Technology
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"Develop people before making products"

The founder Konosuke Matsushita spoke these words.

"A company is its people. No business will grow without securing the proper personnel"

In the past and in the future, what moves the world is nothing other than "people."

We have things to accomplish.

We have responsibilities to fulfill.

There are things that can only be done by Panasonic Group, which has been developing and expanding worldwide products and services by always staying close to our customers’ lives.

Our mission is to embody the desires of people around the world making further contributions toward creating an ideal society and lifestyles while solving global social issues.

Panasonic Group will contribute to meet various challenges with its people and technologies.
Look ahead to the “Future,” keep taking on challenges.
Aim to an “ideal society and lifestyles” while solving global social issues
Aim to an “ideal society and lifestyles” while solving global social issues

Mobility
- Autonomous Driving/Solutions
  - Obstacle Detection
  - Human State Recognition
  - External Perception
  - Dispatch Control System

Sustainability
- Energy Optimizations
  - Next-Generation Power Devices
  - Lithium Ion Battery System
  - Contactless Power Supply System

Well-being
- Home
  - Lifestyle Noticed Everyday
    - Face Authentication In/Out
    - Face Settlement Self-checkout
    - Identification of Membership Facilities
    - Detection of Suspicious Persons

- Origin of Life
  - Lifestyle Data Analysis
  - Emotion Estimation
  - Variable House

- Integration of External Services with Lifestyles

Business
- Next-Generation Stores and Facilities
  - Unmanned Service Pot (Automatic Settlement)
  - Unmanned Delivery Robots
  - Automatic Inventory/Replenishment
  - Behavioral Prediction

- Improving Plant and Logistic Efficiency
  - Improvement of Work Capacity (Power Efficiency Assist)
  - Autonomous Mobile Robot
  - Logistics/Transport Robots

Network/Platform

Key Device/Manufacuring
- AI/IoT/BigData
- Sensing Technology
- Robotics
- Clean Energy
### Technologies-1

#### AI / IoT / BigData

<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity Sensing</td>
<td>The Activity Sensing Technology specializes in the understanding of human behavior in context by processing and analyzing data from sensors in home. More comfortable and personalized services in the home can be offered through this technology.</td>
</tr>
<tr>
<td>Speaker Identification</td>
<td>Accurate extraction and identification of speaker features enables non-contact identification by voice, contributing to the provision of detailed services in consideration of hygiene and privacy.</td>
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#### Sensing Technology

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Sensing Camera</td>
<td>In addition to high image quality, high sensitivity, and high resolution, near-infrared light is used, for example, to detect blood vessels that are usually invisible. By visualizing normally invisible objects, this camera can be used for a variety of sensing applications.</td>
</tr>
<tr>
<td>Multimodal Authentication</td>
<td>By combining and complementing multiple AI functions, advanced sensing functions are realized. We provide speedy solutions that contribute to problem solving through the evolution of AI technology.</td>
</tr>
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</table>

#### Digitalization

<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
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<tbody>
<tr>
<td>Nessum</td>
<td>In the expanding IoT society, Internet connectivity is the key. “Nessum” enables secure and easy connections between devices and existing lines such as control, coaxial and power lines, as well as short-range high-speed radio.</td>
</tr>
<tr>
<td>Fifth Generation Mobile Communication</td>
<td>Sixth generation mobile networks have been developed for high-speed, high-capacity, and extremely low-latency next-generation communication networks, where various frequency bands and radio systems can be used simultaneously or by switching. This creates a radio environment suitable for the IoT age.</td>
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#### Supportive Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Digital / Cloud Technology</td>
<td></td>
</tr>
<tr>
<td>Optical Device Technology</td>
<td>Ultrasound/laser projection lens for video projectors</td>
</tr>
<tr>
<td>Video / Audio Technology</td>
<td>Digital camera / Omnidirectional array microphone consisting of many directional microphones</td>
</tr>
<tr>
<td>B2B Device Technology</td>
<td>Industrial devices</td>
</tr>
<tr>
<td>Lighting Technology</td>
<td>Lighting system using laser technology / Next-generation headlight</td>
</tr>
<tr>
<td>Biological Science Technology</td>
<td></td>
</tr>
</tbody>
</table>
# Technologies-2

## Robotics
- **Housekeeping / Nursing-care Robots**
- **Social Issue-solving Robots**

## Key device / Manufacturing
- **All Solid State Batteries**
  - Novel solid-state electrolytes with high safety have been successfully developed. We will challenge to realize all solid-state batteries with exceeding performances in safety, energy-density, and charging speed over conventional rechargeable batteries.
- **Phononic Devices**
  - Extraordinary high heat flow controllability can be achieved through phononic devices with nanoscale periodic structures (phononic crystals), which will contribute to solving thermal issues associated with carbon-free society in the AI/IoT era.

## Physical Augmentation
- **Kansei Augmentation**

## Photon Integrated Devices
- Next-generation sensors will be created through the development of new materials and process technologies for integration, and the demonstration of innovative sensing by means of cutting-edge sensor technology, biosensing technology, and optical/micromachining technology.

## Materials Informatics
- Innovation in material development has been realized through the use of cutting-edge AI technologies and HPC. Rapid prototyping cycles of data collection, modeling, prediction, and evaluation accelerate the discovery of novel materials with target properties and reduce the overall R&D time in half.

## Clean Energy
- **Energy Creation**
  - Home Power Generation: Using hydrogen and oxygen, electricity can be generated at home according to the energy demand of each household, creating an eco-lifestyle a step ahead of the times.

## Energy-storage
- Development of a system using high capacity storage batteries was proactively promoted to create an increasingly compact/comfortable HEV with power storage. Power-storage system; Automotive Lithium-ion battery system.

## Supportive Technologies
- **Heat utilization technology**
  - Air-to-Water
  - Absorption Refrigerator
- **Material/Device Technology**
  - inverter compressor, Polypropylene-hybrid reinforced resin
- **Comfortable Air Control Technology**
  - Thermal insulation technology, Thermal discharge technology, Purification technology, Antimicrobial technology
- **Material Production Technology**
  - Functional materials for motor vehicle
- **Environmental Core Materials**
  - High Biomass Cellulose Fiber Molding Materials
- **Simulation Technology**
  - Finite element analysis, simulation technology
Our Activity

**Challenge Activities**
- Support for corporate culture reform and co-creation
  - Creating new experiences by supporting the challenges of diverse employees
- Promotion of innovation
  - World-class technology and business leaders, mainly in Silicon Valley, create new products and services with a sense of speed and initiatives.
  - Contributing global innovation and business growth by organic linkage between business, technology, and creativity.

**External Activities Related to Academic Societies and Industrial Policy**
- Academic society activities and paper submission
  - Taking on the challenge of the world’s top-level publications (Nature, Science, IEEE, etc.)
- Standardization activities
  - Setting up sites in North America, Europe, China, and Singapore to promote standardization activities globally.
  - International Standard: EC (electrical and energy system), ITU (communication system), ISO, etc.
  - Forum: Consortium: 3GPP, NGMN, CSA, etc.
  - Global government policy: European Commission (Green by Digital, China new energy car)
- Joining in national projects in Japan
  - Cabinet Office: Cross-ministerial Strategic Innovation Promotion Program (VIP)
  - Ministry of Education, Culture, Sports, Science and Technology: JST(TM) Research and development program of basic research and core technology (Moonshot, CREST, ASTEP, etc.)
  - JST: Japan Science and Technology Agency
  - Ministry of Economy, Trade and Industry: NEDO energy / environmental technology, and industrial technology projects
  - NEDO: New Energy and Industrial Technology Development Organization
  - Ministry of Internal Affairs and Communications: Research and development for information and communication technology

**Toward a New Stage**
- Training ourselves by various measures as well as conducting joint research activities with various universities and research institutions, and creating innovative new products and business models

**Open Innovation**
- Joint research: Universities and research institutions worldwide
  - Outside Japan
    - imec(Belgium), MITI(USA), Stanford University(USA), TNO(Netherlands) etc.
  - Inside Japan
    - Cooperation with over 400 national research institutes and university laboratories
    - Panasonic research centers have been established on campuses at The University of Tokyo, Kyoto University, Osaka University, Kyushu Institute of Technology, University of Fukuoka, and joint researches are carried out.

- Collaboration and Co-creation: Breaking away from self-reliance / Emphasis on speed
  - Win-win relationship building
  - Establishment of New Business Creation Schemes (2022)
    - Investments in the U.S., Venture Investment Fund “VCC Ventures III L.P.”
    - Established Vieureka Co., Ltd., through joint investment
    - Blake IP information “Intangible Asset” and co-create with partners

**R&D Human Resources Development Program**
- Training Programs for Core-technology Enhancement
  - Rank-based Technical Training Programs for Enhancement of Core-technology
  - Technology Exchange Workshop in the Company for Crosswise Innovation
- Hands-on Growth Programs for Supporting Challengers
  - Domestic and International Studying Abroad
  - Horizontal Company-wide Resource Exchange
Ryuji Sakata  Joined in 2012
Technology Division, Panasonic Holdings Corporation

I majored in aerospace engineering, which had nothing to do with information technology. However, as I was handling data processing programs in my research, I became interested in information technology. After joining the company, I was assigned to the Information Systems Section. I understood the importance of acquiring skills to make use of various data, and apart from my work, I improved my skills through competitions and so on in the community "Kaggle" where data scientists from all over the world gather, and I was able to obtain the title of Grandmaster in June 2019. Based on this experience, I am currently working on developing algorithms that collect and analyze data when mobile batteries are in use to improve convenience. I am also a lecturer at AI training courses and contribute to the development of AI human resources.

Kyourei Ri  Joined in 2014
Process Automation Business Division, Panasonic Connect Co., Ltd.

I was born in Harbin, Heilongjiang Province, China. While attending a Japanese university, I worked hard to earn a living by working part-time to study Japanese, and as an overachiever, I received the privilege of tuition exemption for four years. When I met the "implementation machine" that is expanding globally at the company information session for job hunting, my heart fluttered. A mounting machine is an equipment that places electronic components on a printed circuit board at high speed and accurately. I joined the company because I wanted to be involved in this equipment development. In my third year at the company, I worked as a project leader in new product development, and now I am developing core technologies for supply parts units to make the plant's mounting line the world's first "unmanned". I want to gain confidence that I can do it if I work hard, and become an engineer who can be active globally.

Ryohei Yoshida  Joined in 2017
Infotainment Systems Business Division, Panasonic Automotive Systems Co., Ltd.

I want to make products that propose the ideal way of cars such as electric vehicles and autonomous driving. I joined the company knowing that Panasonic is a leading company in this field. After working on the hardware design of the display unit for Europe, I am now in charge of the electrical circuit design for the domestic development of the display audio unit for automobiles (with functions other than car navigation) such as video and music. In automotive units, where strict standards are set, the area in which dedicated semiconductor ICs are installed is becoming smaller and smaller. My opportunity to show skills is whether I can think of the optimum arrangement for preventing the interference of communication between ICs in a unit and the retention of heat as if I were solving an advanced puzzle, and finish the assembly of technologies in different areas as one system.

Yoichiro Ikegami  Joined in 2011
Kitchen Appliances Business Division, Panasonic Corporation

"I want to make something amazing." It was a phrase that had been in the back of my mind since I was a child. I like to think about how to make people think "interesting" rather than making things themselves. My dream was to "make amazing home appliances," and I joined Panasonic because I had the image of developing various home appliances. I am thinking of the benefits that can be provided for all cooking activities, not just for home appliances alone, but for the entire kitchen space. Currently, I am in charge of managing the implementation development of "Kitchen Pocket", an integrated application for kitchen appliances, and developing new functions. "Creating something that has never been done before" is finally my dream entrance.

Mizuhiko Kawakami  Joined in 2016
Manufacturing Innovation Division, Panasonic Holdings Corporation

I am engaged in the development of equipment to manufacture "Rechargeable batteries for vehicles" that will accelerate the shift to environmentally friendly vehicles. I liked robots since I was a child, so I joined the club when I was a student, and also participated in the robot contest. My goal is to "want to contribute to society by making useful products using the equipment I designed." To this end, we are working to ensure that our facilities are optimized by working on equipment specifications with the parties involved in the ordering process within the Group. Through these activities, I feel more responsible for my work. I feel that it is only Panasonic that can develop its own equipment together with the ordering party by making full use of its many advanced technologies.
Pursuit of "Better Life" will change the future.

Our basic business philosophy of "make the lives of people around the world richer and happier through business" is at the core of everything we do. Although we have changed the shape of our business in line with the times, we continue to value the people's desire of better life.

"We aim to contribute to development of the world by providing convenient, reassuring, and comfortable lifestyles in various fields globally."

And with the recent renewal of our company operating system, we aim to clarify the societal issues that need to be solved and accelerate our R&D and the creation of new businesses.

We take our customers' feedbacks and requests seriously, always put ourselves in their shoes, to make "contributions" that far exceed their expectations through our technologies.

We also hope to create an environment that encourages challenges so that Panasonic Group's technologies can shine even brighter.

And we hope you look forward to the exciting R&D possibilities we offer in the years ahead.

Tatsuo Ogawa
Panasonic Holdings Corporation
Executive Officer
Group Chief Technology Officer (Group CTO)
In-charge of Pharmaceutical Affairs