Briefing on Sustainability

Technological Development for Sustainable Growth

Notes:

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YASKAWA Electric Corporation

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1. Yaskawa Electric as a Company Founded on Technology

Company Motto "A Company Founded on Technology," Embodying the Founder's Passion History of Value Creation through Technology Strengths of Technologies Cultivated Presence

Company Motto "A Company Founded on Technology," Embodying the Founder's Passion

At the time of the establishment of the company, Daigoro put up the company motto of "being a company founded on technology" in order to <u>conduct business with the company's own</u> <u>technology, rather than imitating the leading Western technologies.</u> The culture of "being a company founded on technology" nurtured at the early stage of the entrepreneurial process has been passed down to the present day.



A Company Founded on Technology

[Description of the calligraphy]

"A company founded on technology" was the top priority phrase in the policy put up by Shinichi Hashimoto, the sixth president of Yaskawa, when he became president in 1996.

Later, when he visited China in 1998, he asked the chief priest of Kansan Temple in Suzhou to write it. This phrase conveys the passion that <u>"we will provide products that meet customer needs with world-class</u> <u>technologies</u>. In order to achieve this, it is essential to have a strong commitment and love for product <u>development</u>, in addition to a sincere commitment to technological development.".

History of Value Creation through Technology

Determining <u>electric motors and their applications</u> as major pillars of our business, we have supported the cutting-edge industries of each age with our proprietary technologies and products.

Development of industry and society

- Startup periodCoal mining equipment shifted from
(Early 1900s)steam engines to electricity (motor).
- 1950s Energy shifted from coal to oil, and the heavy and chemical industries developed.
- 1970s Expansion of mass production of automobiles, home appliances, etc. during Japan's high economic growth

1990s Popularization of personal computers and progress in computerization

2000s Spread of the Internet and smartphones

2010~ Transition to a data-driven society through the use of IoT and AI

2015~ Transition to a decarbonized society

Changes in Yaskawa Technologies and Businesses

Started to manufacture **electrical equipment for coal mines** which were mostly imported at that time.

Development of highly reliable motors and controllers necessary for steel plant control

Proposed concept of "Mechatronics" ahead of the world (1969)

Accelerated business expansion from conventional process automation to **factory automation**

Japan's first all-electric industrial robot MOTOMAN was born (1977)

High-speed, high-precision AC servo drive became essential for the manufacture of large quantities of electronic components

Launched "i³-Mechatronics," a new solution concept (2017)



Blast furnace



Interior of Yaskawa factory in 1922



Developped Minertia motor which is the basis for current servo motors (1958)



MOTOMAN-L10



Chip mounter



"i3-Mechatronics" demonstration plant, YASKAWA Solution Factory (2018)

Strengths of Technologies Cultivated

We have promoted development aiming at world's first and world's best for the core technologies of motion control, robotics technology, and power conversion.

Expansion into core products



Developped minertia motor which became the basis for the servo motor available today for the first time in the world(1958)
World-class basic performance such as rotational speed, resolution

point of differentiation

Motion Control



and speed frequency response htroller ·Sensing and data utilization function (Σ-Link *1)



- Optimal control of cells (processes combining equipment and robots)
- Developed Japan's first all-electric articulated robot (1977)
- ·In-house production of key components (servo motors)
- •World's best product lineup and application response
- •Response to new business areas (Food & Agri, Biomedical)



- •Developed **world's first** PWM controll model ^{*2} transistor AC drive (1974)
- ·Application know-how of various machines and equipment
- •Energy-saving and high-efficiency performance (application of WBG device *3)
- ·Control technology and sensing technology based on motor drive

*1 A communication system developed by Yaskawa Electric that can receive multiple sensor signals between servo amplifiers and encoders *2PWM (Pulse Width Modulation) control is a method for controlling power through high-speed switching.

*3 A new type of power converter that can operate at much higher voltages, frequencies, and temperatures than conventional semiconductor materials

Presence



Minertia motor (The basis for current servo motors)

Since the invention of **the world's first** minertia motor in 1958, a total of **20 million** servo motors have been shipped.

No. 1 market share in the world at **17%** (Company's own estimation)





MOTOMAN-L10

Since the commercialization of **Japan's first** all-electric vertical articulated industrial robot in 1977, a total of **500,000** units have been shipped.

One of the **WORLd's top 4** industrial robot manufacturers





Since the commercialization of **the world's first** general purpose transistor AC drive in 1974, a total of **30 million** AC drives have been shipped. As an energy-saving equipment, Yaskawa AC drive reduces global annual electric power consumption by **approximately 4%**. (Company's own estimation)





2. Toward the Realization of Vision 2025

Development of Core Technologies for Value Creation in Vision 2025 i³-Mechatronics Concept Factory Automation/Optimization Based on i³-Mechatronics Application of Mechatronics for Sustainable Development of Society

Development of Core Technologies for Value Creation in Vision 2025

Contribute to solving customers' management issues in addition to creating new added value to society, through evolution of core businesses, and expansion into new fields by applying mechatronics technology



*i³-Mechatronics: Yaskawa's solution concept for realizing new industrial automation revolutions

i³ -Mechatronics Concept



integrated

intelligent

innovative

Evolution of echatronics through the use of data

Realization of new industrial automation revolution



Factory Automation/Optimization Based on i³⁻Mechatronics

*1: Areas for real-time data analysis and Information processing for providing feedback (Areas close to production sites, such as plants and production sites) *2: Software that can collect, store, and analyze data on equipment at production sites in real time

Application of Mechatronics for Sustainable Development of Society

Contributing to a sustainable society by applying mechatronics



Eco PM motor flat type and AC drive

Clean Power



PV inverter for solar power generation and electric appliances for wind turbines

Food&Agriculture



Vegetable factory

Humatronics



Biomedical robot

3. Technology Development Centered on YASKAWA Technology Center (YTC)

Aims and Results of "Technology Integration" YASKAWA Technology Center Overview YASKAWA Technology Center Concept Integration of Development Processes (integrated) Consolidation and Creation of Intelligence (intelligent) Creation of Innovative Technologies (innovative) Specific Examples of Open Innovation

Aims and Results of "Technology Integration"



YASKAWA Technology Center Overview

Name	YASKAWA Technology Center (YTC)
Address	Within Yaskawa Electric Headquarters
Construction Cost	15 billion yen
Personnel	Approx. 650
Total area	Approx. 25,500 m
Operation started	September 2021









Integration of Development Process

Consolidated the development functions of the Yaskawa Group's technologies, products, and production technologies in one place



Consolidation and Creation of Intelligence

Evolving value creation by connecting information of the value chain globally



Creation of Innovative Technologies

Diverse systems and environments promoting collaboration with external parties and creative activities





A place to share technologies and issues with actual machines



A large hall

Environment that promotes creative activities





Diverse work styles



Shared space for human interaction



Customers' equipment to learn by touching physically

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Specific Examples of Open Innovation

Strengthening the development of new technologies and systems through industryacademia-government collaboration

•Kyushu University

Conducting exchanges of engineers and human resource development, including joint research in the agricultural field

• Kyushu Institute of Technology (Cabinet Office, 'Subsidy for Regional Universities and Regional Industrial Revitalization' project) Joint research on autonomous robots through innovative robotics technology



•Tokyo Institute of Technology

With the theme of research on ultralight actuators for collaborative robots, "Yaskawa Joint Research Course on Future Technology" was established

•JA Zen-Noh (National Federation of Agricultural Cooperative Associations of Japan) Business alliance for contributinon to developing Japanese agriculture and strengthening Japan's international competitiveness in food field.



demonstration robot

Strawberry selection robot



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