Aircraft, Defense & Space Business Plan

Keisuke HIROSE
Executive Vice President, Head of Commercial Aviation Systems

Hiroyuki KOGUCHI
Senior Fellow, Senior General Manager, MRJ Division

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

July 12, 2019
Mitsubishi Heavy Industries, Ltd.
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   3-1. Driving the MRJ Business
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4. Integrated Defense & Space Systems Segment
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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)

### Revenue

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>(In billion yen)</td>
<td>718.3</td>
<td>677.5</td>
<td>700.0</td>
<td>720.0</td>
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</table>

### Orders Received

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<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
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</thead>
<tbody>
<tr>
<td>(In billion yen)</td>
<td>714.6</td>
<td>610.6</td>
<td>700.0</td>
<td>700.0</td>
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</table>

### Profit from Business Activities

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>(In billion yen)</td>
<td>△63.5</td>
<td>△37.4</td>
<td>△20.0</td>
<td>0</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>(FY)</td>
<td>△9%</td>
<td>△6%</td>
<td>△3%</td>
<td>0%</td>
</tr>
</tbody>
</table>

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2-1. Overview

Boeing

- **787**
  - Main wings
  - MHI: main wing boxes
  - Photo courtesy of Boeing

- **777X**
  - Aft fuselage
  - MHI: aft fuselage, tail fuselage and entry doors
  - Photo courtesy of Boeing

- **777**
  - Tail fuselage
  - MHI: aft fuselage, tail fuselage and entry doors
  - Photo courtesy of Boeing

- **737**
  - Inboard flaps
  - MHI: inboard flaps
  - Photo courtesy of Boeing

Aircraft components for Bombardier, etc.

- **Global 5000/6000**
  - MHI: main wings, center-fuselage and center wing
  - Photo courtesy of Bombardier

- **Challenger 300/350**
  - MHI: main wings
  - Photo courtesy of Bombardier

Boeing Wide-body jets

Boeing Narrow-body jets and business jets

Aircraft components for Boeing

MHI: main wings, center-fuselage and center wing

MHI: aft fuselage, tail fuselage and entry doors

MHI: inboard flaps
2-2. Management Structure

Keisuke HIROSE
Segment Head

Yuji HIRANO
General Manager (for Boeing 787)

Hiroshi TANEDA
Deputy Segment Head (for technology)

Satoshi SAWAGUCHI
Deputy General Manager (for Bombardier)

Kenji INABA
Deputy General Manager (for Boeing)

Planning & Administration Department

Commercial Airplanes Division

Engeneering Steering Department

Aviation Business Development & Strategy Department

Domestic Bases

MHI Aerospace Vietnam Co., Ltd.
President Yasushi SATO

MHI Canada Aerospace Inc.
President Janet Wardle

Overseas Bases

Kobe: Skin Manufacturing Plant 777 fuselage skin
Eba: Metal Assembly Plant 777(7X)/767 fuselage panels (large key components)
Shimonoseki: Composite Components Plant 787 composite components
Oye: Components Plant Key components (development/mother factory)
Oye West: Composite Assembly Plant 787 main wings
2-3. 2018 Business Plan Progress Status (1/3)

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

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
   - 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

- Redution of Composite Lay up Inspection (Process Control)
- Next Generation Composite Lay up Machine
- AI/IoT Application to Inspection
- Expansion of Real-time Production Monitoring
**Aim for global structure to meet OEM expectations, enhancing supply chain in North America and Asia**

<table>
<thead>
<tr>
<th>MHI</th>
<th>North America</th>
<th>MHICA</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assembly</strong></td>
<td><strong>Parts</strong></td>
<td><strong>Bombardier business jets (Tier1)</strong></td>
<td><strong>Small packages: flight control surfaces, doors, etc.</strong></td>
</tr>
<tr>
<td>Boost efficiency through automation/manpower saving</td>
<td>Boost efficiency through consolidation</td>
<td>• Global/Challenger main wing assembly</td>
<td>• B737 flap, B777 door assembly</td>
</tr>
<tr>
<td>• 787 wing boxes (Nagoya)</td>
<td>• Large parts (Kobe/Hiroshima)</td>
<td>• Materials/parts procurement in Canada (expanding)</td>
<td>• Parts production and procurement in Vietnam (planned)</td>
</tr>
<tr>
<td>• 777/767 aft fuselages (Hiroshima)</td>
<td>→ Adjacent to assembly plant</td>
<td>• Development of new customer base (planned)</td>
<td></td>
</tr>
</tbody>
</table>

**OEM : Original Equipment Manufacturer, SC : Supply Chain**
2-4. Business Policies and Strategies

**2018 Business Plan**
- Increase SpaceJet commercial value
- **Production technology**
  - Improve productivity for commercial production
  - Pursue synergies with SpaceJet
- **Leading-edge technology**
  - Lighter weight
  - Lower costs

**Expand into new business areas**
- High value-added products (Components, etc.)
- Operation support
- Electrification

**Expand into differentiated competitive advantage areas**
( Targeting new Tier1 structure packages)
- Low carbon
- Digitalization

**Medium- to long-term plans**
- Expand into differentiated competitive advantage areas
- Continue "Business Structure Reforms" (strengthen existing existing businesses)
- Promote automation (manpower saving → full automation)
- Expand globally / Restructure business portfolio

**2021 Business Plan**
- Increase SpaceJet commercial value
- **Production technology**
  - Improve productivity for commercial production
  - Pursue synergies with SpaceJet
- **Leading-edge technology**
  - Lighter weight
  - Lower costs

**Expand into new business areas**
- High value-added products (Components, etc.)
- Operation support
- Electrification

**Expand into differentiated competitive advantage areas**
( Targeting new Tier1 structure packages)
- Low carbon
- Digitalization

**Medium- to long-term plans**
- Expand into differentiated competitive advantage areas
- Continue "Business Structure Reforms" (strengthen existing existing businesses)
- Promote automation (manpower saving → full automation)
- Expand globally / Restructure business portfolio

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3-1. Driving the MRJ Business (Organization)

**President and CEO**
Seiji Izumisawa

**Senior Vice President, Head of Commercial Aviation Systems**
Keisuke Hirose

**President**
Hisakazu Mizutani

**CDO**
Alex Bellamy

**General Manager, MRJ Division**
Shunji Okada

**CDO : Chief Development Officer**

**Senior Fellow**
Hiroyuki Koguchi

**President**
Hitoshi Iwasa

**President**
Hitoshi Iwasa

**Senior Vice President**
Keisuke Masutani

**Head of PMD**
Hiroyuki Tatsuoka

**Mitsubishi Aircraft Corporation**

**MRJ Division**

**Overseas**

**Mitsubishi Aircraft Corporation America**
3-1. Driving the MRJ Business

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

**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”

TIA: Type Inspection Authorization  LOA: Letter of Authorization (Notice from FAA to its Pilots and Staffs to authorize on boarding to SpaceJet as a part of TC related activity)
3-2. Progress Towards First Delivery 2020
Progress and Achievements of TC Tests

• 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
- 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)
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
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
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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4-1. Overview (1/3)

Defense

F-2 Fighter

SH-60K Maritime Patrol Helicopter

Space Systems

FY2018 Revenue

Defense

H-IIA Launch Vehicle

H-III Launch Vehicle

H-II Transfer Vehicle (HTV)

“Shiranui” Destroyer

PAC-3

SM-3

“Oryu” Submarine

Type 16 Mobile Combat Vehicle

Type 10 Main Battle Tank

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4-1. Overview (2/3)

Management Structure

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

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)
4-1. Overview (3/3) (FY2018 Major Projects and Orders Received)

**Defense**

- **SM-3**
  2018 Oct, Dec
  Successful flight test of anti-ballistic missile
  (U.S. Department of Defense)
  Development has been completed

- **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)
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

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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

Space Systems

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

Total: ¥8.4trn

1) Space systems industry ¥0.4trn
2) Space services industry ¥0.8trn
3) Space equipment Industry ¥1.5trn
4) User industries Purchasing ¥5.8trn

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)

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

M&S: Modeling and simulation  MRO: Maintenance, Repair and Overhaul
4-3. Measures Targeted at FY2021 and Beyond (2/5)

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

#### 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

### 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

- In preparation of operation system for launch services

#### Satellite Data Utilization

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

Cyberattacks targeting critical infrastructure

Threats from suspicious ships

Intensification of natural disasters

Vehicle control

Command and control

Network

Image & sensor processing

Recognition / identification

Cybersecurity

AI

Route planning

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

UAV: Unmanned aerial vehicle, UUV: Unmanned underwater vehicle, USV: Unmanned surface vehicle
### Growth Strategies for Next 3-Year Business Plan

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

<table>
<thead>
<tr>
<th>Cybersecurity</th>
<th>Situational awareness</th>
<th>Wide-area status observation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FY2016-FY2017</strong></td>
<td><strong>FY2017</strong></td>
<td><strong>FY2017</strong></td>
</tr>
<tr>
<td>• In collaboration with NTT, developed malfunction detection device for control equipment</td>
<td>• Started concept study</td>
<td>• Started concept study</td>
</tr>
<tr>
<td>• Developed unmanned autonomous vehicles and surveillance control system</td>
<td>• Developed unmanned autonomous vehicles and surveillance control system</td>
<td>• Survey of customer needs</td>
</tr>
<tr>
<td><strong>FY2018</strong></td>
<td><strong>FY2018</strong></td>
<td><strong>FY2018</strong></td>
</tr>
<tr>
<td>• Commercialization and market launch</td>
<td>• In-house demonstration testing</td>
<td>• In-house demonstration testing</td>
</tr>
<tr>
<td>• Improved functions such as automatic generation of detection rules</td>
<td>- Network (remote) monitoring</td>
<td>(disaster detection/analysis, vessel differentiation)</td>
</tr>
<tr>
<td>• Mounting in defense equipment</td>
<td>- Automated ship landing of unmanned aircraft</td>
<td>- High-volume visual analysis processing</td>
</tr>
<tr>
<td>• Demonstration testing at waste incineration facility and power generating plant</td>
<td>- Manpower-saving control device</td>
<td>- Differentiation/identification using AI</td>
</tr>
<tr>
<td><strong>FY2019 and beyond</strong></td>
<td><strong>FY2019 and beyond</strong></td>
<td><strong>FY2019 and beyond</strong></td>
</tr>
<tr>
<td>• Use of AI, development of advanced defense functions</td>
<td>• Demonstration testing at customer sites</td>
<td>• Demonstration testing at customer sites</td>
</tr>
<tr>
<td>• Proactively undertake demonstration tests with potential customers, toward expanding applications</td>
<td>• Improve usability, toward commercialization</td>
<td></td>
</tr>
</tbody>
</table>
Expand business territory from land, sea, air and space to cyberspace and provide total solutions enabling safety and security
MOVE THE WORLD FORWARD