Briefing on Robotics Business
- Current Business Status and Growth Strategy -

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YASKAWA ELECTRIC CORPORATION
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1. Current Status and Outlook of Robotics Business
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Performance of the Robotics Business

- Performance improved through the 1H of FY2018 due to increased global investment demand, particularly in China.
- After that, we were faced with the influence of US-China trade friction and the spread of new coronavirus infection.
- In the 2H of FY2020, in addition to the recovery of the automobile market, investment in automation in the general industry is accelerating.

*1 Data up to FY2018 are based on Japanese GAAP (IFRS adopted in FY2019)
*2 Reference data for the period from September 21, 2017 to March 20, 2018 due to the change in the fiscal year end
*3 Data reflecting the impact of the reclassification of segments conducted in FY2019
FY2020 Quarterly Operating Profit

- While new coronavirus affected revenue significantly in 1Q, we stayed in the black through thorough expense control
- After 2Q, automobile-related demand has been recovering mainly in China. Profitability improved through continued expense control while revenue grew

Breakdown of changes in operating profit (FY2019 4Q → FY2020 1Q → 2Q → 3Q) (billions of yen)

<table>
<thead>
<tr>
<th>FY2019 4Q</th>
<th>FY2020 1Q</th>
<th>FY2020 2Q</th>
<th>FY2020 3Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.7</td>
<td>0.3</td>
<td>2.2</td>
<td>1.7</td>
</tr>
</tbody>
</table>

- Revenue decreased due to the impact of the new coronavirus, which inhibited installation of robots.
- Value added decreased as capacity utilization deteriorated.

→ Stayed in the black by controlling expenses

- Projects that had been postponed were recorded in revenue due to partial normalization of production activities.
- Capacity utilization and product mix improved

→ Generated profits without increasing expenses as revenue increased

- Auto-related demand recovered in China, Europe, etc.
- Continued to control expenses

→ Achieved a profit level of FY2019 4Q of pre-corona crisis
## FY2020 4Q Outlook and Initiatives

### FY2020 4Q Robotics results are expected to improve both in sales and profits, QoQ and YoY

<table>
<thead>
<tr>
<th></th>
<th>FY2020 4Q</th>
<th>FY2020 3Q</th>
<th>Changes (QoQ)</th>
<th>FY2019 4Q</th>
<th>Changes (YoY)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forecasts</td>
<td>Results</td>
<td>Profit ratio</td>
<td>Profit ratio</td>
<td>Amounts</td>
</tr>
<tr>
<td>Revenue</td>
<td>Total</td>
<td>101.0</td>
<td>93.1</td>
<td>+7.9</td>
<td>+8.5%</td>
</tr>
<tr>
<td></td>
<td>Robotics</td>
<td>36.3</td>
<td>34.2</td>
<td>+2.1</td>
<td>+6.0%</td>
</tr>
<tr>
<td>Operating profit</td>
<td>Total</td>
<td>7.2</td>
<td>6.7</td>
<td>+0.5</td>
<td>+6.7%</td>
</tr>
<tr>
<td></td>
<td>Robotics</td>
<td>2.6</td>
<td>1.7</td>
<td>+0.9</td>
<td>+50.0%</td>
</tr>
</tbody>
</table>

### Initiatives by Market and Field

#### Auto-related market
- Respond to next-generation manufacturing reforms in Japan, Europe, and the US.
- Capture aggressive capital investment demand by Chinese OEM manufacturers. We will also enhance our products targeting Tier 1 parts suppliers, and propose high-value-added systems that combines the i³-Mechatronics concept to differentiate us from local SIers.

#### General industrial sector
- Capture demand for automation investment in growth markets such as new infrastructure* in China
- [Growth market] Next-generation communication standards ‘5G’-related, EV-related, 3C market such as PCs and smartphones, health equipment-related under coronavirus crisis

#### Semiconductor- and LCD-related markets
- Accelerate sales expansion with new products against the backdrop of increased demand for smartphones and data centers

*Initiatives led by the Chinese government to rapidly promote the digitization of industry in seven specific areas
2. Progress and Issues in Mid- and Long-term Business Plans

① Market Environment of Industrial Robots

② Progress and results of Challenge 25 and future initiatives

③ Initiatives to Increase Profitability
Market Environment of Industrial Robots

◆ Outlook on global shipment units

- In 2020, due to the influence of the new coronavirus, all regions except China are expected to have negative growth of -10% to -20% over the previous year.
- Shipments are expected to return to pre-corona levels around 2022

◆ Global market share analysis by application

- Percentage of 6-axis articulated robots: 25% of the general applications (Ratio of 4-axis or less multi-axis arms: approx. 75%)
- Market share of industrial robots in general industrial sector
- Composition of applications of industrial robots in the global market
- Percentage of 6-axis articulated robots: 80 - 90% of the auto-related applications
- Market share of industrial robots in the automotive market

Source: IFR World Robotics 2020 "All type shipments", forecasts for and after 2020 are Yaskawa estimates
<table>
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<tr>
<th>Initiative 1</th>
<th>Expand orders in key markets (Automobile and general markets)</th>
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</thead>
<tbody>
<tr>
<td><strong>Automobile market</strong></td>
<td>Proposing total solutions based on the i³-Mechatronics concept to respond to changes in production processes accompanying the shift to EVs and expansion of automated fields</td>
</tr>
<tr>
<td><strong>General market</strong></td>
<td>Expanding robotics applications in the growing markets especially in China's 3C market</td>
</tr>
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<table>
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<tr>
<th>Initiative 2</th>
<th>Expand product and technology areas by strengthening development capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Development of new products</strong></td>
<td>Expansion of the lineup of collaborative robots, semiconductor wafer transfer robots, small robots (payload less than 10 kg), etc.</td>
</tr>
<tr>
<td></td>
<td>Market deployment of YASKAWA Cockpit, which aggregates and utilizes data</td>
</tr>
<tr>
<td></td>
<td>Accelerated development of YRM controller (tentative name) for data-based cell control</td>
</tr>
<tr>
<td><strong>Development of new products</strong></td>
<td>Develop next-generation robots that contribute to improving manufacturing efficiency and quality by supporting high-mix variable volume production through further data utilization</td>
</tr>
<tr>
<td></td>
<td>Expand collaborative robots’ lineup and improve usability</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Basic Policy 3</th>
<th>Boosting production capacity and productivity in response to market expansion</th>
</tr>
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<tbody>
<tr>
<td><strong>Capacity expansion</strong></td>
<td>Robot production began in Slovenia</td>
</tr>
<tr>
<td></td>
<td>Rectification of production process due to completion of Changzhou 3rd plant in China</td>
</tr>
<tr>
<td><strong>Productivity improvement</strong></td>
<td>Introduction of collaborative robots at Plant No.1 in Kitakyushu</td>
</tr>
<tr>
<td></td>
<td>Introduction of Yaskawa Solution Factory Concept to plants in Japan and China (Changzhou)</td>
</tr>
</tbody>
</table>

| **Automobile market** | Deploy differentiation strategy through realization of high added value such as improvement of welding quality through use of digital data |
| | Expansion of after-sales service business through predictive maintenance functions |
| **General market** | Enhance solution proposal with YRM controller (tentative name) |
| | Strengthen collaboration with Chinese robot manufacturers |

| **Development of new products** | Reestablish global production capacity and optimizing production and cost structures |
| | Restructure production system in Japan and responding to volume fluctuations through automation and data utilization |
| | Integrate production lines and complete automation of commercial testing and painting processes |
Initiatives to Increase Profitability

**Enhancement of production capabilities**

- **Optimizing global capacity balances**
  - Create a lean manufacturing system to reduce costs and improve capacity utilization

- **Construction of highly efficient production lines through operation-free**
  - Production control process is standardized and further efficiency improvement is aimed at by automation and labor saving

- **Realization of a production system that can flexibly respond to fluctuations in production volume**
  - Integration of production lines and complete automation of commercial testing and painting processes

**Enhancement of sales capabilities**

- **Creating business opportunities through integrated sales and service operations**
  - Strengthen proposal capabilities through synergy effects from the acquisition of a service and engineering subsidiary and aim for a highly profitable structure

**Implementation of regional strategy**

<table>
<thead>
<tr>
<th>Region</th>
<th>Strategy</th>
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</table>
| Japan  | • Respond to the “manufacturing reform” of automobile OEM manufacturers  
         • Accelerate sales expansion through new products in the semiconductor and food markets |
| Europe | • Strengthen approaches to automobile manufacturers by leveraging the strengths of local production |
| Asia   | • Expand sales to major local manufacturers through the i³-Mechatronics proposal  
         • Responding to the shift to EVs in new technological fields |
| North America | • Strengthen measures in the logistics market |
| China  | • Capture new demand in growth markets such as 3C and 5G-related industries  
         • Acquire positions in the growing semiconductor market |
3. Growth Strategy

① Evolution of Robotics Solutions

② i³-Mechatronics Concept
Evolution of Robotics Solutions (1/2)

Robotics applications continue to expand

- Imitation of humans' movements
  - Golf swing robot

- Pursuit of new robotics applications
  - MotoMINI

Robots optimized for painting application
- LCD and semiconductor transfer robots
- Picking, packing, palletizing robot

Painting
- Arc welding
- Spot welding

Welding
- Laser welding
- Seven-axis robot

Transfer
- Dual-arm robot for biomedical application

Biomedical
- Analysis pretreatment robot cell

Self-Propelled dual-arm robot

Multi-skill
- Visual technique
- Force sensing technique

Collaborative robot HC 10 DT

Expansion of skills
- Use of various sensors
- Improvement of work tools

High Productivity = Accuracy, High Volume, High Speed

Multitasking, Flexibility, and Interaction

Ability required of the robot

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Evolution of Robotics Solutions (2/2)

Evolution to improve process flexibility

- Coexistence with people without safety fences
- Repositionable
- High-mix variable volume production
- Changes in production processes
- Automatic change of production process by self-propulsion
- Collaborative work among people

Evolution to autonomy

Expansion of autonomous capacity with IoT and AI

- Autonomous self-running
  - Modifying work processes
- Automatic generation of motion (teaching-free)
  - Automatic generation of motion paths
  - Automatic generation of tasks based on the state information
- Guarantee of work quality
  - Estimation of work quality by operation data
  - Inspection by audio and image
- Responding to changes over time
  - Change of operating parameter
  - Prediction of robot failure

Movement by a hand-cart
i³-Mechatronics Concept (1/2)

- integrated
- intelligent
- innovative

Advances in Mechatronics though digital data management

Realize revolution of industrial automation
i^3-Mechatronics Concept (2/2)

- **ERP/SCM**: Data Center/Cloud
- **MES**: Feedback
- **Controller**: Converted into physical motion
- **Equipment (Cartesian coordinate robot)**
- **Robot**: YRC (Robot controller)
- **Equipment + Robot**: MP (machine controller)
- **MECHATROLINK-4**
- **Cell/System**: (Assembly, processing, etc.)
- **YRM Controller** (tentative name)
- **YASKAWA Cockpit +2**
- **Data collection**
- **Analysis**
- **Monitoring**

**Model generation and learning**
- Accumulation of know-how

**Utilization and analysis of “big data”**

**Application of models**
- Defect monitoring model
- Predictive maintenance model
- Recovery judgment model

**Real-time execution of the analyzed models**

**Cloud/FOG**
- IoT/AI

**Digital data management**
- FA(Edge*)
- Data connection

**Production automation**
- Converted into physical motion

**IT**
- Feedback

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*1: Edge is an information processing field for data analysis and feedback that require real-time performance at production sites or factories.

*2: A software that able to collect, store, and analyze real-time data on equipment and devices at production sites.