Aero Engine, Space & Defense Business Area Briefing

May 17, 2019

IHI Corporation
Tomoharu Shikina, Board Director and Managing Executive Officer,
President of Aero Engine, Space & Defense Business Area

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1. Aero Engine, Space & Defense Business Area Outline

1. Aero Engine, Space & Defense Business Area Outline

Aero Engine, Space & Defense Business Area

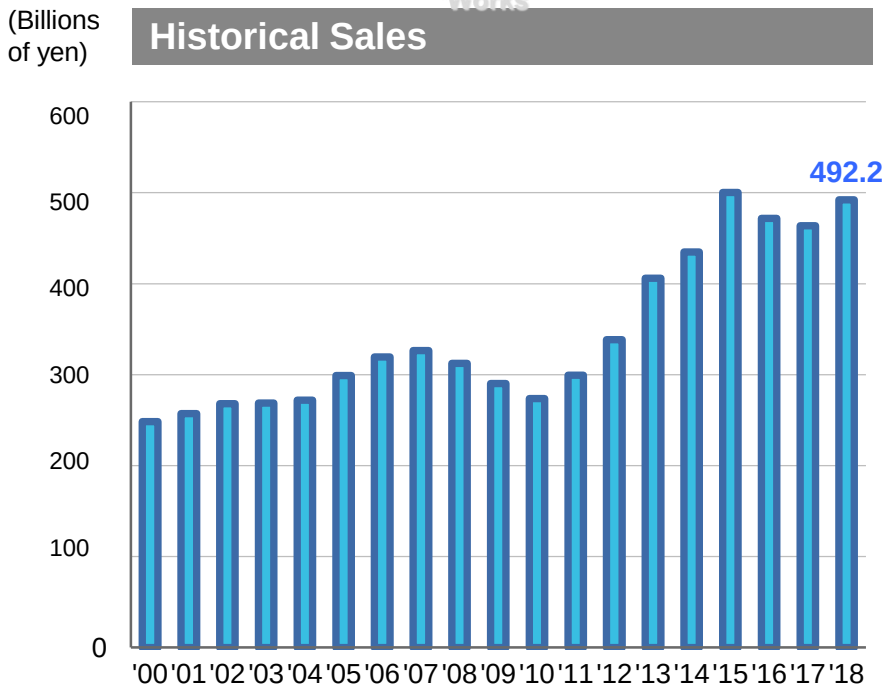
Business head: Tomoharu Shikina, Board Director and Managing Executive Officer
Number of employees: 6,454 (on consolidated basis, as of March 31, 2019)

- Defense Systems Div.
- Civil Aero-Engine Div.
- Space Development Dept.
- Research & Engineering Div.
- Manufacturing Div.
  - Mizuho Aero-Engine Works
  - Kure Aero-Engine & Turbo Machinery Works
  - Soma No.1 Aero-Engine Works
  - Soma No.2 Aero-Engine Works

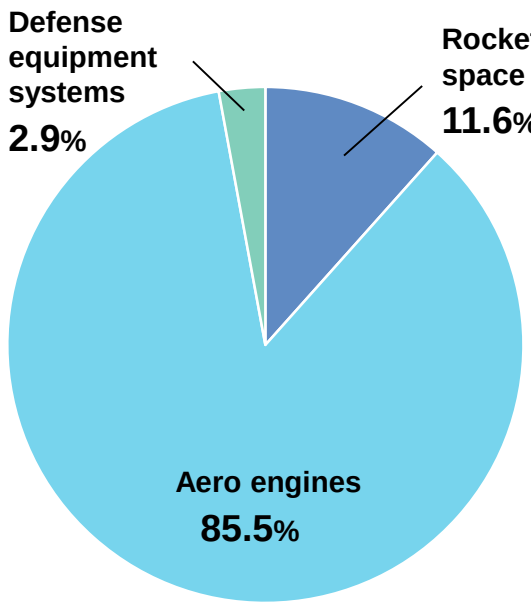
Main affiliates

- IHI Aerospace Co., Ltd.
- INC Engineering Co., Ltd.
- IHI Jet Service Co., Ltd.
- IHI Castings Co., Ltd.
- IHI Master Metal Co., Ltd.
- IHI Aero Manufacturing Co., Ltd.

Historical Sales



FY2018 Sales composition (Consolidated)



Sales Amount: ¥492.2 billion
(Operating margin:9.4%)

2. Management Policies Based on Group Management Policies 2019

2. Management Policies Based on Group Management Policies 2019

Goal to reach

Leverage advanced technology to open new vistas for air transportation, defense systems, and space utilization, and help materialize social comfort and safety

Civil aero-engine business

- Help materialize safe, comfortable, economical, and environment-friendly air transportation by driving advances in unique technologies and manufacturing capabilities

Defense business

- Contribute to national security through frontline equipment and logistic support based on advanced systems technologies

Rocket systems and space utilization business

- Build rocket lineup and deploy launch services to match social needs
- Provide space utilization solutions that harness satellite data in diverse industries and fields

Establish our position as a key global aerospace industry player by taking advantage of unique technologies and manufacturing capabilities supported by robust quality assurance system

Addressing social issues

Environmental impact reduction

- Use resources and energy efficiently
- Enhancing technological innovations

Safe, secure, and comfortable lifestyles

- Improve safety and reliability of air transportation
- Countermeasure against climate change
- Maintain social and public peace

2. Management Policies Based on Group Management Policies 2019

Focuses over three years

Strengthen business foundations

Apply advanced technologies to improve customer value in lifecycles

- Make safety and quality top priorities and build and maintain a robust quality assurance system
- In aero engines, qualitatively and quantitatively bolster aftermarket responsiveness, principally for civil aero engines, accelerating efforts to build an advanced maintenance business notably by setting up sites employing advanced Internet of Things and information and communication technology and enhancing the parts repair structure
- In the defense area, extend the scope of support and provide more advanced logistic support
- In the space business, manufacture rocket systems and promote launch services

Build a robust operational structure

Build a lean and flexible structure to further reinforce competitiveness

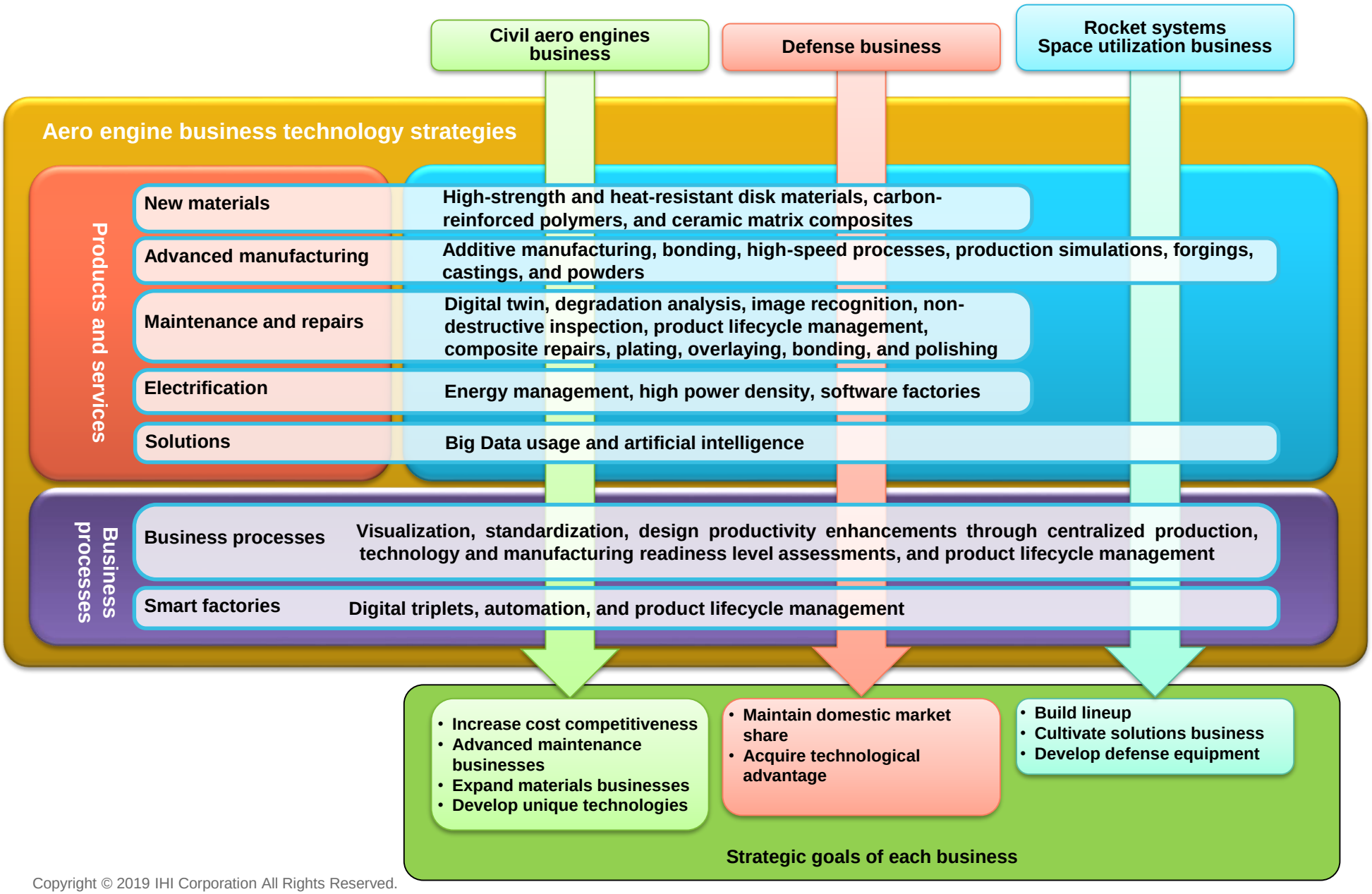
- Develop employees and workshops that can ensure excellent quality and deploy the necessary resources while strengthening our organization to swiftly recovery trust
- Further enhance our global competitiveness by stepping up smart factory efforts to accelerate productivity improvements while optimally and rapidly allocating engineering resources groupwide

Accelerate preparations for tomorrow

Build a business model that can deliver outstanding value across the entire value chain

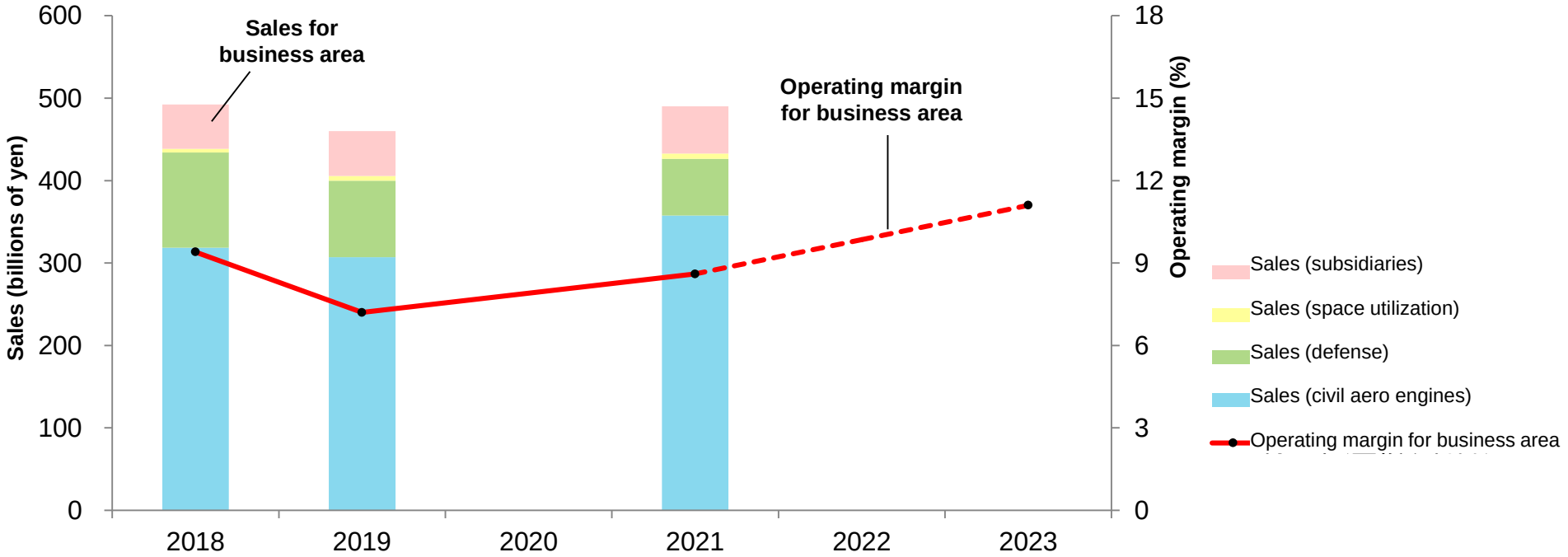
- Expand our materials forming businesses and drive advances in proprietary technologies and manufacturing capabilities for composite materials
- Develop engines for next-generation fighter jets and develop defense equipment business overseas
- Harness satellite data in developing new space utilization solutions businesses

2. Management Policies Based on Group Management Policies 2019



2. Management Policies Based on Group Management Policies 2019

Business area targets

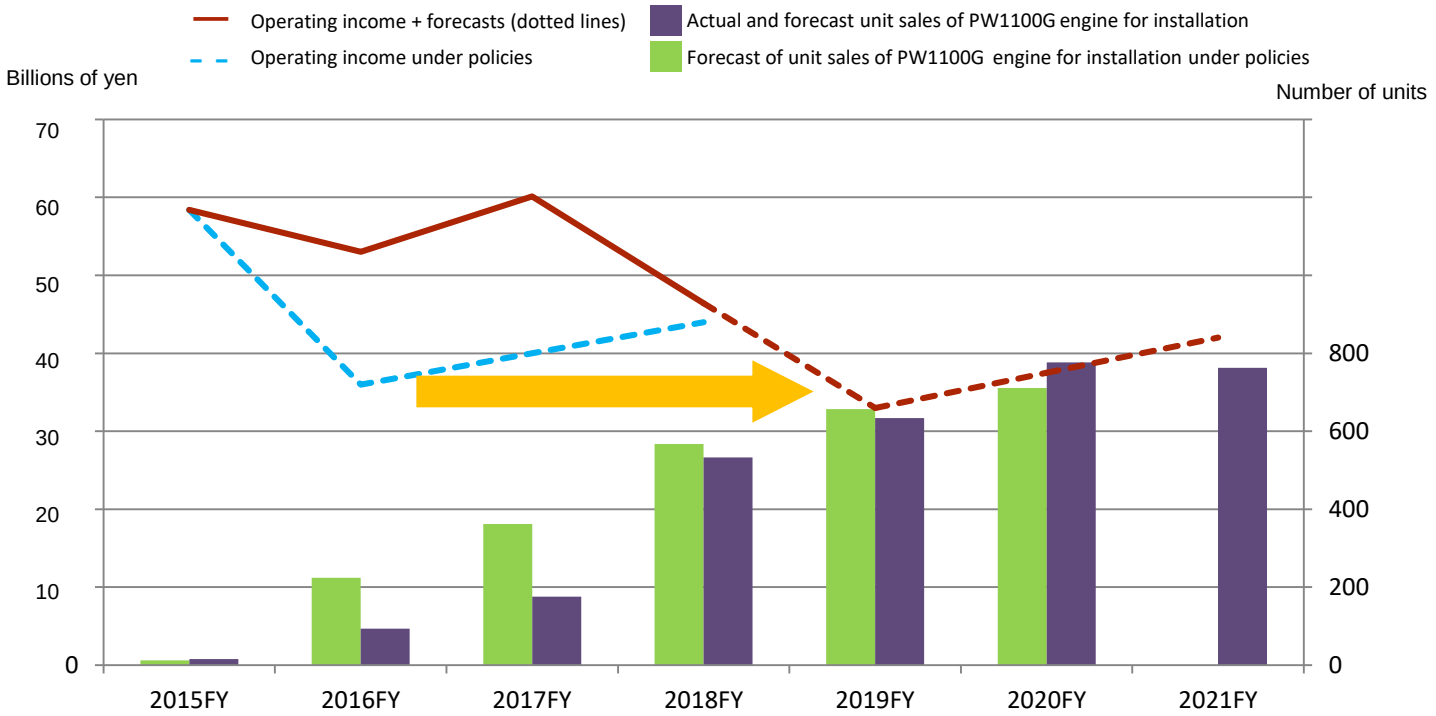


Business outlook

- In FY2019, the operating margin will temporarily decrease due to expense in the initial mass production stage for the GE9X and PW1100G engines.
- Although mass production of the GE9X engine is scheduled to start in FY2020, operating margin is expected to be improved, while spare parts sales of existing models will remain stable and PW1100G after-sales services will increase considerably.
- Going ahead with countermeasure against declining defense business sales and radical cost reduction in civil aero-engine production / maintenance business for profit margin recovery

2. Management Policies Based on Group Management Policies 2019

Operating income in Aero Engine, Space & Defense business (Compared with Group Management Policies 2016 targets)



Situation with PW1100G engine

- Time point when we formulated Group Management Policies 2016
  Performance was assumed to bottom out in FY2016 and FY2017 when sales surged just on mass production launch before cost reduction make progress.
- Now
  Sales failed to rise because of initial technical issues in FY2016 and FY2017, so results improved. We now expect performance to bottom out in FY2019 instead of earlier because of recent materials cost hikes and productivity improvement shortfalls.

3. Individual Business Strategies

3-1. Civil Aero Engine Business

IHI

Focuses over three years

Increase cost competitiveness

- Radical cost reduction through engineering and production technology liaison taskforce (focus resources on bottleneck processes)
- Progress toward smart factory setup: Incorporation of information and communication technologies and Internet of Things to enhance and automate plant production technologies
- Establish overseas sites to strengthen OEM engineering collaboration and supply chain

Advanced maintenance businesses

- Introduction and expansion of maintenance site (create highly productive new sites employing advanced information and communication and IoT technologies
- Enhance parts repair structure

Expand materials businesses

- Casting material for turbine blades, Forged material for disks
- Carbon Fiber-Reinforced Plastics (CFRP)
- Metallic powder business

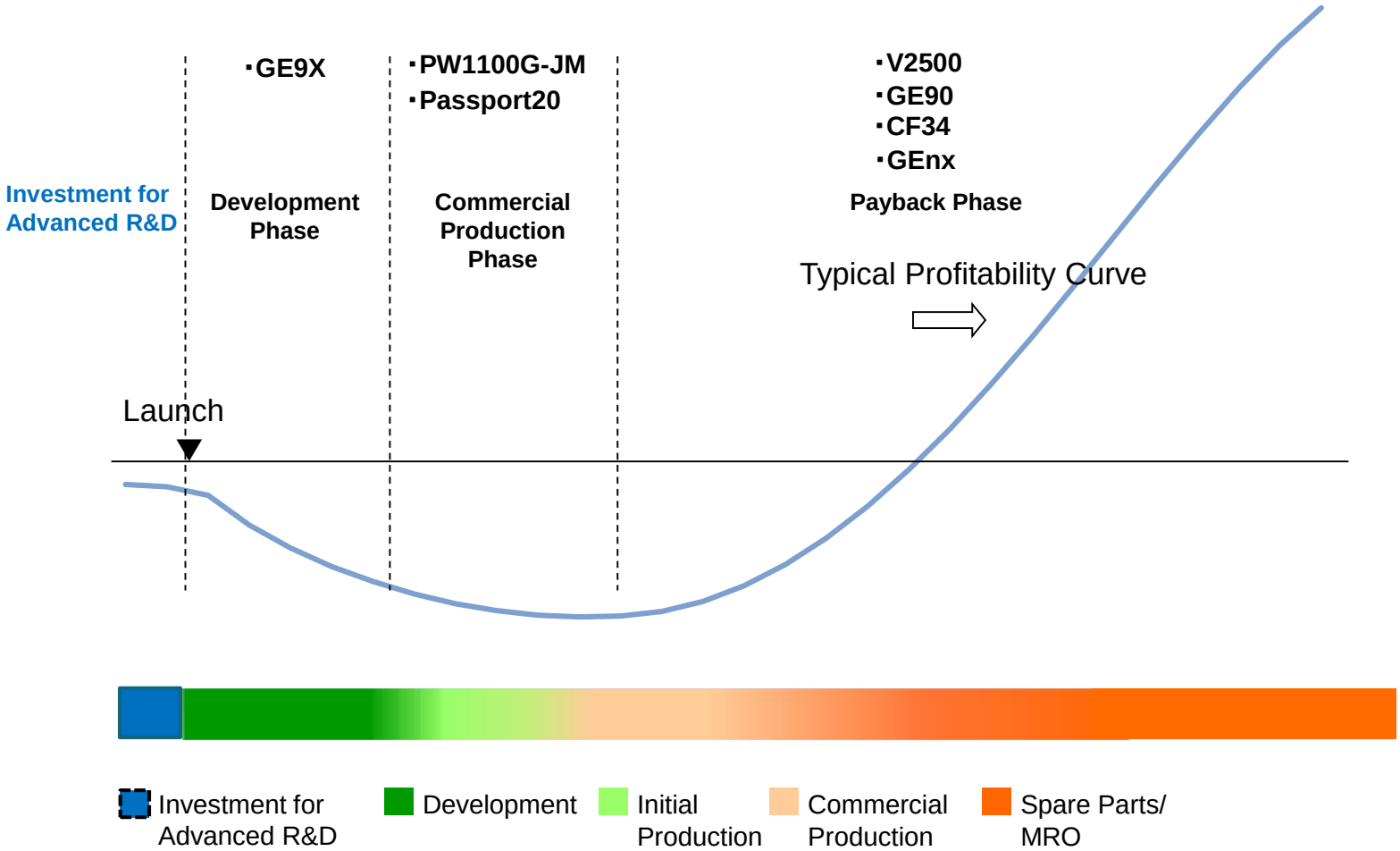
Develop unique technologies

- Fan blades of composite material
- Turbine parts of ceramic matrix composite
- Parts production technology with additive manufacturing

3-1. Civil Aero Engine Business

Business attributes

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



3-1. Civil Aero Engine Business

IHI

Portfolio of engine programs in which IHI participates

Engine Program*	Aircraft (Type)	Main Partners	Unit Sales	Status
			(As of March 31, 2019	80s 90s 00s 10s 20s
V2500 	A320, MD-90 (Single Aisle)	Pratt & Whitney Japan Aero Engine Corporation (JAEC) (IHI・・14%) MTU Aero Engines	**7,688**	Started development in 1984
GE90 	777 (Medium Widebody)	General Electric IHI・9% Safran	**2,715**	Joined GE's development program in 1990
CF34 	Bombardier CRJ (Regional Jets)	General Electric JAEC (IHI・・27%)	**5,331**	Joined GE's development program in 1996
GEnx 	787, 747 (Small Widebody, Widebody)	General Electric	**1,826**	• Development: 2004~ • Shipment: 2011~
PW1100G-JM 	A320neo (Single Aisle)	Pratt & Whitney JAEC (IHI・・15%) MTU Aero Engines	**1,058**	• Development: 2011~ • Shipment: 2014~
Passport20 	Bombardier Global 7500/8000 (Business Jets)	General Electric JAEC (IHI・・27%)	**66**	• Development: 2012~ • Shipment: 2016~
GE9X 	777X (Medium Widebody)	General Electric JAEC (IHI・11%) Safran MTU Aero Engines	-	• Development: 2014~ • Shipment: 2019~

*Excluding programs in which IHI's participation is production only

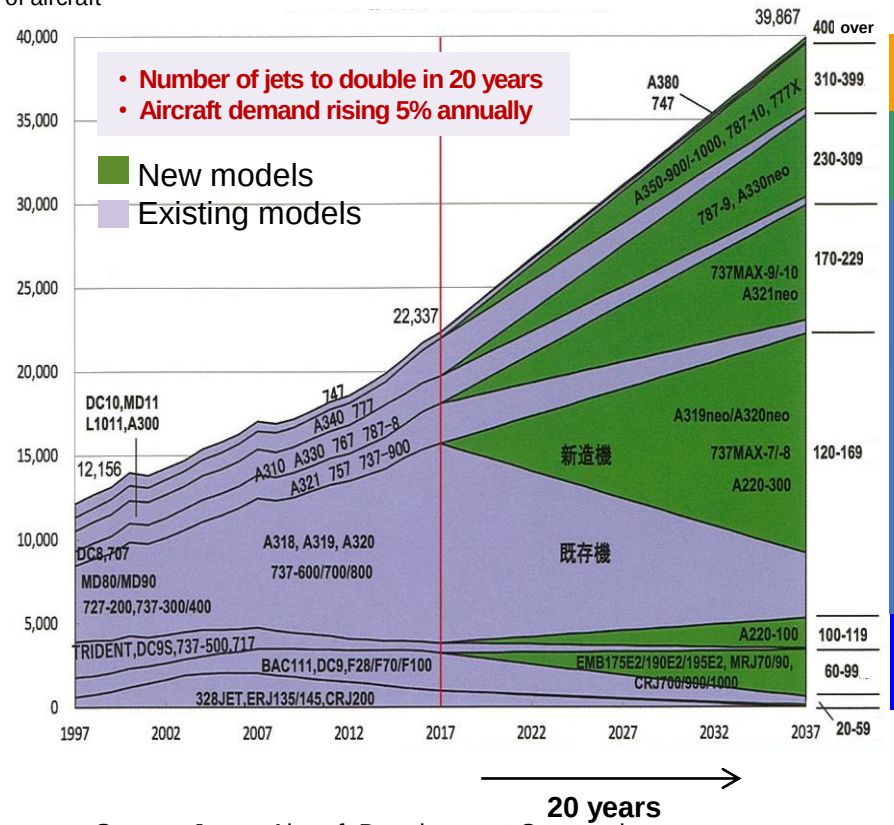
Development Initial Production Commercial Production Spare parts/MRO

Sources: General Electric, Pratt & Whitney, and JAEC

Civil-aero engine development activities

- With global aircraft demand poised to grow steadily in the years ahead, IHI has participated in best-seller engines development and mass production businesses programs for all classes, from small to ultra-large models
  → Getting into second cycle
- Developing unique technologies with whole domestic supply chain and pursuing new opportunities worldwide

Fleet mix forecast of passenger jets



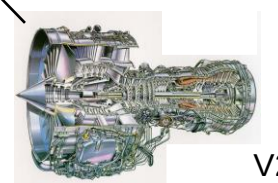
Source: Japan Aircraft Development Corporation

In mass production | **New-generation models**

GE90 engine
(Boeing 777)
IHI's share: 9%

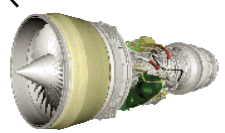
GE9X
(Boeing 777X)
IHI's share: 11%

GEnx engine
(Boeing 787)
IHI's share: 13%



V2500 engine
(Airbus A320 series)
IHI's share: 14%

PW1100G-JM
(Airbus A320neo)
IHI's share: 15%



CF34 engine
(for Bombardier and
Embraer Regional Jet)
IHI's share: 27%

Passport 20
(Bombardier G7500/8000)
IHI's share: 27%

Sources: General Electric and Japan Aero Engine Corporation

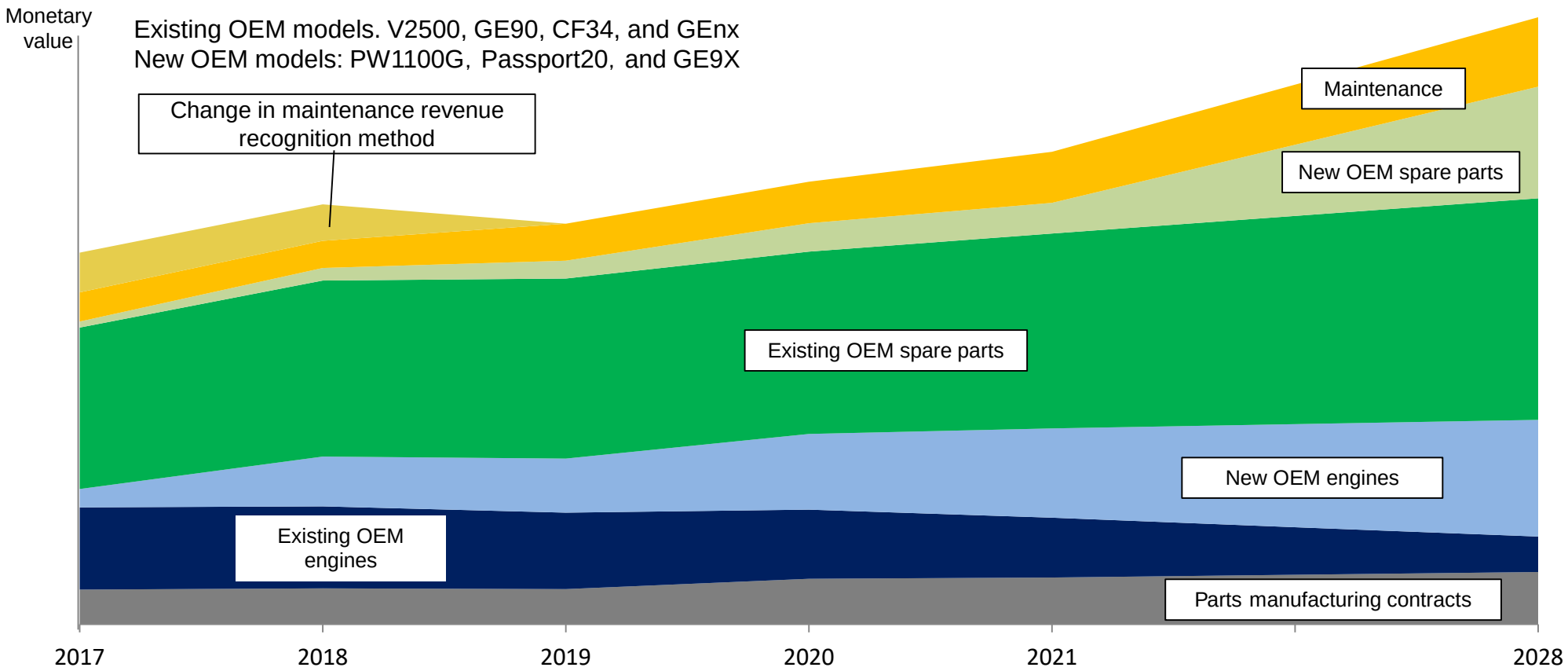
3-1. Civil Aero Engine Business

IHI

Business scale

➢ **This business is expected to expand in line with steadily expanding aircraft demand**

Business scale outlook

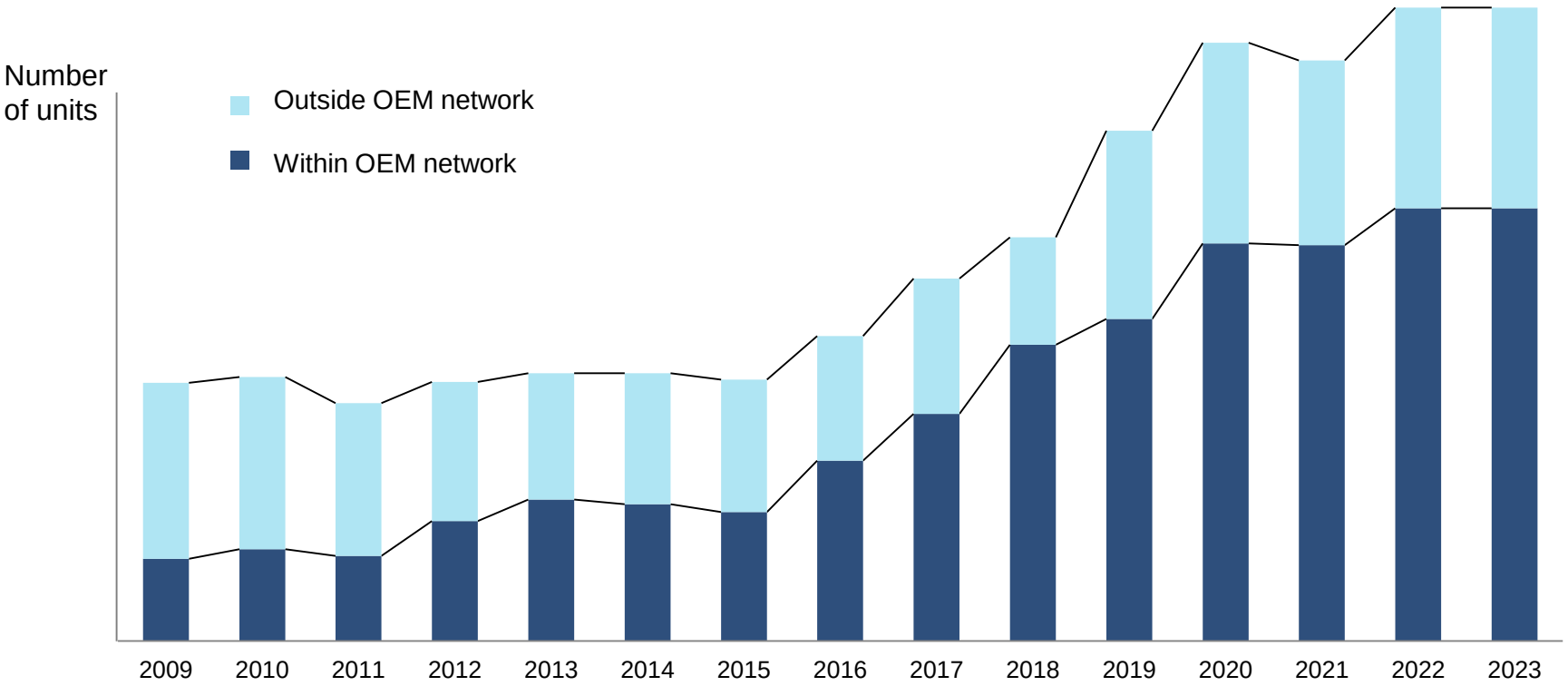


3-1. Civil Aero Engine Business

Driving maintenance business advances

- **Number of engines maintained within the network is expected to keep increasing worldwide**
- **We are creating and expanding an engine maintenance and parts repair structure, while establishing a solid quality assurance system.**

Number of V2500 and PW1100G engines maintained (market total)



3-1. Civil Aero Engine Business

IHI

- We have expanded our production network by setting up new operations in Tsurugashima and Yokohama to handle growing parts production and maintenance volume

Tsurugashima Works

Tomioka Plant (IHI Aerospace)

Soma No. 1 Works

Soma No. 2 Works

Soma Works of IHI Castings Co., Ltd.

Matsumoto Works of IHI Castings Co., Ltd.

Mizuho Works

Kure No. 2 Works

IHI Master Metal Co., Ltd.

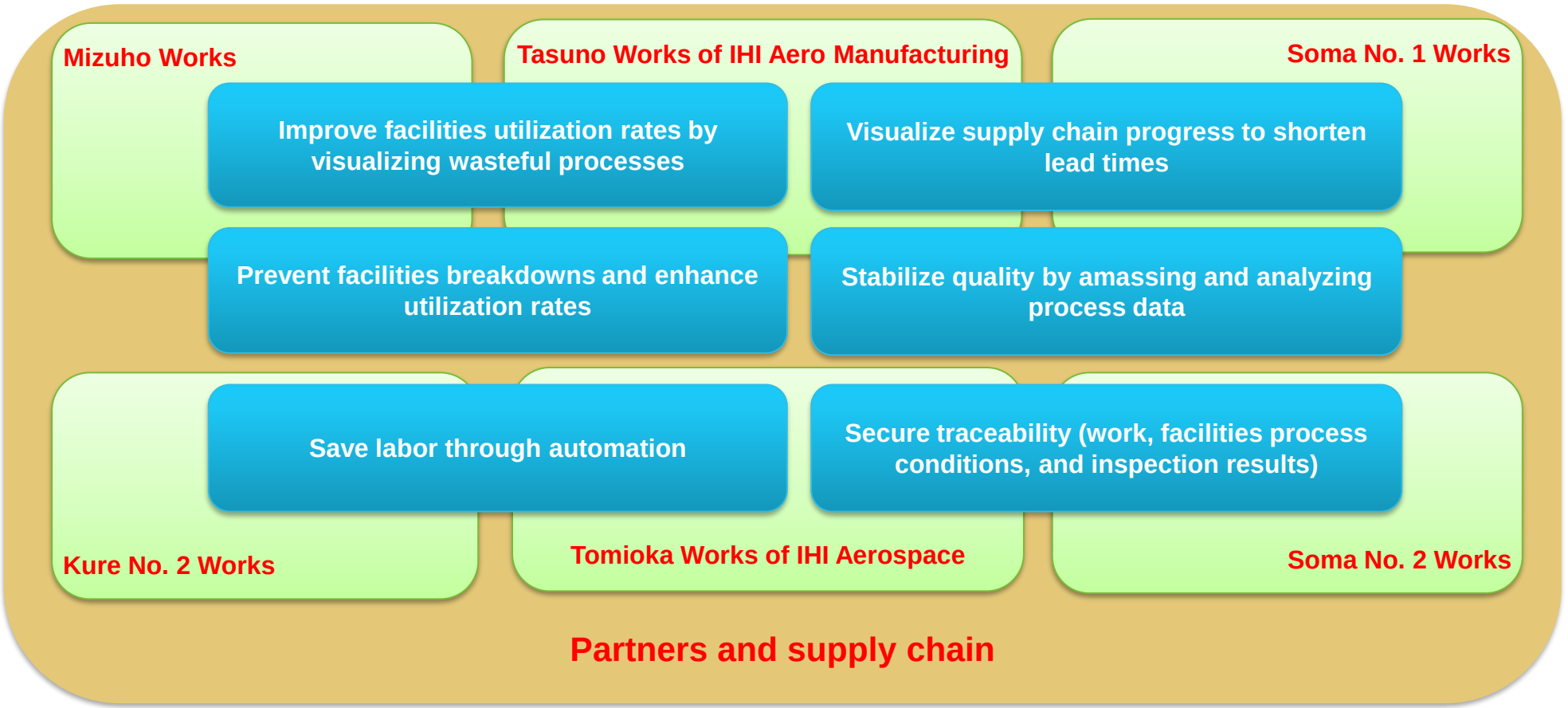
IHI Aero Manufacturing Co., Ltd.

Yokohama Manufacturing Department

3-1. Civil Aero Engine Business

Overview of IQ Factories (smart factories in this business area)

- **Improving production efficiency by optimally leveraging equipment and human resources in works and supply chains in this business area**



3-2. Defense Business

IHI

Focus over three years: Build for the future in an increasingly adverse business climate

Apply advanced technologies to enhance products and logistic support

- Undertake existing model upgrade programs (F-7 modifications, T-56 upgrades, and F-100, F-110, and T-700 repairs)
- Deploy new models (F-135 and F-3 and T-700 successors)
- Pursue logistical support advances in line with broader comprehensive contracts

Pursue R&D to in fighter jet engines

- Develop future fighter engines (start development program in 2021, for envisaged installations in the 2030s)

Cultivate overseas markets to solidify production and technology platforms

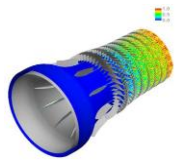
- Expand licensed parts production exports and secure engine maintenance, including for U.S. forces in Japan

Joint international development of engines for future jet fighters

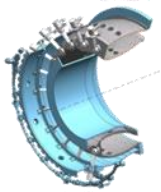
- We are leveraging world-class component technologies amassed in the XF9-1 engine delivered in June 2018 to pursue joint international development of engines for future fighter jets

XF9-1 (prototype engine)

Maintaining and reinforcing world-class component technologies and engine development capabilities

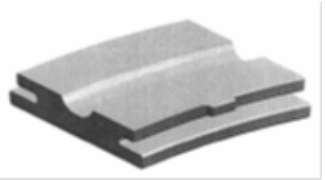


Compressors



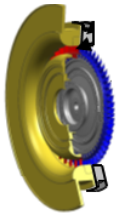
Burners

Advanced monocrystalline wings



Ceramic matrix composite shrouds

Domestically produced disk materials



High-load, high-efficiency, high-pressure turbines

3-3. Rocket Systems and Space Utilization Business

Focuses over three years

Build a rocket systems lineup catering to new needs and enter the launch services business

- Solid fuel rocket technology and updated liquid fuel propulsion technologies to secure certain market shares and earnings
- Prepare Epsilon launch services and undertake development to enhance competitiveness
- Participate in advanced compact rocket business and engage in trials to build new business model

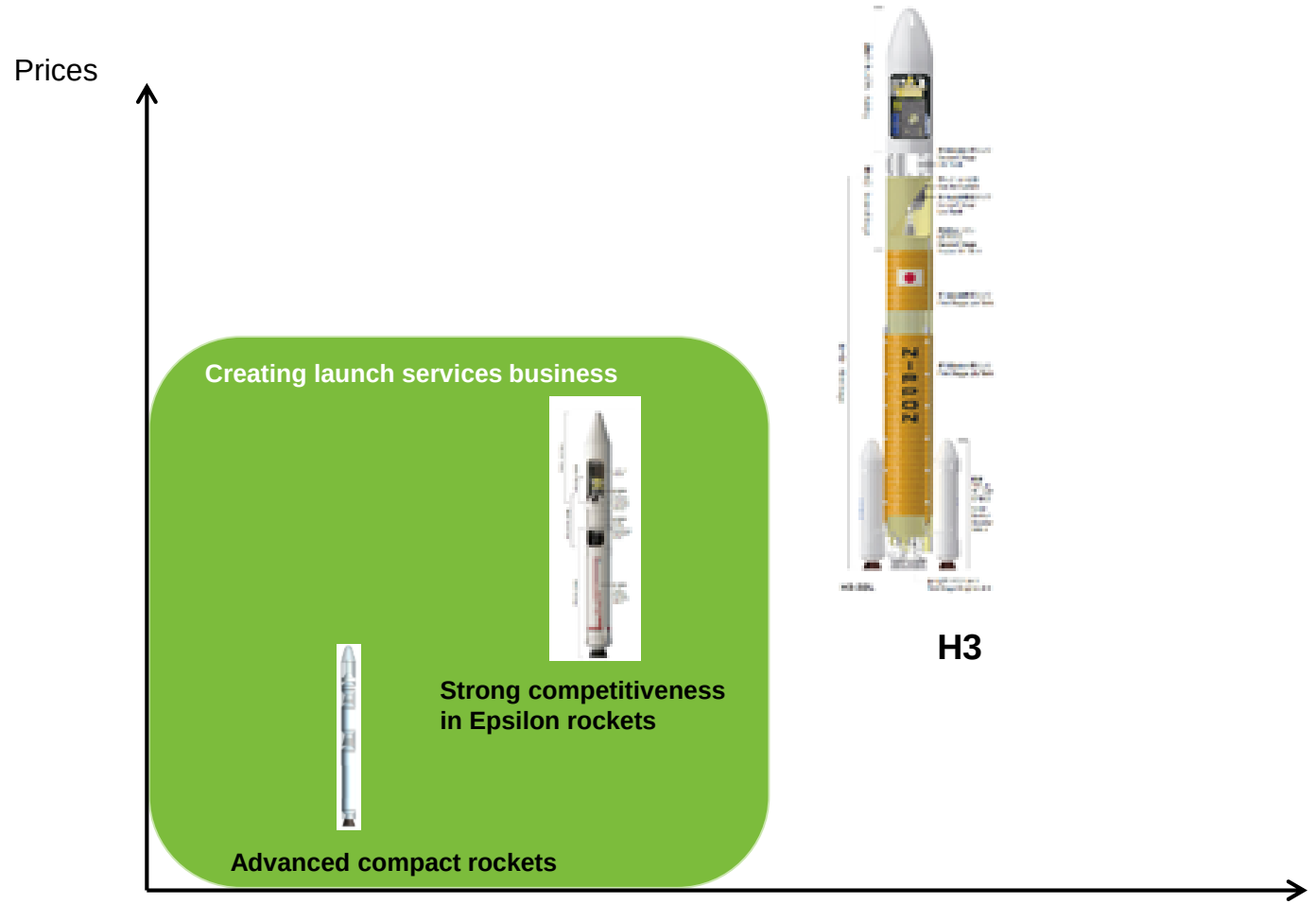
Develop new space exploration solutions businesses

- Create proof-of-concept platforms with customers to cultivate new solutions businesses that utilize satellite data
- Drive advances in AI, Big Data analysis, image processing, and other related technologies

3-3. Rocket Systems and Space Utilization Business

Build a rocket systems lineup catering to new needs and enter the launch services business

- **Maintain stable revenues and earnings in accommodating rocket lineup upgrades and cater to new small satellite launches**



4. Conclusion

4. Conclusion

- **We will establish and maintain a robust quality assurance structure in view of safety and quality being our top priorities**

- **Civil aero-engine business**
  - ✓ Cut costs by concentrating resources on bottleneck processes
  - ✓ Solidly rebuild our maintenance business and launch Tsurugashima Works operations to bolster the parts repair structure that is an earnings source

- **Defense business**
  - ✓ Drive advances in products and logistic support to cope with an increasingly adverse business climate
  - ✓ Pursue R&D in engines for future jet fighters

- **Develop unique technologies to expand businesses**

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.