

# Aero-Engine, Space & Defense Business Area Briefing



October 23, 2024

**IHI Corporation**

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President of Aero-Engine, Space & Defense Business Area

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## 1. Today's Key Messages

**IHI**

Generate revenue of **¥800 billion** by **FY2030** and **¥1,000 billion** by **FY2040**

**Sustainably increase** civil aero-engine **sales and earnings over the medium and long terms**

**Bolster** defense business **sales and earnings** on higher defense budgets and institutional reforms

In the space business, **increase contributions to national space development and cultivate private sector operations**

These are our key messages for today.

In the Aero-Engine, Space & Defense Business Area, we are leveraging years of technical expertise to deliver sustainable growth.

We aim to generate revenue of 800 billion yen by fiscal 2030 and 1 trillion yen by fiscal 2040.

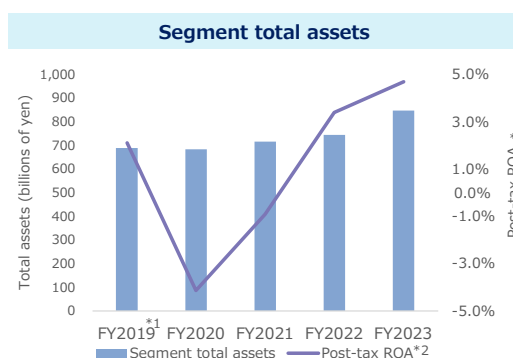
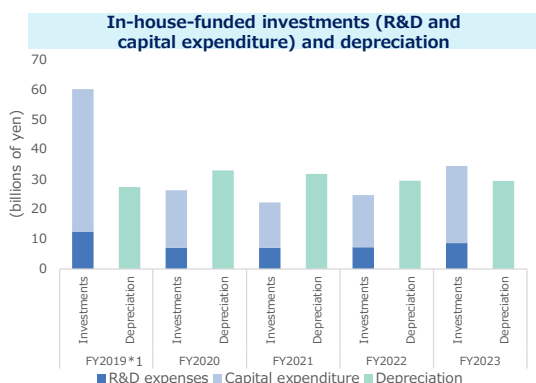
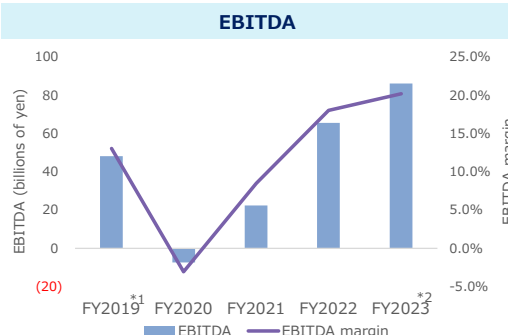
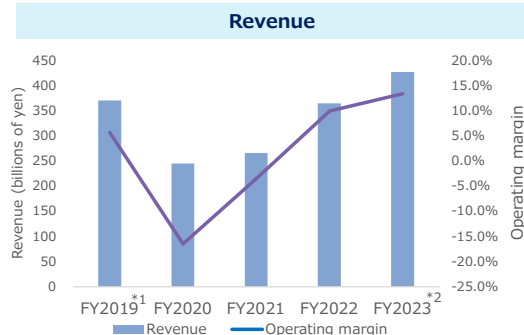
To those ends, we will:

- Sustainably increase civil aero-engine sales and earnings over the medium and long terms
- Bolster defense business sales and earnings on expanded defense budgets and institutional reforms
- Increase space contributions to national space development and cultivate private sector operations

## 2. Business Area Operating Results

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Revenue and earnings growth far exceeded pre-pandemic levels



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\*1 International Financial Reporting Standards applied to fiscal 2019 figures.  
\*2 Excluding impact of PW1100G-JM powder metallurgy issue in fiscal 2023.  
\*3 Post-tax ROA = Post-tax earnings divided by total assets.

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Let's first look at how we have performed over the past five years.

The top half of the slide shows revenue and EBITDA. Their growth has far exceeded pre-pandemic levels.

The bottom left of the slide shows our capital expenditures and depreciation. While capital expenditures surged in fiscal 2019 because of the construction of the Tsurugashima Aero-Engine Works and other work, since fiscal 2020 this spending had remained on par with depreciation.

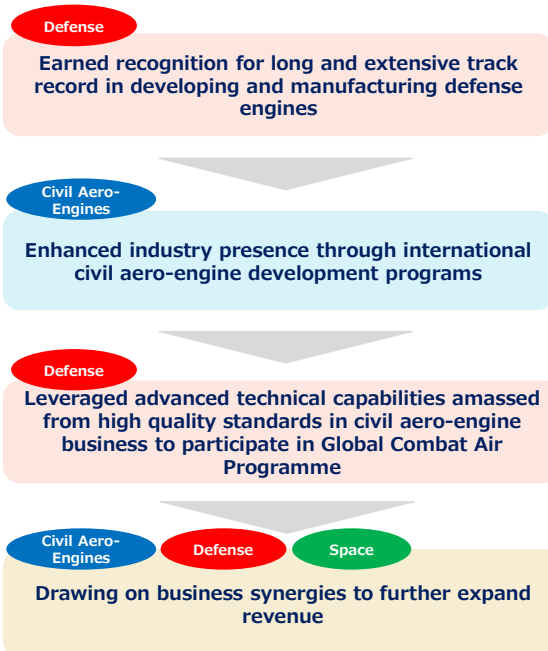
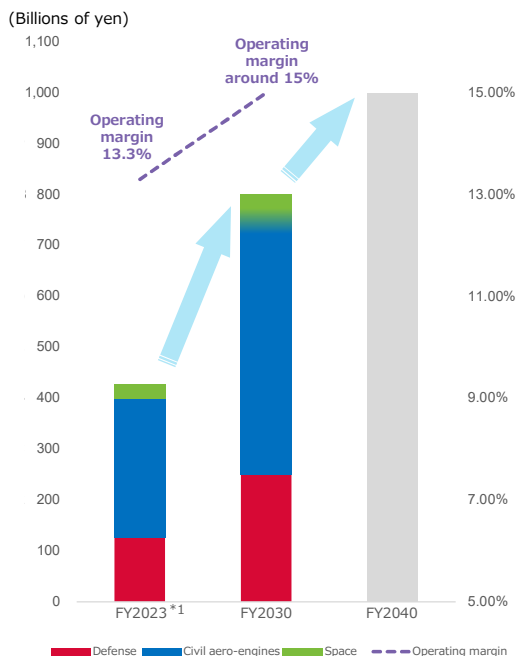
We will keep investing in growth while assessing business opportunities and risks.

The bottom right of the slide shows our total assets in this business area. As a rising post-tax return on assets demonstrates, our asset efficiency has improved every year.

### 3. Business Area Goals



**Boost revenue to ¥800 billion by FY2030 and ¥1,000 billion by FY2040  
Deliver sustainable growth by leveraging core propulsion technologies to maximize business synergies**



\*1 Excluding impact of PW1100G-JM powder metallurgy issue in fiscal 2023  
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By fiscal 2030, we target 800 billion yen in revenue and an operating margin of around 15%. We look for revenue to reach 1 trillion yen by fiscal 2040.

We accordingly consider it necessary to reinforce business synergies based on our core propulsion technology.

As you see on the right of the slide, our engine development began with defense programs. We drew on those foundations to participate in international civil aero engine development programs.

We have enhanced our industry presence by refining our technological capabilities to match the demanding quality standards of overseas original equipment manufacturers.

Our experience culminated our inclusion in the Global Combat Air Programme, an international joint development program for next-generation fighter jets, as Japan's engine manufacturer representative.

This is an example of synergies among businesses, the source of our strength. We will strive to maximize synergies across all areas, including space, to pursue sustainable growth.

## Civil Aero-Engine Business



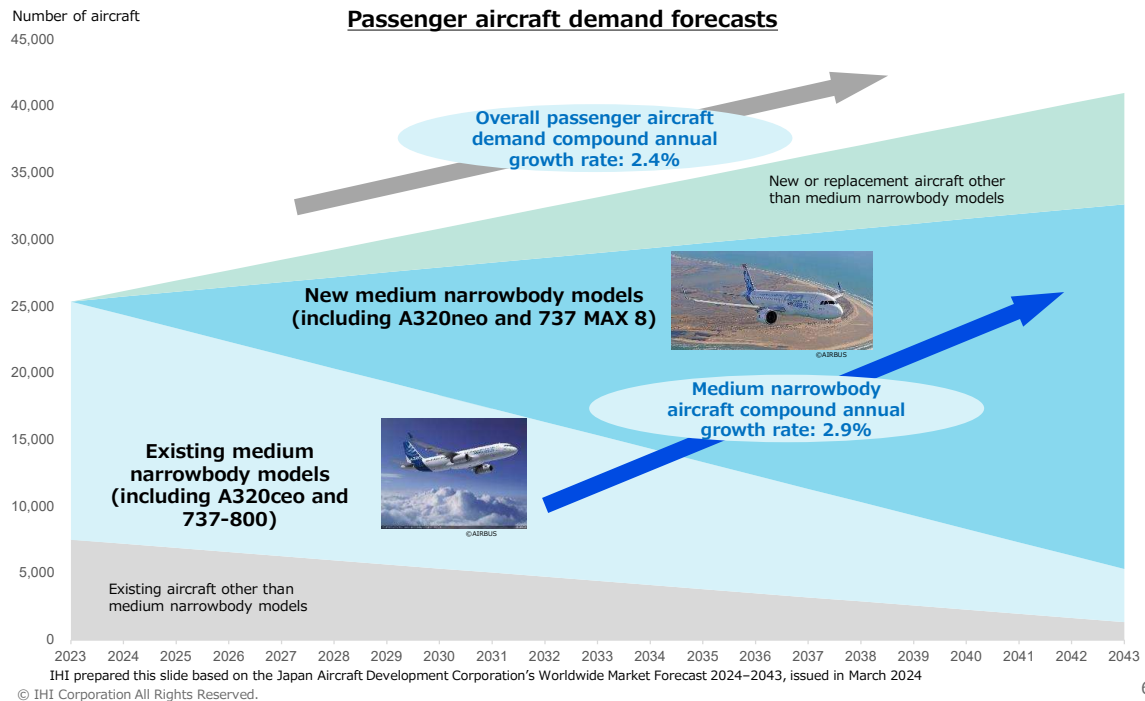
I will now explain initiatives within each business segment, starting with the Civil Aero-Engine business.

**4. Civil Aero-Engine Business:  
(1) Market Trends**



**Demand expanding particularly for medium narrowbody aircraft employing key offerings**

✓ Passenger aircraft demand growth to match that of global passenger demand (3.5% annual growth rate for 2020~2043)



Let me start by discussing the market climate.

Here we present our passenger aircraft demand forecasts through the 2040s.

With demand continuing to rise, the overall passenger aircraft market should grow at a compound annual growth rate of 2.4%.

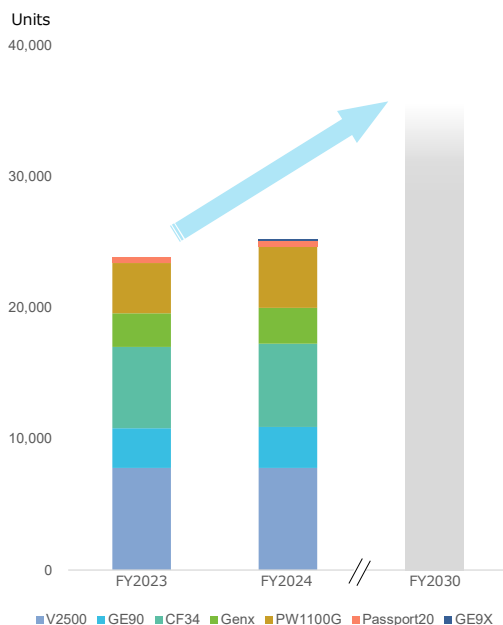
Medium narrowbody models represent a significant volume segment. The trends augur well for us as a supplier for that segment with such engine models as the V2500 and PW1100G-JM.

#### 4. Civil Aero-Engine Business: (2) Business Scale Expansion

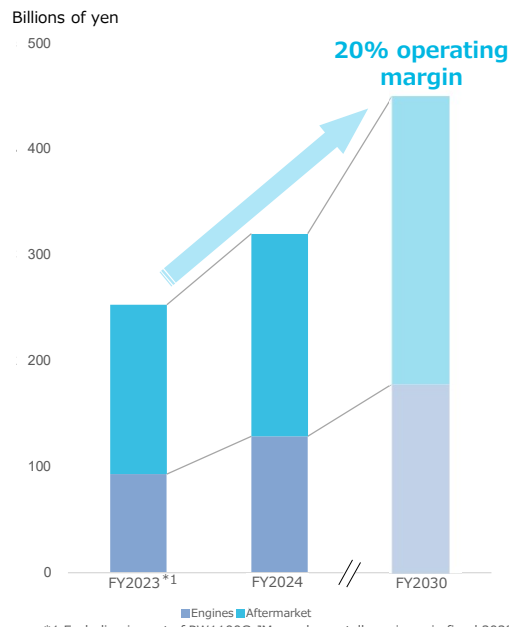


Total engine shipments have steadily increased, with aftermarket revenue growth being even faster

Cumulative engine shipments



Civil aero-engine business revenue



\*1 Excluding impact of PW1100G-JM powder metallurgy issue in fiscal 2023.

Note: Aftermarket encompasses spare parts + maintenance and parts repairs

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Next, we show where our Civil Aero-Engine business stands.

The graph on the left shows cumulative engine shipments, which have steadily increased.

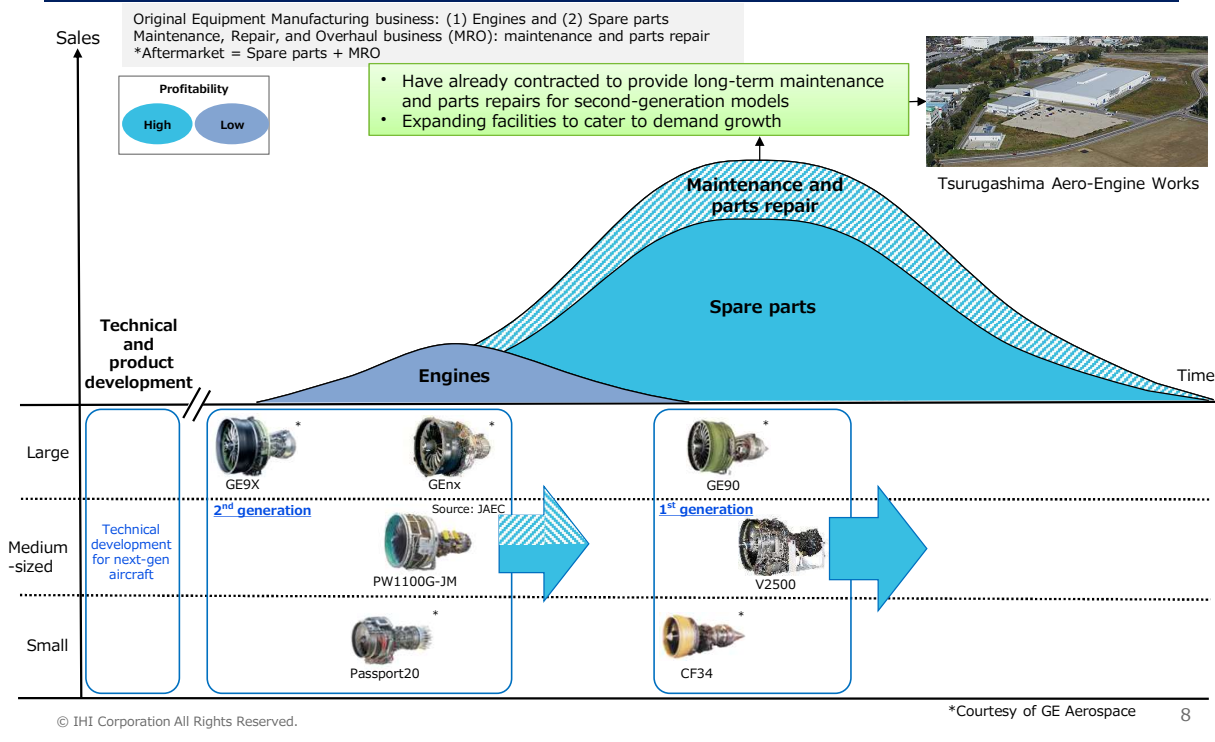
As the total number of engines in operation continues to grow, the scale of the aftermarket business should rapidly expand, fueling significant overall growth for this.

The graph on the right shows our outlook for 2030. We target revenue of around 450 billion yen and an operating margin of 20%.

#### 4. Civil Aero-Engine Business: (3) Envisioned Earnings Model



Invest earnings from existing engines in next-generation models to establish solid revenue streams for the medium through long terms



This diagram presents our revenue generation model across the civil-aero engine lifecycle. The vertical axis presents revenue and the horizontal axis indicates time.

Mass production starts after an initial development phase, followed by installation and operation. As the engines remain in service, demand grows for spare parts, engine maintenance, and parts repairs.

As you can see, most of the revenue comes from the aftermarket business. This is a common civil aero-engine industry revenue model.

Our first-generation engines generate revenue largely through spare parts sales. Our second-generation offerings will transition from mass production to the aftermarket phase and enter the recovery phase within several years. In addition to spare parts sales, we will also strengthen our engine maintenance and parts repair businesses, which were smaller in scale for first-generation engines.

To meet these increasing demands, we plan to fully operationalize and further expand our Tsurugashima Aero-Engine Works.

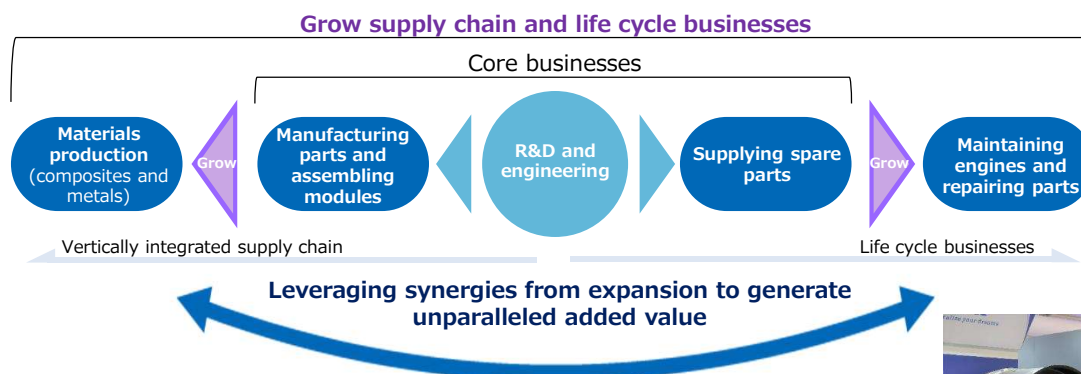
The key to success here is to maintain this revenue model across the long term. We will accordingly invest some earnings from first- and second-generation engines to develop technologies for next-generation aircraft, thus solidifying our long-term revenue base.

**4. Civil Aero-Engine Business:**  
**(4) Leverage Manufacturing Prowess to Boost Competitiveness**



**Endeavor to add even more value to next-generation engine program**

- ✓ Enhance added value by expanding the value chain beyond existing core businesses
- ✓ Generate unparalleled added value through synergies by expanding supply chain and lifecycle business



**PW1100G-JM example**

- The IHI Group developed composite materials offering exceptional design flexibility
- We were the world's first to employ composite materials with structural fan exit guide vanes, earning accolades for contributing significantly to weight reduction



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This slide shows how we are leveraging our manufacturing capabilities to become more competitive.

Take a look at the graphic in this slide.

Our business traditionally focused on R&D and engineering in the center, manufacturing parts and assembling modules to the left, and supplying spare parts to the right. Over the years, we broadened the scope of our value chain to encompass materials production further to the left and maintaining engines and repairing parts further to the right, thereby added more value. Harnessing our expertise in engineering and materials production has enabled us to offer low-cost, high-quality maintenance and repairs. Expanding the value chain has generated new synergies, driving even more of our unparalleled added value.

For the PW1100G-JM engine, for example, we developed composite materials, enabling highly flexible product design. We were the world's first to employ such materials with structural fan exit guide vanes, earning accolades for contributing significantly to weight reduction.

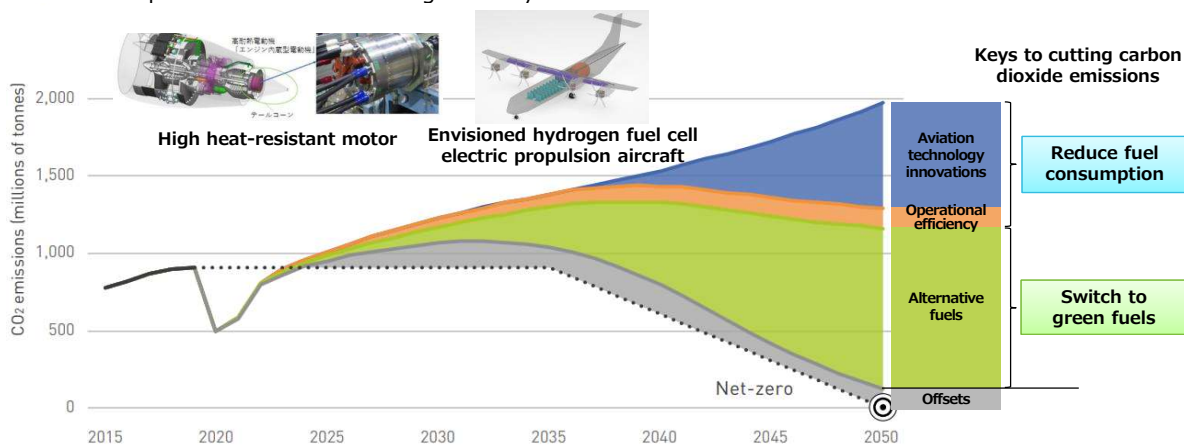
Our synergies are fruits of our technological strengths. We will continue to tap our unique technologies to expand added value.

#### 4. Civil Aero-Engine Business: (5) Toward Next-Gen Propulsion Systems



##### Undertake R&D to achieve carbon neutrality by 2050

- ✓ Tap in-house technological seeds to spearhead the development of new propulsion systems and electric power and thermal management systems



##### R&D harnessing Green Innovation Fund

###### Electrification

1. High heat-resistant motor: Electric generator built into engines
2. Gas bearing motor: Electric turbo machinery and electric blower
3. Electric power and thermal management systems

###### Hydrogen fuel cell efforts

Liquid hydrogen tanks/hydrogen fuel cell fuel supply systems, and fuel cells

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Finally, I will touch on our long-term research and development endeavors. As you know, achieving carbon neutrality by 2050 will necessitate cutting fuel consumption and transitioning to green fuels. We are pushing forward with R&D in such areas as electrification and hydrogen fuel cells, drawing on external funding to assist with these efforts.

By drawing on our groupwide technical expertise, we aim to spearhead developments and help resolving societal challenges. We believe that our ongoing efforts will make us more competitive and expand our revenue opportunities.

# Defense Business



I will now turn to our Defense business.

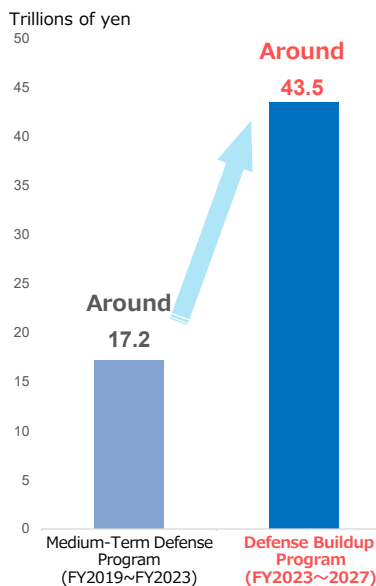
## 5. Defense Business: (1) Help Overhaul Nation's Defense Capabilities



IHI offers products and services for all seven major programs to "Fundamental reinforcement of Japan's defense capabilities"

✓ Japanese government aims to increase defense budget to 2% of GDP by FY2027

The expenses based on contracts (material expenses) to be newly concluded

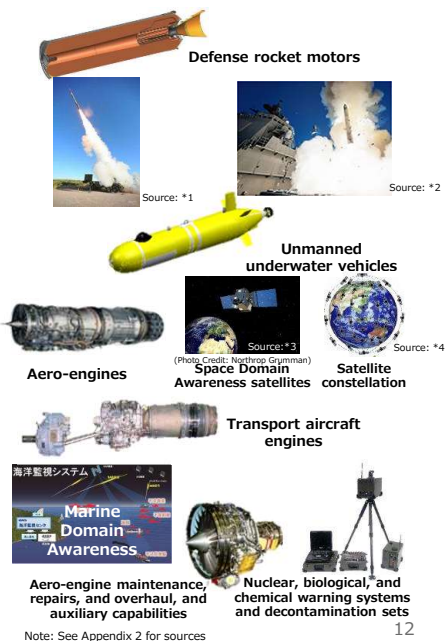


Figures based on above program and plan

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Seven major programs to "Fundamental reinforcement of Japan's defense capabilities"

- Stand-Off Defense Capabilities
- Integrated Air and Missile Defense Capabilities
- Unmanned Defense Capabilities
- Cross-Domain Operation Capabilities
- Mobile Deployment Capabilities/Civil Protection
- Command-and-Control and Intelligence-related Functions
- Sustainability and Resiliency



Note: See Appendix 2 for sources

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I would like to revisit the topic of Defense business expansion that President Hiroshi Ide discussed in May this year.

In response to the government's policy of "Fundamental reinforcement of Japan's defense capabilities", "the Defense Buildup Program" was formulated with significant expansion, and the defense budget was increased accordingly.

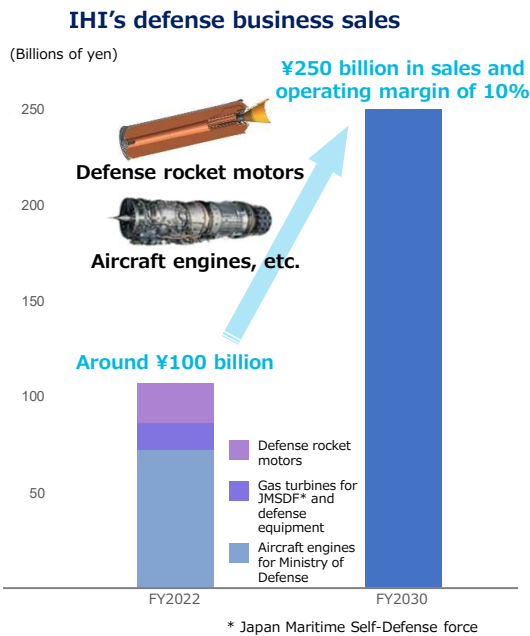
The National Defense Strategy and other key documents highlight seven major programs of "Fundamental reinforcement of Japan's defense capabilities".

IHI offers products and services for all of these programs. Such broad coverage is one of our key strengths.

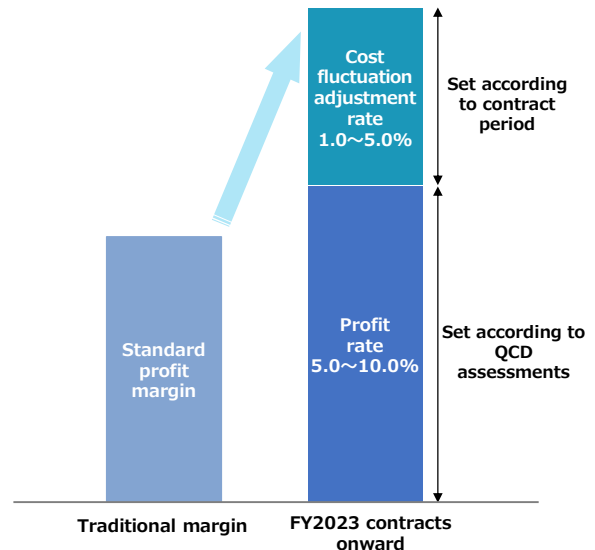
5. Defense Business:  
(2) Medium-Term Goals



**FY2030 targets: Sales of ¥250 billion and operating margin of 10%**



**Enhance profit margins as part of defense industry policy**



- Corporate efforts reflected in profit margins through Ministry of Defense evaluations of quality, cost, and delivery management
- Deploying a cost fluctuation adjustment rate absorbs the risk of cost increases from soaring prices and other uncontrollable factors

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Next, I will outline our medium-term revenue and earnings targets. We look for revenue to reach around 250 billion yen by fiscal 2030, the key drivers being defense rocket motors and aircraft engines.

In terms of profit, we now have a policy to improve profit margins.

Now we are expecting the Ministry of Defense to allow us enjoy up to 10% profit margin by ensuring them, appreciating our strengths, which are quality, cost and delivery time management as a result of our cooperate effort.

Also procurement price hike, which is out of our control, will be taken into consideration.

Depending on the contract period, 1 to 5% cost hike will be transformed into our pricing.

We will provide extensive explanations to ensure the Ministry of Defense assesses us appropriately.

## 5. Defense Business: (3) Expand Solid-Fuel Rocket Motor Business



### Provide propulsion systems for numerous medium- to-large-diameter missiles

- ✓ Solid rocket motors for missile propulsion systems contribute to standoff defense and integrated air defense missile defense capabilities

SM-3 Block IIA  
(Joint development and production by Japan and US)



PAC-3/PAC-3MSE



Type-11 surface-to-air missile/  
Surface-to-air guided missile for  
base air defense

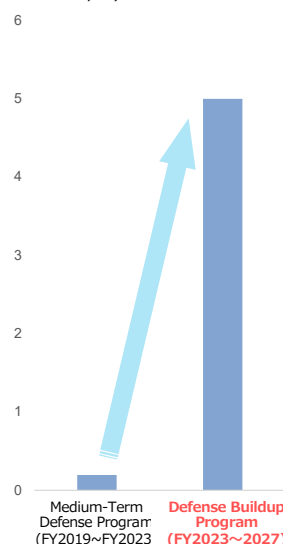


Note: See Appendix 2 for sources

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Standoff defense capability-  
related budget

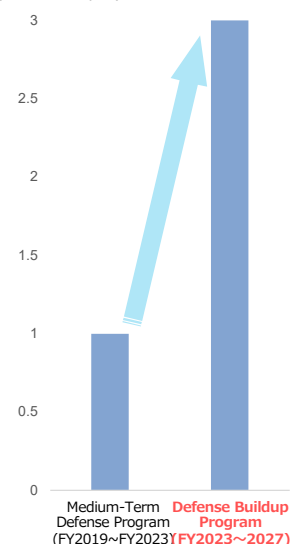
(Trillions of yen)



Figures based on above plan

Integrated air and missile defense  
capability-related budget

(Trillions of yen)



Figures based on above plan

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The defense rocket motor business is key revenue expansion driver. Our company engages in the solid-fuel rocket business, providing propulsion systems for missiles in the defense sector. Most of the large to medium size missiles, including SM-3 Block IIA and PAC-3, which are shown in the picture, are using IHI's solid fuel rocket motors.

As the graph on the right shows, the current Defense Build-up Program allocates a substantial portion of the budget to stand-off defense and integrated air and missile defense capabilities. Stand-off defense is a capability to deal with naval vessels and landing forces invading into our country from outside of their threat range. Integrated air and missile defense refers to systems that intercept ballistic missiles and other aerial threats.

In both of these areas, our technology can contribute significantly. We aim to steadily expand our business in these areas.

**5. Defense Business:**

**(4) Strengthen Defense Equipment Transfers**



**Leveraging long experience in developing and manufacturing defense engines to strengthen global deployment of defense business**

**Export licensed domestic engine parts to U.S. original equipment manufacturer**



Help strengthen alliance between Japan and United States by complementing IHI and original equipment manufacturer production capabilities

**Maintenance business for engines mounted on F-35 fighter jets**



(From June 29, 2023, press release)

In Asia-Pacific, serving as regional maintenance depot alongside Australia

**International joint development for next-generation fighter aircraft (GCAP)**



Source: \*1 (computer-generated image)

Playing a vital role by stepping up collaboration with the public and private sectors

Note: See Appendix 2 for sources

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Engine parts exports to original equipment manufacturers, as shown in the upper part of the slide, complement Japanese and U.S. production capabilities and help strengthening national alliances. We look to expand the range of engine models we cover.

Regarding the F-35 engine maintenance business shown in the lower left of the slide, IHI serves as a regional maintenance depot for the Asia-Pacific. We are collaborating with friendly nations that operate the F-35 to bolster the production and maintenance infrastructure.

The lower right of the slide highlights International joint development program called Global Combat Air Programme in collaboration with Japanese, British, and Italian governments and companies.

Beyond these endeavors, we will harness our extensive experience to engage in projects that contribute to Japan's security and reinforce the global expansion of our Defense business.

## Space Business



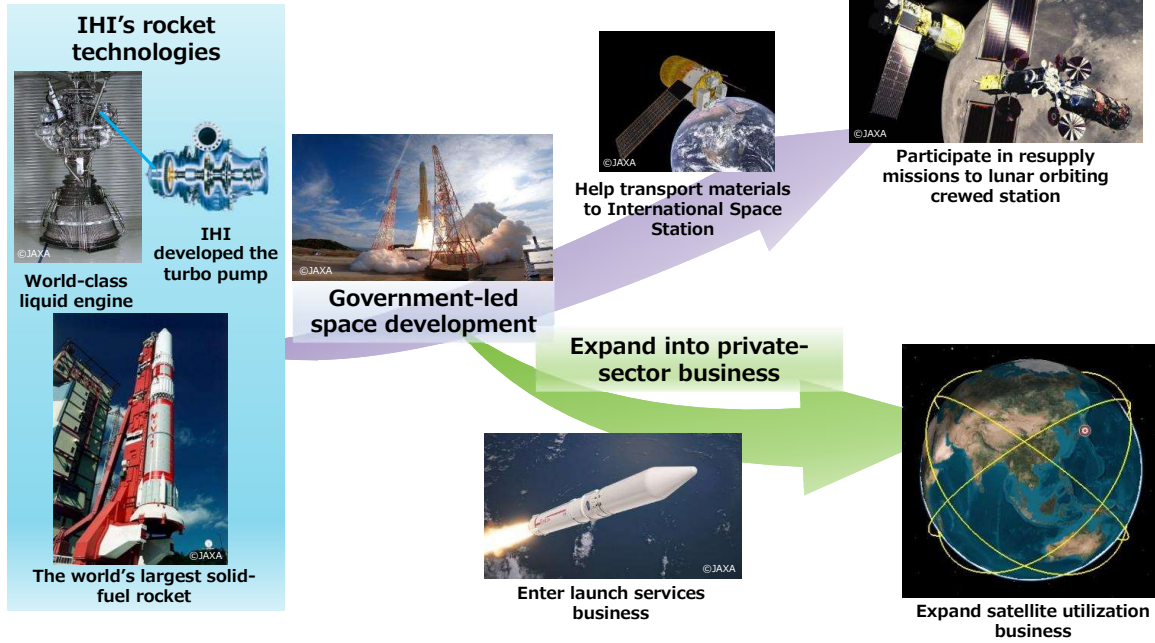
I will now talk about our Space business.

**6. Space Business:**

**(1) Expand Business through Public-Private Collaboration**



**Expand contributions to nation's space development and commercialize launch services**



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We position the Space business as a long-term growth driver. The slide illustrates the development of this business. Building on our rocket and other foundational technologies, we are first contributing to government-led space development initiatives. These efforts include our involvement in HTV, the transfer vehicle to provide supplies to the International Space Station. We aim to participate in resupply missions for lunar-orbiting crewed stations.

The Basic Plan on Space Policy, announced in 2023, emphasizes collaboration between the public and private sectors to address space security and global challenges and create new industries. We plan to tap the production and technological infrastructure that we have created through government projects to contribute to these fields. Efforts will include partnering with other companies, commercializing launch services with the Epsilon rocket, and expanding satellite utilization businesses, thus fostering the growth of these emerging industries.

**6. Space Business:  
(2) Satellite Utilization Services**



**Foster new industries and boost national security by expanding satellite utilization services**

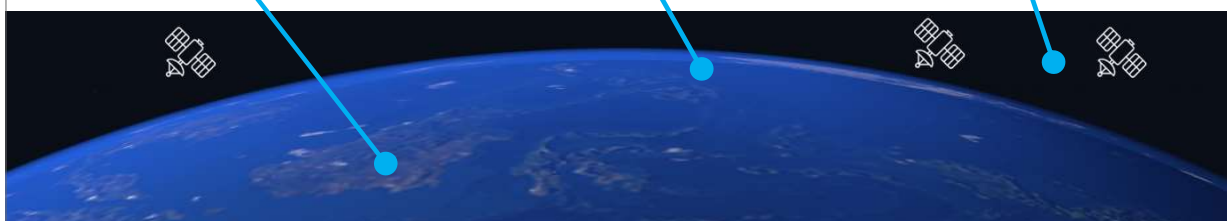
Tropical forest and peatland management combining satellite and ground data (through NeXT FOREST\*1)



Securing maritime safety, including through IHI Ocean Monitoring Service\*2



Collaborating with Northrop Grumman for space domain awareness\*3



\*1 A joint venture with Sumitomo Forestry Co., Ltd. <https://www.ihj.co.jp/csr/nextforest/index.html>

\*2 IHI Ocean Monitoring Service <https://www.ihj.co.jp/ij/business/satellite/>

\*3 [https://www.ihj.co.jp/all\\_news/2022/aeroengine\\_space\\_defense/1198210\\_3479.html](https://www.ihj.co.jp/all_news/2022/aeroengine_space_defense/1198210_3479.html)

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I will now talk about our expansion of satellite utilization services. Many players, including venture companies, are entering this area.

We are pushing forward with projects with Sumitomo Forestry, such as to manage tropical forests and peatlands, while ensuring maritime safety through ship position data obtained from satellites, including through IHI Ocean Monitoring Service. We have also started collaborating with Northrop Grumman to enhance space domain awareness.

Although our efforts in this field are still in their early stages, we aim to leverage our advanced technological capabilities to contribute to Japan's economic development and national security over the long term.

# Toward Tomorrow

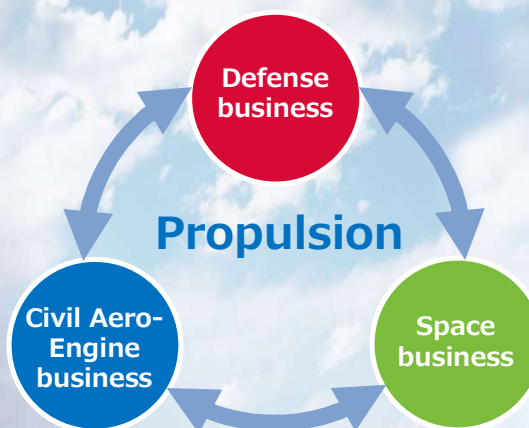


## 7. Toward Tomorrow

**IHI**

IHI will harness its technological expertise based on its propulsion capabilities to:

- Support global air transportation
- Contribute to Japan's security
- Pioneer new space frontiers



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Note: See Appendix 2 for sources

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Lastly, I would like to share my vision for the future.

Over the past 170 years, the IHI Group has helped society develop by cultivating technology in a range of fields.

In the Aero-Engine, Space & Defense Business Area, which I discussed today, we will keep focusing on our core propulsion technology capabilities. In civil aero-engines, we seek to support global air transport. In the defense sector, we will contribute to Japan's national security. In the space field sector, we will pioneer new frontiers.

We aim to be a company, who continuously support the foundation of the society, while leveraging our strength, i.e. our strong technological capabilities.








# Appendix



## Appendix 1: Civil Aero-Engine Program Portfolio



### Product portfolio balanced across generations and sizes

	Engine program*	Aircraft (Type)	Main Partners	Cumulative Unit Sales	Status				
					80'	90'	00'	10'	20'
1 <sup>st</sup> generation	<b>Medium-sized</b> <b>V2500</b> 	A320, MD-90 (Single Aisle)	P&W JAEC (IHI: 14%) MTU	7,782	Started development in 1984				
	<b>Large</b> <b>GE90</b> 	B777 (Medium Widebody)	GE IHI: 9% Safran	3,029	Joined GE's development program in 1990				
	<b>Small</b> <b>CF34</b> 	Bombardier CRJ, ARJ, E170~195 (Regional Jets)	GE JAEC (IHI: 27%)	6,201	Joined GE's development program in 1996				
2 <sup>nd</sup> generation	<b>Large</b> <b>GEEx</b> 	B787, B747 (Small Widebody)	GE JAEC (IHI: 13%) Safran MTU	2,577	<ul style="list-style-type: none"> <li>• Development: 2004~</li> <li>• Shipment: 2011~</li> </ul>				
	<b>Medium-sized</b> <b>PW1100G-JM</b>  <small>Source: JAEC</small>	A320neo (Single Aisle)	P&W JAEC (IHI: 15%) MTU	3,821	<ul style="list-style-type: none"> <li>• Development: 2011~</li> <li>• Shipment: 2014~</li> </ul>				
	<b>Small</b> <b>Passport20</b> 	Bombardier Global 7500/8000 (Business Jets)	GE JAEC (IHI: 27%)	406	<ul style="list-style-type: none"> <li>• Development: 2012~</li> <li>• Shipment: 2017~</li> </ul>				
	<b>Large</b> <b>GE9X</b> 	B777x (Medium Widebody)	GE JAEC (IHI: 10%) Safran MTU	-	<ul style="list-style-type: none"> <li>• Development: 2014~</li> </ul>				

Red text: Joint venture

Blue text: Revenue-sharing partner

■ Development 
 ■ Initial production 
 ■ Commercial production 
 ■ Parts and maintenance expansion

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\* Courtesy of GE Aerospace 22

## Appendix 2: Links for Sources (some in Japanese only)

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- \*1 Air Self-Defense Force website <https://www.mod.go.jp/asdf/equipment/other/Patriot/index.html>
- \*2 Maritime Self-Defense Force website <https://www.mod.go.jp/msdf/release/202211/20221121-1.pdf>
- \*3 Northrop Grumman <https://news.northropgrumman.com/file?fid=5b5049e4a1383544d163f9a3>
- \*4 Cabinet Office website [https://www8.cao.go.jp/cstp/anzen\\_anshin/20221021\\_meti\\_3.pdf](https://www8.cao.go.jp/cstp/anzen_anshin/20221021_meti_3.pdf)

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- \*1 Maritime Self-Defense Force website <https://www.mod.go.jp/msdf/release/202211/20221121-1.pdf>
- \*2 Air Self-Defense Force website <https://www.mod.go.jp/asdf/equipment/other/Patriot/index.html>
- \*3 Air Self-Defense Force website <https://www.mod.go.jp/asdf/equipment/other/yuudoudan/index.html>

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- \*1 Ministry of Defense website <https://www.mod.go.jp/j/policy/defense/nextfighter/index.html>

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- \*1 Ministry of Defense website <https://www.mod.go.jp/j/policy/defense/nextfighter/index.html>
- \*2 Maritime Self-Defense Force website <https://www.mod.go.jp/msdf/release/202211/20221121-1.pdf>



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