

# Aircraft, Defense & Space Business Plan

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Head of Commercial Aviation  
Systems

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Senior Vice President,  
Head of Integrated Defense &  
Space Systems

July 12, 2019

Mitsubishi Heavy Industries, Ltd.

## 1. Business Overview

## 2. Commercial Aviation Systems Segment

2-1. Overview

2-2. Management Structure

2-3. 2018 Business Plan Progress Status

2-4. Business Policies and Strategies

## 3. MRJ Business

3-1. Driving the MRJ Business

3-2. Progress Towards First Delivery 2020

3-3. Commercialization

## 4. Integrated Defense & Space Systems Segment

4-1. Overview

4-2. 2018 Business Plan Progress Status

4-3. Measures Targeted at FY2021 and Beyond

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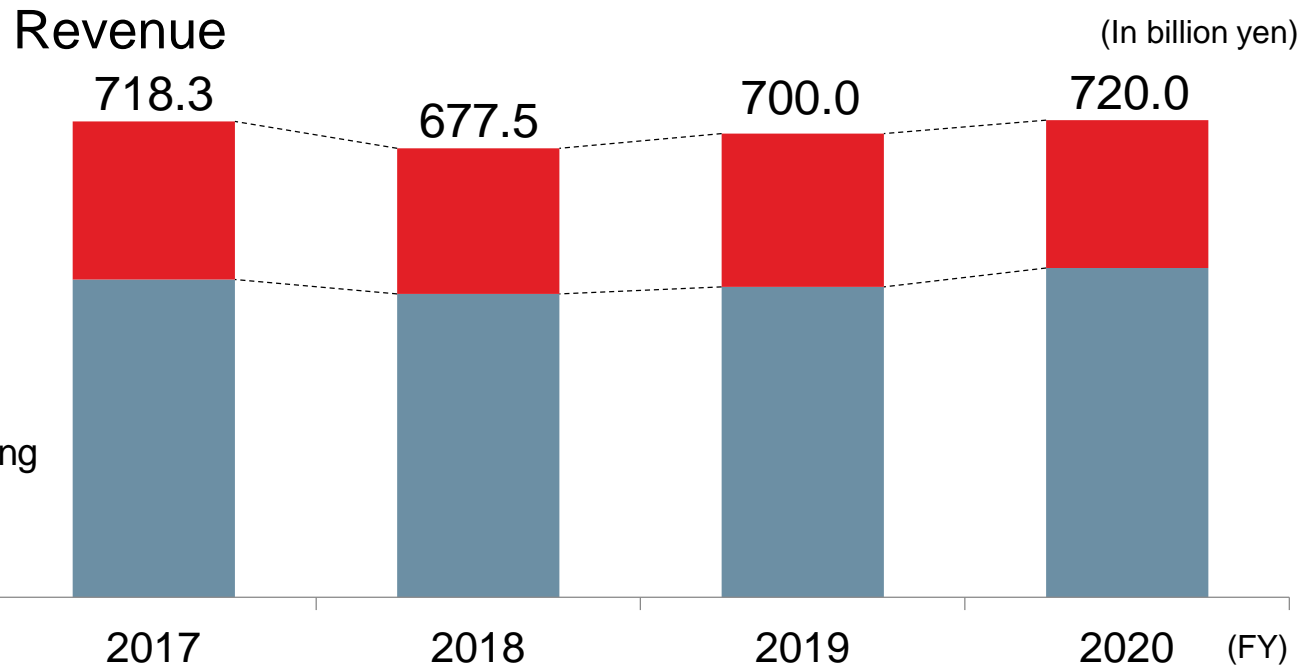
## 4. Integrated Defense & Space Systems Segment

- 4-1. Overview
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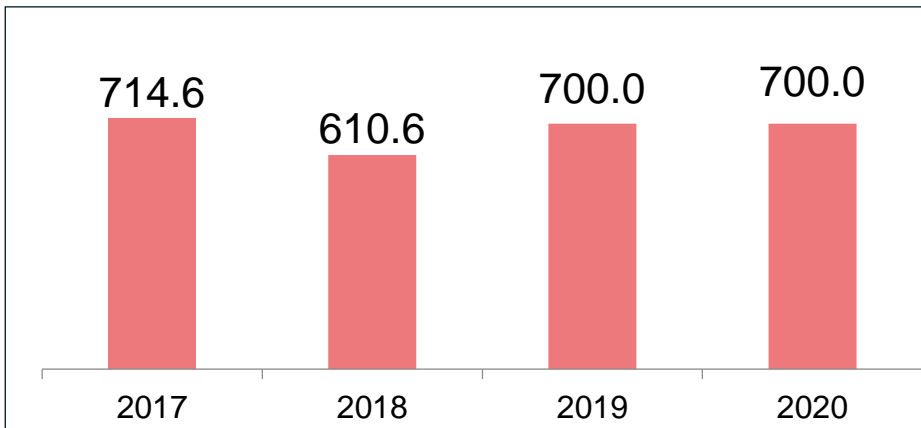
# 1. Business Overview (FY2018 Results and 2018 Business Plan)

## Integrated Defense & Space Systems

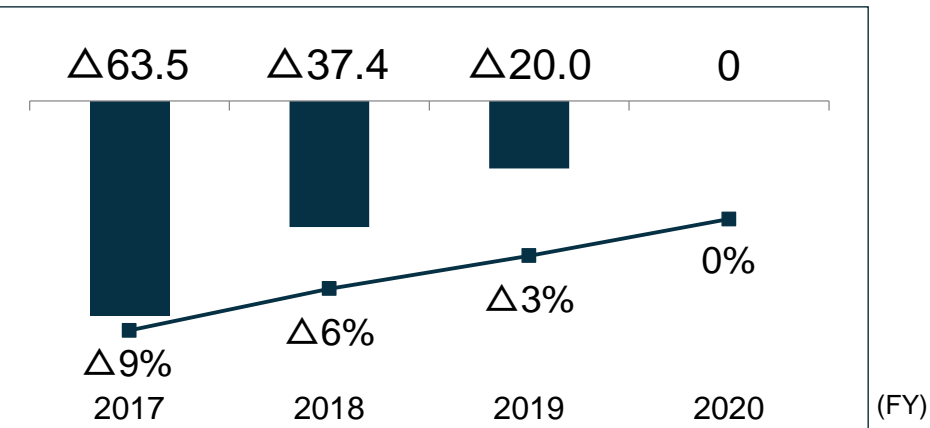
- Naval ships
- Aircraft & missile systems
- Special vehicles
- Space systems
- Commercial Aviation Systems
- Aircraft components for Boeing
- Aircraft components for Bombardier, etc.
- SpaceJet (MRJ)



## Orders Received



## Profit from Business Activities (In billion yen)



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# 2-1. Overview

## Boeing

787

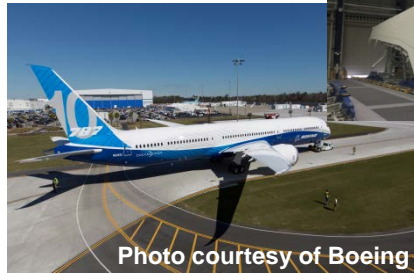


Photo courtesy of Boeing

MHI: main wing boxes



Main wings

Aircraft components for Bombardier, etc.

777X



Photo courtesy of Boeing

MHI: aft fuselage, tail fuselage and entry doors



Aft fuselage

777



Photo courtesy of Boeing

MHI: aft fuselage, tail fuselage and entry doors



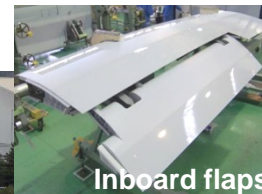
Tail fuselage

737

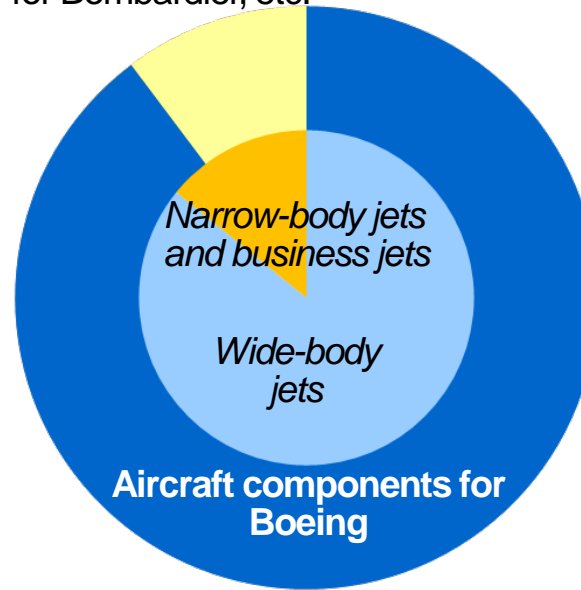


Photo courtesy of Boeing

MHI: inboard flaps



Inboard flaps



## Bombardier

Global 5000/6000



Photo courtesy of Bombardier

MHI: main wings, center-fuselage and center wing



Main wings

Challenger 300/350



Photo courtesy of Bombardier

MHI: main wings



Main wings

# 2-2. Management Structure



**Keisuke HIROSE**  
Segment Head

## Commercial Airplanes Division



**Yuji HIRANO**  
General Manager  
(for Boeing 787)

- Business & Administration Dept. - Quality Dept.
- Business & Marketing Dept. - Production Planning & Control Dept.
- Engineering Dept. - Parts Manufacturing Dept.
- Assembly Dept. - Composite Wing Production Dept.



**Hiroshi TANEDA**  
Deputy Segment Head  
(for technology)



Satoshi SAWAGUCHI  
Deputy General Manager  
(for Bombardier)



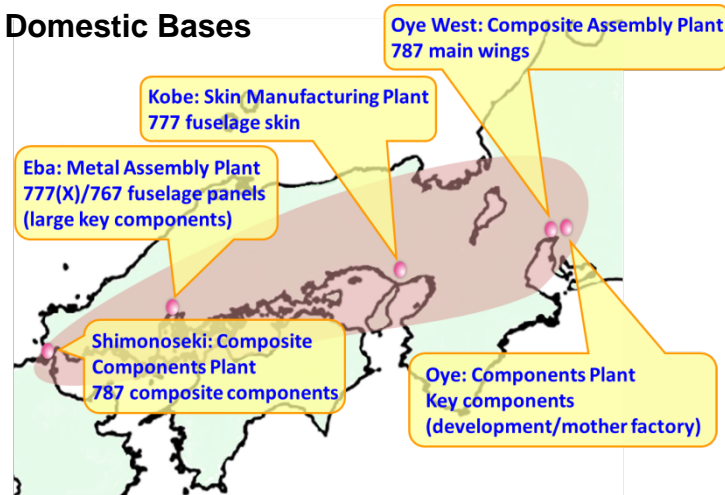
Kenji INABA  
Deputy General Manager  
(for Boeing)

Planning & Administration Department

Engineering Steering Department

Aviation Business Development & Strategy Department

## Domestic Bases



## Overseas Bases

### MHI Aerospace Vietnam Co., Ltd.



President Yasushi SATO

### MHI Canada Aerospace Inc.



President Janet Wardle

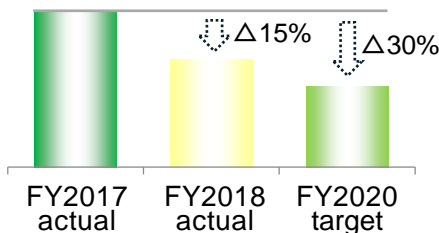


## Business Environment

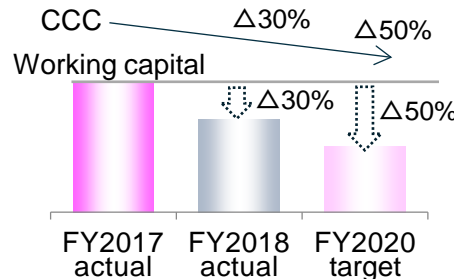
- 1) Market expansion over next 20 years (operating fleets to be doubled)
  - During years of 2018 Business Plan, temporary decrease due to transition from Boeing 777 to 777X. Production to increase from 2020.
- 2) Reduction in contract prices necessary due to fierce OEM sales price competition
- 3) Intensified competition with overseas Tier1 manufacturers

## Status of Current Improvements

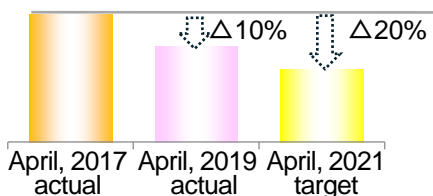
### Shorten production lead time (days)



### Working capital/CCC



### Reduce Fixed cost



Sales to decrease, but earnings to be maintained through higher productivity, fixed cost reductions, etc.

## 2018 Business Plan Progress

### 1. Strengthen cost competitiveness to withstand severe business environment

Promote automation and manpower saving

- Introduce automated equipment
- Automate indirect operations through AI/IoT
- Continue ongoing improvement activities



Automated assembly line for 777X  
787 wing boxes production line for 14shipsets /month production

- Build global production structure
  - Enhance supply chain in North America and Asia

### 2. Expand into areas with differentiated competitive advantages

- Targeting new Tier1 structure packages
  - Advanced materials (composites)
  - Advanced engineering /manufacturing processes (metal processing)

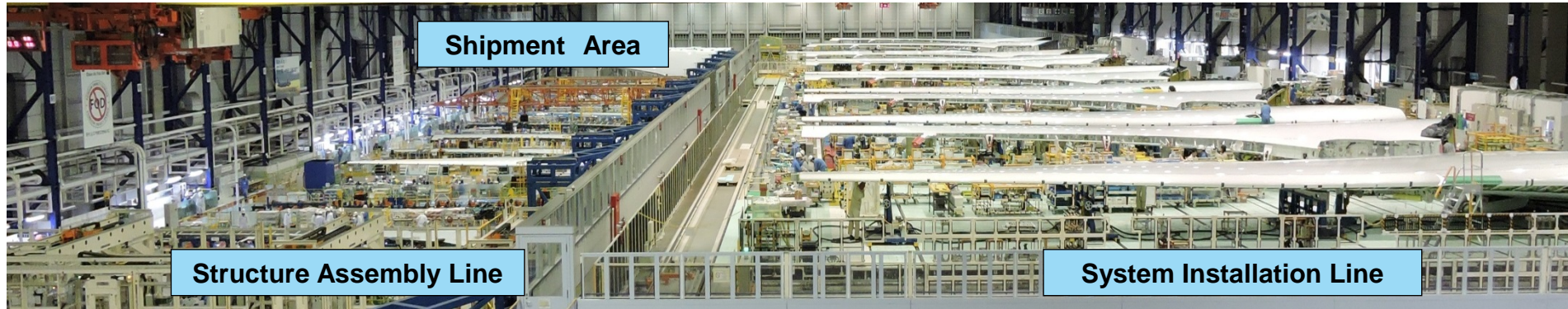
### 3. Expand into new areas

- High value-added products (Components)
- Operation support
- Electrification



# 2-3. 2018 Business Plan Progress Status (2/3)

Established 14shipsets/mo 787 Composite Wing Production. Further Lean production by Automation.



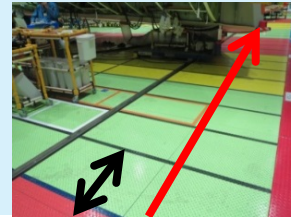
**Expansion of Auto-drill  
(Flowtime Reduction)**



**Unmanned wing transfer  
(Expand Automation)**



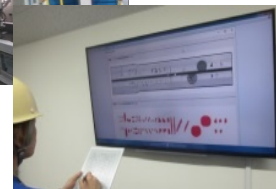
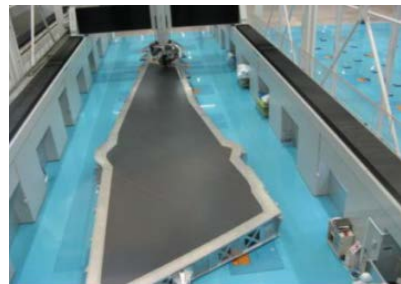
**Moving Line for System Installation  
(Flowtime Reduction)**



**Champion Time Competition  
@Shop Floor**



**Composites factory**



**Reduction of Composite  
Lay up Inspection  
(Process Control)**

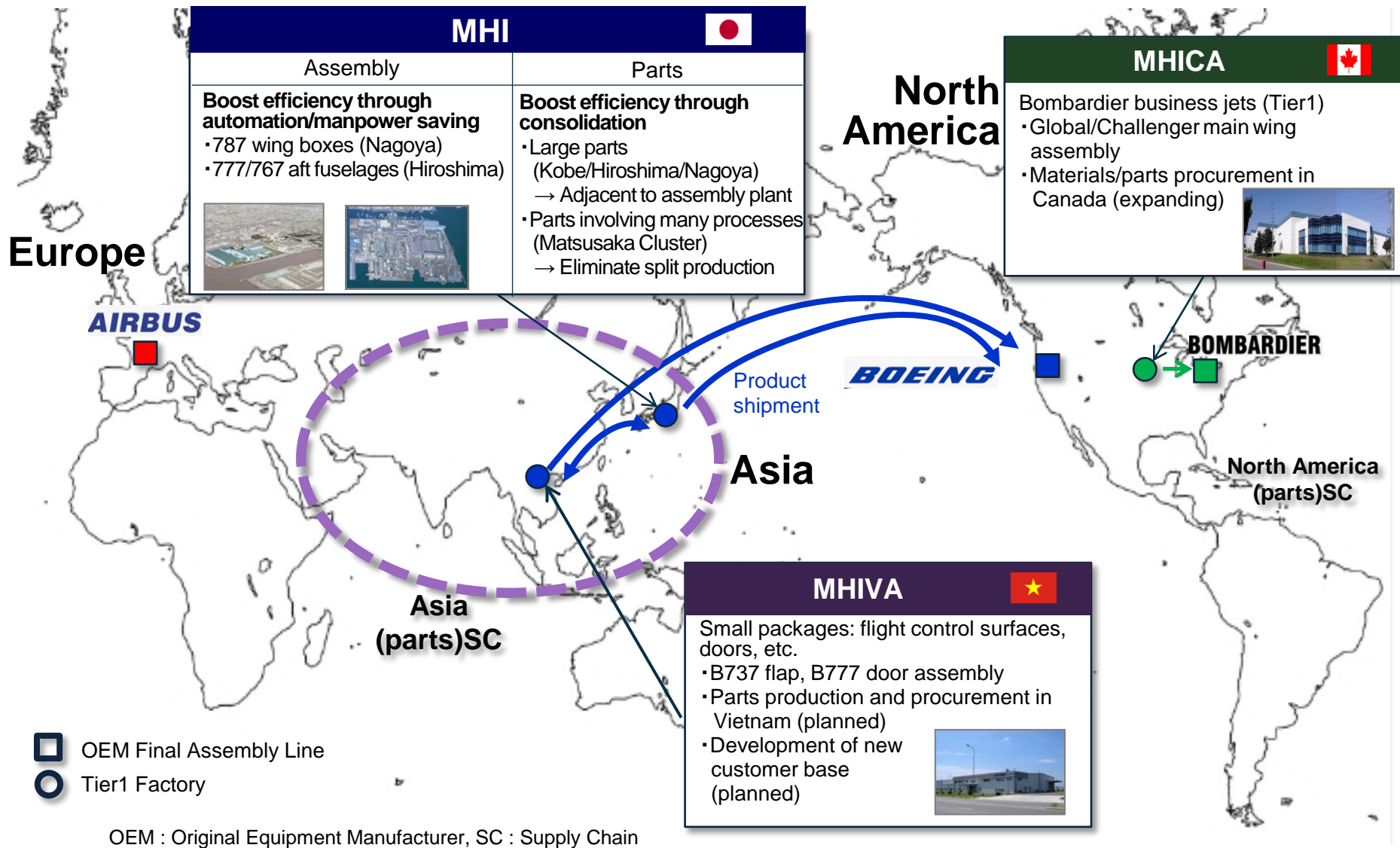
**Next Generation  
Composite Lay up  
Machine**

**AI/IoT Application  
to Inspection**

**Expansion of  
Real-time Production  
Monitoring**

# 2-3. 2018 Business Plan Progress Status (3/3)

Aim for global structure to meet OEM expectations, enhancing supply chain in North America and Asia



# 2-4. Business Policies and Strategies



## Production technology

- Improve productivity for commercial production
- Pursue synergies with SpaceJet

## Leading-edge technology

- Lighter weight
- Lower costs

## Expand into new business areas

Low carbon

Digitalization

- High value-added products (Components, etc.)
- Operation support
- Electrification



Interior materials



Operation support

## Expand into differentiated competitive advantage areas ( Targeting new Tier1 structure packages)

- Advanced materials (composites)
- Advanced engineering /manufacturing processes (metal processing )



Thermoplastic composites



Additive manufacturing

## Continue “Business Structure Reforms” (strengthen existing businesses)

Promote automation (manpower saving → full automation)

Expand globally / Restructure business portfolio

2018 Business Plan

2021 Business Plan

Medium- to long-term plans



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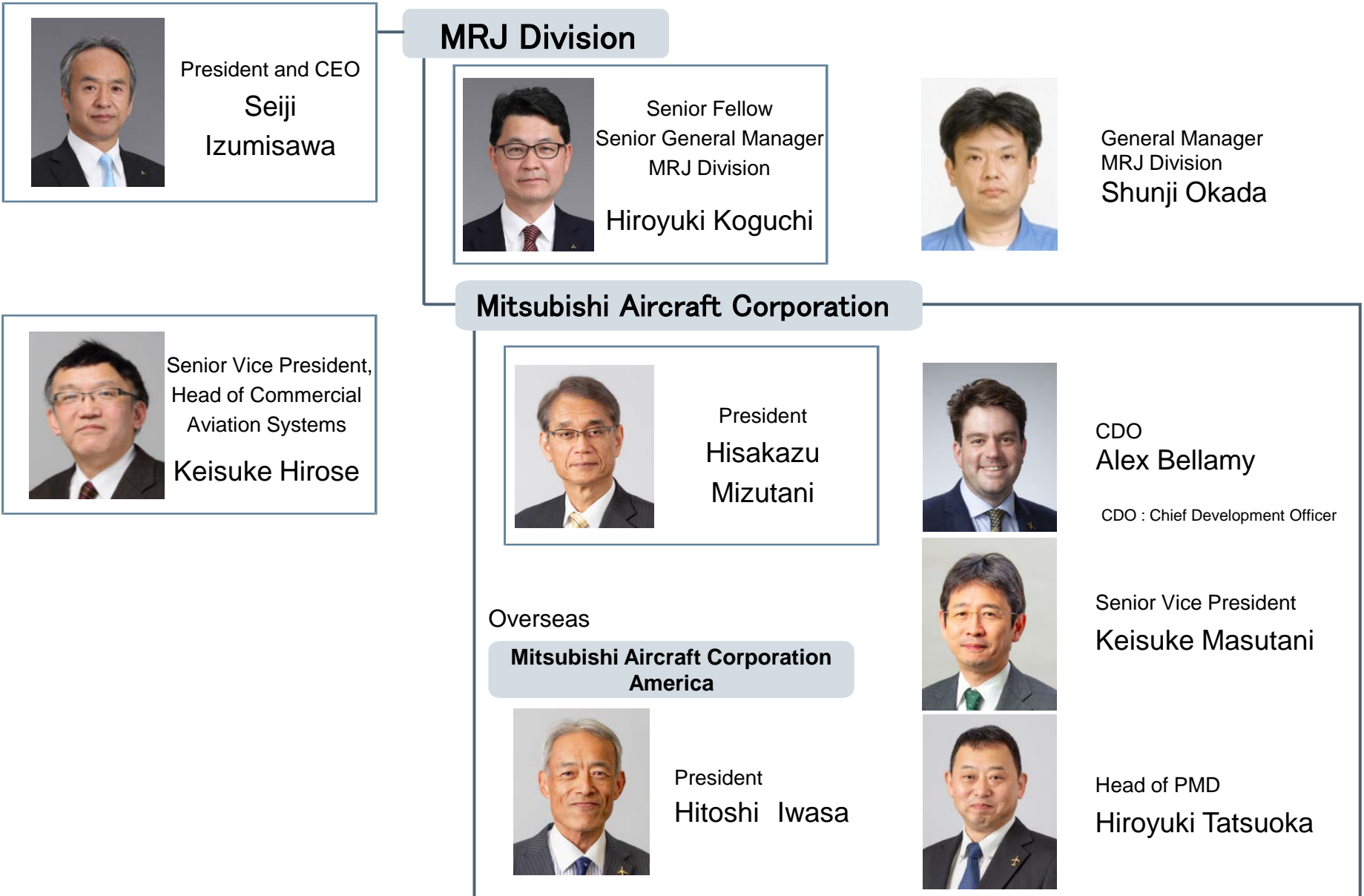
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# 3-1. Driving the MRJ Business (Organization)



# Driving the MRJ Business

**Continue Focus on Obtaining TC**

**Establish a Customer Support System**

**Develop an Optimal System to Support a Synergized Production**

**Develop a Mainstream Product for North American Market and Enhance our Service System**

TC: Type Certification

## 3-2. Progress Towards First Delivery 2020

### FY2018 Achievements

- ◆ Demonstration flight at Farnborough Air Show
- ◆ Obtained TIA from JCAB
- ◆ Type Certification (TC) flight tests started
- ◆ Received LOA from FAA
- ◆ Achieved approximately 2,700 flight hours



Blowing Snow and Freezing Fog Test  
(McKinley Laboratory)



Cross-wind Test

### FY2019 Initiatives

#### Development

- Accelerate TC flight test with additional Flight Test Vehicles
- Prepare a customer support system for First Delivery



#### Paris Air Show

- Announcement of Mitsubishi SpaceJet Family
- Introduced new concept “M100”



### • TC Tests

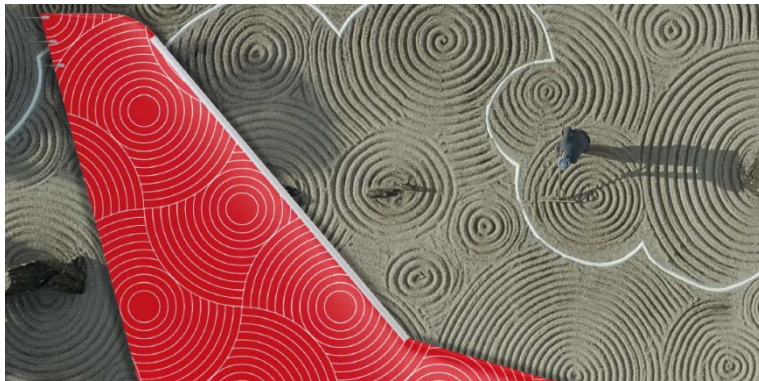
- TC Engine & APU test
- TC Cold temperature test
- TC Anti icing system test
- TC Fuel system test
- TC Avionics test



APU: Auxiliary Power Unit

### 3-3. Commercialization - New brand: Mitsubishi SpaceJet Family

- Naming to emphasize product value, instead of “Regional” market segment
- Provide “Spacious and Wide Cabin & Overhead Bin”, “Ultimate Comfort”, “Environment-friendly” and “Excellent Economics”
- Introducing the “Mitsubishi SpaceJet” family, branded with “Mitsubishi”



#### M90

Designed for **76-92 Seats**  
(The foundation of SpaceJet Family)



#### M100

Designed for **65-88 Seats**  
(Comply with US Scope clause)



#### M200

Designed for **up to 100 Seats**  
(Under consideration)



**SPACEJET**  
Space where it matters

### 3-3. Commercialization - Market of Mitsubishi SpaceJet Family

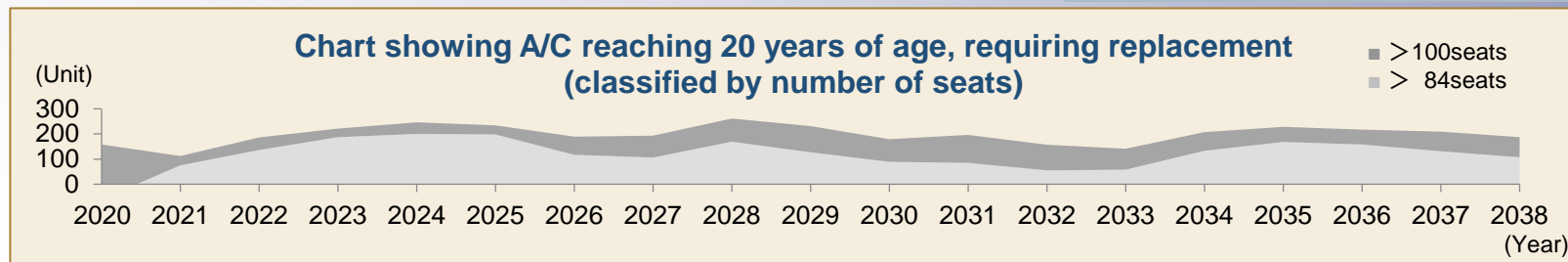
#### Mitsubishi SpaceJet Family

- 5,000+ regional jets (100 seater and below) in demand for coming 20 years
- Strong and stable demand for replacement - as many as average 200 per year
- Two family models: M90 with 76 - 92 seats and M100 with 65 - 88 seats to set a new standard in the RJ segment

**THE REGIONAL AIRCRAFT CATEGORY IS A GROWTH MARKET**

**WE'RE HERE TO ENABLE IT**

Region	Percentage	Count
North America	39%	2,027
Europe	14%	740
Other Asia Pacific	13%	663
China	12%	623
Latin America	7%	352
Africa	6%	287
CIS	5%	238
Middle East	3%	135
Japan	1%	62








## SpaceJet M100

- Designed with excellent performance, adapting to wide range of market needs. Perfectly matches US and global market
- Complies with Scope Clause with 65 - 76 seats three-class cabin configuration, and expandable to 88 seats single-class. Industry leading operational economics and array of cabin options allows the product to flexibly meet various needs across the globe


### SpaceJet M100



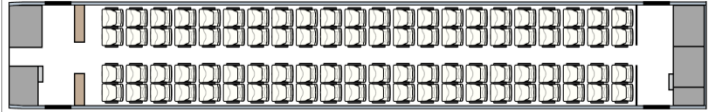
M100 / 65-88 SEATS

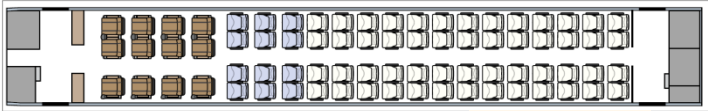
Typical Single Class 84 seats (31inch)




Maximum Capacity 88 seats (29inch)



Typical Triple Class 76 seats (36in/33in/30in)



Premium Class	Premium Economy Class	Economy Class
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**MAXIMUM SIZE ROLLER BAGS**  
 23 x 14.5 x 10 in  
 58 x 37 x 25 cm

188 cm / 6 ft 2 in  
 202 cm / 6 ft 8 in  
 47 cm / 18.5 in  
 5 cm / 2 in  
 46 cm / 18 in  
 276 cm / 9 ft 1 in

## Acquire CRJ Program from Bombardier Inc.

**Acquire Customer Support, Marketing, Sales, and  
TC from CRJ program  
(including US service centers)**

**Complement the Development, Manufacturing,  
Sales, and Customer Support for Mitsubishi  
SpaceJet family**

**Expected transaction closing during first half of  
2020 (subject to regulatory approvals and  
customary closing conditions)**

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## Defense



F-2 Fighter



SH-60K Maritime Patrol Helicopter



PAC-3



SM-3



“Oryu” Submarine



“Shiranui” Destroyer

## Space Systems



H-IIA Launch Vehicle



H-IIB Launch Vehicle



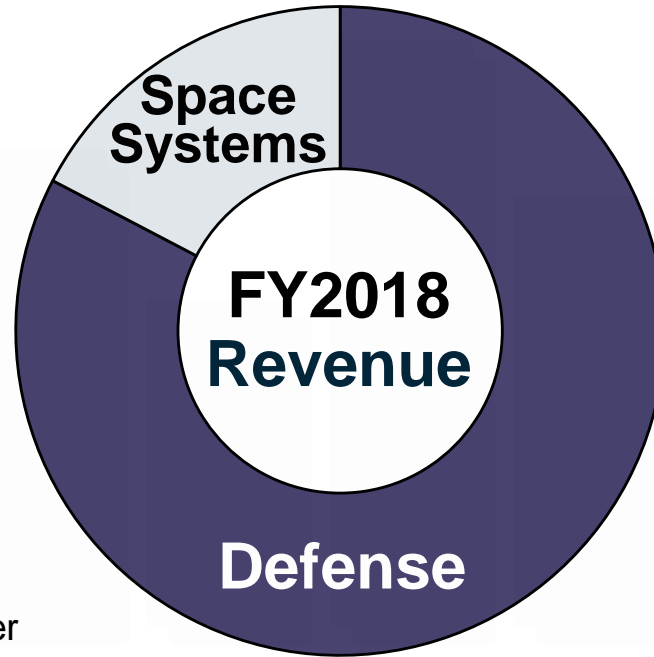
H-II Transfer Vehicle (HTV)



Type 16 Mobile Combat Vehicle




Type 10 Main Battle Tank





## Management Structure




**Naohiko ABE**  
Senior Vice President,  
Head of Integrated  
Defense & Space Systems



**Keiji SAKURAI**  
Senior Fellow  
Senior Chief Engineer  
(Future Fighter)



**Mitsuru HAMADA**  
Senior Fellow  
Senior Chief Engineer  
(Special Affairs)



**Hiroshi ARAKAWA**  
Senior Fellow  
I & I Domain Senior Chief  
Engineer  
IDSS Senior Chief Engineer  
(Acting)

### Product Lines

#### <Defense>



**Masashi MORITA**  
Vice President and  
General Manager  
Aircraft & Missile Systems  
Division




**Motohiro KITAGAWA**  
Senior Fellow  
Vice President and  
General Manager  
Naval Ships & Maritime  
Systems Division



**Takashi OKAZAKI**  
Vice President and  
General Manager  
Special Vehicle Division

#### <Space Systems>




**Masahiro ATSUMI**  
Senior Fellow  
Vice President and  
General Manager  
Space Systems Division

### Functions



**Hitoshi SHIRAISHI**  
Vice President and  
General Manager  
Planning & Administration  
Department



**Koji ABE**  
Vice President and  
General Manager  
Advanced System  
Programs Department



**Takashi FUJII**  
Vice President and  
General Manager  
Procurement  
Department

## Defense

- **SM-3**

2018 Oct, Dec

Successful flight test of anti-ballistic missile  
(U.S. Department of Defense)

- Development has been completed -

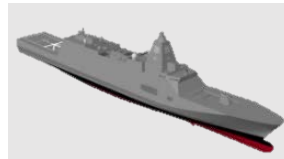


©MDA

- **Multi-Purpose Compact Destroyer**

2018 Oct

Orders received for 2 vessels



- **Christening and launch ceremony**

2018 Oct

Submarine "Oryu"  
(Kobe)



- **Delivery ceremony**

2019 Feb

Destroyer "Shiranui"  
(Nagasaki)



## Space Systems

- **Launch vehicles**

- 1) **Launch of H-IIA/B**

2018 Jun	H-IIA	No. 39
Sep	H-IIB	No. 7
Oct	H-IIA	No. 40



- 2) **Launch services**

2018 Dec

Agreement with Inmarsat  
(UK) on H3 launch after 2022



- 3) **H3 (First launch scheduled for FY2020)**

2019 Jan

Started 1st-stage BFT  
(battleship firing test)



- **HTV**

2018 Sep	No. 7	Launch
Nov	No. 7	Re-entry

**HTV-X in detailed design  
underway**

**(No. 1 scheduled for launch on  
H3 in FY2021)**



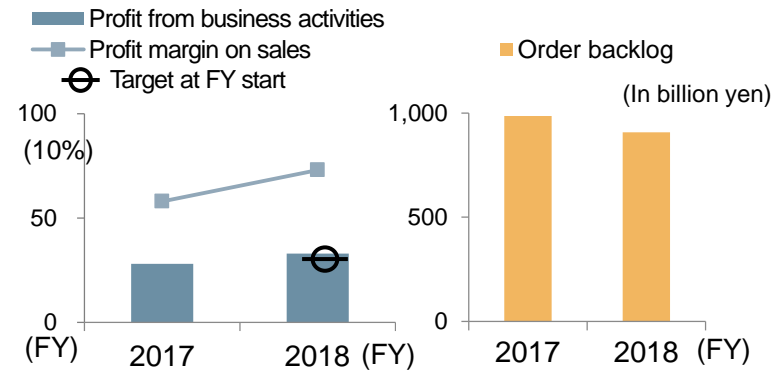
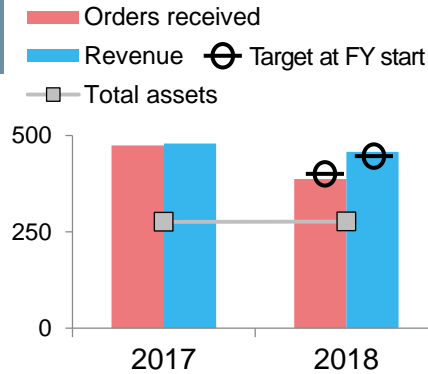
©JAXA

# 4-2. 2018 Business Plan Progress Status

## Achievements in FY2018

■ Generally smooth progress toward achievement of 2018 Business Plan targets

- Sales revenue reached target
- EBIT slightly exceeded target on fixed/variable costs reduction



## Business Environment

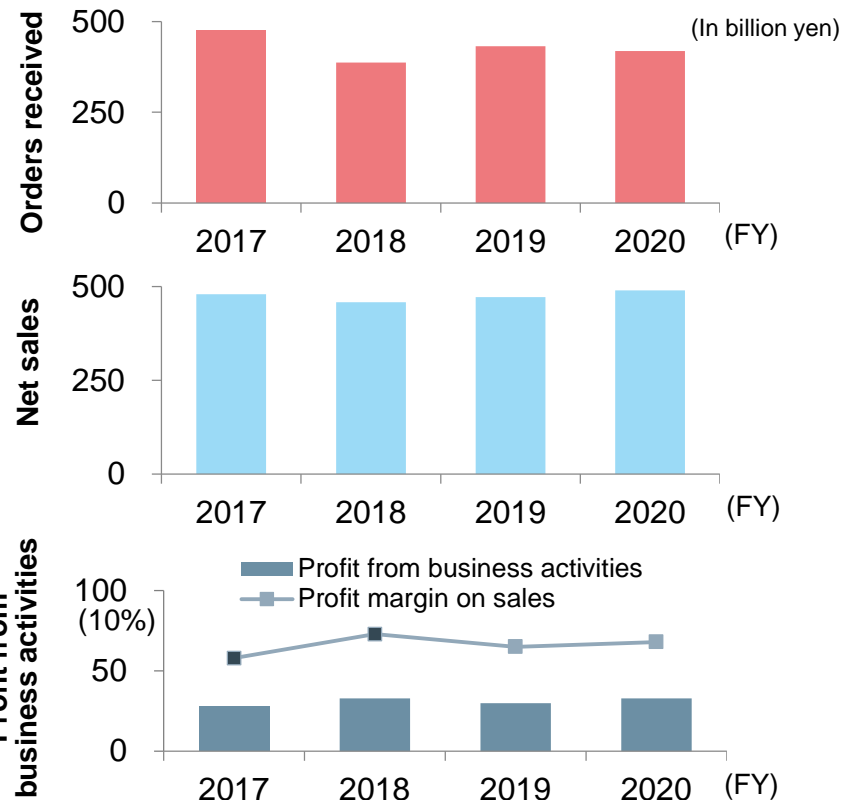
■ Government plans established in FY2018 fell within MHI's range of assumptions made when 2018 Business Plan was formulated.

- Defense: National Defense Program Guidelines for FY2019 and Beyond / Medium Term Defense Program (Dec 18, 2018)
- Space systems: Basic Plan on Space Policy revised (Dec 11, 2018)

## Policies for FY2019 and FY2020

■ Firmly hold to basic policies of 2018 Business Plan

- Expand business through acceleration of growth strategies
  - Steadily get next core businesses up and running
  - Prepare for promoting medium and long term business plan
- Continuously strengthen existing businesses
  - Reduce fixed costs rate
  - Reduce variable costs

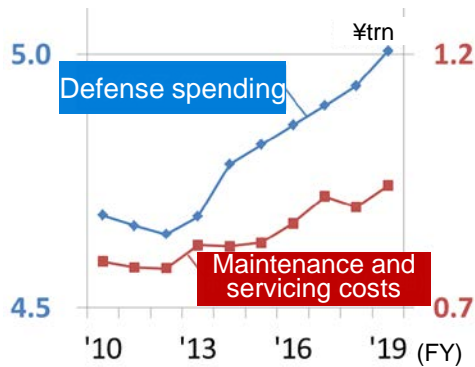


# 4-3. Measures Targeted at FY2021 and Beyond (1/5)

## Long-range Market Outlook

### Defense

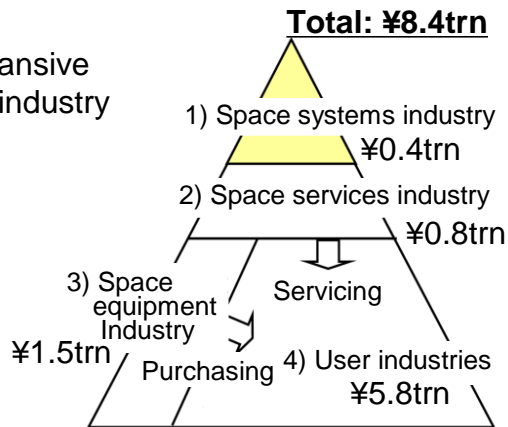
- Defense budget in increasing trend (increased maintenance and servicing costs)
- Formulation of new National Defense Program Guidelines and Medium Term Defense Program
  - ✓ Early start of future fighter development
  - ✓ Projected growth in space, cyber and electromagnetic domains



Source: Compiled by MHI based on online information of Japanese Ministry of Defense and House of Councillors

### Space Systems

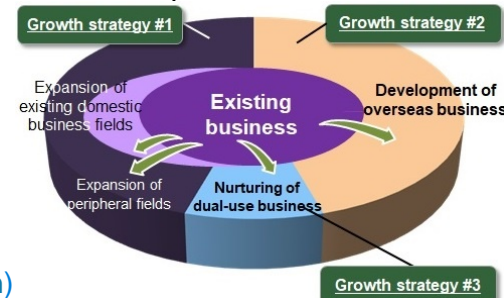
- Market extremely expansive below space systems industry (MHI core business)



Source: Compiled by MHI based on The Society of Japanese Aerospace Companies' (SJAC) "JAPANESE SPACE INDUSTRY ANNUAL SURVEY REPORT -FY2017 Results-"

## Growth Strategies for Next 3-Year Business Plan

- #1: Expansion of existing domestic and peripheral fields (ref: page 26)
  - 1) Existing business
    - Steadily get next core businesses up and running (future fighter, H3 launch vehicle)
    - Expand business scope such as command and control, M&S, etc.
  - 2) Peripheral fields
    - Expand MRO business in maintenance and servicing fields
    - Expand into new peripheral fields (space (including satellite information usage), cybersecurity, unmanned vehicles etc.)
- #2: Overseas business expansion
  - 1) Adapting MHI components for use in overseas equipment
    - Utilize channels with overseas manufacturers cultivated through existing businesses
    - Collaborate with Japanese government in parallel with inter-company consultations
  - 2) Potential international joint development projects
    - Start international joint development projects with alliance countries (MHI support Japanese government)
    - Enter joint development projects
- #3: Establishment of dual-use development businesses (ref: pages 27-28)
  - Utilize core technologies of defense and space business
  - Meet private-sector demand particularly in safety and security field (Cybersecurity, Situational awareness, Wide-area status observation)

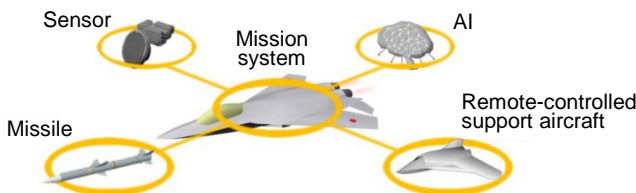


## Growth Strategies for Next 3-Year Business Plan #1: Expansion of existing domestic and peripheral fields

### Defense

#### Future Fighter

- New Medium Term Defense Program calls for early development led by Japan
- Acquisition completed of all key technologies necessary to start development
- Research on the integration of the mission system of a fighter aircraft incorporated into FY2019 budget



Integration of mission system (conceptual image)

Source: Ministry of Defense website ("Overview of FY2019 Budget")

### Space Systems

#### H3 Launch Vehicle

- Under development for the first launch in FY2020
  - Detailed design phase of launch vehicle systems completed; now in production and testing phase
  - 1st-stage battleship firing test with propulsion system and engines began in early 2019



Battleship firing test

- In preparation of operation system for launch services

Existing

#### MRO business

- Entry into government maintenance work as private sector for the needs of low birthrate and aging population
  - Involvement of defense aircraft, etc. underway toward integrating management of armed forces and in-house maintenance data, contributing to maintenance streamlining
- Expand into MRO business for U.S. forces stationed in Japan
  - MRO underway for equipment models common to Japan and U.S. forces, in areas where MHI can use its own facilities

#### Satellite Data Utilization

- Pursue analyzing satellite images and other data for maritime domain awareness and disaster response (Japanese and surrounding seas).

Peripheral



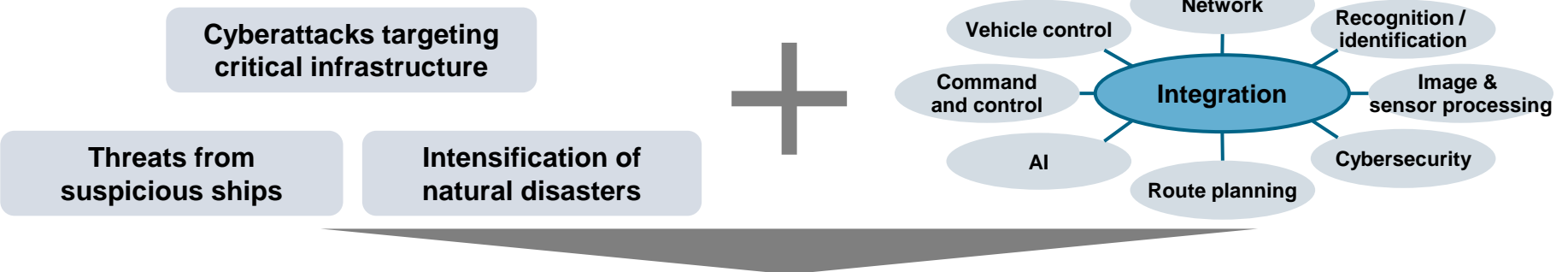
# 4-3. Measures Targeted at FY2021 and Beyond (3/5)

## Growth Strategies for Next 3-Year Business Plan #3: Establishment of dual-use development businesses 1/2

- Provide total solutions enabling safety and security
- Meet private sector demand for dual use cutting edge technologies developed in Defense & Space Systems business

Expanding needs for safety and security measures

MHI technologies cultivated in defense and space areas



### Total solutions for safety and security

Cybersecurity

Situational awareness

Wide-area status observation

**InteRSePT**  
Protection of Control Systems

**CoasTitan**  
Monitoring by Unmanned Vehicles

**BRAINS**  
Analysis of Wide-Area Image Data



Real-time analysis of operation patterns in infrastructure control systems; early anomaly detection



Developed system matching customer needs, integrating UAVs, USVs and UUVs



Satellite image data analyzed by AI, enabling swift grasp of damage, contributing to disaster relief

## Growth Strategies for Next 3-Year Business Plan

### #3: Establishment of dual-use development businesses 2/2

#### Cybersecurity

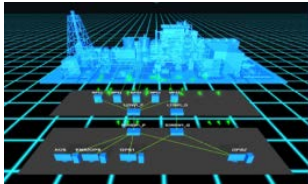


##### FY2016-FY2017

- In collaboration with NTT, developed malfunction detection device for control equipment

##### FY2018

- Commercialization and market launch
- Improved functions such as automatic generation of detection rules
- Mounting in defense equipment
- Demonstration testing at waste incineration facility and power generating plant



##### FY2019 and beyond

- Use of AI, development of advanced defense functions
- Proactively undertake demonstration tests with potential customers, toward expanding applications

#### Situational awareness



##### FY2017

- Started concept study
- Developed unmanned autonomous vehicles and surveillance control system

##### FY2018

- In-house demonstration testing
  - Network (remote) monitoring
  - Automated ship landing of unmanned aircraft
- Manpower-saving control device



##### FY2019 and beyond

- Demonstration testing at customer sites
- Improve usability, toward commercialization
- Interface with unmanned underwater/ground vehicles
- Add situation analysis function, toward disaster situation monitoring

#### Wide-area status observation

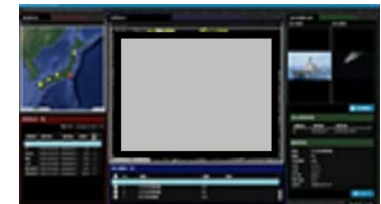


##### FY2017

- Started concept study
- Survey of customer needs

##### FY2018

- In-house demonstration testing (disaster detection/analysis, vessel differentiation)
  - High-volume visual analysis processing
  - Differentiation/identification using AI
  - Improved operability



##### FY2019 and beyond

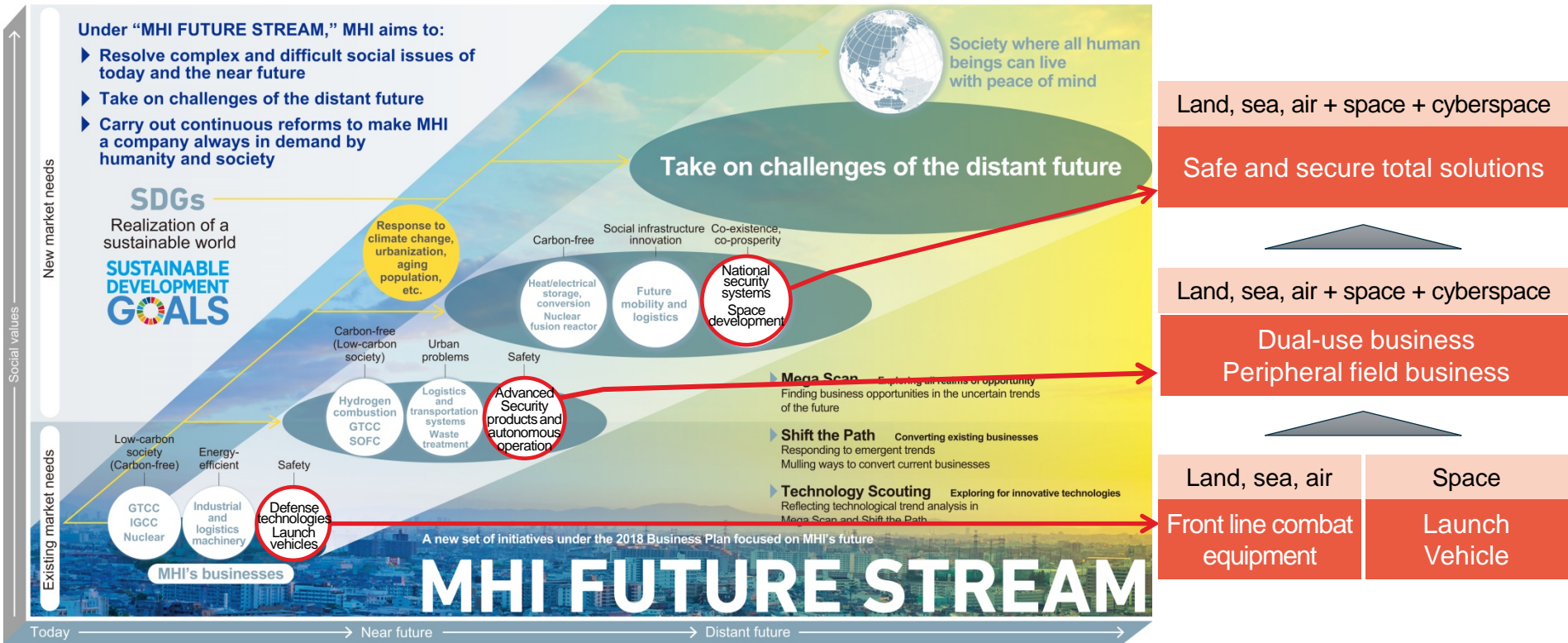
- Demonstration testing at customer sites



# 4-3. Measures Targeted at FY2021 and Beyond (5/5)

## Long-term vision

**Expand business territory from land, sea, air and space to cyberspace and provide total solutions enabling safety and security**



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