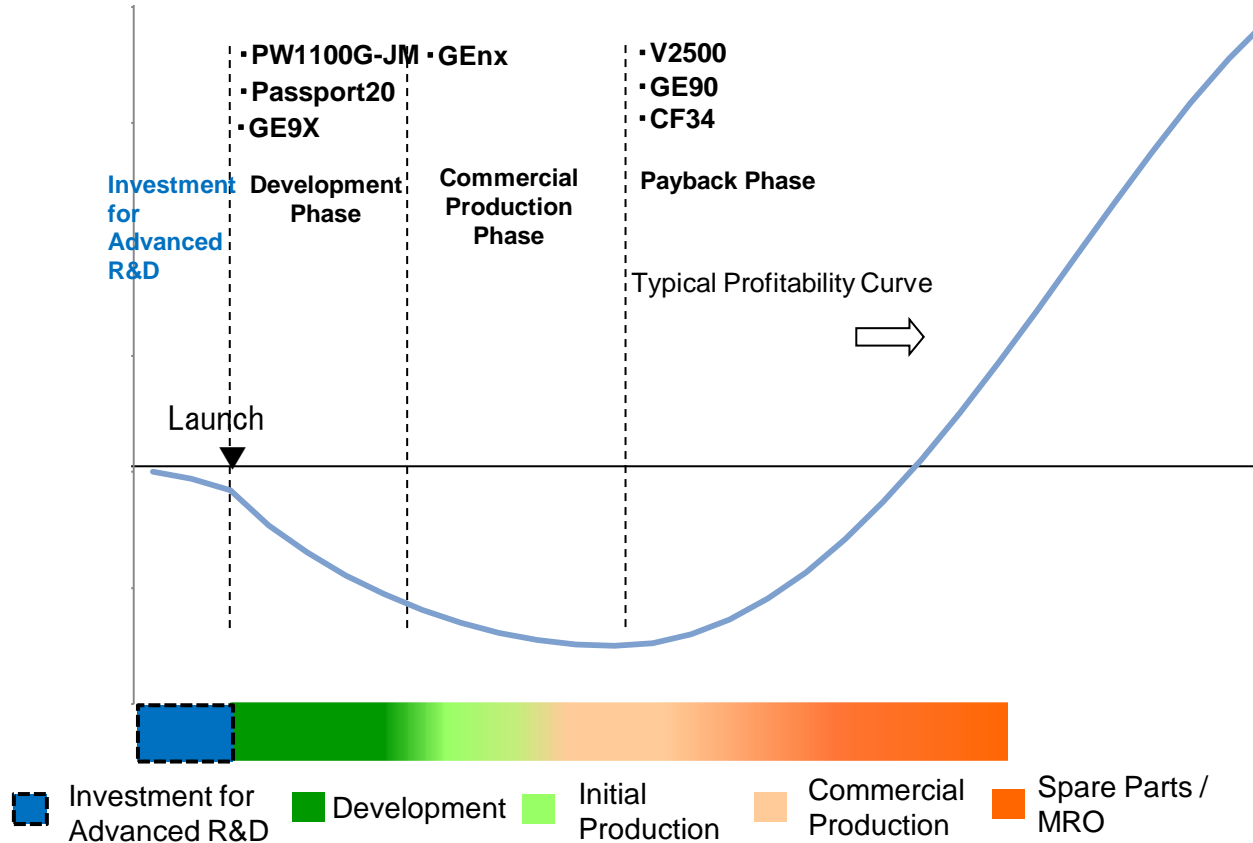


(): Accumulated unit sales of IHI's engines

➤ **Aftermarket ratio should rise as accumulated unit sales increase**

Key Attributes of Commercial Engine Business

- Advanced technology requirements
- Large initial investments
- Payback over 15 to 20 years



➤ **While existing programs are increasingly entering payback phase, ready to invest much in advanced technology development**

Carbon Fiber and Ceramic Matrix Composites

High-Strength forging Materials for Next-Generation Engines

Carbon Fiber Composite




Left: Structural Guide Vane (SGV)
Right: Fan Case

Ceramic Matrix Composite



Turbine Nozzle

High-Strength Forging Material



Long Shaft

High-Temperature, High-Strength Forging Material



Large Turbine Disk

Used in PW1100G-JM

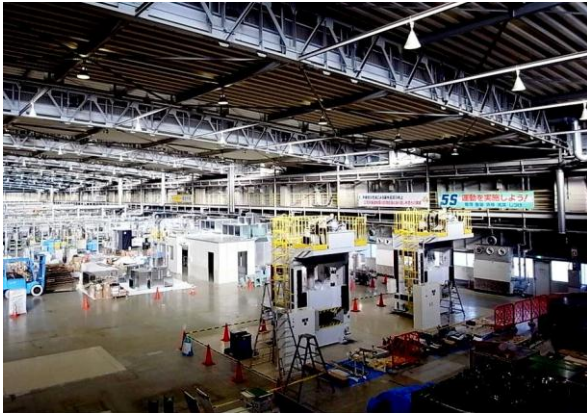
Developing for next-generation engines

- Enhancing thermal efficiency and reducing engine weight to improve fuel economy

Bolstering Production Facilities for PW1100G-JM

Soma No. 1 Works

Structural guide vane line
Operational Launch: 2nd half of 2014



Structural Guide Vane

IHI Aerospace Tomioka Plant

Fan case line (No. 3 Works)
Operational launch: 2nd half of 2014



Fan Case

Soma No.2 Works

Integrated bladed rotor line
Operational Launch: 1st half of 2014



Integrated Bladed Rotor



- Each site employed IHI's composite materials and manufacturing expertise in constructing new lines
- Aiming to strengthen global cost competitiveness

Aircraft market growth

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Appendix



Mizuho Works

- Assembles and overhauls jet engines and light gas turbines
- Produces defense and space equipment

Site area	189,000m ²
Building space	65,000m ²



Kure No.2 Works

- Produces and repairs jet engines and gas turbine parts
- Assembles and tests land and marine gas turbines

Site area	47,800m ²
Building space	40,100m ²

Tomioka Plant (IHI AEROSPACE)

- Produces space and defense equipment
- Produces fiber-reinforced plastic parts

Site area	490,490m ²
Building space	84,228m ²



Soma NO.1 Works

- Produces and repairs jet engine and gas turbine blade components

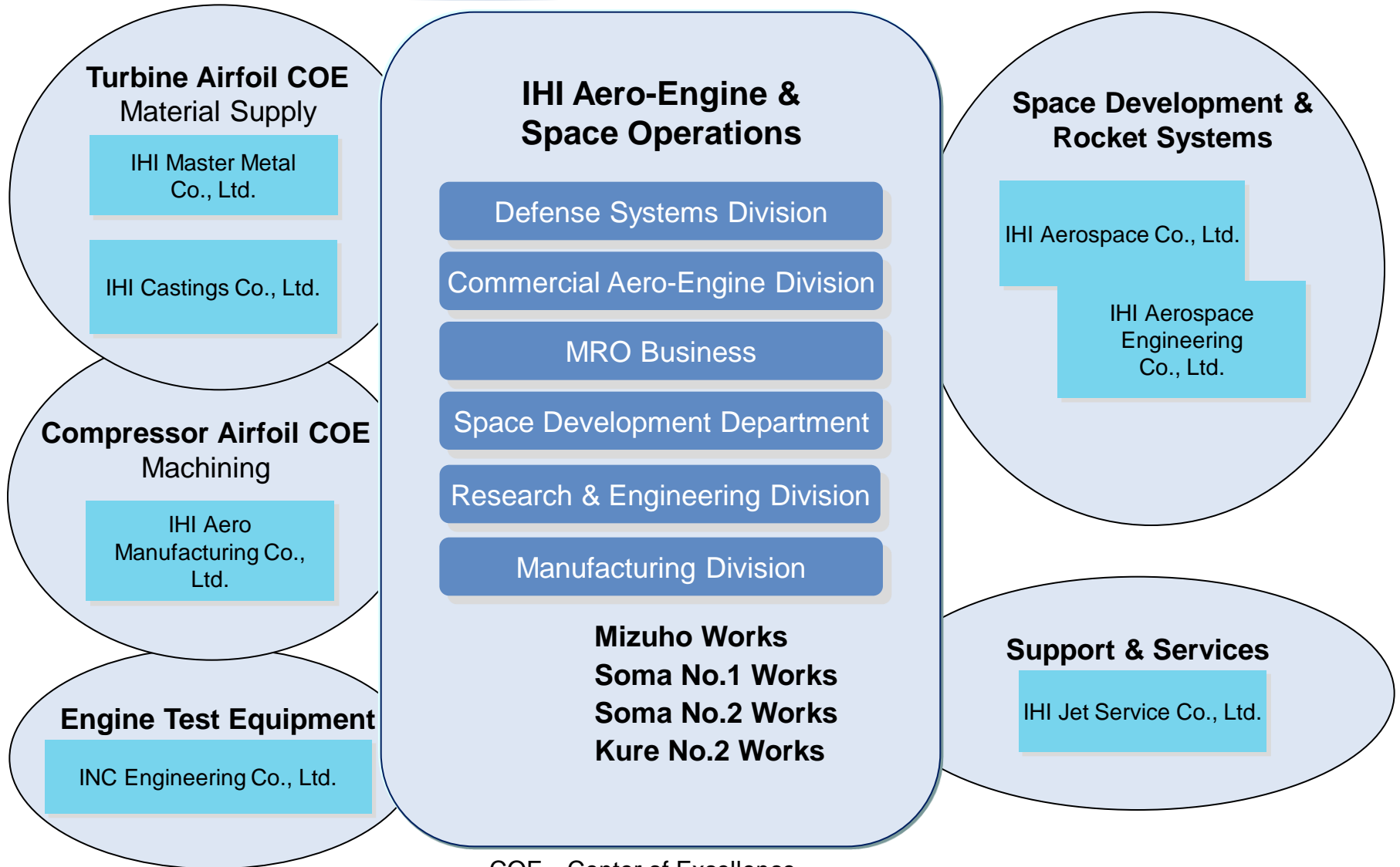
Site area	159,000m ²
Building space	37,700m ²

Soma No.2 Works

- Produces and repairs small and medium-sized parts of jet engines
- Produces space equipment parts

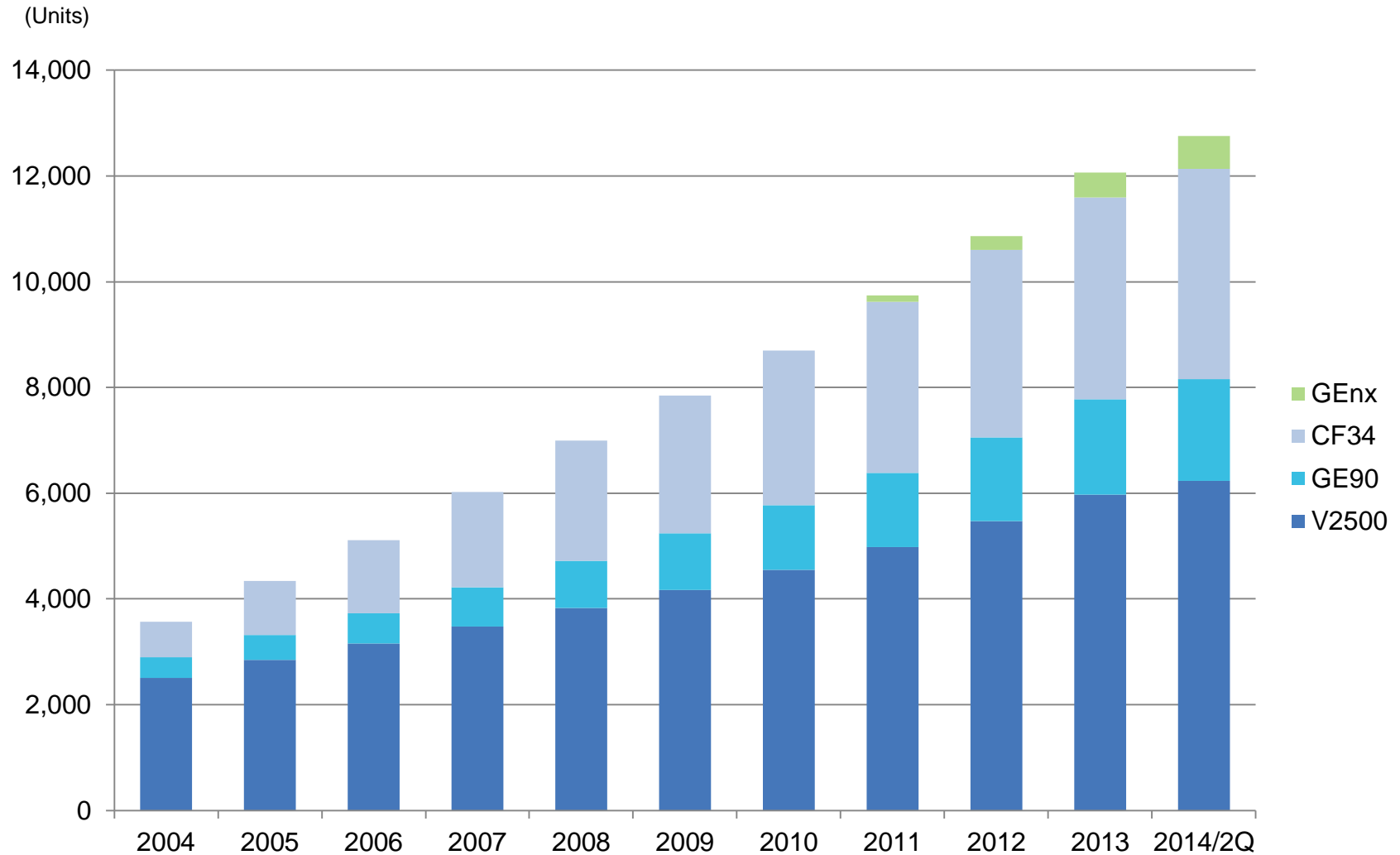
Site area	167,300m ²
Building space	54,200m ²

Organization and Group Companies



COE : Center of Excellence

Accumulated Unit Sales of Commercial Aero-Engines



IHI

Realize your dreams

Forward-looking figures shown in this material with respect to IHI's performance outlooks and other matters are based on management's assumptions and beliefs in light of the information currently available to it, and therefore contain risks and uncertainties. Consequently, you should not place undue reliance on these performance outlooks in making judgments. IHI cautions you that actual results could differ materially from those discussed in these performance outlooks due to a number of important factors. These important factors include political environments in areas in which IHI operates, general economic conditions, and the yen exchange rate including its rate against the US dollar.