Aircraft, Defense & Space
Business Plan

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Mitsubishi Heavy Industries, LTD
Contents

1. Business Overview

2. Commercial Aviation Systems Segment
   2-1. Overview
   2-2. Review of 2015 Medium-Term Business Plan

3. MRJ Business
   3-1. Development Status
   3-2. Preparations for MRJ Production
   3-3. Efforts aimed at Commercialization
   3-4. MRJ Business Restructuring to Assure Long-Term Business Continuity

4. Integrated Defense & Space Systems Segment
   4-1. Overview
   4-2. Review of 2015 Medium-Term Business Plan
   4-3. Policies and Strategies of 2018 Medium-Term Business Plan
1. Business Overview (FY2017 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 Airbus, Bombardier, etc.
- MRJ

Orders Received

<table>
<thead>
<tr>
<th>Year</th>
<th>Orders Received (in billion yen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>955.0</td>
</tr>
<tr>
<td>2017</td>
<td>721.5</td>
</tr>
<tr>
<td>2018</td>
<td>650.0</td>
</tr>
<tr>
<td>2020</td>
<td>700.0</td>
</tr>
</tbody>
</table>

Net Sales

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Sales (¥722.9 billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>703.4</td>
</tr>
<tr>
<td>2017</td>
<td>722.9</td>
</tr>
<tr>
<td>2018</td>
<td>700.0</td>
</tr>
<tr>
<td>2020</td>
<td>720.0</td>
</tr>
</tbody>
</table>

Operating Income / EBIT (in billion yen)

<table>
<thead>
<tr>
<th>Year</th>
<th>Operating Income / EBIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>0.9</td>
</tr>
<tr>
<td>2017</td>
<td>-15.1</td>
</tr>
<tr>
<td>2018</td>
<td>-15.0</td>
</tr>
<tr>
<td>2018</td>
<td>-45.0</td>
</tr>
<tr>
<td>2020</td>
<td>0.0</td>
</tr>
</tbody>
</table>

After IFRS adoption
1. Business Overview

MHI FUTURE STREAM  In step with social evolution

Under “MHI FUTURE STREAM,” MHI aims to:
- Resolve complex and difficult social issues of today and the near future
- Take on challenges of the distant future
- Carry out continuous reforms to make MHI a company always in demand by humanity and society

Take on challenges of the distant future

Society where all human beings can live with peace of mind

MHI FUTURE STREAM  A new set of initiatives under the 2018 Business Plan focused on MHI’s future

MHI’s businesses

GTCC IGCC Nuclear
Industrial and logistics machinery
Defense technologies
Launch vehicles

Response to climate change, urbanization, aging population, etc.

SDGs Realization of a sustainable world

Carbon-free (Low-carbon society)
Urban problems
Safety

Logistics and transportation systems
Waste treatment
Advanced security products and autonomous operation

Heat/electrical storage, conversion
Nuclear fusion reactor

Future mobility and logistics
National security systems
Space development

Social infrastructure innovation
Co-existence, co-prosperity

Mega Scan  Exploring all realms of opportunity
Finding business opportunities in the uncertain trends of the future

Shift the Path  Converting existing businesses
Responding to emergent trends
Mulling ways to convert current businesses

Technology Scouting  Exploring for innovative technologies
Reflecting technological trend analysis in Mega Scan and Shift the Path
1. Business Overview

2. Commercial Aviation Systems Segment
   2-1. Overview
   2-2. Review of 2015 Medium-Term Business Plan

3. MRJ Business
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2-1. Overview

Aircraft components for Boeing, Airbus, Bombardier, etc.

- **Boeing**
  - 787
  - 777
  - 777X
  - Photo courtesy of Boeing

- **Airbus**
  - A380

- **Bombardier**
  - Global 5000/6000
  - Challenger 300/350

**Narrow-body jets and business jets**

- MHI: main wing boxes
- MHI: fwd and aft cargo doors
- MHI: main wings, center-fuselage and center wing
- MHI: aft fuselage, tail fuselage and entry doors
- MHI: inboard flaps
- MHI: main wings
2-2. Review of 2015 Medium-Term Business Plan

Summary

◇ Establish structures to boost production rate
  • Automated production line for 777X fuselages
  • Preparation for 12/14 shipsets mo. production of 787 wing-boxes
  • Restructuring of SCM and reform of procurement processes for commercial aircraft
    (Establishment of “Commercial Aircraft Procurement Center” and the Matsusaka cluster)
  • Introduction of new production planning/management system
    (ERP(Enterprise Resource Management) system)

◇ Delay in adapting to changing business environment
  • Launched “Business Structure Reform” activities from FY2017
    (reductions in flow time and fixed costs, etc.), which resulted in upward trend profitability.

Business Circumstances

(1) Market expansion over next 20 years (operating fleets to be doubled)
  • Temporary production decrease through 2018 Business Plan period due to transition period from Boeing 777 to 777X

(2) Necessity to reduce contract prices due to fierce OEM sales price competition

(3) Intensified competition with overseas manufacturers
  • Increased performance of Machine Tools
  • Development in IoT technologies
  • Active M&A transactions and acceleration of alliances and market realignment

Future Initiatives

◆ Strengthen cost competitiveness to withstand severe business environment

◆ Ensure differentiated competitive advantages to overwhelm the competitors

◆ Enhance Value-added proposals to the customers

Continue
“Business Structure Reform”
2-3. Policies and Strategies  
2018 Medium-Term Business Plan (1/3)

Continue Business Structure Reform

1. Maintain Income by improving productivity and reducing fixed costs, etc.

2. Pursue differentiation with competitors

(1) Improve productivity

- Accelerate manpower savings by introducing automated equipment
- Automate indirect work process using AI/IoT
- Concentrate production capacities to achieve high efficient parts manufacturing (Integrated production lines/Matsusaka cluster)

(2) Reduce fixed costs

- Replace auxiliary/routine man-work by IT systems
  → Reduce labour costs
- Upgrade personal abilities and skills(*), optimized reallocation of human resource through multi-skilling educations
- Reduce working capital and generate cash flow by advanced procurement processes(*)
- Bring outsourced work process in-house through utilization of upskilled human resources

(3) Control external expenses

- Introduce systems for acquisition of specialist skills, including information systems such as AI/IoT/RPA, production processes, procurement operations, CAD/NC programs, etc.
2-3. Policies and Strategies
2018 Medium-Term Business Plan (2/3)

◆ World Class Assembly Production Line for 777X and 787

Panoramic view of M-PAL (Multi Panel Pulse Assembly Line)

- Skin positioning assembly
- Panel assembly
- Frame assembly
- Inspection

Real time monitoring of production line
Equipment check /preventive maintenance
Apply AI/IoT to inspection work
Expand scope of automation (manpower saving → unmanned operation)
2-3. Policies and Strategies
2018 Medium-Term Business Plan (3/3)

Increase MRJ’s commercial value

Production technology
- Improve productivity for commercial production

Leading edge technology

Synergy with other MHI business area
- Defence/Space

New business areas
- Future aircraft
- Traffic control etc.

Expansion to differentiated competitive advantage areas
- Advanced materials (Composites)
- Advanced engineering/manufacturing processes (Additive Manufacturing)
- High value-added products (Key-components, etc.)

Continue “Business Structure Reform” and strengthen existing businesses
- Promote automation (manpower saving→full automation)
- Upskill and cross-train human resources

MEGA SCAN
SHIFT THE PATH

Photo courtesy of Boeing
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3-1. Development Status

**FY2017 Achievements**

- Established development organization with global aviation industry experts assigned to key positions
- Enhanced development structure with cross-functional organizations
- Type certification acquisition from Federal Aviation Administration (FAA) for Pratt & Whitney (P&W) PW1200G engine
- MRJ exhibited at Paris Air Show
- Started part fabrications for the modification of flight test aircraft
- Achieved over 1,800 flight hours

**FY2018 Solutions**

**Development**

- Accelerate type certification (TC) flight tests
- Proceed the assembly of additional flight test aircrafts

**Farnborough Air Show**

- Following Paris Air Show last year, plan to exhibit the MRJ and conduct flight demonstration
Status of Initiatives

- Completed development of enterprise resources planning (ERP) system and commenced operational testing
- Developed MRJ web portal with Boeing's support
- Selected Mitsui-Soko as Logistics Partner to utilize their infrastructure in US/Europe
- Selected HAECO Americas, Pemco World Air Services (PEMCO), and MRO Japan as the preferred MRO service providers in North America and Asia
- Crew Training by CAE with using their training network

Global Bases for Spare-Parts and Training

- Establish CS Business Operation Bases in Japan and the U.S., then expand operations to other regions
  - Establish three bases for global spare-parts logistics and support networks, with the U.S. and Europe to be our second and third hubs
  - Expand global training centers in accordance with customer base expansion

MRO: Maintenance, Repair and Overhaul
3-2. Preparation for MRJ Production (2/2)

Preparation for MRJ Production / Production Organization

- Consider additional capital expenditure in line with orders as well as market and customer trends to meet demand with eye on maximum 10 aircraft per month production rate
- Planning to introduce automated structural assembly and state-of-the-art IT tools and IoT for production processes to achieve cost reduction and prompt production rate up

- Wing parts integrated production line
- Fuselage Panel Skin Fabrication Line
- Logistics/IT-related

- Oye Plant
  (Component manufacturing)

- Tobishima Plant
  (Structural assembly)

- Matsusaka Plant
  (Component cluster, tail assembly)

- Global Logistics Center
  (Nippon Express logistics center)

- Nagoya Airport,
  Final Assembly Hangar

- Final assembly hangar, paint hangar, etc.

- Integrated Steel Parts Fabrication Line

- Automatic Riveter for Panel Assembly

- Paint booth

- Kitakyushu Airport
  (Flight testing (sub-base))

- Kobe Shipyard & Machinery Works
  (Large component manufacture)

- Mitsubishi Heavy Industries Aero Engines
  (P&W GTF Engine)

- P&W: Pratt and Whitney
  GTF: Geared Turbo Fan

- Major Investment
3-3. Efforts aimed at MRJ Commercialization (1/3)

Value of MRJ Program

◆ Global air traffic has raised by 5% every year, and preference in the market for low cost and high frequency air operation is stimulating demand for single-aisle aircraft like the 737/320. The upgrade and expansion of the single-aisle network also brings an increase in demand for smaller category aircraft operations covered by Regional Jet (RJ).

◆ Secure a future business profit base by establishing the position as airframe OEM in the commercial aviation industries, which is expected to grow over the medium-to-long term.

◆ Aimed at expanding business opportunities into high value-added sectors, such as systems and components, by utilizing experience in the airframe OEM business and technical capabilities in the Tier 1 business.

◆ Increase the global brand strength of MHI Group by making an image leader out of the aviation business, with a spotlight on its leading edge technology.

◆ Establish a business foundation of total aircraft integration in Japan, creating the foundation for the development of Japanese aerospace industry, including equipment.
Market Outlook

3-3. Efforts aimed at MRJ Commercialization (2/3)

RJ market overall

- The 60-99 seat-class aircraft market, which is the target market for the MRJ, also includes replacement demand for “out-of-product” RJ (59 seats-or-less), and demand is expected to be around 3,500 aircraft over the next 20 years.
- There are currently approximately 3,200 RJs in service worldwide, and many of them are likely to generate future replacement demand, with North America and Europe accounting for 70% of that demand.

Number of RJs in service (As of the end of 2017)

<table>
<thead>
<tr>
<th>Region</th>
<th>New deliveries</th>
<th>60-99 seat (2017)</th>
<th>100-119 seat</th>
<th>20-59 seat</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td></td>
<td>1,800 (2017)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RJ (less than 100 seat-class) demand forecast

- World’s largest RJ market, approx. 1,800 aircraft in service at end of 2017.
- Due to the Scope Clause, it is currently difficult for the MRJ90 to operate at major US airlines. However, the MRJ70 can operate under the current Scope Clause.
- Trend for demand at major airlines to shift toward 100+ seat-class. Meanwhile, suitable routes for RJs exist, and a given level of demand is expected to continue.
- Currently majority of small size aircraft is by Turboprop, but growth is expected due to development of airport infrastructure and maturing of operations.

Source: Flightglobal Flight Fleets Analyzer (End of December, 2017) (RJ with less than 100-seat)
### Business Opportunities in Commercial Aviation Industry

**3-3. Efforts aimed at MRJ Commercialization**

- **Identify business opportunities across the entire aircraft sales life cycle for future revenue growth**

#### Players and service content

<table>
<thead>
<tr>
<th>Player</th>
<th>Roles</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Airframe OEM</strong></td>
<td>Aircraft sales</td>
<td>Aircraft sales to Operators</td>
</tr>
<tr>
<td></td>
<td>Spare part sales</td>
<td>Spare part sales to Operators</td>
</tr>
<tr>
<td><strong>Component Supplier</strong></td>
<td>Manufacture and sale</td>
<td>Component sales to Airframe OEMs</td>
</tr>
<tr>
<td></td>
<td>Spare part sales</td>
<td>Spare part sales to Operators</td>
</tr>
<tr>
<td><strong>Lease &amp; Finance</strong></td>
<td>Secure slots</td>
<td>Secure aircraft in anticipation of vacant slots at airlines</td>
</tr>
<tr>
<td></td>
<td>Financing</td>
<td>Providing leasing aircraft with using Lessor's better finance position</td>
</tr>
<tr>
<td></td>
<td>Residual value risk</td>
<td>Offset Residual risk from Operator to Lessor (by leasing aircraft)</td>
</tr>
<tr>
<td></td>
<td>Create used aircraft market</td>
<td>Used aircraft sales</td>
</tr>
<tr>
<td><strong>MRO</strong></td>
<td>MRO</td>
<td>Maintenance and repair services for aircraft and components</td>
</tr>
</tbody>
</table>

**MRJ/Airframe OEM business**

**Opportunity for high value-added Market**

**Cooperate with outside partners**

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OEM: Original Equipment Manufacturer

MRO: Maintenance, Repair and Overhaul

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3-4. MRJ Business Restructuring to Assure Long-Term Business Continuity

Steady Progresses at MRJ90 Development

- MRJ90 Development and TC acquisition
- Delivery of first aircraft to ANA in mid-2020

Approach to assure Long-Term Business Continuity

- Strengthen ties with Tier 1 businesses
- Strengthen sales and customer support structures
- Pursue full-scale development and early TC acquisition of MRJ70
- Expand profitability through business synergy and entry into high value-added markets
- Enhance human resources and consider partnerships with outside agencies
- Secure business base in the commercial aviation industry by quickly establishing a firm presence in the largest RJ markets
1. Business Overview

2. Commercial Aviation Systems Segment
   2-1. Overview
   2-2. Review of 2015 Medium-Term Business Plan

3. MRJ Business
   3-1. Development Status
   3-2. Preparations for MRJ Production
   3-3. Efforts aimed at Commercialization
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4-1. Overview

**Defense**
- F-2 Fighter
- SH-60K Maritime Patrol Helicopter
- PAC-3
- SM-3
- "Seiryu" Submarine
- "Asahi" Destroyer
- Type 10 Main Battle Tank

**Space Systems**
- H-IIA Launch Vehicle
- H-IIB Launch Vehicle
- H-II Transfer Vehicle (HTV)
- Type 16 Mobile Combat Vehicle

**FY2017 Net sales**

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4-1. Overview (FY2017 Major Projects and Orders Received)

**Defense**

- **F-35**
  - 2017 Jun: Unveiling ceremony for first plane assembled in Japan
  - Nov: First Aircraft Delivery
  - 2018 Jan: Second Aircraft Delivery

- **New type of destroyers**
  - 2017 Aug: Selected as primary contractor

- **Delivery ceremonies**
  - 2018 Mar: Asahi-class destroyer “Asahi” Nagasaki, Soryu-class submarine “Seiryu” Kobe

- **Type 16 Mobile Combat Vehicle**
  - 2017 Aug: Start of delivery
  - Oct: Production vehicle delivery ceremony at Sagamihara

**Space Systems**

- **Launch vehicles**
  - **1) Launch of H-IIA/B**
    - 2017 Jun: H-IIA No. 34
    - Aug: No. 35
    - Oct: No. 36
    - Dec: No. 37
    - 2018 Feb: No. 38

- **2) Order received for launch services**
  - 2017 Sep: Received order for H-IIA Launch Services from U.K. Inmarsat, launch scheduled for 2020

- **3) H3**
  - 2017 Apr: Started LE-9 engine hot firing tests at Tanegashima

- **HTV**
  - **1) HTV-X in preliminary design**
4-2. Review of 2015 Medium-Term Business Plan

Achievements and Status of 2015 Business Plan

- Continuous strengthening of existing businesses
  - Main indicators such as sales and operating income achieved 2015 Business Plan figures
- Preparing for next expansionary step
  - Implementing growth strategy activities to expand business

New Challenges

- Strengthening structure
  - Continued squeezing of fixed costs to contribute to company-wide improvement in operating margins
- Accelerate and strengthen growth strategy
  - Steadily get next core businesses up and running
  - Accelerate 2015 Business Plan growth strategies
Basic Policies

- Expand business through acceleration of growth strategies
- Continuously strengthen existing businesses

Market Trends

Government/domestic
- Foreign military sales (imported components), maintenance, and servicing expenses to increase and front line combat equipment expenses to decrease
- Increased use of outer space in national security field

U.S./global
- Review of U.S. strategy due to increasing technical capabilities of threat countries
  ⇒ Pursuit of superiority in unmanned vehicle and links network
    Importance of ensuring superiority in cyberspace
- Mounting tension in peripheral region
  ⇒ Necessity for equipment to respond to counter threats
    Importance of interoperability with alliance
4-3. Policies and Strategies of 2018 Medium-Term Business Plan (2/6)

Strategy

Growth strategy #1: Expansion of existing domestic and peripheral fields

1. Existing business
   - Steadily get next core businesses up and running
   - Expansion of business territory
     (command and control, M&S, etc.)

Growth strategy #2: Overseas business expansion

1. Adapting MHI components for use in overseas equipment
   - Utilize channels with overseas manufacturers cultivated through existing businesses
   - Lobby Japanese government in parallel with inter-company consultations

2. Potential international joint development projects
   - Enter joint development projects with alliance countries
   - Promote start-up in collaboration with Japanese government

Growth strategy #3: Establishment of dual-use development businesses

- Utilize core technologies of defense business
- Meet private sector demand particularly in security field

Targets

<table>
<thead>
<tr>
<th>Year</th>
<th>Orders received (Billion yen)</th>
<th>Net sales (Billion yen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>450</td>
<td>500</td>
</tr>
<tr>
<td>2016</td>
<td>550</td>
<td>500</td>
</tr>
<tr>
<td>2017</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>2018</td>
<td>450</td>
<td>500</td>
</tr>
<tr>
<td>2020</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>

M&S: Modeling and simulation  MRO: Maintenance, Repair and Overhaul
### Growth Strategy #1 Expansion of existing domestic and peripheral fields

#### Defense

**BMD**

<table>
<thead>
<tr>
<th>FY2017 achievements</th>
<th>Future solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSE missile</td>
<td>• Stable MSE missile manufacturing and delivery</td>
</tr>
<tr>
<td>• Initial product preparation in (full) progress.</td>
<td>• Business proposal to integrate Aegis Ashore and MSE, etc. to enhance BMD capabilities</td>
</tr>
<tr>
<td>• Continuing production contracts SM-3 Block II A</td>
<td></td>
</tr>
<tr>
<td>• Commencement of missile delivery for U.S. government</td>
<td></td>
</tr>
<tr>
<td>MSE missile</td>
<td></td>
</tr>
<tr>
<td>Source: Lockheed Martin website</td>
<td></td>
</tr>
<tr>
<td><strong>MSE</strong>: Missile Segment Enhancement <strong>BMD</strong>: Ballistic Missile Defense</td>
<td></td>
</tr>
</tbody>
</table>

**Launch Services**

<table>
<thead>
<tr>
<th>FY2017 achievements</th>
<th>Future solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Launched five H-IIA rockets</td>
<td>• Continue successful launches</td>
</tr>
<tr>
<td>• Started hot firing tests of 1st and 2nd stage engines of H3 Launch Vehicle</td>
<td>• Steadily accomplish H3 development</td>
</tr>
<tr>
<td>• Received order for H-IIA Launch Services from a global satellite operator, Inmarsat</td>
<td>• Increase presence in the commercial/overseas market</td>
</tr>
</tbody>
</table>

#### Periphery

**MRO business**

- Entry into government maintenance work under private sector
  - Integrated management of armed forces and in-house maintenance data, contributing to streamlining of maintenance
- Expand into MRO business for U.S. forces stationed in Japan
  - Field that can utilize equipment models common to Japan and U.S. and owned facilities

**Satellite Data Utilization**

- Analyze satellite images and other data for maritime domain awareness and disaster response (Japan and surrounding seas).

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**MSE missile**

- Initial product preparation in (full) progress.
- Continuing production contracts SM-3 Block II A
- Commencement of missile delivery for U.S. government

**BMD**

- Ballistic Missile Defense

**Aegis Ashore**

- Integrating defense systems and capabilities

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Growth Strategy #2 Overseas business expansion

**F-35 fighter**

- **FY2017 achievements**
  - Maiden flight of the first aircraft assembled at MHI
  - The first and second aircraft delivery

- **Future solutions**
  - Continuous On-Schedule delivery
  - Stand-up MRO&U capability

- Image of MRO&U:
  - Maintenance, Repair, Overhaul, and Upgrade

- Ferry flight to Misawa Air Base

(Source: http://www.jsf.mil/)

**Joint development and production of SM-3**

- **FY2017 achievements**
  - Japanese Cabinet has approved procurement plan for SM-3 production (FMS procurement from U.S. government)
  - Commenced delivery of SM-3 for U.S. integration test

- **Future solutions**
  - Commence smooth commercial production under joint Japan-U.S. production system

- Components developed by U.S. in charge of production
- Components developed by Japan in charge of production

- Image of joint production system:
  - Missile assembly
  - U.S. in charge of production
  - Japan in charge of production

- Flight test mission: Feb 3 2017 (U.S. time)

(Source: Acquisition, Technology & Logistics Agency website)

**New Business**

- Initiatives underway together with Government, toward potential international joint development projects
- Discussions underway among international companies toward adapting MHI key components for use in overseas equipment

**Make use of key technologies and channels cultivated in defense and space systems business**

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Leverage core technologies cultivated in the defense and space area to develop new business in the **advanced security, automation, and autonomy fields.**

**Advanced security**

**Cybersecurity**

- **FY2017 achievements**
  - Completed InteRSePT® product commercialization
  - Applied to defense products
  - Started business development for overseas consumer applications

- **Future solutions**
  - Enhance capabilities and expand functions
  - Expand product applications and build up track record
  - Strengthen sales capabilities through alliances

**Automation and autonomy**

**Coast guard system using unmanned vehicles**

- **FY2017 achievements**
  - Demonstration using prototype
  - Market survey in Japan and overseas

- **Future solutions**
  - Add components and enhance level of autonomy
  - Product commercialization through joint development with partners
Expand business territory from land, sea, air and space to cyberspace and provide total solutions enabling safety and security

Under “MHI FUTURE STREAM,” MHI aims to:
- Resolve complex and difficult social issues of today and the near future
- Take on challenges of the distant future
- Carry out continuous reforms to make MHI a company always in demand by humanity and society

Dual-use business
Peripheral field business

Safe and secure total solutions

Front line combat equipment
Launch Vehicle

Land, sea, air
Space

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MOVE THE WORLD FORWARD