Business Briefing on Machine Tool

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MITSUBISHI HEAVY INDUSTRIES, LTD.
## Relationship between Machine Tool and Business Domains

<table>
<thead>
<tr>
<th>Business domain</th>
<th>Customers/Markets</th>
<th>Segment</th>
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<td></td>
<td></td>
<td>Shipbuilding &amp; Ocean Development</td>
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<tr>
<td>Energy &amp; Environment</td>
<td>• Power companies</td>
<td>• GTCC</td>
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<tr>
<td></td>
<td>• Gas companies</td>
<td>• Power plants</td>
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<tr>
<td></td>
<td>• Resource companies (oil, chemicals, steel)</td>
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<tr>
<td>Machinery, Equipment Systems</td>
<td>• Core industries (steel, etc.)</td>
<td>• Stationary engines</td>
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<td></td>
<td>• Automotive industry</td>
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<tr>
<td></td>
<td>• Logistics, etc.</td>
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</tr>
<tr>
<td>Transportation</td>
<td>• Airlines (air)</td>
<td>• Commercial Ships</td>
</tr>
<tr>
<td></td>
<td>• Shipping companies (sea)</td>
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<tr>
<td></td>
<td>• Railways (land), etc.</td>
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<tr>
<td>Defense &amp; Aerospace</td>
<td>• Ministry of Defense (land, sea, air)</td>
<td>• Destroyers &amp; submarines for the Ministry of Defense</td>
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<td>• JAXA</td>
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</table>
1. Overview of Machine Tool

2. Review of FY2011 (Review of 2010 Mid Term Business Plan)

3. Target of 2012 Plan

4. Business Strategies
   (1) Basic Policy
   (2) Structure of Issues
   (3) Globalization
   (4) Expansion of New Growth Business
   (5) Upgrading Process Technologies

5. Summary

- Precision cutting tools
- Engine valves
- Power transmissions
- Large-sized machine tools
- Gear cutting machines
- Special-purpose machines
- μ V1 micro milling machines
- Room temperature wafer bonding machines
- Precision machinery products

Machine tools: 79%
1. Overview of Machine Tool: Worldwide Locations

- **MHI-Europe**
  - Machine tool service

- **MHI-Shanghai (in Beijing)**
  - Machine tool sales and service

- **MHI-India**
  - Machine tool sales and service

- **MHI-Korea**
  - Machine tool sales and service

- **MHIA-MTD**
  - Machine tool sales and service

- **MMH/MHI Machine Tool (H.K.)**
  - Machine tool sales and service

- **[MHI-Thailand]**
  - Machine tool sales and service

- **Ritto Machinery Works**
  - Ritto, Shiga prefecture
  - Development and manufacture of all products
  - Number of employees: 900

- **MHII-MTD**
  - To begin operating in October 2012
  - Bangalore, India
  - Manufacture of gear cutting machines
  - Number of employees: 10
  - (affiliated with Machine Tools only)

- **MHII-IPT**
  - Acquired in May 2005
  - Ranipet, India
  - Manufacture and sales of precision cutting tools
  - Number of employees: 500

- **MHI-CM**
  - Began operating in March 2011
  - Changshu, Jiangsu province, China
  - Manufacture of gear cutting machines
  - Number of employees: 10
  - (affiliated with Machine Tools only)

- **Federal Broach**
  - Acquired in April 2012
  - Harrison, Michigan, United States, and others
  - Manufacture of broach tools and broach machines
  - Number of employees: 192

- **MHI-Shanghai Machine Tool Co. Ltd.**
  - (H.K.)
  - Machine tool sales and service

- **[MHI Brazil]**
  - Machine tool sales support

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2. Review of FY2011: Orders Received and Net Sales (Consolidated)

- Won equipment-related demand from the automotive, construction machinery, and energy sectors, resulting in an increase in orders received.
- Won orders related to aggressive overseas investments by domestic customers.
- Demand was strong in China, India, Southeast Asia, and North America.

Domestic performance recovered due to sales from large-scale works.
With regard to exports, orders received were strong, returning to the level they had reached before the global financial crisis.
The profit level also recovered, due in part to increased net sales and improved productivity.

Achieved orders received, net sales, and operating profit far in excess of the targets of the 2010 Plan
2. Review of FY2011 by Product (Consolidated)

1. Gear cutting machines
- Both domestic and overseas demand were strong. Orders received increased significantly, exceeding the level they had reached before the global financial crisis.
- Won orders related to aggressive investments in emerging countries by domestic customers.
- Overseas demand was also led by emerging countries, including China, India, and Southeast Asian countries. Orders from North America were also secured due to strong demand from the automotive, construction, and energy sectors.

2. Large-sized machine tools
- Won a certain level of demand from the construction machinery sector of emerging countries. However, domestic demand was relatively slow and remained at the previous fiscal year's level.
- In emerging countries, competition with competing European manufacturers has grown fierce.

3. Special-purpose machines
- Continued to receive orders from overseas automobile manufacturers and the aircraft sector, having secured the previous fiscal year's level of orders received.

4. Precision machinery products
- The automotive sector is the mainstay for both precision cutting tools and engine valves. Orders received remained at the previous fiscal year's level, due in part to the impact of the Great East Japan Earthquake.
3. Target of 2012 Plan: Orders Received, Net Sales, and Operating Profit (Consolidated)

**Orders received**
- Target value for the final fiscal year of the Plan: FY2007 level, which was the peak
- Increase orders for products for overseas markets, including China and Asia
- Aim for a business size of 100 billion yen

(Billion yen)

**Net sales and operating profit**
- Target values for the final fiscal year of the Plan: FY2007 level, which was the peak
- Aim to significantly increase operating profit by increasing orders received and net sales, establishing the hollow valve business, and increasing the profitability of overseas manufacturing companies, among other measures
4. Business Strategies: (1) Basic Policy

Increasing business size and profits by accelerating globalization efforts and increasing added value

- Building a business structure resistant to market fluctuations, based on two businesses with different market characteristics (machine tool and precision machinery)

- Further strengthening businesses as pillars of profit
  - Localizing production, sales, and service
  - Driving M&A and alliances

- Expanding new growth businesses
  - Establishing the hollow engine valve business in earnest
  - Expanding room temperature wafer bonding machines

- Upgrading process technologies
  - Upgrading in-house process technologies and creating new businesses
Measures for increasing added value, including expansion of the product lineup, have been completed to a certain extent. We will focus our efforts on globalization and the expansion of new fields and businesses.
4. Business Strategies:
(3) Globalization - Localization of Production and Sales 1)

Expansion of gear cutting machine business in India (1/2)

Past trends and forecast of year-on-year changes in 2-wheeled and 4-wheeled vehicle production in India

Real GDP growth rate of India

5.2% 3.9% 4.6% 6.9% 7.6% 9.0% 9.5% 10.0% 6.2% 6.6% 7.2% 3,350

Year-on-year changes in 2-wheeled vehicle production

- 9% 34% 9% 46% 10.6% 7.2%
- 9% 14% 19% 29% 17% 11% -5% 5% -6% -3%
- 5% 17% 11% -5% 25% 27% 22% -5% 5%
- 25% 27% 22% 10.6% 7.2%

Locations of plants of Indian automobile manufacturers and MHI’s local production plants

- MHI established a plant in Bangalore, which is attracting automobile manufacturers’ plants.

Provide gear processing systems locally in a one-stop manner through cooperation with MHI-IPT (precision tool manufacturer).

- Both 2-wheeled and 4-wheeled vehicles will grow strongly, by more than 20% year on year.
- In India, 20 million people join the youngest group of the productive population every year as potential purchasers of the products.
4. Business Strategies: (3) Globalization - Localization of Production and Sales

Overview of MHI plant in India

- Establishing the gear cutting machine plant as an organization under the Machine Tool Group of MHI-India.
- In addition to functions for machine tool sales and service, we will establish functions for gear cutting machine production, showroom functions, training center functions, parts center functions, and procurement functions for all machine tool products.

- Plant site area: Approx. 4,000m²
- Building area: Approx. 2,500m²
- To be completed in October 2012 (commencement of operation)

Sales targets

Maintain the top market shares for gear cutting machines and precision tools in India, thereby expanding the business.
4. Business Strategies:  
(3) Globalization - Localization of Production and Sales 2)

**Expansion of machine tool business in China**

**Concept**
- Gear cutting machines
- Retention
- Narrowing down targets
- Improving customer response capability through resident engineers’ activities
- Increasing the power of the MHI brand by delivering flagship units
- Possibility of future local production also envisioned

**Establishing the Changshu plant in China as a core plant**
- Add production models, GE20A and GE25A - Enhance the showroom function
- Enhance the function for the local procurement of major parts of machine tools (in cooperation with MHI China)
- Consolidate service staff and integrate their activities; add parts center function

**Expand the business by getting closer to customers through localization.**

Global expansion of precision tool business

Collaborations with MHI-IPT (India) and Federal Broach (U.S.)

(1) MHI-IPT
- Integrated operation with Ritto Machinery Works to make India the core base.
  ➔ Secure capacity to export as well, by increasing production capacity through aggressive investments.
  ➔ Build an integrated production system by using common facilities for designing, CAM, and processing. Achieve shorter delivery times and production in optimal locations. (Enable the production of the same products anywhere with the same lead times.)

(2) Federal Broach
- Enhance its strength further through integrated operation with Ritto.
  ➔ Improve its productivity by supporting production technology and production management.
  ➔ Increase its production capacity through capital expenditure.
  ➔ Boost the appeal of products from Ritto by utilizing the expertise of Federal Broach.

Increase the size of the precision tool business to the 15 billion yen level, to be ranked among the top three in the world.
(1) Overview of Federal Broach & Machine Company
- Established: 1934
- No. of employees: 192
- Locations: Harrison, Michigan (Head Office) and three other plants
- Business descriptions: Broach tools, broach machines
  ➔ A leading broach manufacturer worldwide

Acquired in April 2012

(2) Purposes
- Winning new customers, including the U.S. Big 3 (synergy involving machines)
- Strengthening helical broaches and Christmas broaches, which are promising
- Benefiting from strong synergetic effects created by the highly complementary relationship between the two companies in terms of target markets and products

PMI* is being accelerated to maximize synergy. We will continue to drive M&A and alliances.

*PMI: Post Merger Integration, or management for integrating organizations after M&A

<Plant locations>

<Mainstay products>

Helical broach
Pot broach
Broach machine
Christmas broach

<Comparison of target markets>

<table>
<thead>
<tr>
<th>Region</th>
<th>MHI</th>
<th>Federal Broach</th>
</tr>
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<tbody>
<tr>
<td>North America</td>
<td>2%</td>
<td>66%</td>
</tr>
<tr>
<td>Europe</td>
<td></td>
<td>14%</td>
</tr>
<tr>
<td>Asia</td>
<td>98%</td>
<td>20%</td>
</tr>
</tbody>
</table>
4. Business Strategies:
(4) Expansion of New Growth Businesses 1)

Establishing the hollow engine valve business in earnest

- Demand for engine vehicles will continue to constitute the majority of global demand for all vehicles
  (2020: 90%, or approx. 98% if HEVs are included)
- Engine performance has improved year after year. Engines are in the process of evolution.
- Lighter weight and higher combustion efficiency, the features of hollow engine valves fulfill, will be even more important going forward.

**Engine valve business plan**

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<tr>
<th>'11</th>
<th>'12</th>
<th>'14</th>
<th>'16</th>
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<tbody>
<tr>
<td>Valves for mass-produced small cars (hollow valves)</td>
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<tr>
<td>Valves for high-performance luxury cars (hollow valves)</td>
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<tr>
<td>Conventional valves</td>
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</table>

- Commenced mass production and deliveries for high-performance luxury cars in October 2011.
- Performance and durability tests are being undertaken by several major automobile manufacturers.

Increase the business size by getting the valves adopted for mass-produced small cars in addition to high-performance luxury cars.

**Breakdown of global demand**

- EVs, FCVs
- HEVs
- Engine vehicles

**METI finalized the new fuel efficiency standards for passenger vehicles**

<table>
<thead>
<tr>
<th>Passenger vehicles</th>
<th>FY2009 Actual</th>
<th>FY2020 Target</th>
<th>Fuel efficiency improvement rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16.3 km/L</td>
<td>20.3 km/L</td>
<td>24.1%</td>
</tr>
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</table>

* JC08 mode

**Changes in the average fuel efficiency values of gasoline passenger vehicles in 10-15 mode**

- 16.3 km/L
- 20.3 km/L
- 24.1%

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4. Business Strategies:
(4) Expansion of New Growth Businesses 2)

- Enhance the features of the room temperature wafer bonding machines, which can be used for bonding a variety of materials
  - Fields of high-frequency devices, light-emitting diodes (LEDs), and power devices → Increase materials that can be bonded and shorten the cycle time
- Cultivating the field of 3D multilayer devices (market size: 14 trillion yen)
  - The market will definitely expand, led mainly by memory LSIs and logic LSIs → Ensuring greater precision and improving bonding reliability

Increase the business size by expanding the subject applications and concentrating development efforts on growth fields.

Upgrading in-house manufacturing through Process Technology Centers

The processing of key parts is carried out at the Machine Tool facilities.
## 4. Business Strategies:
### (5) Upgrading Process Technologies 2)

<table>
<thead>
<tr>
<th>Step 1: Upgrading in-house process technologies</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>◆ Development of an aircraft main wing processing facility, etc.</td>
<td>Solving the issues related to the key parts processing technologies of in-house machinery plants to achieve globally competitive production</td>
<td></td>
<td></td>
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<tr>
<td>◆ Introduction of machine processing for key aircraft parts</td>
<td>Efficiency improvement of processing of difficult-to-cut materials</td>
<td></td>
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<tr>
<td>◆ Productivity improvement of aircraft engine processing line</td>
<td>* Achieving faster, more efficient 5-axis processing</td>
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<tr>
<td>◆ Development of process technologies for other key parts</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 2: Creating new Machine Tool businesses</th>
<th>Making proposals to customers based on cutting-edge process technologies and cultivating markets leading to new businesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>◆ Proposal of a business dealing with machines for processing large-size precision parts for aircraft</td>
<td>◆ Proposal of solutions in the manufacture of automotive parts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 3: Support for overseas plants</th>
<th>Provision of support with production technologies to MHI’s overseas plants (collaboration with the MHI Manufacturing System activities by the Manufacturing Innovation Division)</th>
</tr>
</thead>
<tbody>
<tr>
<td>◆ Cost reduction measures for the plants of Air-Conditioning &amp; Refrigeration Systems</td>
<td>* Handling issues regarding the innovations of Process Technology Centers for responding to full-scale overseas production</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Acquiring cutting-edge process technologies</th>
<th>Developing cutting-edge process technologies by participating proactively in internal and external consortiums for studying process technologies, for example</th>
</tr>
</thead>
<tbody>
<tr>
<td>◆ Technologies for the high-speed processing of special metals</td>
<td>◆ Technologies for processing advanced materials</td>
</tr>
</tbody>
</table>

**Commercializing cutting-edge process technologies (large-sized special purpose machines).**
5. Summary

We are continuing our initiatives with the following key policy:

**Increasing business size and profits by accelerating globalization efforts and increasing added value**

Aiming for a 100 billion yen business and the top global market shares for gear cutting machines and large-sized machine tools, we will continue the rapid, steadfast pursuit of the strategies under the 2012 Mid-Term Business Plan.

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