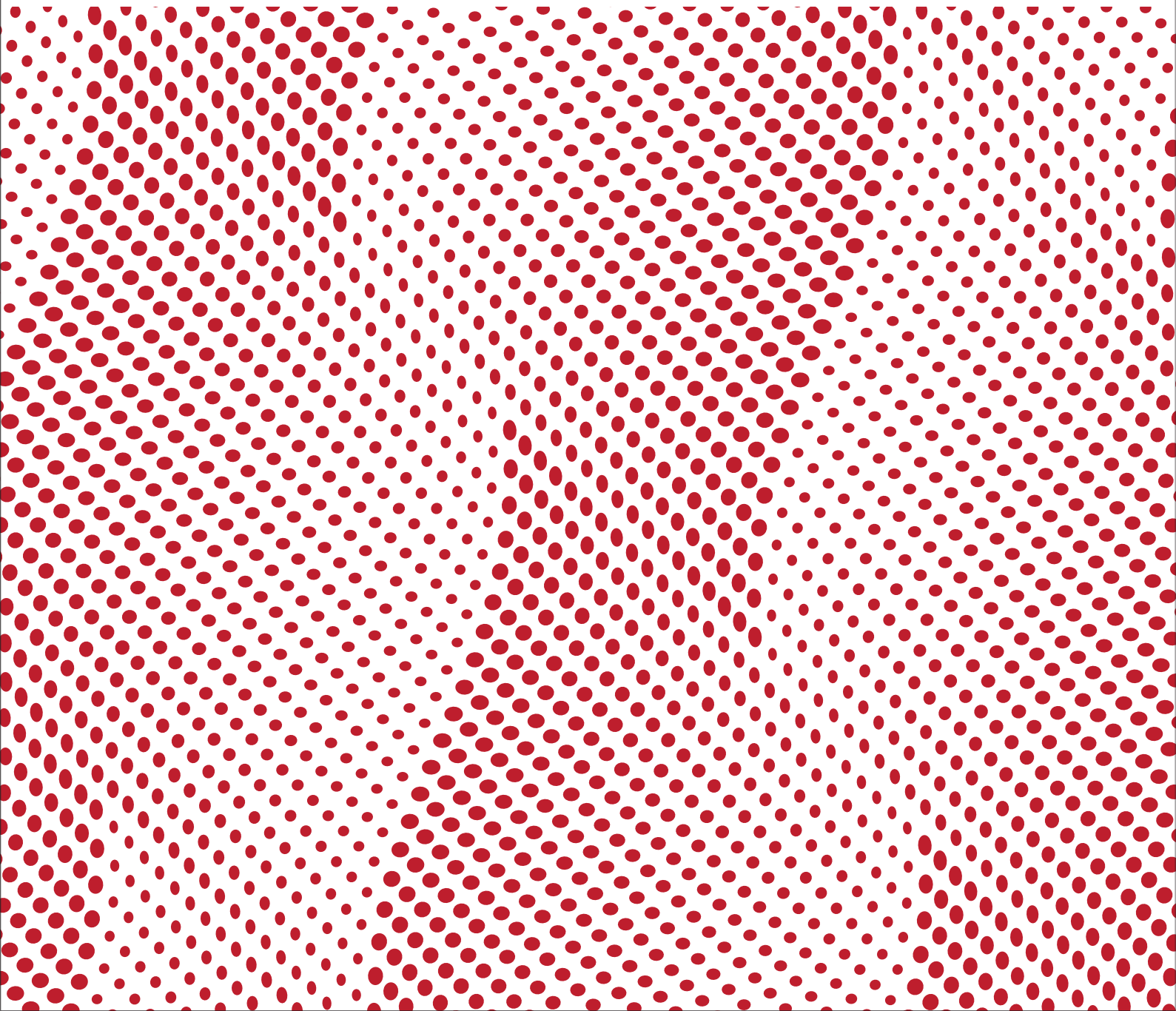
HAMAMATSU
PHOTON IS OUR BUSINESS

HAMAMATSU PHOTONICS K.K.

Integrated Report 2021



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Editorial Policy

Hamamatsu Photonics published the Integrated Report 2021 as a medium to share mid-to-long term value creation through both financial and non-financial information. The International <IR> Framework provided by the International Integrated Reporting Council (IIRC) and the Guidance for Integrated Corporate Disclosure and Company-investor Dialogue for Collaborative Value Creation provided by the Ministry of Economy, Trade and Industry were used as reference in preparing this integrated report. Our corporate website also includes even more extensive and detailed information. Please read the Integrated Report 2021 together with the information on our website.

Environment
Social
Governance

Guidance for Collaborative Value Creation

Reporting Organization

The Integrated Report 2021 focuses on reporting of non-consolidated information about Hamamatsu Photonics K.K.The scope of the financial information encompasses 26 companies (as of September 30, 2021), including Hamamatsu Photonics K.K., 21 consolidated subsidiaries, and 4 entities accounted for using the equity method.
The scope of the non-financial information, GHG emisshons (Scope 1 and 2), Water, and Renewable energy, encompasses Hamamatsu Photonics K.K, domestic consolidated subsidiaries, and overseas manufacturing consolidated subsidiaries from FY2021.

Reporting Period

The reporting period for this integrated report is FY2021 (October 2020 to September 2021).

Management Philosophy of the Hamamatsu Photonics Group

We pursue the unknown where no one has yet explored. By leveraging photonics technology to establish new industries and reach for the world's highest levels of manufacturing excellence, we build enterprise value and contribute to the development of science and technology.

Light is a fundamental technology that supports various industries, and further advances in photonics technology are required on a global scale, to achieve technological innovation today and to improve the performance and accuracy of electronic equipment in the future. However, only a small fraction of the nature of light has been elucidated. We explore fields not yet explained. Based on the knowledge generated by that inquiry, we enhance our enterprise value by discovering practical applications with which to create new industries and expand our business operations.

At the same time, we have a duty to generate a stable earnings base and continuous growth on which a long-term development of technology depends. To respond flexibly and quickly to the expansion of the photonics industry and to changes in the business environment, we have formed a framework for the proactive investment in R&D and equipment for continuously stable and high earnings, based on our medium-to-long-term vision.

In addition, we believe that people, technology and knowledge are the foundation of sound management. We improve ourselves everyday through our work, discovering the things that only we can do. In so doing, we conduct technology development which is backed up by the knowledge, needs and competitive technologies for building the photonics industry. We believe it is vital that we, guided by a mind of "Wa" *, foster a corporate culture that can combine our individual talents to form a whole that is greater than the sum of its parts. At the heart of this, effort is a bottom-up operational approach that is focused on the workplace.

*"Wa": means collaborative spirit and integration of diversified talents.

HAMAMATSU
PHOTON IS OUR BUSINESS

Representative Director and President
Akira Hiruma

To Our Stakeholders

Review of FY2021

In the FY2021, we continued to face extremely difficult business conditions due to the threat of COVID-19. We maintained and continued our business activities despite the unprecedented circumstances and pursued our core photonics technologies, which we have consistently pursued since our establishment, for further development. As a result, we were able to achieve record sales and profits. The structure of the industries that utilize photonics is an inverted pyramid shape with Hamamatsu positioned at the bottom as a supplier of devices, such as optical sensors and optical devices. The size and fields of these industries grows as we move upward. We have found new applications for photonics technology through co-creation with customers, and by expanding the angle of the inverted pyramid of the industries that utilize photonics, we have been able to provide products to many industries and continue to grow. In the Medical-Bio Instruments business, demand for products related to PCR testing and X-ray computed tomography (CT) to diagnose pneumonia expanded, although there were naturally some industries that experienced declines in demand due to COVID-19. In the Industrial Instruments business, demand from the semiconductor industry is expected to grow due to 5G investment and the increase in telework. Responding to this and other changes, our strength as a seller of a high mix of products produced in low volumes to a variety of industries was also put to good use. In addition, industries that had suffered a major downturn due to COVID-19 also showed signs of recovery as the economy moved toward normalization. We feel that this proves once again that the products of our customers that use our devices are necessary for society and that our devices serve as key enabling technology and important to customers. Just as electrons enriched mankind in the 20th century, the 21st century is said to be the age of photons, and the application of photonics technology is advancing in a wide range of fields, backed by the unlimited potential of light. However, it is still largely unknown how light and matter interact. We will continue to pursue our core photonics technology and take on the challenge of further growth.

Further Growth Opportunities Through Digitalization

As a result of the COVID-19 pandemic, physical movement and human interaction have become restricted and sales activities rapidly became more impersonal. We were aware of the need for sales activities utilizing digital technology even before the COVID-19 pandemic occurred and once again felt the need to respond using that technology in earnest. Until now, we have always placed importance on face-to-face communication in our sales and our development activities. However, the use of digital technology has made it possible for development staff to obtain information on customer issues and requests at the same time as the sales staff which has mainly been acquiring information from customers. Sharing customer issues and requests and building co-creative relationships are important to expand the angle of the inverted pyramid of the industries that utilize photonics. By further deepening communication through digitalization, we expect to further expand our applications. I also feel that we can expect sales to expand through digital marketing. Through the proactive utilization of digital marketing, especially for system products, we are able to reach out to customers with whom we have had little contact in the past. This opened new markets and led to more inquiries than expected. That said, I don't think it is a good idea for everything to be impersonal. For individual communication, face-to-face communication is easier to communicate. As such, it is important to understand the advantages and disadvantages of non-face-to-face communication. We are not simply thinking about face-to-face communication and non-face-to-face communication in binary terms but rather are considering the best way to communicate.

Creating a Sustainable Society

The importance of creating a sustainable society is increasing as various social issues such as global warming come to light. In order to create a sustainable society, we must take action not only at the company level but also on a multifaceted manner at the regional and global levels. At first, I think that human resources are important for the company. Since our founding, we have inherited the mindset of pursuing photonics technology, our core technology, and I feel that this mindset has been promoted mainly through on-the-job training. However, in order to achieve further growth, we need to cultivate the next generation of leaders who have a venture spirit, similar to the spirit found in those who launch a startup company. The Global Strategic Challenge Center (GSCC), which was established in 2018, is playing a central role in identifying companies for Hamamatsu Corporate Venture Capital to invest in and fostering in-house ventures. The activities of the GSCC are aimed at building an organization that can take on challenges without fear of failure, leading to the development of the next generation of leaders. Until now, although we have had domestic employees go overseas, we rarely had employees come to Japan from overseas, such as employees of local subsidiaries. In the future, I would like to accept employees of local subsidiaries in Japan and have them participate in not only sales, but also manufacturing, research and development, and many other activities. In the future, we would like to develop a diverse workforce that will be capable of joining the management team. Next, I think it is important to create industries for a region. We have established Biophotonics as a field of study at the Graduate School for the Creation of New Photonics Industries and are supporting small and medium-sized companies and venture companies that use photonics technology to manufacture new medical and bio instruments. The Hamamatsu region is a place offering a high level of manufacturing technology that has been cultivated through the textile, musical instrument, and transportation industries. As photonics technology is often referred to as a "key technology," I hope to see many industries that utilize photonics, emerge from the Hamamatsu region by fusing the region's advanced manufacturing technology with photonics technology. I believe that it is important to vitalize the region by creating industries that take advantage of these regional characteristics.

Lastly, I think that climate change measures are important for the world. Global warming has become an issue that we cannot ignore even in our daily lives, such as natural disasters that we have never experienced before and rain in Greenland, where it used to only snow. We recognize that it is an issue that we need to address as soon as possible. We have been making efforts to reduce greenhouse gas emissions by using renewable energy in our business activities and investing in converting to energy saving equipment. In addition, we formulated a Long-Term Vision of Global Warming Countermeasures in 2020 and obtained SBT certification in October 2021. In order to reduce greenhouse gas emissions throughout the entire value chain, we will continue to promote energy saving within the Group, actively introduce renewable energy, reduce greenhouse gas emissions from non-energy sources and develop and provide low carbon products. We will also contribute to the realization of a decarbonized society through initiatives such as collaboration in the value chain. I also believe that photonics technology can contribute to climate change measures. In FY2021, through Hamamatsu Corporate Venture Capital, we invested in a company that possesses technology to improve the efficiency of solar power generation using photonics technology. We believe that such efforts can also contribute to climate change countermeasures.

The start toward becoming a truly global company

We are taking a new step forward to become a truly global company. For us, a truly global company is one that has a venture spirit, manufactures the world's best products in the Hamamatsu region, and creates new industries by applying these products with customers around the world. Although we have strong sales channels overseas, most of our research and development, design, and manufacturing are done in the Hamamatsu region. The research and development core of optical sensors and light sources, which comprise our core business, will continue to be conducted in this region. In the future however, it will be important for us to respond quickly by region to the demands of our overseas customers, as the Hamamatsu Photonics Rapid Design Group does, and to expand the application of photonics technology overseas by investing in university start-ups around the world to identify anticipatory needs, conduct application research at local sites, and create a group organization that can consider M&A opportunities. Our goal of becoming a truly global company is also linked to human resource development. At present, several company-wide projects are underway, led by executive officers, to address the issues we have identified. Younger employees are also participating in these projects, giving them the opportunity to experience what management is like. We have been emphasizing the importance of each individual having the sense that everyone is a manager through human resource development focusing on small-group based departmental management. Together with the sense of profitability that we have fostered as a result, I would like to strengthen our human resource development by getting involved in the projects that the company is currently undertaking. My motto is "status quo is not an option." The world's best products are being created one after another in the Hamamatsu region and are used more and more around the world. We will continue to take on new challenges with a venture spirit to become a truly global company.

In August 2017, Hamamatsu Photonics K.K. became a registered participant of the United Nations Global Compact.

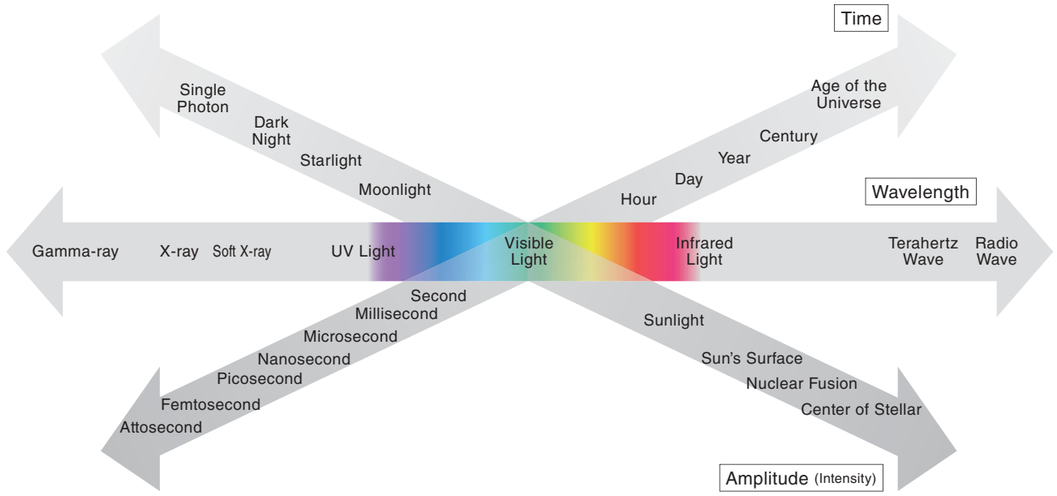
WE SUPPORT UN GLOBAL COMPACT

Hamamatsu Photonics will continue to grow, making every member of our organization more able to contribute to the betterment of society by creating new industries with photonics technology. We, as a global company, uphold the Ten Principles of the United Nations Global Compact and contribute to the sustainable growth of society.

What is “Light”?

Always striving to reveal the infinite and hidden potential of light.

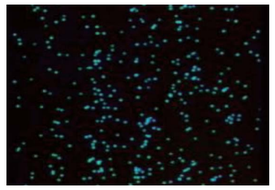
“Light” is always present around us and is still filled with much mystery.
The core of these mysteries is found in the strange nature of light that has the properties of a wave and a particle, no mass, and travels faster than anything else in the universe.



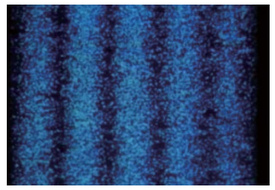
The human eye can detect “visible light” at a wavelength between 400 to 700 nanometers. Visible light corresponds to the multiple colors of the rainbow. UV light, X-rays, and gamma-rays exist on shorter wavelengths than those beyond the violet. On the other hand, infrared light, terahertz waves, and radio waves exist on the longer wavelengths than those beyond the red. In addition to wavelengths, light also possesses many other attributes such as amplitude (intensity), time, polarization and phase, which influence various aspects of our world. The reason to extend the use of photonics technology in the field of advanced science, such as unknown elementary particles and gravitational wave detection can be found in these characteristics. Light is the source of potential to expand the knowledge of mankind. We contribute to human health and happiness, as well as the development of science and technology, through the supply of optical sensors, light sources and the systems using them.

Wave-Particle Duality of Photons

This is Young’ s Interference Experiment or Double-slit Interference Experiment. This experiment shows interference fringes appear even if the light is drastically weakened to the level of having only one particle. This demonstrated that in the double-slit interference experiment, one photon particle simultaneously passed through the two slits and interfered by itself. Photon has the wave-particle duality.



▲When light weakened to an extremely low brightness limit and projected on a screen is detected, it behaves like a particle.



▲However when the recorded particle count increases, an interference fringe appears.

▲Watch a video of the experiment.

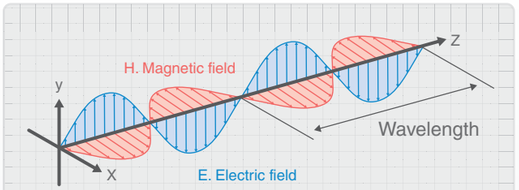
Let’s think about light and photons

Vol.01 Light is an Electromagnetic Wave

Let's take a look at some basic knowledge about light from our website Photon Terrace, a website designed for people to learn more about light.

Light is an Electromagnetic Wave

Electromagnetic waves are waves of electric and magnetic fields that vibrate in orthogonal directions. The light that brightens up a room and the radio waves used for TVs, mobile phones, wireless networks, etc. are all variation of electromagnetic waves. The distance that an electromagnetic wave travels while an electric field (magnetic field) oscillates for one cycle is called its wavelength. The difference in wavelengths gives rise to the difference in colors we see as well as various other characteristics and properties of light and radio waves.
We use these characteristics and properties to our advantage.
Let's take a look at the different wavelengths of light.



Wavelength: The distance between the successive crests or troughs of a wave. The units nanometer (nm, one billionth of a meter) and micrometer (μm, one millionth of a meter) are used for measurement.

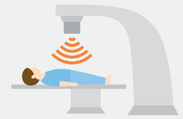
Wavelengths vary from shorter than the size of an atom to as long as a skyscraper!

◀ Short wavelength — **Various Wavelengths of Light** — Long wavelength ▶

	Gamma Rays	X-rays	UV Light	Visible Light	Infrared Light	Radio Waves
	Shorter than 0.01 nm	0.01 nm - 10 nm	10 nm - 400 nm	400 nm - 700 nm	700 nm - 1 mm	1 mm - 10 km or longer
Size comparison of wavelengths		Atom	Particle	Protein	Virus	Bacterium Cell	Ant	Skyscraper
Familiar applications	• Radiation therapy equipment for cancer and other diseases	• X-ray examinations • Luggage inspections at airports, etc.	• Anti-counterfeiting of banknotes, credit cards, etc.	• Urban lighting • Blu-Rays and DVDs • Projection mapping	• Far-infrared heaters • Remote controls	• TVs and radios • Mobile phones • Microwave ovens

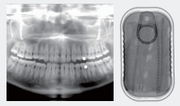
Gamma Rays

Gamma rays are high energy electromagnetic waves emitted from atomic nuclei in an excited state. When gamma rays enter a material, high-speed electrons are generated and act on the surrounding material. That characteristic is used for sterilization and radiation therapy for cancer.



X-rays

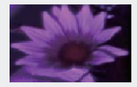
With a wavelength of about 0.01 nm, X-rays have a characteristic of easily passing through objects. They are used for medical x-ray photography to see inside the body and for quality inspections at factories.



UV Light

Ultraviolet (UV) light, which deviates from visible light to shorter wavelengths, is invisible to the human eye although visible to birds and insects. As shown in the photo on the right, even flower petals that appear to have no pattern to the human eye show a dark pattern at the center to the eyes of insects that can see UV light. This is thought to allow insects to find nectar and fly to it.

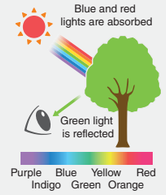
▲A flower seen by a human



▲A flower seen by an insect

Visible Light

Visible light is light in the wavelength range of about 400 nm to 700 nm. Light with a wavelength falling in this range is visible to humans. The reason why plant leaves appear green in sunlight is because the material in the leaves absorbs blue and red light, and only the green light that is reflected reaches our eyes.

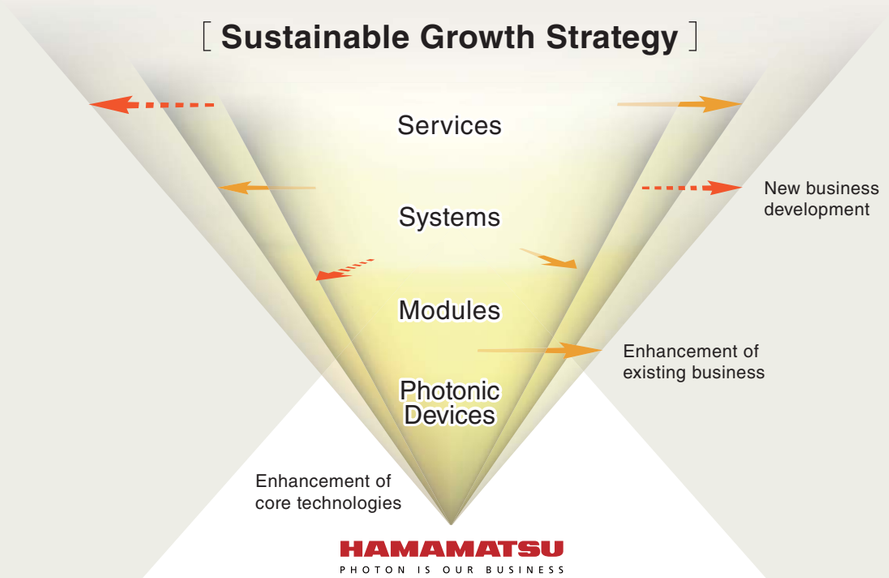


Infrared Light

Infrared light is light (electromagnetic wave) with a wide range of wavelengths, from 700 nm to 1 mm and is further classified into near-infrared, mid-infrared, and far-infrared lights. Near-infrared light, which is close to visible light in terms of wavelength, is used in familiar applications such as remote controls for audio-visual equipments and home appliances as well as for communications between mobile terminals. In addition, infrared light is emitted from any heat source (anything that gives off heat). For example, the human body at a temperature of about 37 °C constantly emits far-infrared lights around 10 μm. Ear thermometers and thermal imaging cameras can measure body temperature by measuring the infrared radiation.

Photon Boy

Photon terrace
https://photonterrace.net
Photon Terrace Search



Key Enabling Technology

Nothing is possible without it.
No destination can be reached without it.
Future needs cannot be realized without it.
We are proud that our photonics technology is a Key Enabling Technology.

The structure of general industry is a pyramid shape with the end-product manufacturers at the top.
However, the structure of the applied photonics industry is an inverted pyramid shape.
Hamamatsu Photonics, as a supplier of devices such as optical sensors and devices, is positioned at the bottom.
The size and fields of these industries grows as we move upward.
However, Hamamatsu Photonics does not simply supply products from the bottom of this pyramid,
but rather supplies the Key Enabling Technology that heightens end-product performance found
at the core of industries that utilize photonics.
As we expand our business reach upwards from photonic devices to modules,
co-creation with customers discovers new applications,
broadens the angle of the inverted pyramid structure for industries that utilize photonics,
and diversifies the utilization of photonics technology.
Moreover, to anticipate needs that customers are not yet aware of themselves,
we must collaborate with ventures that aim for new businesses that use photonics technology,
which in turn means that developing internal ventures is important.
In the future, we will nurture and embody the same venture spirit we have held since our founding,
while strengthening our core photonic devices to strategically broaden the industries which utilize photonics,
and foster sustainable growth.

Global Strategic Challenge Center (GSCC)

Investing for New Business Development

For sustainable growth and future development that will continue over the next five to ten years, we need to take on strategic challenges that look ahead toward the future. The Global Strategic Challenge Center (GSCC) is charged with the mission of promoting such challenges.

Goals of the GSCC

01

Aim to solve social issues by accurately identifying the potential needs of society, and pioneering new business development not bound by existing businesses.

02

Strengthen the venture spirit inherited since the founding to develop the next generation of leaders.

Industries that utilize photonics have an inverted pyramid shape. Our photonics technology, which is positioned at the bottom of the pyramid, is the foundation for new business development in a wide range of fields. In order to achieve GSCC's mission of sustainable growth and contributing to society, we must create new applications and expand the angle of the inverted pyramid. To this end, GSCC possesses an in-house venture function that expands from within by taking on new challenges that are not bound by existing business frameworks, and a corporate venture capital (CVC) function that expands from the outside by investing in startup companies. In addition, we aim to create new innovations not only through internal collaboration but also by actively collaborating with external research institutions and start-up companies in which we invest. These activities lead to strengthening of the venture spirit inherited since the founding to develop the next generation of leaders.

Products and Applications

Our Key Enabling Technology

Key Enabling Technology, our core technology, is developed around three businesses with a broad portfolio of products ranging from photonic devices, modules and system products. This section introduces some of the applications and methods in which a variety of products are used in industries that utilize photonics.

Photomultiplier Tubes, Imaging Devices and Light Sources
(Electron Tube segment)

Optical sensors using vacuum technology such as high-sensitivity photomultiplier tubes and phototubes, Imaging devices such as scintillators, as well as various kinds of light sources such as lamps.

Opto-semiconductor Devices
(Opto-semiconductor segment)

Optical sensors (photodetectors) such as Si photodiodes, image sensors, photo ICs and light emitting devices such as infrared LED and opto-semiconductor modules.

Image Processing and Measurement Systems
(Imaging and Measurement Instruments segment)

Imaging systems, photometry systems, and measurement and analysis systems that use optical sensors as key components and are deployed in a wide range of fields.

Main Application Fields

Medical-Bio P.11,12

Industry P.13,14

Analysis P.15

Transport P.15

Academic Research P.16

TOPICS

Contributing to the Realization of a Decarbonized Society

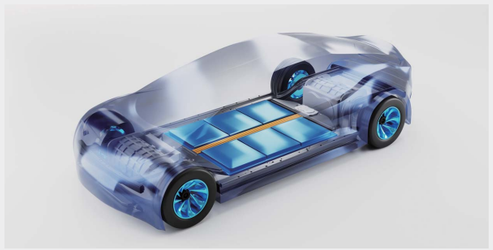
As a company that contributes to society through photonics technology, Hamamatsu Photonics aims to realize a sustainable society looking toward a future where the Earth, its people, and all living things coexist in a harmonious balance by recognizing that the most important issue is achieving harmony with the environment, society, and the economy. Within these, measures against climate change are our priorities. Our technology is contributing to measures against climate change in many ways.

Air and Gas Analysis

A response founded on accurate measurement and analysis of root causes is essential to solve current and future issues. Our products and technologies are used in the environmental measurement field where higher precision and reliability are required, such as for greenhouse gas measurement. Gas analysis, which measures the absorbance of gases at specific wavelengths (UV, visible, and infrared lights), has advantages over other measurement methods such as being a non-contact measurement and having high selectivity. We provide light sources and detectors for the detection and measurement of gas concentrations.

Various devices used for gas analysis

Lithium-ion Battery



The lithium-ion battery business is expected to grow strongly with rechargeable batteries attracting attention as a means of storing renewable energy and for use in electric and hybrid vehicles, which are beginning to become widely used. As part of this, our products are widely used for inline, non-destructive inspection in the component process and inspection process to detect internal defects and foreign matter contamination from the viewpoint of battery performance and safety. Combining a microfocus X-ray source with a high-sensitivity, high-speed readout X-ray TDI camera enables high-speed, high-precision inspection.

X-ray image of lithium-ion rechargeable battery designed for electric vehicle use

Microfocus X-ray sources

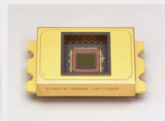
X-ray TDI camera

Sorting for Recycling

In the process of waste treatment and recycling, photonic devices are used to sort recyclable materials such as plastics. We provide light sources, optical sensors, and cameras for detection methods such as near-infrared spectroscopy (including hyperspectral imaging), LIBS (laser-induced breakdown spectroscopy), and dual-energy X-ray imaging. Each of them has special characteristics including the ability to provide high sensitivity, high resolution, high speed, wide bandwidth, and the ability to be miniaturized, enabling high quality recycling by identifying and separating various materials with high accuracy.

X-ray line scan camera

FTIR engine



InGaAs area Image sensor

01 Medical-Bio

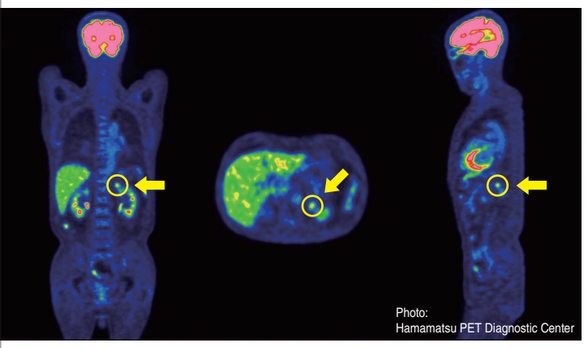
Examining the Body

■ X-ray CT

Computed tomography (CT) is used to find various lesions in the body by taking images of the human body cut into slices by irradiation such as X-ray. Si photodiode arrays are used as detectors in CT scanners.


Si photodiode array


CT image

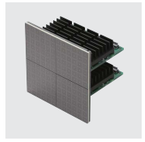


PET image (arrows indicate areas where kidney cancer is present)

■ PET

PET is an abbreviation for Positron Emission Tomography, a method of capturing and imaging the special gamma rays produced by positrons. It is used for cancer tests and dementia (brain function) tests. Scintillators, photomultiplier tubes, and MPPC® are used as detectors in PET systems.


Photomultiplier tube


MPPC® module

■ Blood Testing

Blood testing is widely used in the diagnosis of diseases and for making treatment decisions. Among the many blood testing methods, one uses an optical sensor to capture data possessed by the cells contained in the specimen (blood or blood components) in the form of fluorescent or transmitted light. Xenon flash lamps are used as light sources, while Si photodiodes and photomultiplier tubes are used as detectors.


Xenon flash lamp


Si photodiode array


MPPC® module


Photomultiplier tube (Photosensor module)

■ Antigen / Antibody Testing

As a type of immunological testing, antigen / antibody testing is used for examination and diagnosis of various diseases such as cancer and infectious diseases. For this type of testing, a highly sensitive photomultiplier tube is used to measure the weak luminescence generated by the reaction between the specimens and reagents to measure the target substance.

DNA Testing

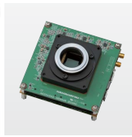
■ PCR

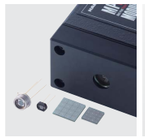
Polymerase chain reaction (PCR) is a technology used for the mass replication of DNA. Although it has become widely known as a method to test for COVID-19, it is also used in a variety of applications, including molecular biology and clinical research. Photomultiplier tubes, MPPC®, and CMOS cameras are used to detect the amplification of DNA through fluorescence detection.

■ DNA Sequencer

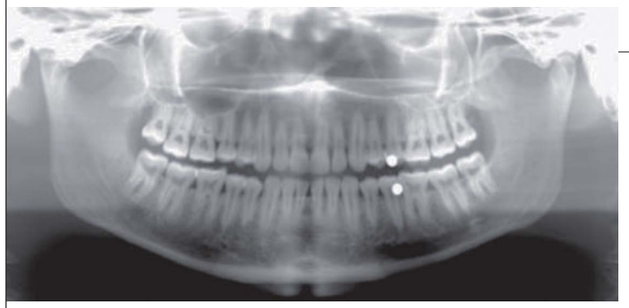
DNA sequencing is a technology that automatically decodes the base sequence of DNA, the genetic information of organisms. It is used in various types of research at universities and research institutes. In the field of cancer medicine, it is important to analyze the genetic information of cancer cells quickly and comprehensively. This technology contributes to medical treatment and drug discovery by fulfilling such a need. One of the analysis methods is to determine the nucleotide sequence through fluorescent labeling each type of base (A, T, G, C) and detecting the weak light emitted. Our high-sensitivity image sensors and cameras are used to achieve such a method.


Photomultiplier tube (Photosensor module)


CMOS camera for scientific measurement


MPPC® / MPPC® module


CCD image sensor



Dental Examination

■ Dental X-ray Imaging

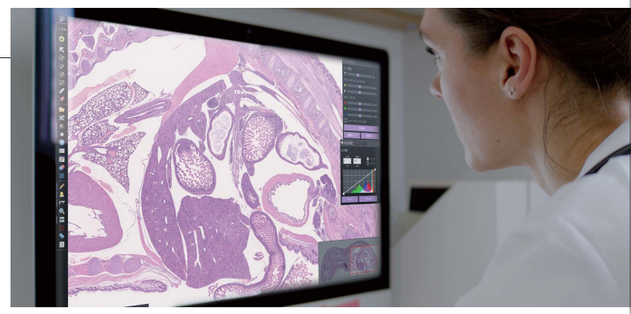
The use of X-ray flat panel sensors as detectors in X-ray based dental diagnostic equipment enables digital imaging at high speed and with much lower radiation exposure dose.


X-ray flat panel sensor

Supporting and Innovating “Pathology”

■ Digital Slide Scanner for Pathology

It is said that one in every two Japanese people suffers from cancer. Although early detection and early treatment are the best ways to combat cancer, it is said that there is currently a shortage of pathologists in Japan who can provide definitive diagnosis of diseases, especially cancer. Our digital slide scanner NanoZoomer® can convert glass slide specimens such as tissues and cells into digital data with high speed and high resolution. By sharing digital data over a network, it enables exchange of opinions among pathologists and advice from medical specialists in other locations, thereby allowing for remote consultations that contribute to reducing the burden on pathologists.



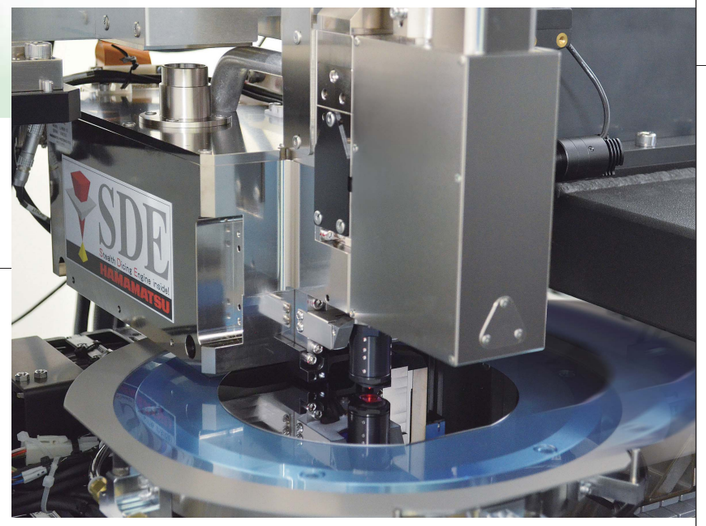

Digital slide scanner “NanoZoomer®”

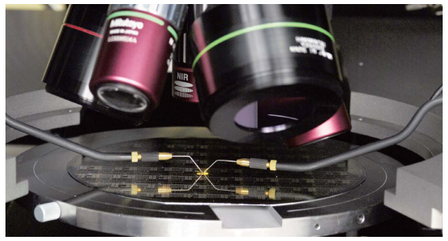
02 ／ Industry

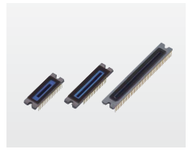
Multifaceted Support for Semiconductor Manufacturing

■ Semiconductor Manufacturing / Inspection

Our products are also widely used during the manufacture of semiconductors, which are indispensable in modern life. These include film thickness gauges for non-contact measurement, plasma process monitors for continuous measurement of plasma emission during the process, optical sensors such as image sensors and photomultiplier tubes used in the inspection process, light sources such as lamps and LDLS™ laser-driven light sources, Stealth Dicing Engine™ for high-speed, high-quality wafer cutting, and failure analysis systems for identifying failure locations in semiconductor devices.



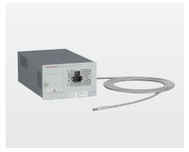

Wafer inspection


TDI-CCD image sensors


Laser-driven light source "LDLS™"


Stealth Dicing Engine™ system


Failure analysis system

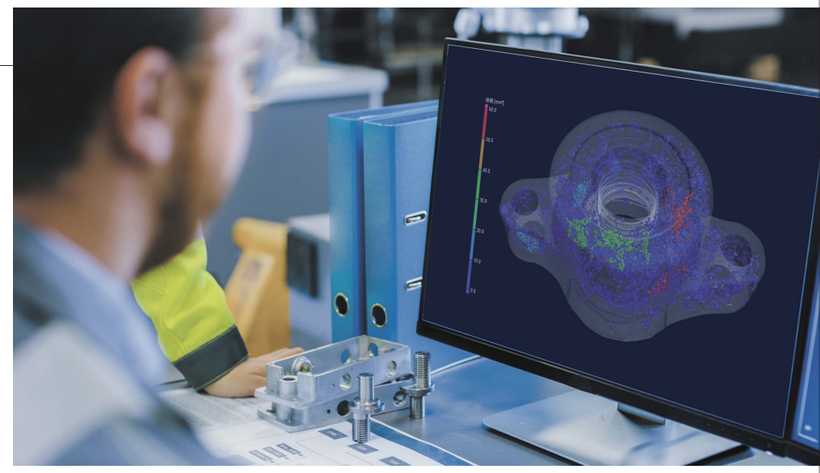

Film thickness gauge


Plasma process monitor

Inspection of the Inside of Things

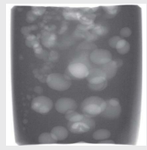
■ X-ray Non-destructive Inspection

X-ray non-destructive inspection, which enables non-contact inspection and analysis of the structure and properties of an object in real time, is widely used in our daily life. Examples include production and inspection processes in the manufacturing industry, inspection of infrastructure equipment, inspection of foreign matter in food, and baggage inspection at airports. Our microfocus X-ray sources are used as X-ray sources, and X-ray line sensor cameras and Si photodiode arrays are used as detectors.

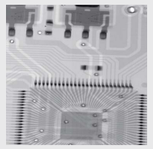


Example images


Image taken during baggage inspection

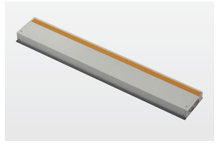

Food inspection

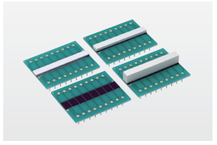

Internal shape inspection of Li-ion batteries


Electronic part inspection


Microfocus X-ray source


Soft X-ray source


X-ray line scan camera


Si photodiode arrays

Supporting Factory Automation

■ Factory Automation (FA)

Optical switches are used in factories and distribution warehouses to detect the presence/absence, passage/arrival of objects, detection of bumps, and detection of surface conditions. It consists of a light emitter and a light receiver, and detects the presence or absence of an object without contact. In addition, many motors are used for the joints of industrial robots, and optical rotary encoders are widely used to detect the rotation angle of the motor with high accuracy in order to control the motion. We supply many photonic devices suitable for Optical switches and rotary encoders.


Si PIN photodiode

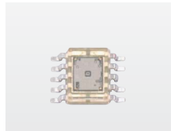
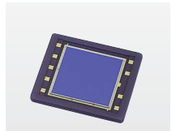
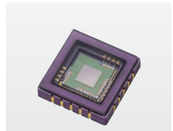
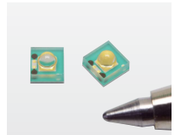


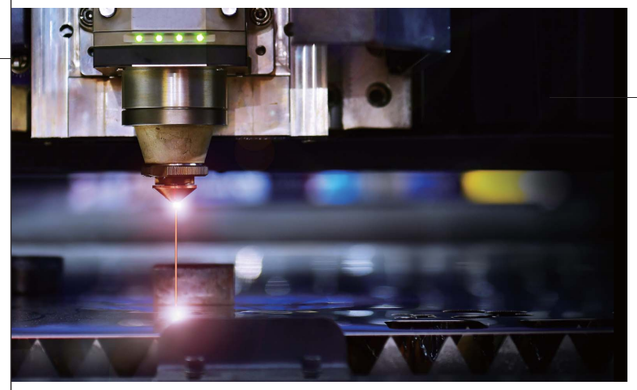
Photo IC


CMOS image sensor


PSD


Profile sensor


LED



Laser-based High-precision Manufacturing

■ Laser Processing

Compared to conventional methods, laser processing saves resources and energy, enabling clean processing with low environmental impact. We supply a wide range of lasers for localized, high-speed, and efficient heating processes, such as resin welding, and for fine processing, such as cutting and drilling, with minimal thermal impact on the object.


Pulsed laser diode bar module


SPOLD® LD irradiation light source


Direct diode laser


MOIL® ultrashort pulsed solid state laser


Pulsed solid state laser

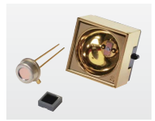

LCOS-SLM (optical phase modulator)

03 ／ Analysis

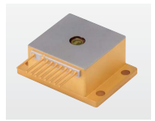
Protecting the Health of the Earth

■ Atmospheric Measurement

Light sources and optical sensors using infrared light are used to detect greenhouse gases and air pollutants. X-rays, beta rays, and neutron rays are used to measure dust (PM2.5), and ultraviolet rays are used to decompose pollutants in the atmosphere.

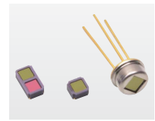


Mid infrared LEDs



Quantum cascade laser

Xenon flash lamp

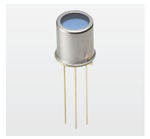


InAsSb photovoltaic detectors

■ Water Quality Tests

Water quality tests are conducted to detect water pollution in rivers, oceans, and groundwater, which can cause environmental degradation and health hazards. A number of potential contaminants exist in water, and their major components are regulated by law and regulations regarding their reference values and measurement methods. Our high-sensitivity optical sensors and high-intensity light sources are used in water quality testing equipment that needs to be able to detect extremely small amounts of contaminants.

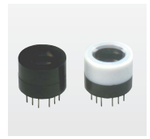
Xenon flash lamps



Si photodiode

Image sensor

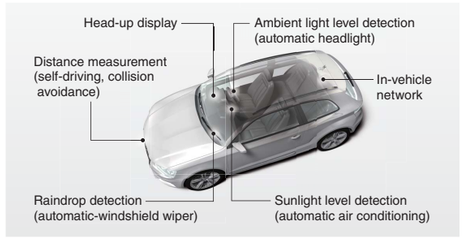
Photomultiplier tube



Phototubes

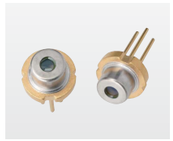
04 ／ Transport

Supporting Innovative Automotive Technologies to Realize Safety, Security and Comfort



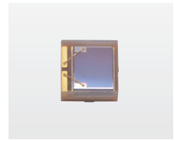
■ LiDAR and Other Automotive Related Technologies

LiDAR (Light Detection and Ranging) is a technology that serves as the eyes of self-driving systems, using infrared lasers and sensors to determine the position and distance of surrounding objects. The distance is measured by irradiating a laser light onto an object and capturing the reflected light with an optical sensor. Pulse laser diodes, etc. are used as light sources, and various optical sensors such as Si photodiodes and Si APDs are used as detectors. In addition to this technology, our opto-semiconductor devices are used for many functions designed for safety, security, and comfort, including ambient light level detection to achieve automatic headlight, raindrop detection for automatic-windshield wiper, and sunlight level detection for automatic air conditioning.

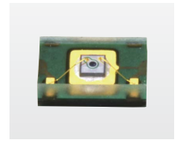


Pulse laser diodes

Photosensor with front-end IC

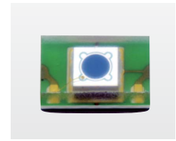


MPPC®



Si APD

InGaAs APD



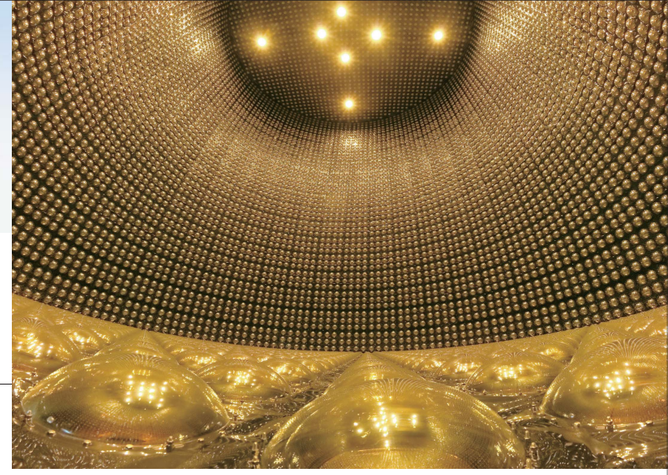
Si PIN photodiode

05 ／ Academic Research

Supporting Next-generation Neutrino Observation

■ Neutrino Observation

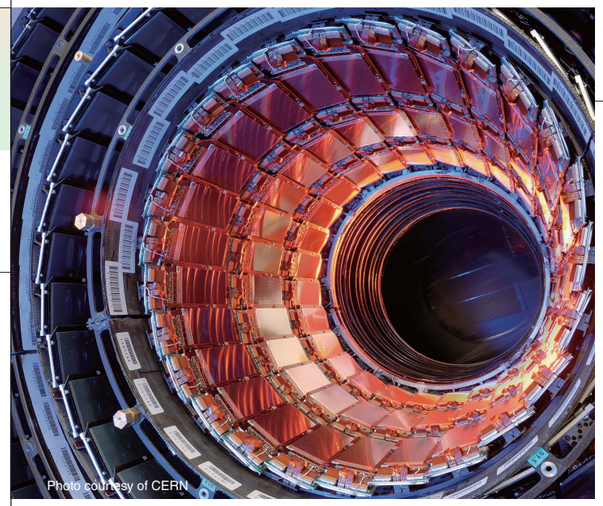
On 23 February 1987, Kamiokande Neutrino Observatory made an historical achievement. They had the first neutrino observation from a supernova explosion. The part of the tool that was able to capture the once in a lifetime chance of observing a neutrino in space 160,000 light years away was the world's largest 20-inch-diameter Photomultiplier Tube (PMT) manufactured by Hamamatsu Photonics. Ceaseless innovation realized even higher performance in the Super-Kamiokande used today and has laid the foundation for the blueprint of the next-generation observation system, the Hyper-Kamiokande. The Hyper-Kamiokande will use new 20-inch-diameter PMTs. We have signed a contract with the Institute for Cosmic Ray Research of the University of Tokyo, which is leading the research, to deliver 16,400 tubes. Construction of the Hyper-Kamiokande has begun in May 2021 with experiments expected to start in 2027.



Inside the Super-Kamiokande

Photo of Hyper-Kamiokande groundbreaking ceremony held in May 2021
Photo courtesy of Kamioka Observatory, Institute for Cosmic Ray Research, University of Tokyo

New 20-inch-diameter PMTs

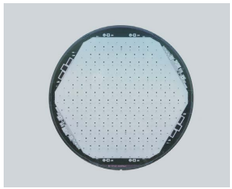


SSDs installed in the CMS tracker at CERN's LHC

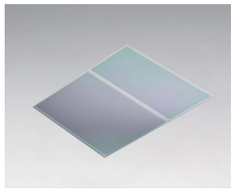
Supporting Next-generation Large Accelerator Experiments and Particle Observation

■ Large Accelerator Experiment Based Observation

Our silicon sensors will be used in the next High Luminosity Large Hadron Collider (HL-LHC), and the European Organization for Nuclear Research (CERN), which is leading the research, has announced that it has signed a delivery contract with us. The ATLAS and CMS detectors of the HL-LHC will use three types, about 75,000, of silicon sensors. HL-LHC based experiments are scheduled to begin in 2027. The Higgs boson, which was previously undiscovered, is called the "God Particle" that gives matter its mass. In 2012, the experiment finally confirmed the existence of this particle using the Large Hadron Collider (LHC), the world's largest accelerator that has a 27-kilometer circumference. Hamamatsu Photonics SSD (Silicon Strip Detectors) contributed to this great discovery. These SSD detected the tracks along which the particles pass, to a resolution of within a few dozen micrometers.



8-inch pad detector,
one of three types of silicon sensors



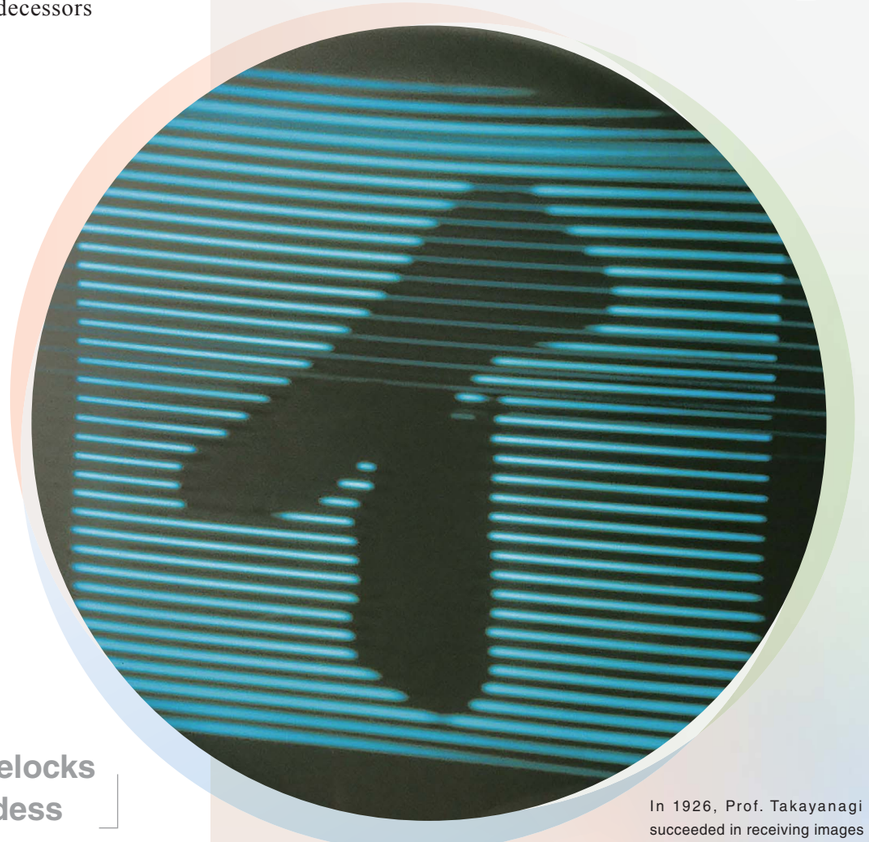
SSD used for "Higgs boson" detection

Signing of contract with CERN in August 2019

The Origin of Management

The spirit of pursuing the unknown and unexplored - inherited from our predecessors

Pursuing the Unknown and Unexplored



In 1926, Prof. Takayanagi succeeded in receiving images on the world's first electronic cathode-ray tube. "イ" is derived from the "Iroha" order as the first character of the traditional syllabary. (The picture is of the reproduction device.)

Seize the Forelocks of the Goddess

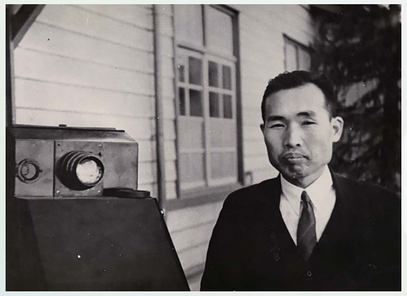
Prof. Kenjiro Takayanagi has come to be respectfully known as the "father of Japanese television." There was always one woman who was a muse to Prof. Takayanagi in his pursuit of the unknown. This woman was "Fortuna" - the goddess of fortune in Roman mythology. As told in these myths, Fortuna only had forelocks with no hair at the back of her head. One would have to be one-step ahead of her, wait for her to catch-up, and then turn around and seize her by her forelocks. When trying to develop technology to benefit society in the next ten or twenty years, we have to strive to go farther ahead than people think is necessary. That pioneering approach led to the success of the world's first electronic television.

Light to Electricity, Electricity to Light

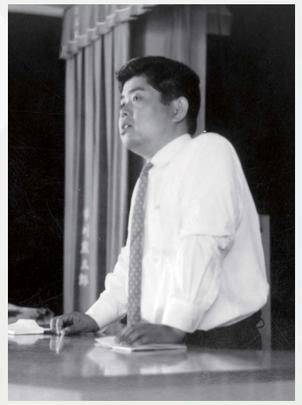
Prof. Takayanagi passed on his spirit to create things that did not yet exist in the world to his student, and our founding president Heihachiro Horiuchi and former president Teruo Hiruma. Our entire company fully embodies this spirit. From almost the start of the company's inception, Teruo Hiruma, who was mainly in charge of sales, encouraged everyone at Hamamatsu Photonics to make the world's best products. He established a system to engage with the research industry and travelled the world in an effort to develop markets. Teruo Hiruma inherited the ideals of Prof. Takayanagi and Heihachiro Horiuchi, and through his actions, our organization has grown into a world-class company.

Make the World's Best Products

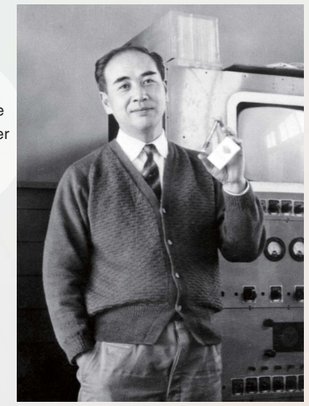
Photonics Technology Will Surely Help Society



Prof. Takayanagi and an Iconoscope Television Camera (1935)



Lecture by Teruo Hiruma (1960)



Heihachiro Horiuchi and the 1/2-Inch Diameter Vidicon (1963)

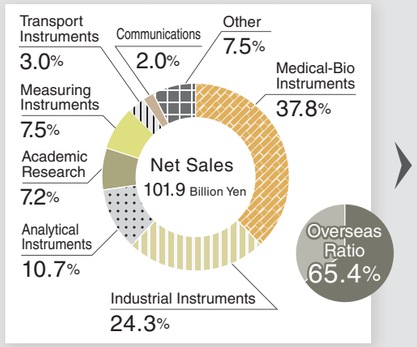
What Can We Do with Light?

The origin of our company to engage in photoelectric conversion technology and the applied products to grow with the advancement of photonic technologies lies in the unyielding spirit to confront the unknown and unexplored realms.

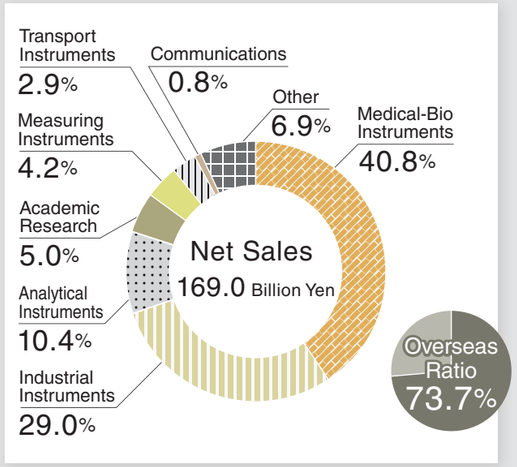
At the 25th anniversary ceremony for Hamamatsu TV Co., Ltd. (renamed to Hamamatsu Photonics K.K.), Heihachiro Horiuchi passed the baton of president to Teruo Hiruma. On the left, Prof. Takayanagi attends the ceremony as a guest. (1978)

Our History

▼FY2011 (Sales by Industry and Application)



▼FY2021 (Sales by Industry and Application)



1953
Established Hamamatsu TV Co., Ltd.(former name)

1969
Established an affiliated company in the USA

1973
Established a joint venture company in Europe

1982
Introduced divisional system

1983
Company name changed to Hamamatsu Photonics K.K.

1984
Registered for off-exchange stock trading

1988
Established a joint venture company in China

1996
Company's stock registered on the second section of the Tokyo Stock Exchange

1998
Company's stock registered on the first section of the Tokyo Stock Exchange

The history of our growth

▶ 1st Term: 1953 to 1972

From Founding to Product Development

Inheriting the spirit of Prof. Kenjiro Takayanagi, founder President Heihachiro Horiuchi established Hamamatsu TV Co., Ltd. with the second President Teruo Hiruma. The office building was a storehouse that had survived the flames of air raids. Even while confronting the difficulties of having few knowledgeable and skilled employees, acquiring expertise through literature and other materials this new company took on the work with an unwavering spirit to “try before you say you can’t” toward a goal of making the world’s best products. The unique corporate climate of an “all researchers system” was created, and through the fun in each and every day even during the struggles at the time of our founding.

▶ 2nd Term: 1973 to 1981

Expand New Applications from Analysis

The construction of a new factory put in place a production system. However, the impact of the oil shock, and the appreciation of the yen at that time, forced us to face the only financial deficit since the founding of our company. Analysis was the mainstay product application for the company at that time. However, we talked with customers about their challenges and developed 1/2-inch diameter head-on PMT. An opto-semiconductor for X-ray CT scanners then followed. This swept the optical sensor market for X-ray CT scanners and recovered our business performance. Thereafter, we developed other new products and generated new demand to expand applications from analytical and medical fields to industrial, academic, measurement and a wide range of other fields.

▶ 3rd Term: 1982 to 1989

Establish Current Management Base through a Divisional System

To acquire advanced technology and expertise, and continue to drive superior planning and development capabilities, heightening the reputation of the company is indispensable in securing and cultivating excellent human resources. Therefore, we changed the name of the company to Hamamatsu Photonics K.K. and grew into a public company by officially registering on the over-the-counter of the stock market. As the corporate scale expanded and products diversified, we introduced a divisional system, which has become our current management base, to engage in business activities that can flexibly maneuver more efficiently, to adapt to the changing times.

▶ 4th Term: 1990 to 2008

A New Challenge to the Human Unknown and Unexplored Realms

A strong mentality to make the world’s best products is strengthened by our employees thanks to our work to establish superior technology and develop new products unified as a company. Furthermore, to achieve even more high-minded company goals, we had to take on challenges in the “human unknown and unexplored realms” that bring about new research findings. As some specific fruits of these pursuits, we established the Central Research Laboratory, the Hamamatsu Medical Imaging Center for validating the early detection of cancer and dementia, and the Graduate School for the Creation of New Photonics Industries for the education of human resources who aim to create new industries that use photonics technologies.

▶ 5th Term: 2009 and Beyond

Change of President and Management System

Akira Hiruma was appointed as the third president of Hamamatsu Photonics, succeeding Teruo Hiruma who had led the company since its founding. We have been working on a system to secure stable profits through a divisional system. However, for further development, we established our business headquarters, compound semiconductor fabrication center, and GSCC as cross-divisional organizations. In addition, we have introduced an executive officer system, which allows us to plan medium- and long-term projects that are important to the future of the entire Group.

Episodes

Historical Episodes

▲ Our first side-on photomultiplier tube type R105 in 1959

01 Research Industry

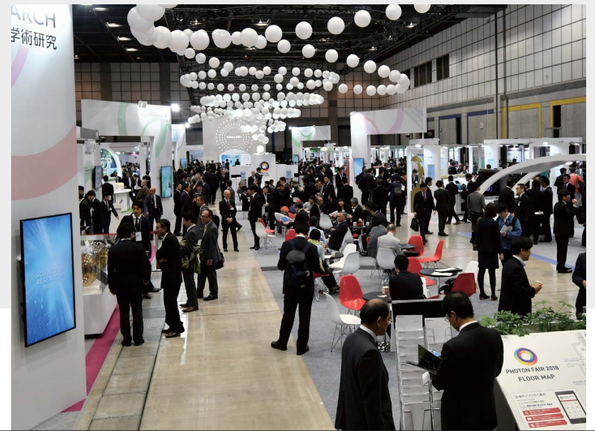
"Once the photomultiplier tube is made, I'll call you sir Hamamatsu TV"

These words were said by one of our partners, just after Hamamatsu TV Co., Ltd was founded. At the time, photomultiplier tubes were a product major enterprises were struggling to realize. The world thought Hamamatsu TV, which was still a small local workshop, had absolutely no chance of developing a photomultiplier tube.
However, at the time, these words energized our engineers. They held stubbornly to their position and at the workbench repeatedly enhanced prototypes, before asking for, and intently listening to feedback from customers, only to then re-start the trial-and-error process all over again. Based on the belief that the world would surely accept Hamamatsu TV, tremendous amounts of tests were carried out every day. Now, 60 years later, the photomultiplier tubes made by Hamamatsu Photonics continue to be a mainstay product that packs performance far and above other photomultiplier tubes on the market.
Great care and passion is part of our daily work. We discover unknown phenomena and realize things thought impossible. We use this as a stepping-stone in the further pursuit of the advancement of new photonics technologies. This in and of itself is the research Industry.
In the ongoing quest to explore the unknown, curiosity and craftsmanship remain constant to serve as the driving forces propelling us to new heights.

02 Photon Fair

Conveying the Future of Photonics Technology

The Photon Fair (HAMAMATSU PHOTONICS K.K. Exhibition) serves as a milestone for us to improve our technologies and enables opportunities of co-creation to let the world know about our technologies. It represents our pride as a leading company in the photonics industry and provides a platform for us to share information about our products.
In 1979, on the occasion of the opening of our Osaka sales office, we held a private exhibition "Hamamatsu TV Co., Ltd. comprehensive exhibition" focusing on the introduction of new technologies, technical negotiations, and lectures. The main objective of the exhibition was to let as many people as possible know about our company Hamamatsu TV (former name) and its corporate commitment, rather than just promoting our products. The name of the exhibition was later changed to "Photon Fair". After a nine-year hiatus due to the economic recession caused by the collapse of the bubble economy, the fair was resumed in the form of Photon Fair 1998, and with the launch of the Central Research Laboratory during that time, it became a place to showcase our research and development, as well as future business development based on our company's philosophy, further strengthening our branding. The Photon Fair also serves as an opportunity to further promote the aspect of co-creation with industry, academia, and government. Since 1998, the fair has been held approximately every five years, and the venue is now settled in Hamamatsu, the city where our company is based. The Photon Fair is an event to show what our company will look like in five to ten years, and it has become a valuable place to create ties and opportunities between our company and all of our stakeholders, including customers, local residents, and employees' families.



▶ Photon Fair 2018 (ACT CITY Hamamatsu)

▲ Poster display venue

03 Prototype and Research Presentation

Performing Research and Development to Support Sustainable Growth

Since the 1970s, we have been continuously holding prototype and research presentations to present the divisional research and developmental themes of the Central Research Laboratory. Although the presentations are currently online-based due to COVID-19, past presentations were given once a year at each business site (five times in total annually). Despite being voluntary participation, the venue was always filled with employees listening to the presentations, and active discussions were held even in front of the poster displays. Although purposes for participating in the event vary from large to small, there is no doubt that the common goal of many participants is intellectual interest in new products and knowledge, and by opening up the content of their research within the company, the prototype research presentations have become opportunities for internal co-creation. Our sustained growth is due in large part to the fact that sales, manufacturing, and R&D are functioning together to meet the demands of the market. Prototype and research presentations play a part in this.

04 Contributions to the Nobel Prize

"Try before you say you can't."

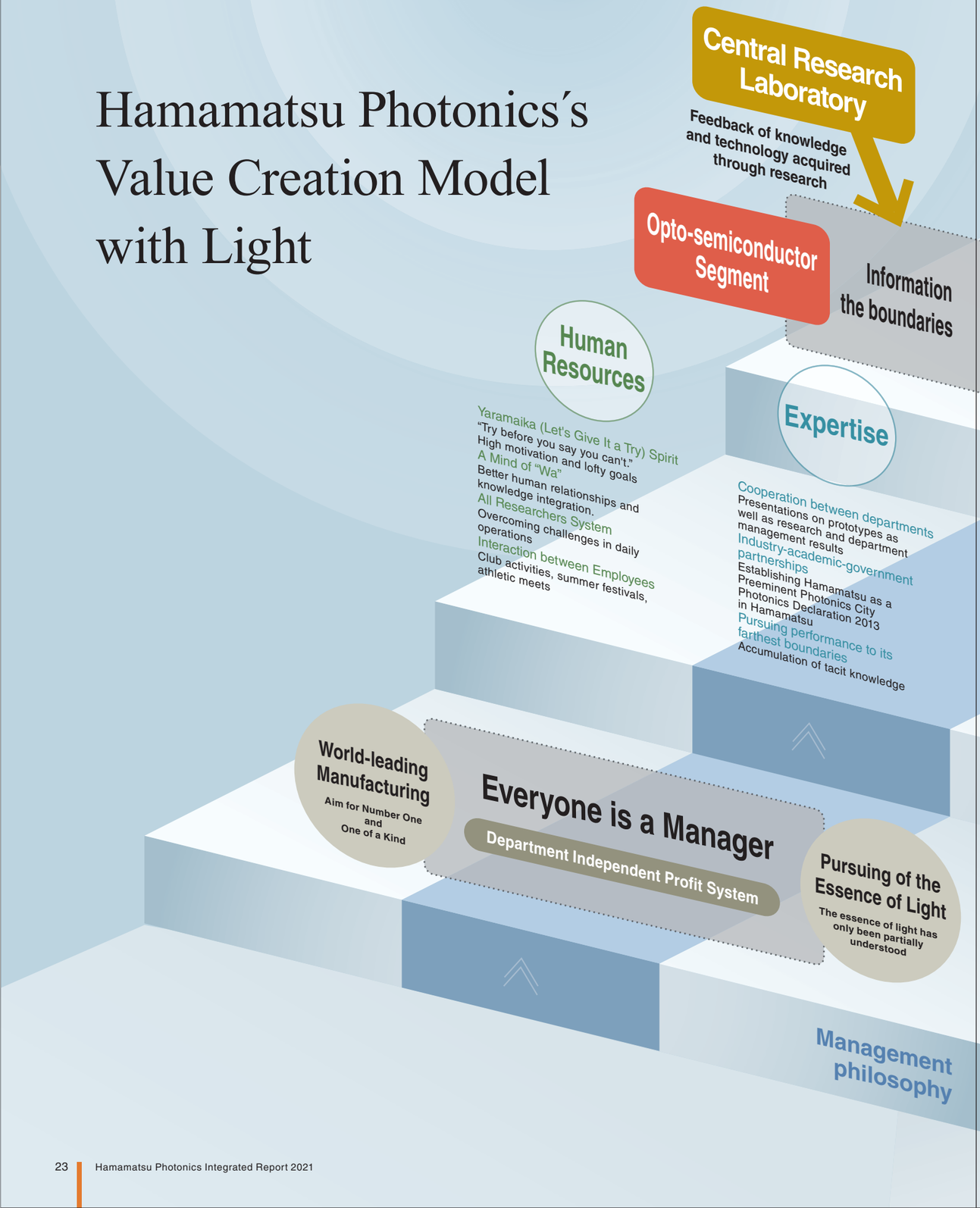
Our belief to respond to the needs of our customers has supported the growth of the company. In 1979, Prof. Masatoshi Koshiba from the University of Tokyo's School of Science asked us to develop a 20-inch-diameter photomultiplier tube.
At the time, the world was working to develop 8-inch-diameter photomultiplier tubes while we had just begun development of 5-inch and 8-inch-diameter photomultiplier tubes. This was not a simple request, but swayed by the passion of Professor Masatoshi Koshiba, we started development. Many challenges confronted us, but we concentrated the manufacturing technology that we had amassed into this large tube development. The 20-inch-diameter photomultiplier tube was completed just five months after the start of development.
This is how 1,050 20-inch-diameter photomultiplier tubes for Kamiokande were delivered in 1982. On 23 February 1987, at 4:35 in the afternoon, a neutrino from supernova 1987A that appeared in the Large Magellanic Clouds 160,000 light years from Earth, was captured by Kamiokande. This was the first time in the world a supernova neutrino had been observed. It heralded the dawn of neutrino astronomy - the search for astronomical objects through elementary particles.
Later on, Super-Kamiokande contributed to proving that neutrinos have mass, and this work has carried over to Hyper-Kamiokande, which is currently in the planning stage.

2002	Prof. Masatoshi Koshiba awarded the Nobel Prize in Physics	
	Kamiokande	
	Colossal achievement of neutrino observation	
	[Photomultiplier tube]	
2013	Prof. Higgs and Prof. Englert awarded the Nobel Prize in Physics	
	CERN	
	Discover Higgs boson	
	[Opto-semiconductor devices/photomultiplier tubes]	
2015	Prof. Takaaki Kajita awarded the Nobel Prize in Physics	
	Super-Kamiokande	
	Discovery that neutrinos have mass	
	[Photomultiplier tube]	

▲ Prof. Takaaki Kajita (right) and President Akira Hiruma (left)

Pursuing the Unknown and Unexplored Realms

Hamamatsu Photonics's Value Creation Model with Light



Management base that supports business strategy

Human Resources	・Number of employees: 5,279 (Domestic employees: 4,051 Overseas Employees: 1,228) ・Ratio of R&D personnel: Approx. 10%
Expertise	・Number of patents held: 6,787 ・Publicly funded R&D themes: 162 (cumulative)
Organization	・Free cash flow: 23.1 billion yen
Technology	・R&D expenses: 11.3 billion yen ・Net sales and R&D expense ratio: 6.7% ・Representative product share: Approx. 90% ・Custom product ratio: More than 70%

Activities for the Environment

Efforts to Tackle Climate Change Issues

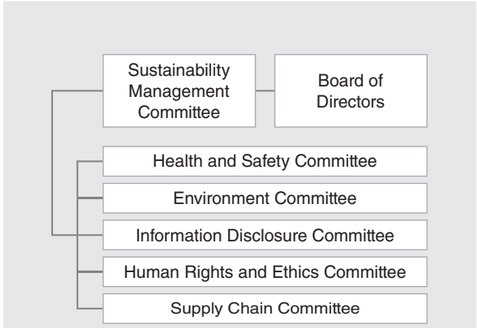
Information Disclosure Based on TCFD Recommendations

In August 2020, Hamamatsu Photonics announced to support recommendations of the Task Force on Climate-related Financial Disclosures (TCFD), with the company proceeding with analysis on the financial risks and opportunities that climate change poses to our business. We disclose some of the results of our considerations based on the TCFD recommendations.

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

Governance

Based on our Basic Policy of Sustainability and Fundamental Environmental Policy, we have given importance to efforts for tackling climate change, which are reviewed by the Environment Committee and the Information Disclosure Committee, chaired by executive officers. We have built a PDCA (Plan Do Check Act) cycle which the Sustainability Management Committee, chaired by the Directors, Director Managing Executive Officer carefully examines the results of review and then important matters are reported, deliberated, and overseen by the Board of Directors. Finally, decided matters are disseminated throughout the company.



Strategy

We recognize that changes in the environment and society caused by climate change affects our business. To clarify the key risks and opportunities among them, we have conducted scenario analysis on 1.5/2°C and 4°C scenarios for our entire business in the following steps. Going forward, we will continue to consider measures against identified issues.

01/Identify Key Risks and Opportunities

Market changes and Technological Changes	Reputation
Governmental policies and laws	Physical risks

02/Define Scenarios

Define multiple scenarios that encompass the transition and physical risks associated with the organization

03/Assess Impact on Business

Impact on business	
Input costs	Business costs
Profit	Supply chain
Suspension of business	Timing

04/Define Measures

Measures
Business model transformation
Portfolio transformation
Capacity and technology investment

Risk Management

We have formulated environmental management rules and operate under a company-wide environmental management system. We set environmental goals and targets to work towards each year based on the evaluation of the environmental risks and opportunities including climate change. Our management team reviews the results and tasks, and we work hard to achieve better environmental performance through constant improvements within our business. We have quantitatively assess the financial impact of 16 items as transition risks, physical risks, and opportunities under multiple climate related scenarios, and have identified key risks and opportunities. Some of them are as follows.

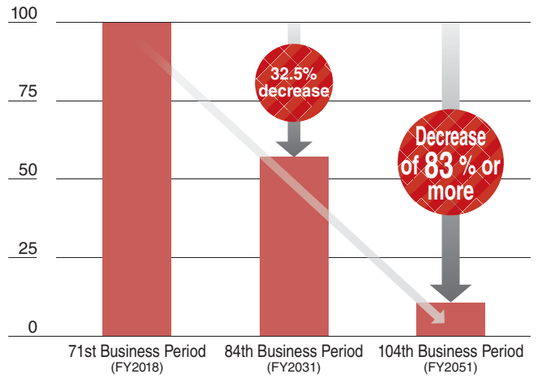
Category		Impact on business (2030)	Potential financial impact	
			1.5/2°C	4°C
Risks	Transition	Product competitiveness drops and sales decrease due to low evaluation by customers	**High**	-
		Increase in short-term operational costs due to introduction of renewable energy and promotion of energy saving	Medium	-
	Physical	Suspension of business (production bases, logistics, inventory, supply chain) and decrease in sales due to increasingly more severe storm and flood damage	Medium	**High**
		Damage to production bases and increased facility restoration costs due to increasingly more severe storm and flood damage	Medium	**High**
Opportunities		Medical-Bio Instruments: Increase in sales of products related to specimen inspection	Medium	Medium
		Industrial Instruments: Increase in sales of products related to EV battery inspection equipment	Medium	Medium
		Analytical Instruments: Increase in sales of products related to environmental analysis	Medium	Low

Indicators and Targets

In October 2021 our greenhouse gas (GHG) emission reduction target, based on our Long-term Vision of Global Warming Countermeasures, received certification from the Science Based Targets initiative (SBTi), an international environmental organization. This was awarded, as our target was scientifically based and consistent with the Paris Agreement.
Meanwhile, as key indicators for the mid- and long-term environmental perspective we set, evaluate and manage environment-related factors such as GHG emissions, water consumption and renewable energy consumption. Scope 1, 2, and 3 emissions were calculated based on the GHG Protocol and were verified by a third party.

Long-Term Vision of Global Warming Countermeasures and SBT Certification-based GHG Emission Reduction Targets

▼ Scope 1 and 2



· Our GHG emissions (Scope 1 and 2) for FY2021 was 59,386 t-CO2. We reduced it by 13 % (the target 7.5 %) compared with FY2018.
· Our SBT certified target (Scope 1 and 2) aims to reduce GHG emissions in FY2031 by 30 % compared with FY2019.

▼ Scope 3

Category 1	76% of suppliers by spend covering purchased products and service will have science-based targets by FY2026
Category 11	15% reduction by FY2031 (Compared to FY2019)

*Scope 1:
Direct emission from use of fuels, city gas, GHGs from non-energy sources, etc., CFC leaks
*Scope 2:
Indirect emissions from the use of purchased electric power, etc.
*Scope 3:
Indirect emissions from the value chain (purchase of goods and services, logistics, sales, and disposals, etc.)

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

▼ For more information, please refer to the link below.

Environment

https://www.hamamatsu.com/jp/en/our-company/sustainability-and-csr/environment.html

Activities for Society

Efforts for the Vital Human Resources of Hamamatsu Photonics

Significance of Our Activities for Society

We hope to provide value to society, such as the human health and happiness, through our company activities. Our employees are the foundation for us to achieve this goal. Therefore, we work to provide a work-friendly environment for all of our employees and strive to maintain and improve their physical and mental health. To fulfill that need, we recognize the importance of building an organization and corporate culture in which employees are encouraged not merely to support the status quo but to actively engage based on free and innovative thinking.

Specific Activities

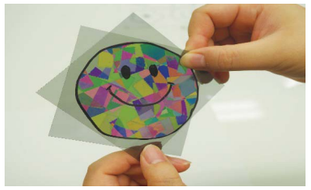
Promotion of Women's Participation and Advancement in the Workplace

We believe that women's active participation is to enable women to fulfill their roles in positions they are best suited for and to work for a long time without worrying about leaving the company due to childbirth, childcare, or nursing care, and to demonstrate their abilities, which in turn bring positive value to the company's long-term performance. Therefore, in addition to the systems stipulated in the Act on Childcare Leave, Caregiver Leave, and Other Measures for the Welfare of Workers Caring for Children or Other Family Members, we have established our own systems, such as shift work for childcare and leave for male employees to take when their spouses give birth, which are being used effectively.

Participation in Riko-Challe

Riko-Challe is an initiative led by the Gender Equality Bureau of the Cabinet Office to help female junior high school and high school students develop an interest in science and engineering fields. In 2021, we held an online seminar and workshop on light followed by a discussion with female employees on the given topic. We believe these experiences will educate and help students to choose their career paths. We believe these experiences will educate and help students to choose their career paths. Participants of our previous event were only residents of Shizuoka Prefecture, where the Company is located, however, in the 2021 event, there were also participants from other prefectures.

▼Summer Riko-Challe 2021



By attaching cellophane tape on top of a transparent plate with a picture drawn on it and sandwiching it between polarizing plates, participants were able to create stained glass using the characteristics of light.

Operation of Dormitories for Single Employees

As many employees, especially new hires, join the Company from distant regions, we provide a dormitory for single employees as part of our welfare program. As of April 2021, there are about 300 employees living in the company dormitories. We also provide interested employees with breakfast and dinner services, providing a stable base for the lives of young employees so that they can work while maintaining and managing their physical and mental health.

Health Management Initiatives

In accordance with its Corporate Health Policy, Hamamatsu Photonics promotes health management in cooperation with Photonics Group Health Insurance Society. Based on the verification of effectiveness, the Company implements various measures after proposal, discussion and approval by the Headquarters and Branch Health and Safety Committees and by the Board of Executive Officers.

◀ Body design school

To maintain and improve the physical strength of employees, the Company holds a body design school, and conducts physical strength measurements. Employees are also encouraged to walk and use sports facilities.

In addition to the regular medical check-ups mandated by law for the purpose of the early detection and treatment of diseases, we also conduct dental check-ups.

We recommend health screening and PET examinations to our employees. Hamamatsu Photonics and the health insurance society help with these costs.

As part of our mental health measures, we have formulated a three-year, mental health promotion plan. The mental health education program is tailored to each employee rank.

▼Mental-health Education Programs

FY2018	Focused on all employees
FY2019	Focused on managers and 5th to 6th year employees
FY2020	Focused on middle-tier employees

▼Percentage of Employees Answering Stress Check

FY2018	96.3 %
FY2019	95.8 %
FY2020	97.5 %

All employees are encouraged to recognize the signs and different types of stress through our stress check-up program, known in-house as the "Mental Health Check". This aims to reduce stress in the workplace, together with group analysis and on-site training.

Fruits of Our Efforts

The average length of service is 16.3 years for male employees and 14.9 years for female employees with a turnover rate of 0.8 %. The average acquisition rate of paid leave was 72.8 % (76.5% in the previous year). Additionally, the percentage of employees on mental health leave for one month or longer was 0.44%, which is lower than the average (0.7%) of business sites with 1,000 employees. The reinstatement rate after temporary leave for childcare was 100% for three consecutive years. There is an increasing trend in the number of employees who use various systems including temporary leave for childcare by male employees.

For four consecutive years (2018 to 2021), the Company earned certification as an Excellent Health and Productivity Management Corporation (Large Enterprise Division) (White 500).

2021 Health and productivity White 500

Future Challenges and Countermeasures

Hamamatsu Photonics primarily recruits science students. This has created a tendency to hire relatively few women because the percentage of women in the sciences is low. Ensuring diversity is important to facilitate multifaceted viewpoints in the development of new technology in the future. For this reason, we are engaging in recruitment activities as per the action plan outlined in the Database on Promotion of Women's Participation and Advancement in the Workplace. Additionally, we always strive to better the working environment and promote health management in an effort to make certain every employee can live a prosperous life.

▼ For more information, please refer to the link below.

CSR/ESG Information

https://www.hamamatsu.com/jp/en/our-company/sustainability-and-csr.html

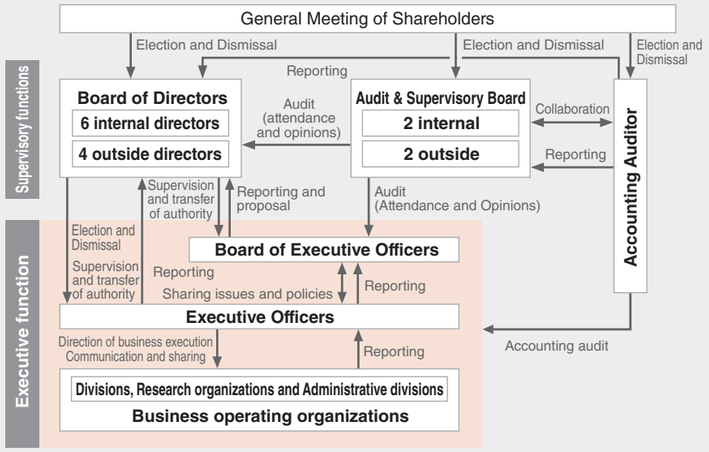
Activities for Governance

Foundation of Hamamatsu Photonics Supporting the Pursuit of the Realms of the Unknown and Unexplored

Significance of Strengthening Corporate Governance

Our products are used as key devices that contribute to human happiness and the sustainable growth of society in medical, analytical, industrial and a wide range of other fields. We will enhance our corporate value toward ongoing social contributions in the future. In order to do so, Hamamatsu Photonics formulates and shares its corporate philosophy because all of our employees unified in both action and principle toward the future is indispensable. We believe this can generate stable earnings, furthers research and development, and fosters growth. Therefore, we are building a distinct governance structure suitable for Hamamatsu Photonics.

▼Meeting structure under the Our Governance System



Specific Activities and Strengthening the Corporate Governance System

As a listed company, we recognize that we have a fiduciary responsibility to our including business partners, suppliers, employees, and local communities. In order to appropriately fulfill these fiduciary responsibilities and take accountability as well as increase corporate value from a medium- to long-term perspective, we believe that governance is of utmost importance and we are making continuous efforts to strengthen and improve it.
To provide further details, this section presents information on the governance reforms that we implemented from 2020 to 2021.

Increase of the Number of Outside Directors

We added another Outside Director in December 2020 and one more in December 2021. As a result, we have six internal directors and four outside directors, meaning that outside directors accounted for 40% of the total number of directors as of the end of December 2021. Outside directors provide oversight from an external perspective, and to enhance the effectiveness of their oversight, we provide them with an overview of the Company as appropriate. In addition, we provide them with materials for Board of Directors meetings three to four days prior to each meeting so that they have sufficient time to consider the contents of the agenda.

Establishment of Nominating and Compensation Committee

In July 2021, we established the Nominating and Compensation Committee. Our Nominating and Compensation Committee is formed on a voluntary basis and positioned as an advisory committee. In accordance with the Nominating and Compensation Committee regulations, the majority of committee members must be outside directors, and we have made it clear that we will respect their findings. The Board of Directors ultimately decides on the nomination of candidates for directors and the amount of remuneration to be paid to directors. By ensuring fairness, transparency, and objectivity in decisions made by the Board of Directors, we are striving to gain further understanding and trust from the market.

Change in Term Length for Directors and Introduction of Skill Matrix

At the General Meeting of Shareholders held in December 2021, we received approval for a partial amendment to our Articles of Incorporation, changing the term length for directors to one year. In addition, we introduced a skill matrix that is used to take into account the knowledge, experience, and abilities necessary for each Director so that the Board of Directors can fulfill its supervisory function. Although we will continue to manage our company based on research and development from a medium- to long-term perspective, we have shortened the term length for directors to one year because we believe that increasing the opportunity to reflect shareholders' confidence and promoting management with a sense of urgency will be beneficial for governance. Also, by introducing the skill matrix, we were able to reaffirm our awareness of what “skills” are necessary for our directors to possess. We will continue to check for excesses and deficiencies in terms of skills and strive to fulfill them in order to create a strong Board of Directors. (Current skill matrix can be found on page 48 of this Integrated Report).

Evaluation of the Effectiveness of the Board of Directors

To enhance the effectiveness of the Board of Directors, since 2016 the members of the Board of Directors have been asked to conduct self-evaluations. All Directors and Audit & Supervisory Board Members are subject to a five-level evaluation and a free-form descriptive questionnaire regarding the composition, operation and responsibilities of the Board of Directors. The results are reported to the Board of Directors and are used when appropriate to improve the Board’s operation. In 2020 and 2021, we conducted a questionnaire by a third-party agency in order to secure transparency and objectivity.

Dialogue with Investors

We hope that our shareholders will hold our company shares over the long term. For this reason, we believe that it is important to participate in dialogue with investors in order to facilitate understanding about our businesses. Under the supervision of the director in charge, actual dialogues (for investor relations (IR) and shareholder relations (SR)) are handled by the executive officer in charge or an executive in cooperation with the Investor Relations Office and other departments. In addition, the opinions obtained through IR and SR are reported to the Board of Directors to promote information sharing.

Compensation Scheme for Directors

We require Directors to strive forward with a medium- to long-term perspective, rather than merely with a short-term mindset. Therefore, we see it appropriate to put basic remuneration at the base of the Company’s compensation scheme for Directors. We have also introduced stock-based compensation with restrictions on transfer as part of the Company’s compensation scheme. The purpose of this is to encourage our Directors to hold the Company’s stock on a long-term, stable basis, with the intention that they share the same perspectives as our shareholders and contribute to the sustainable growth of Hamamatsu Photonics’ corporate value. The specific amounts for both basic remuneration and restricted stock remuneration are determined by the Board of Directors, and their ratio is generally 85 to 15.

Fruits of Our Efforts

01 We established a basic corporate governance policy aligned to our management philosophy. We also formulated a basic approach to corporate ethics and compliance, both of which are publicly available.

02 Hamamatsu Photonics has had no legal violations or company scandals.

03 The current number of Directors is 10, of which 4 (40%) are outside directors.

04 We held 218 briefings for investors during FY2021.

Future Challenges and Countermeasures

The challenge is whether we can meet matters deemed necessary in the short-to-mid-term for stakeholders, while also satisfying mid-to-long term requirements. Therefore, Hamamatsu Photonics advances its core technologies such as photodetectors, which are the foundation of its business, whilst never forgetting the venture spirit held since our founding, planning and endeavoring to develop new technologies, and cultivating the human resources entrusted with these tasks. We share the things we see as important, as well as our values, with all of our shareholders and various other stakeholders involved to build long-term relationships based on trust. In the future, ongoing contributions to society are directly connected to the perpetual existence of corporate organizations.

▼For more detailed information about our corporate governance, please refer to the link below.

CSR/ESG Information

https://www.hamamatsu.com/jp/en/our-company/sustainability-and-csr.html

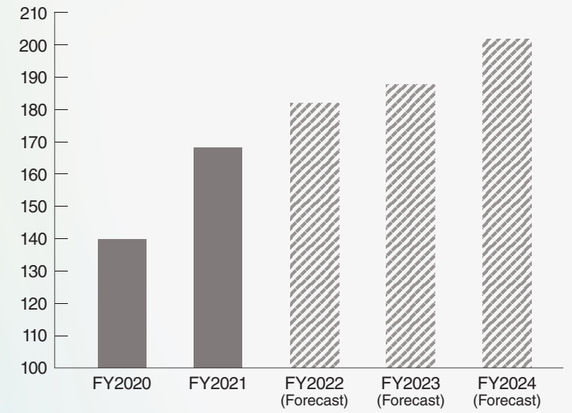
Basic Policy on Corporate Governance

https://www.hamamatsu.com/content/dam/hamamatsu-photonics/sites/documents/01_HQ/01_hamamatsu/csr/corporategovernance_en.pdf

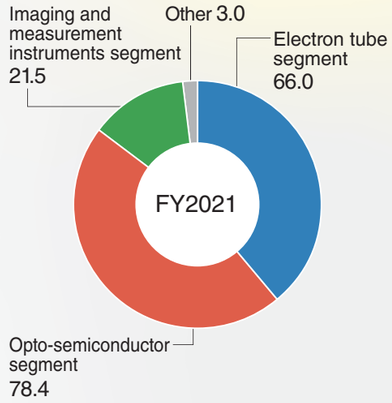
Review and Vision of Each Division

- Electron Tube Division (Electron Tube segment)
- Solid State Division (Opto-semiconductor segment)
- Systems Division (Imaging and Measurement Instruments segment)
- Central Research Laboratory

▼ Medium-term sales plan (Unit: Billion Yen)



▼ Consolidated financial results by business segment (Unit: Billion Yen)



Electron Tube Division

Develops, manufactures and sells optical sensors such as photomultiplier tubes, various light sources, X-ray related products, and laser-applied products.

P.33

Solid State Division

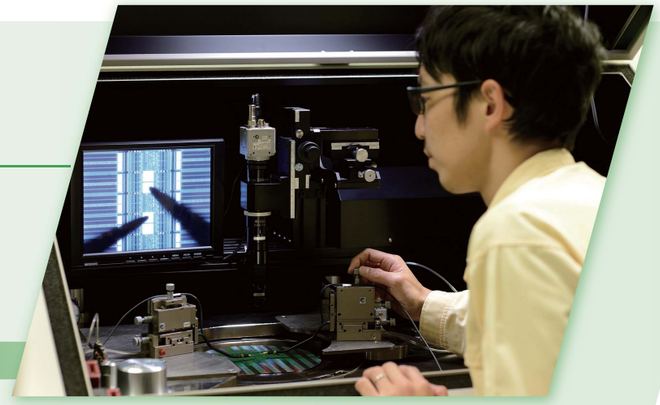
Develops, manufactures, and sells opto-semiconductor devices such as photodiodes, photo ICs, and image sensors, as well as module products based on them.

P.35

Systems Division

Develops, manufactures and sells specialized systems for industrial and research applications in the life science, semiconductor and medical fields.

P.37



Central Research Laboratory

Engages in a broad spectrum of research projects, including fundamental research into the nature of light, and uses technology and knowledge gained to perform industrial applied research.

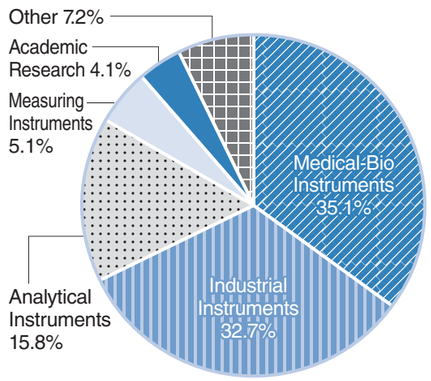
P.39

Electron Tube Division

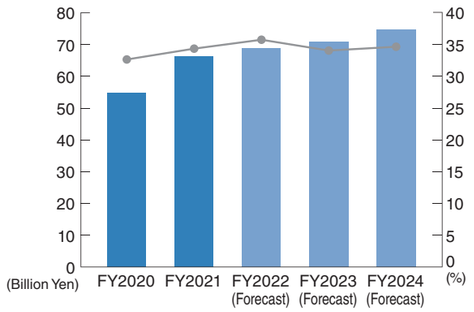
(Electron Tube segment)

Electron tube devices are key devices for measuring and capturing phenomena that were impossible to find up to now. We achieve this by applying our long-fostered basic and element technologies. Our new manufacturing technology creates innovative devices that are more compact and optimized for particular usage environments, expanding the application fields of the equipment in which those devices are integrated. Electron tube devices that have actively been used in a wide range of fields including medical diagnosis, spectroscopic analysis, semiconductors, biology, and academic research are now being pushed to their ultimate performance limits to meet customer needs and to expand the market.

▼ Sales ratio by industry and application (FY2021)

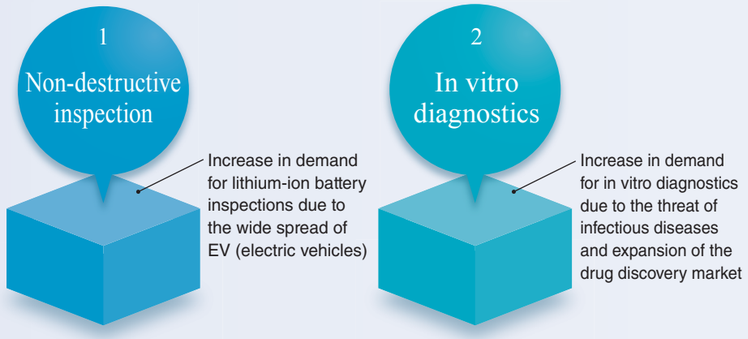


▼ Consolidated financial results by business segment



Medium-term Growth

▼ Promising Markets



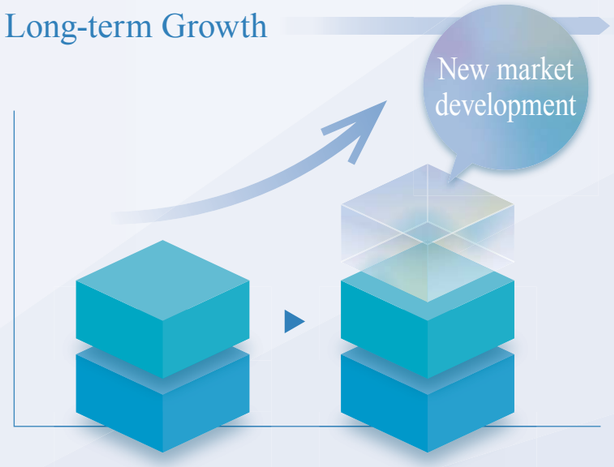
▼ Risks

- Tight production capacity due to rapid increase in demand

↓

- Construction of a new building
- Increase in the number of production personnel, including cooperating with subsidiaries

Long-term Growth



▼ Direction to Progress

- Develop detectors, light sources, X-ray related products, and laser-applied products with performance that can only be achieved with our technology of the Electron Tube Division
- Develop new markets with technologies within divisions as well as new technologies through M&A

▼ Investment for Sustainable Growth

- Establish a cross-divisional design team in addition to division-based research and development
- Strengthen collaboration among divisions and the Central Research Laboratory

Photomultiplier Tubes, Imaging Devices, Light Sources, and X-ray Sources

Features

Electron Tube Division continues to grow as a result of the strength of product development and market development by each production department. The manufacturing process for photomultiplier tubes has required a high-level of manual labor and this is why I believe development work done at the production site is essential, as it is where manufacturing actually takes place. Product development and market development by department provides a high level of freedom, allowing us to actively engage in development activities even in small markets. In order to take advantage of this strength and achieve further growth, we have created a design team that shares the technology of each department. In addition to the photomultiplier tube, which is our most dominant product within Electron Tube Division, this division offers a wide range of other products, such as light sources and applied products, that have successfully developed new markets. By sharing technologies not only within a particular department but also from other departments, we will strengthen our product development and continue to achieve sustainable growth by further developing new markets.

Review of FY2021

In the medical-bio field, sales of photomultiplier tubes (PMT) for medical inspection and monitoring systems such as PCR tests and flow cytometers increased due to rising demand in Japan and overseas. Also, in the industrial field, sales of these items for semiconductor inspection equipment increased, mainly overseas, in response to the expanding semiconductor market, and sales for academic applications such as high-energy physics experiments also grew, resulting in increased sales of photomultiplier tubes. Regarding sales of imaging devices and light sources, in the industrial field, accompanying the global penetration of 5G and the expanding production of EV (electric vehicles), sales of microfocus X-ray sources for non-destructive testing increased, mainly in Asia, for circuit board inspection applications and automotive battery testing applications. Sales of Stealth Dicing Engine for high-speed, high-quality silicon wafer dicing and light sources for semiconductor wafer inspection equipment also increased owing to growth of the semiconductor market.
In total, the Electron tube business closed FY2021 with net sales of JPY 66.0 billion (up 20.9% year-on-year) and an operating profit of JPY 22.6 billion (up 26.9% year-on-year).

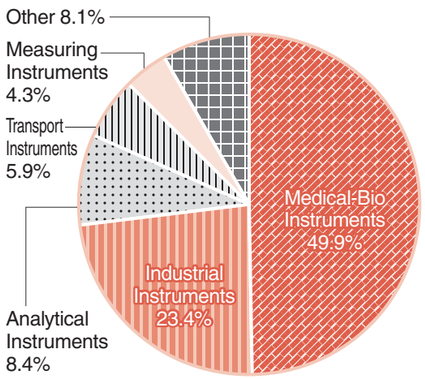
Solid State Division

(Opto-semiconductor segment)

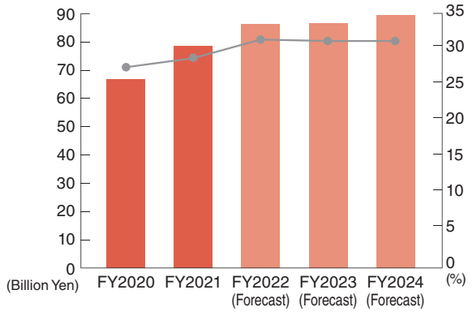
Solid State Division has explored physical properties that determine opto-semiconductor performance since the early days in this field and succeeded in creating a variety of product lineups. Our opto-semiconductor products incorporate unique semiconductor process technology, mounting & packaging technology, and MEMS technology, and cover a wide wavelength range from infrared, visible, ultraviolet, all the way to X-rays and high energy rays. They are used for a wide range of fields including medicine, industrial applications, academic research, analysis, and in vehicle electronics. We will continue to pursue opto-semiconductor technology, always staying one step ahead, to meet the increasingly sophisticated needs of the future.

Division Director,
Solid State Division
Takayuki Suzuki

▼ Sales ratio by industry and application (FY2021)



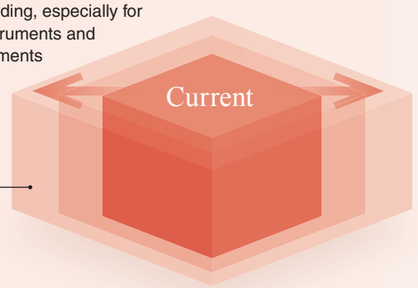
▼ Consolidated financial results by business segment



Medium-term Growth

▼ Promising Markets

In addition to the recovery from the effects of COVID-19 in the existing market, the market is expanding, especially for medical-bio instruments and industrial instruments



▼ Risks

- Strain on production system due to rapid increase in demand
  - Increase in investment to improve production efficiency
- Potential part procurement issues
  - Change of procurement method for parts that procurement may be an issue

Opto-semiconductors

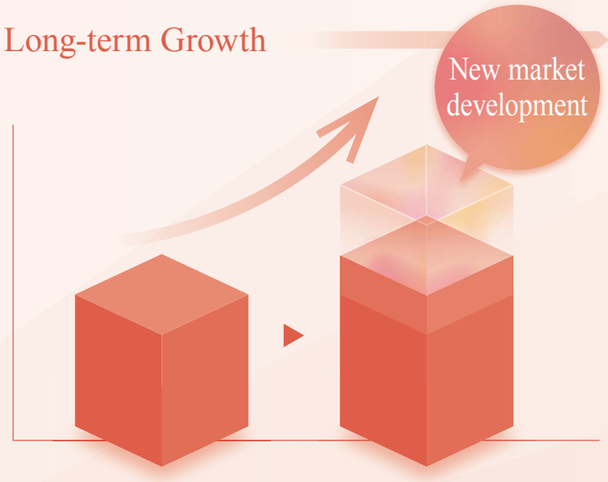
Features

The Solid State Division does not develop technologies or equipment for a single application but for horizontal expansion to wider applications in order to maintain high-mix low-volume production, whilst also increasing production efficiency. This is where our strength comes from. In addition, this broadening of applications has given us the ability to come up with creative capabilities to develop products that our customers want. LiDAR, a technology which is currently the focus of attention in autonomous driving, is also used for measuring distances in everyday life (such as distance measurements at golf courses and robotic vacuum cleaners) as well as in cutting-edge academic research. Although customer requirements differ depending on application, our creative capability and development capability is strengthened by making products highly functional for each application. In addition, the modularization efforts that we have focused on in recent years have enabled us to provide not only sensor capabilities but also optimal functions to customers with different needs. We will continue to grow by making proposals that are best suited to our customers.

Review of FY2021

In the medical-bio field, sales of silicon photodiodes for X-ray CT increased in response to continued growth in demand in Japan and overseas. In addition, in the industrial field, sales of image sensors for semiconductor fabrication and inspection equipment increased due to rising global demand for semiconductors, while in the FA (Factory Automation) field, such as controls for industrial robots, etc., sales of photo ICs, photodiodes and LEDs increased. In total, net sales for the Opto-semiconductor business were JPY 78.4 billion (up 17.6% year-on-year) and an operating profit of JPY 22.6 billion (up 23.2% year-on-year).

Long-term Growth



▼ Direction to Progress

- Expansion into new markets based on story from the social roadmap as conceived by the division
- Strengthen competitiveness through functionalization and productivity improvement

▼ Investment for Sustainable Growth

- Establishment of a business planning department to support the development policy of the entire division
- Strengthen investment for functionalization and productivity improvement

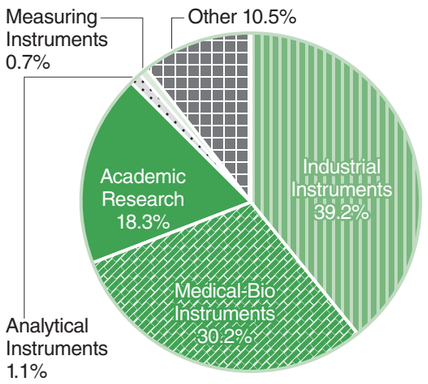
Systems Division

(Imaging and Measurement Instruments segment)

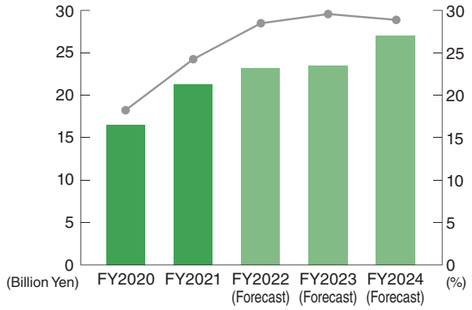
Our Systems Division is developing and manufacturing system products that integrate light detection technology, imaging technology, and image processing technology by using optical sensors. As a leading sensor manufacturer, we use our expertise and technology to design and develop applied products that combine core products using high-speed, high-sensitivity, and high-resolution technologies, such as cameras, with peripheral technology and equipment. We develop products that maximize the performance of sensors.

Division Director,
Systems Division
Tadashi Maruno

▼ Sales ratio by industry and application (FY2021)

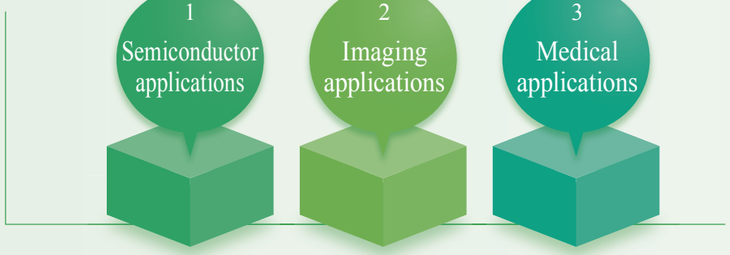


▼ Consolidated financial results by business segment



Medium-term Growth

▼ Promising Markets



- Concentrate management resources in markets where we have cultivated and have high market share and introduce new products based on new concepts
- Strengthen digital marketing

▼ Risks

- Direction of development not matching market needs

- Strengthen expertise by organizing development, manufacturing, and sales that are in line with the market

Image Processing and Measurement Systems

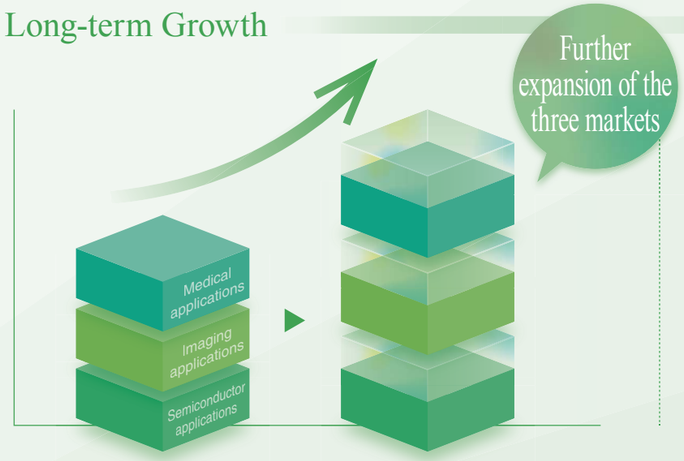
Features

Systems Division, through a development structure that can clearly satisfy market needs, has utilized this strength in FY2021 by transforming each department into a group of expert professionals. This was achieved by organizing each process, such as product planning, sales strategy, market research, prototype/principle verification, prototype creation, and commercialization. By gaining a deeper understanding of the market in which we have accumulated information and where we have a large market share, we aim to achieve sustainable growth by discovering new needs and by planning new concept products that do not replace existing products.

Review of FY2021

Sales of board cameras for medical inspection and monitoring systems increased due to continued growth in demand in North America. In addition, sales of digital slide scanners for remote pathologic diagnosis systems grew due to rising demand from inter-hospital networks mainly in Europe. Sales of failure analysis systems for semiconductor devices also grew, mainly in Europe and Asia, against the backdrop of expanding capital investment. In total, net sales of the Imaging and measurement instruments business were JPY 21.5 billion (up 28.6% year-on-year) and operating profit of JPY 5.3 billion (up 71.2% year-on-year).

Long-term Growth



▼ Direction to Progress

- Strengthen product lineup for the promising three markets through in-house development and M&As

▼ Investment for Sustainable Growth

- Strengthen human resources through human resource development programs
- Strengthen indirect department for M&A promotion

Central Research Laboratory

(Basic and Applied Research)

What will our future be like 20 or 30 years from now? How about a future where all people can enjoy comfortable and active lives with peace of mind, and where optimal balance is maintained among the Earth, its people and all living things? To make this dream a reality, we will have to overcome many obstacles and challenges. Our Central Research Laboratory is conducting R&D work that conforms to "sustainability" values. We call this work "Life Photonics" which is based on the theme of "life" encompassing a broad range of areas such as life, living things, human life, vitality sources, and ways of living. We will continue researching a diverse spectrum of photonics and optical technologies taking "Life Photonics" as our motivating theme.

Genesis and Role of the Central Research Laboratory

By 1990, Hamamatsu Photonics had established itself as a world-leading manufacturer of optoelectronic components and systems. The company had gradually grown, and its divisions were producing market-leading products. In the field of research and development, we have been interacting with world-class researchers and are now participating in joint research. In order to effectively pursue the unknown and unexplored realms of light in this environment, we decided to create our very own Central Research Laboratory. Central Research Laboratory was established in Hamakita-ku, Hamamatsu City, to act as a compass, which guides us into the future. The Tsukuba Research Center (Tsukuba City) and Industrial Development Center (Nishi-ku, Hamamatsu City) also became a part of Central Research Laboratory to further expanding our research base. The Central Research Laboratory is currently advancing basic research and the applied research of photonics technology under the keywords "Life Photonics." "Life" here does not refer to concepts such as medical and life sciences but it takes on the broad meaning of life and living. By making this "life" possible through photonics technology, we will help build a sustainable society. Central Research Laboratory has two primary roles. Our first responsibility is to contribute to Hamamatsu Photonics business. We will help foster growth by providing the expertise and technologies necessary for product development in each division, while collaborating with them to commercialize products using our accumulated knowledge. Our second responsibility is to advance research into fundamental measurement and fundamental physics in the pursuit of the unknown and unexplored realms of light. By standing shoulder-to-shoulder with universities and research institutes worldwide and conducting leading-edge research, Hamamatsu Photonics obtains new findings develops science and technology, and contributes to human health and happiness.

Tsukuba Research Center,
Central Research Laboratory

Industrial Development Center,
Central Research Laboratory

Central Research Laboratory

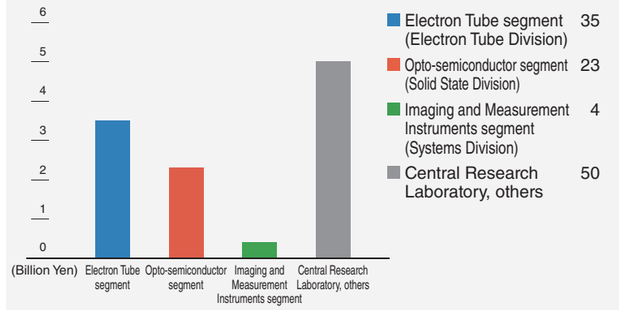
For Future Growth

The importance of Central Research Laboratory to function in both of its roles: "to contribute to business" and "to pursue the unknown and unexplored realms of light" has remained unchanged. Collaborations with divisions that we have been focusing on in recent years are yielding results, including the transfer of technologies. In FY2021, a researcher who had been dispatched to an overseas research institute was transferred to a division to commercialize the results of the research. As a result of these achievements, I feel that collaboration is expanding from a conventional organization-to-organization collaboration to a person-to-person collaboration. On the other hand, what I feel is an issue is the change in communication methods. Information obtained through face-to-face communication is also important for research and development. Although we are also working on a number of long-term themes with high hopes, I think that some information is lacking when not obtained directly face-to-face. We will continue to provide opportunities to obtain information, including dispatching employees to overseas research institutions.

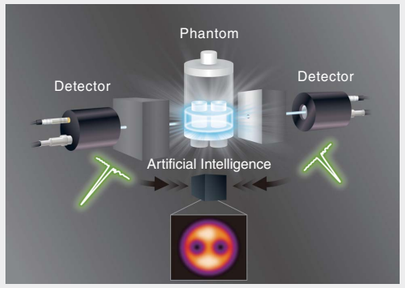
Research and Development

Hamamatsu Photonics is promoting basic research aimed at creating new knowledge and new industries in the fields of biotechnology, medicine, information, communications, energy, materials, space/astronomy, and agriculture by making full use of the unique photonics technology that we have cultivated over many years. We are also engaged in the development of new products and the enhancement of the functionality and added value of existing products.

R&D expenses (FY2021)



Basic Research — Achieved World's First Success in Imaging for Nuclear Medicine without Image Reconstruction

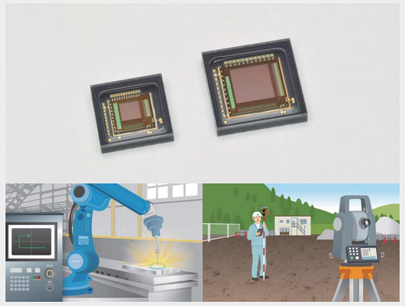


▲ Illustration of devices used in experiments for this research. The radiation emitted from the phantom was detected using a pair of detectors, and the illustration (lower center) was successfully obtained by signal processing using artificial intelligence.

In the medical field, we are working to improve imaging technology for nuclear medicine examinations, such as PET. In nuclear medicine examinations, in order to obtain high-definition diagnostic images, it is necessary for the detector to accurately capture the position of the radiation emitted from the patient's body, but due to the characteristics of current detectors, this is corrected in image processing that reconstructs the image. We have recently conducted a phantom [1] detection experiment using a high temporal characteristic detector, which captures radiation more accurately, and artificial intelligence. This resulted in the success of acquiring an image without image reconstruction for the first time in the world [2]. By applying this achievement, we expect to create a new inspection system that is simple, compact, and capable of rapid diagnosis, while having the same or better accuracy than conventional nuclear medicine inspection systems. In addition, this system is expected to reduce the physical burden on patients and medical personnel by improving examination efficiency and reducing radiation exposure. In the future, we will promote research to further improve the accuracy of imaging for practical use.

(Note) [1] In the field of nuclear medicine, a phantom is a device used to evaluate the imaging technology of an examination device, and in this research, we conducted experiments using a phantom with radiation distribution.
[2] These results were obtained in collaboration with the University of California, Davis, University of Fukui, and Kitasato University.

Product Development — Newly developed profile sensor with built-in calculation function that enable high-speed position detection



▲ Newly developed profile sensor (top) and examples in which this product can be used in surveying instruments and factory automation equipment (bottom)

A profile sensor is a type of image sensor that specializes in detecting the position of an object. Compared to ordinary image sensors, profile sensors have the special characteristic of being able to acquire necessary information at high speed with small amount of signals, and are used in surveying instruments to measure the distance between objects. We have been developing profile sensors for surveying instruments, but in order to output the acquired signals as coordinate data required for surveying, an external control unit that performs arithmetic processing was required. We recently reviewed the circuit design and developed a new profile sensor that can output coordinate data without using a control unit by integrating the circuit that performs the calculation processing into the sensor. This product is expected to make surveying instruments smaller, lighter, and less expensive. In addition, by increasing the signal acquisition speed and adding a function that assists in detecting the position of moving objects, we expect to expand its application to the factory automation field.

Product Development Development of ORCA®-Quest, a qCMOS® camera for scientific measurement that offers the ultimate low-noise performance

ORCA®-Quest

qCMOS® Camera C15550-20UP

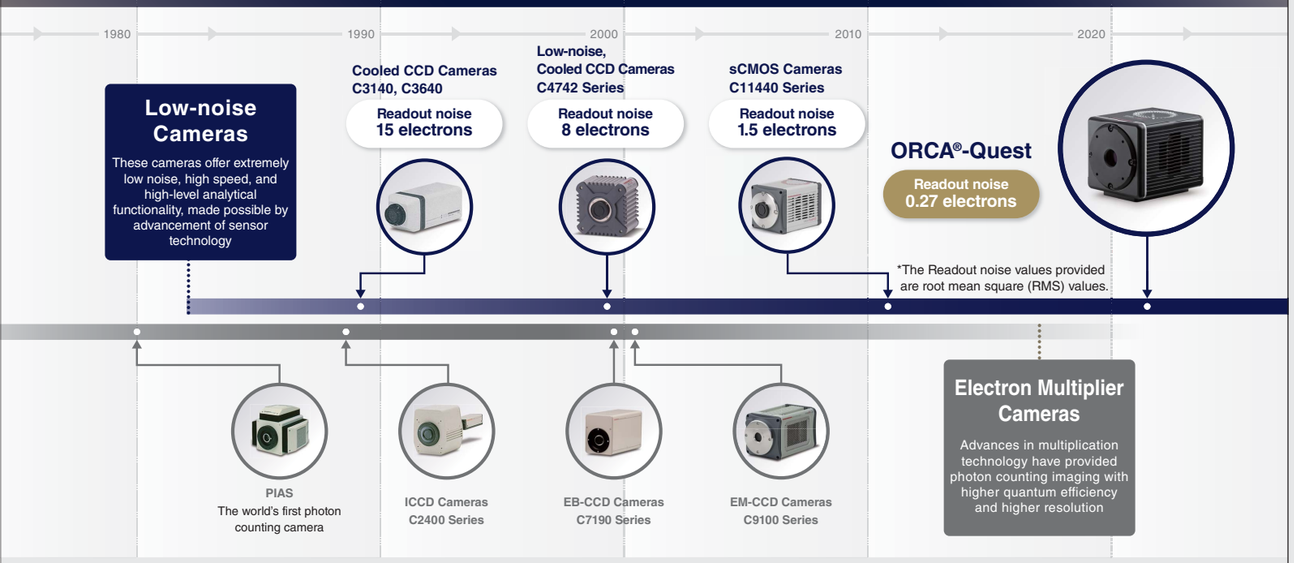
Cameras used for scientific measurements are required to reduce noise to observe extremely weak light. ORCA®-Quest, a qCMOS camera with the ultimate low-noise performance and the ability to acquire images at high resolution and high speed, has been newly developed using the latest semiconductor manufacturing technology and camera design technology that we have cultivated over the years. Thanks to its excellent low-noise performance, ORCA®-Quest is the first camera in the world to achieve two-dimensional photon number resolving measurement, which accurately measures and images photons, the smallest unit of light, in two dimensions. It is expected to accelerate research and development not only in the fields of astronomy and life science, which require imaging under extremely low light levels, but also in the field of quantum technology, including quantum computers, as it will enable more accurate observation of quantum states such as ions and neutral atoms.

The newly developed “ORCA®-Quest”

Development Background

Since the 1980s, we have been developing, manufacturing, and selling low-noise cameras for scientific measurement. Today, we provide products for applications in the life sciences and other academic fields, as well as in the factory automation field, where technology for imaging extremely weak fluorescence and luminescence phenomena is required. In this context, in order to meet the market's demand for even lower noise performance, we have been working on the development of scientific measurement cameras that can perform two-dimensional photon number resolving measurement with ultimate low noise performance.

History of Hamamatsu Photonics Camera Development

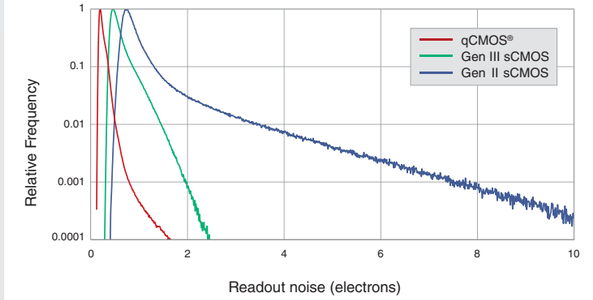


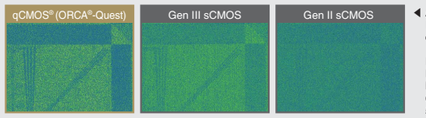
Product Features

(Selected Features)

01 Extremely Low-noise Performance

In order to detect extremely weak light with a high signal and low noise, ORCA®-Quest has been designed to optimize every aspect of the sensor, from its structure to its electronics. Furthermore, by developing a custom sensor using the latest CMOS technology, ORCA®-Quest was able to achieve extremely low-noise performance with an RMS value of 0.27 electrons.





◀ Average of one photon per pixel Incident image (pseudo color display) comparison

Exposure time: 200 ms
Display range:
Minimum to maximum count value
Comparison range:
512 pixels × 512 pixels

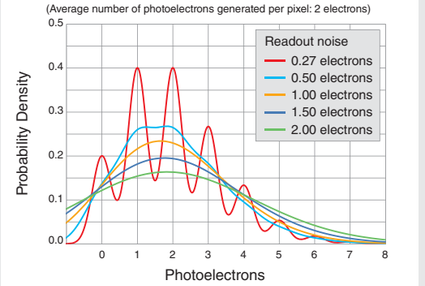
02 Realization of Photon Number Resolving Output

In order to identify the number of photoelectrons, the noise on the camera side must be sufficiently lower than the photoelectron signal amount. ORCA®-Quest achieves photon number resolving, which has been difficult to achieve in the past, by utilizing advanced camera technologies such as stability against temperature and time, individual calibration of each pixel, and real-time correction, in addition to extremely low noise performance at an RMS value of 0.27 electrons.

*Photon number resolving is the identification of the number of photoelectrons, which is not exactly the same as photon detection. However, “photon number resolving” is used in this document because single photoelectrons and single photons are sometimes used interchangeably in detection methods.

Photoelectron Probability Distribution Simulation Data

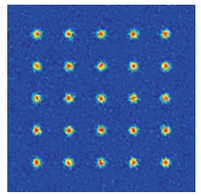
(Average number of photoelectrons generated per pixel: 2 electrons)



Example of Applications (Selected Examples)

Quantum technology - Neutral atom, ion trap

Neutral atoms and ions can be regarded as so-called quantum bits because they can take on a superposition state in which even a single atom has multiple properties. This property is being actively investigated to realize quantum computing and quantum simulation. By observing the fluorescence of trapped ions and neutral atoms, the state of the quantum bit can be determined, and a low-noise camera is used to read out the fluorescence.

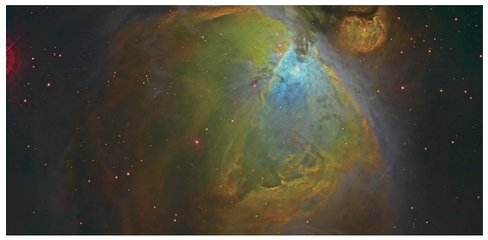


◀ Simulation image

Rb atom	@780 nm
Number of atoms	5 × 5 array
Atomic emission	2000 photons
Background	5 photons
Magnification	20× (NA: 0.4)
Distance between atoms	5 μm

Astronomy - Lucky imaging

When observing stars from the ground, image of a star can be blurred due to atmospheric turbulence and substantially reducing the ability to capture clear images. However, with stable atmospheric conditions during a short exposure, clear image can be sometimes captured. For this reason, lucky imaging is a method of acquiring a large number of images and aligning and integrating only the clear images.



▲ Color imaging of the Orion Nebula using three-wavelength filter

Financial Data for Seven Years

Unit: Million Yen

Consolidated Performance Index	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021
Net sales	120,691	121,852	130,495	144,338	145,912	140,251	169,026
Cost of sales	57,582	60,807	65,670	70,385	71,916	71,774	85,631
Selling, general and administrative expenses	27,897	28,627	30,199	33,857	35,520	34,577	37,709
R&D expenses	11,615	11,873	11,776	12,830	13,071	12,147	11,367
Operating profit	23,596	20,544	22,849	27,263	25,403	21,752	34,318
Ordinary profit	24,658	20,050	24,037	28,088	26,277	22,692	34,648
Profit attributable to owners of parent	16,598	14,419	17,777	21,222	19,918	16,523	25,053
Capital investments	14,338	9,315	13,572	14,221	17,412	20,337	12,982
Depreciation *Tangible fixed assets	8,561	9,888	9,441	10,261	10,950	11,758	12,402
Cash flows from operating activities	16,046	24,160	26,154	23,579	30,875	23,321	39,913
Cash flows from investing activities	▲17,057	4,186	▲13,198	▲8,880	▲16,086	▲16,215	▲16,778
Cash flows from financing activities	▲4,878	▲15,413	▲5,707	▲16,323	▲6,681	▲6,508	▲4,475
Cash and cash equivalents at the end of period	45,556	53,595	63,385	61,824	68,521	68,773	90,008
Total assets	226,179	217,300	239,331	244,914	259,694	271,615	301,676
Equity capital	180,141	169,163	186,939	193,317	202,957	212,680	236,522
Working capital	44,699	44,499	51,262	59,031	60,254	63,901	72,172
Number of shares issued (thousands)	167,529	167,529	167,529	165,011	165,011	165,027	165,041
Operating profit ratio (%)	19.6	16.9	17.5	18.9	17.4	15.5	20.3
ROA (%)	7.5	6.5	7.8	8.8	7.9	6.2	8.7
ROE (%)	9.5	8.3	10.0	11.2	10.1	8.0	11.2

Unit: JPY

Per share information	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021
Net income for current period	103.23	90.23	113.00	136.50	128.67	106.73	161.82
Dividends	34	34	34	37	40	40	48
Payout ratio (%)	32.9	37.7	30.1	27.1	31.1	37.5	29.7

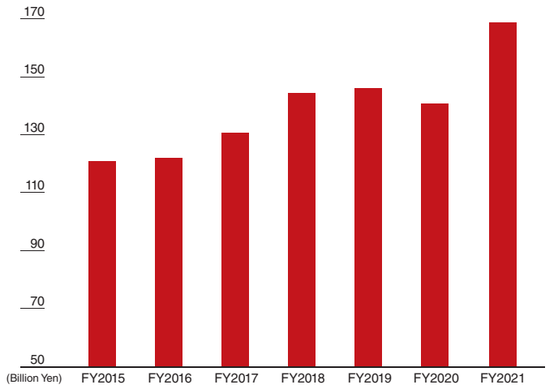
The results for FY2015 are calculated taking into account the 2-for-1 stock split executed in April 2015.

Non-financial data	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021
Average years of service (years) Male	16.1	16.2	16.2	16.4	16.4	16.4	16.3
Average years of service (years) Female	15.9	16.0	15.7	15.1	15.3	14.9	14.9
Average years of service (years) Total	16.1	16.2	16.1	16.2	16.2	16.1	16.1
Turnover rate (%)	0.7	0.9	0.7	0.8	0.9	0.8	——
Maternity leave return rate (%)	100.0	100.0	100.0	100.0	100.0	100.0	——
Greenhouse gases (Scope 1, 2) (t-CO_2)*	55,438	55,925	56,539	57,945	54,005	54,048	59,386
Water (thousand m^3)*	748	724	703	704	749	730	822
Renewable energy (kWh)*	0	0	7,188	6,754	6,050,667	7,099,740	11,544,463

* It encompasses Hamamatsu Photonics K.K, domestic consolidated subsidiaries, and overseas manufacturing consolidated subsidiaries from FY2021.

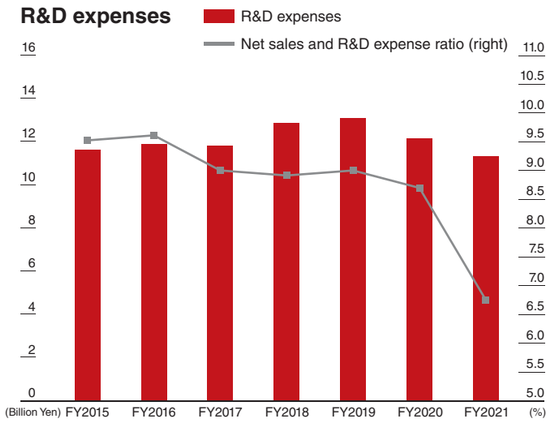
Financial Review

Net sales



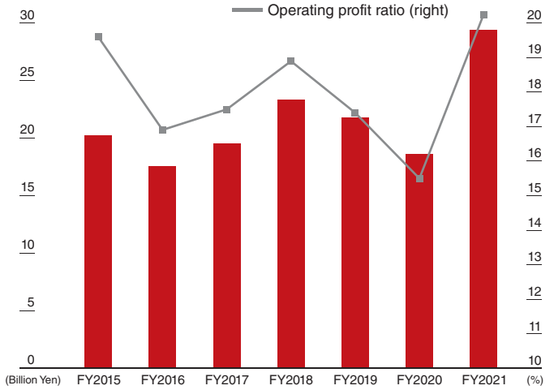
In FY2021, net sales reached 169.0 billion yen, representing a year-on-year increase. In addition to the increase in demand for medical equipment for responding to COVID-19, the recovery of the economy, especially in the industrial sector, and the rise in global demand for digital-related products, including semiconductors, resulted in record-high net sales.

R&D expenses



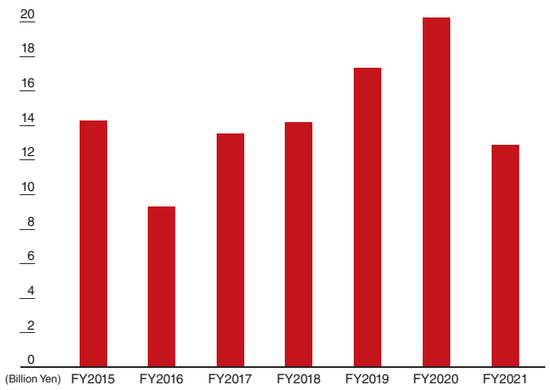
In FY2021, R&D expenses were 11.3 billion yen, representing a year-on-year decrease. R&D expenses, especially for the Central Research Laboratory, decreased due to R&D activities being restricted due to COVID-19. However, since the solidification of core technology by pursuing performance to its farthest boundaries is the foundation of our business growth, we will actively invest in product development and basic research to further strengthen our research and development system.

Operating profit



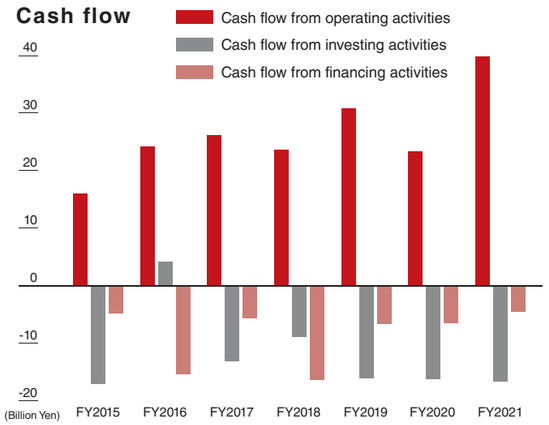
In FY2021, operating profit reached 34.3 billion yen, representing a year-on-year increase. Despite the increase in personnel expenses and depreciation, the operating profit ratio exceeded 20% for the first time since FY2011 due to the increase in net sales.

Capital investments



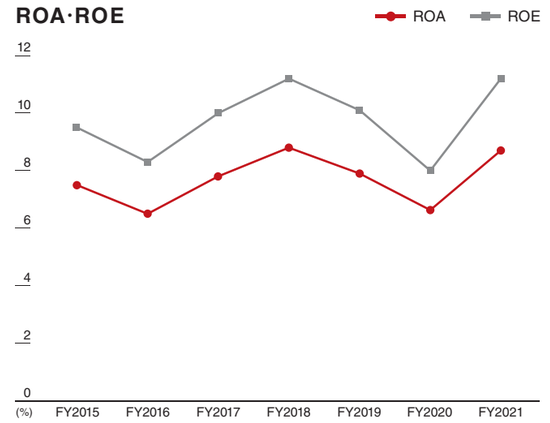
In FY2021, capital investment was 12.9 billion yen, representing a year-on-year decrease. Although construction of our new building has been postponed considering the impact of the COVID-19, we will continue to make further proactive capital investments to strengthen research and development, accelerate the expansion of growth products, and heighten production efficiency.

Cash flow



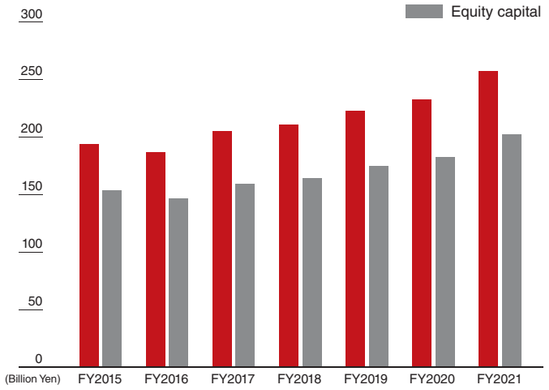
In FY2021, cash flow from operating activities was 39.9 billion due to an increase in net sales. Cash flow from investing activities was minus 16.7 billion yen due to construction of new wings, resulting in free cash flow of 23.1 billion yen.

ROA·ROE



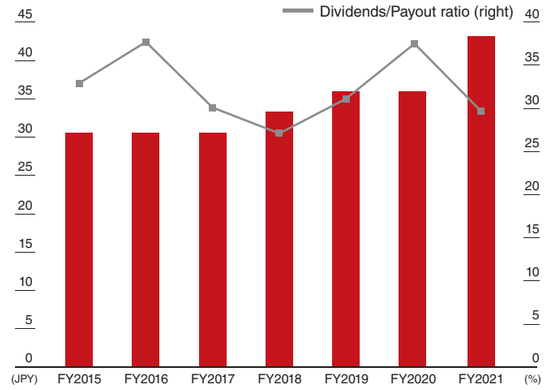
In FY2021, we had an 11.2% ROE (up 3.2 points year-on-year) and an 8.7% ROA (up 2.5 points year-on-year) due greatly to a fall in profits resulting from COVID-19 and other factors. We will improve ROE and ROA by increasing our profit level.

Total assets/Equity capital



The equity capital for FY2021 increased 11.2% year-on-year to 236.5 billion yen. To ensure stable business continuity and to build a research and development system, the equity ratio has been set at 78.4%, a high level. Our policy is to allocate our own cash for capital investment and research and development expenses.

Dividends/Payout ratio



*The results for FY2015 are calculated taking into account the 2-for-1 stock split executed in April 2015.

The dividend for FY2021 increased by 8 to 48 Yen per company share. We aim for a payout ratio of 30% and are providing returns to shareholders through stable dividend increases.

Board Members

Muneo Kurauchi
Outside Audit &
Supervisory Board Member

Yuji Maki
Outside Audit &
Supervisory Board Member

Michihito Suzuki
Audit &
Supervisory Board Member (Standing)

Akira Utsuyama
Audit &
Supervisory Board Member (Standing)

Kenji Yoshida
Director
Managing Executive Officer
Division Director, Administration Headquarters

Tadashi Maruno
Representative Director
Senior Managing Executive Officer
Division Director, Systems Division

Akira Hiruma
Representative Director and President
Chief Executive Officer

Takayuki Suzuki
Director
Managing Executive Officer
Division Director, Solid State Division

Hisaki Kato
Director
Managing Executive Officer
Division Director, Electron Tube Division

Kazue Kurihara
Outside Director

Takuo Hirose
Outside Director

Kenji Suzuki
Representative Director and
Vice President
Chief Operating Officer

Kashiko Kodate
Outside Director

Ken Koibuchi
Outside Director

▼ Executive Officers

Chief Executive Officer
Akira Hiruma

Chief Operating Officer
Kenji Suzuki

Senior Managing Executive Officer
Tadashi Maruno

Managing Executive Officer
Kenji Yoshida Takayuki Suzuki Hisaki Kato Naofumi Toriyama

Senior Executive Officer
Kazuhiko Mori Minoru Saito

Executive Officers
Ken Nozaki Hiroyuki Okada Kazuya Suzuki Koichi Nagumo Shuuichi Osada Haruyoshi Toyoda

▼ Main Areas of Expertise/Experience

▸ Name	Akira Hiruma	Kenji Suzuki	Tadashi Maruno	Kenji Yoshida	Takayuki Suzuki	Hisaki Kato	Kashiko Kodate	Ken Koibuchi	Kazue Kurihara	Takuo Hirose	Akira Utsuyama	Michihito Suzuki	Yuji Maki	Muneo Kurauchi
Business Management/ Management Strategy	●	●	●	●	●	●	●	●		●			●	●
Technological Research and Development	●	●	●		●	●	●	●	●		●			
Finance/Accounting				●									●	●
Legal Compliance				●						●	●		●	●
Global	●	●	●	●	●	●	●	●	●	●			●	●
Sales/Marketing	●	●	●	●	●	●	●	●				●		
▸ Gender	Male	Male	Male	Male	Male	Male	Female	Male	Female	Male	Male	Male	Male	Male

Outside Audit & Supervisory Board Member

Yuji Maki

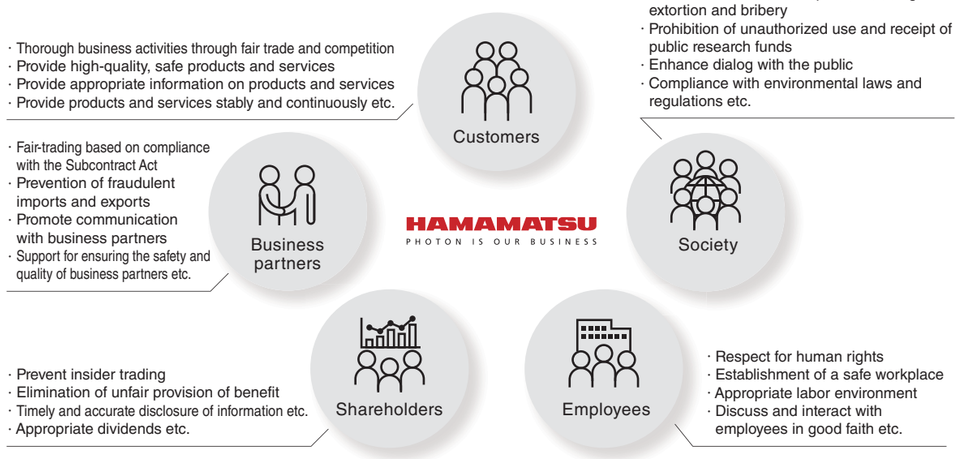
Hamamatsu Photonics is a company that has been developing cutting-edge technologies utilizing photonics as well as nurturing the required human resources for creating things that does not yet exist. In the wake of the great technological and geopolitical changes, being an organization that continues to pursue the unknown and unexplored with President Hiruma at the lead, and our corporate philosophy of creating knowledge in collaboration with our customers have become even more clear. That is why leadership in management and basis of our technology both begin from believing in the people and place that do each work. We established compound semiconductor fabrication center and GSCC, cross-departmental organizations that connect the independent department profit system which include photomultiplier tubes and opto-semiconductors devices segments, and also introduced executive officer system to conduct flexible decision making. If innovations like these are derived from the various communications we do with our shareholders, investors, local communities, employees, family members, and society, I believe we can establish a solid sustainable growth strategy. A governance system that aims to create new industries and expand globally needs to make sure that we always engage in proactive technological development with a spirit to "try before you say you can't". In doing so, we will strive to identify complex risks hidden in the unforeseen as much as possible and engage in active discussion about those matters.

Muneo Kurauchi

Hamamatsu Photonics is a company that has made numerous contributions in creating a prosperous future through world's leading photonics technology, and successfully established a strong financial foundation.
However, under the rapidly changing circumstances, it is considered that these achievements are not sufficient to meet the expectations of various stakeholders. The way society looks at companies is rapidly changing to weigh non-financial activities more.
Reflecting this environment, Corporate Governance Code which was originally introduced in Japan in 2015 was revised this year. Major aspects of the revision included consideration to sustainability/ESG, board independence, and promotion of diversity.
We are already conducting transparent management for both core business activities and social contribution activities to comply with the Code.
I have gained wealth of knowledge on corporate governance including risk management through working in the ever-changing international financial world for the past 40 years. I will utilize my experience to build a robust governance system for Hamamatsu Photonics.

Our Stance toward Stakeholders

We pursue the unknown where no one has yet explored. By leveraging photonics technology to establish new industries and reach for the world's highest levels of manufacturing excellence, we aim to build enterprise value and contribute to the development of science and technology. However, we believe that this is not something that we can achieve alone, but requires co-creation with many stakeholders.
Therefore, we have clarified our stance toward our stakeholders and disclosed it on our website. We also believe that it is important for us to help our stakeholders understand us as a sound and trustworthy company. Below is a list of the stakeholders that we consider important and some of the issues that we consider to be important.
For more information, please refer to our website.



Director, Managing Executive Officer
Kenji Yoshida

Closing Message

I would like to express my gratitude for the many valuable comments we have received through dialogues with various stakeholders since the publication of the first issue of the Integrated Report in 2019.
In addition to deepening our dialogue with the capital market, we have been working on enhancement of our corporate value through these dialogues. One such initiative is the strengthening of our governance system. With the aim of enhancing corporate value from a medium- to long-term perspective, we have undertaken various reforms, such as shortening the term length of Directors, increasing the number of Outside Directors, establishing the Nominating and Compensation Committee, and introducing a skill matrix.
FY2021 is also an important year in which we have made a new start toward our goal of becoming a "truly global company". Various projects are underway, led by executive officers, and we believe that strengthening our governance structure will help strengthen our supervisory functions. We have also established a Sustainability Management Committee to strengthen the involvement of the Board of Directors in sustainability.
FY2022 marks the start of the new prime market on Tokyo Stock Exchange.
We will continue to strive to be the world's highest levels of manufacturing excellence of products using photonics technology, and to aim to grow as a trusted and valued company based on our basic philosophy of contributing to resolving social issues and the development of science and technology, and we will work to further enhance our corporate value with the help of our various stakeholders.
In this report, as in the previous report, we have tried to share our diverse applications of photonics technology, our efforts to mainly expand business of each division, and our ESG initiatives, while focusing on our management stance and values. We hope that this report will be useful in gaining a better understanding of our company.

Global Organizations

Americas

1. New Jersey, United States
2. California, United States
3. Boston, United States

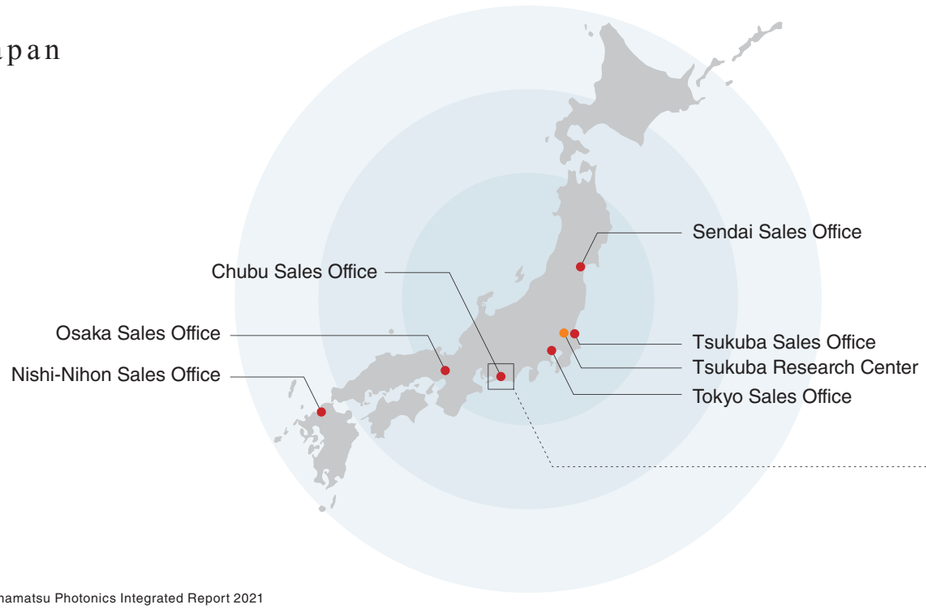
Europe, Middle East, and Africa

4. Germany
5. The Netherlands
6. Poland
7. Denmark
8. France
9. Switzerland
10. Belgium
11. Spain
12. Sweden
13. Russia
14. Italy
15. The United Kingdom
16. Israel
17. South Africa

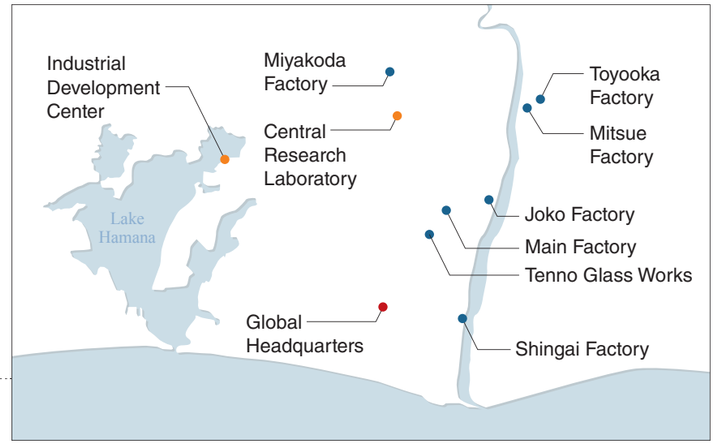
Asia and Oceania

18. Japan
19. Beijing, China
20. Shenzhen, China
21. Shanghai, China
22. Wuhan, China
23. Langfang, China
24. Taiwan
25. Korea

Japan



Hamamatsu



- Sales offices
- Factories
- Laboratories

Corporate Overview (As of September 30, 2021)

Company Name	Hamamatsu Photonics K.K.
Established	September 29, 1953
Global Headquarters	325-6 Sunayama-cho, Naka-ku, Hamamatsu City, Shizuoka Prefecture, 430-8587, Japan
Capital	35,008 Million Yen
Number of Employees	3,766 (Non-consolidated); 5,279 (Consolidated)
Main Product Lines	Photomultiplier Tubes, Imaging Devices, Light Sources, Opto-Semiconductor Devices, Imaging Processing and Measurement Systems
Net Sales (Consolidated)	169,026 Million Yen (FY2021)
Fiscal Year	October 1 to September 30 of the following year
General Meeting of Shareholders	December
Stock Listing	First Section of the Tokyo Stock Exchange
Securities Code	6965
Accounting Auditor	Ernst & Young ShinNihon LLC

Locations (Japan)

■ Global Headquarters

Hamamatsu City, Shizuoka Prefecture

■ Factories

Main Factory, Shingai Factory, Tenno Glass Works, Joko Factory, Miyakoda Factory (All Located in Hamamatsu City), Toyooka Factory, and Mitsue Factory (Both Located in Iwata City)

■ Sales Offices

Tokyo Sales Office, Sendai Sales Office, Tsukuba Sales Office, Chubu Sales Office (Hamamatsu City), Osaka Sales Office, and NishiNihon Sales Office (Fukuoka City)

■ Laboratories

Central Research Laboratory, Industrial Development Center (Both in Hamamatsu City), and Tsukuba Research Center (Tsukuba City)

Consolidated Subsidiaries

Japan

Koso Corporation
Takaoka Electronics Co., Ltd.
Hamamatsu Electronic Press Co., Ltd.
Iwata Grand Hotel, Inc.

Overseas

Americas	Photonics Management Corp. Hamamatsu Corporation Energetiq Technology, Inc.
Europe	Photonics Management Europe S.R.L. Hamamatsu Photonics Europe GmbH. Hamamatsu Photonics Deutschland GmbH. Hamamatsu Photonics France S.A.R.L. Hamamatsu Photonics Italia S.r.l. Hamamatsu Photonics UK Limited Hamamatsu Photonics Norden AB
Asia/ Other	Hamamatsu Photonics (China) Co., Ltd. Hamamatsu Photonics Taiwan Co., Ltd. Beijing Hamamatsu Photon Techniques Inc. Hamamatsu Photonics Korea Co., Ltd. Hamamatsu Photon Medical Technology (Langfang) Co., Ltd* Hamamatsu Photonics Scientific Instrument (Beijing) Co., Ltd. Hamamatsu Photonics Israel Ltd.

* The trade name of Hamamatsu Photon Medical Technology (Langfang) Co., Ltd. was changed in June 2021.

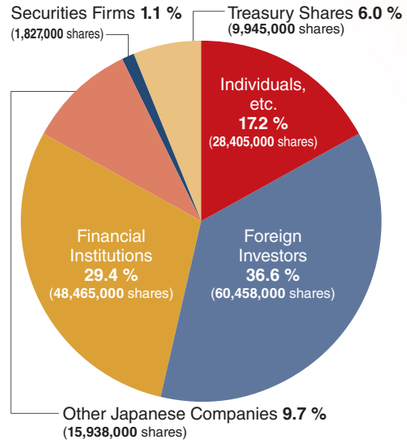
Stock Information (As of September 30, 2021)

Total Number of Authorized Shares (Common Stock)	500,000,000
Number of Shares Issued	165,041,841 (Including 9,945,645 shares of treasury shares)
Number of Shareholders	19,372
Transfer Agent and Registrar	Sumitomo Mitsui Trust Bank, Limited

Name	Shares Held	Percentage of Total Shares Outstanding
The Master Trust Bank of Japan, Ltd. (Trust Account)	23,110,500	14.9%
Toyota Motor Corporation	8,400,000	5.4%
Custody Bank of Japan, Ltd. (Trust Account)	6,429,300	4.1%
Hamamatsu Photonics K.K. Employees	4,181,971	2.7%
Custody Bank of Japan, Ltd. (Trust Account 9)	4,181,800	2.7%
SSBTC Client Omnibus Account	3,563,917	2.3%
The Nomura Trust and Banking Co., Ltd. (Investment Trust)	3,327,700	2.1%
State Street Bank West Client - Treaty 505234	2,773,887	1.8%
JP Morgan Chase Bank 385635	2,764,400	1.8%
RBC ISB S/A DUB NON RESIDENT/TREATY RATE UCITS-CLIENTS ACCOUNT	1,964,300	1.3%

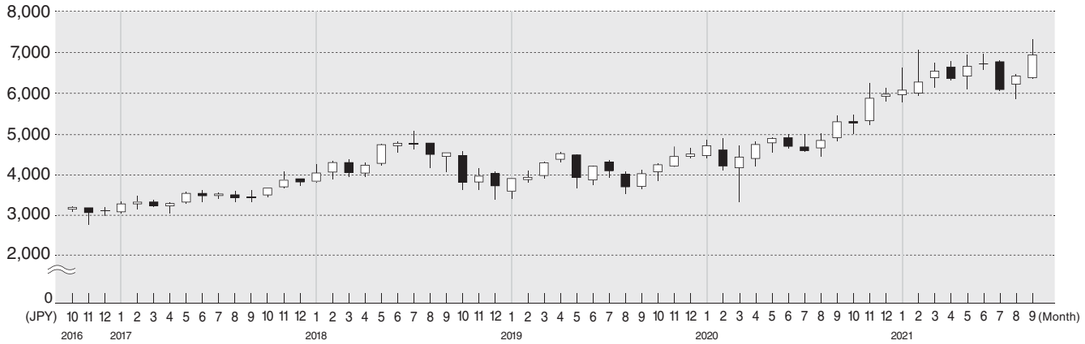
(Note) 1. The company holds 9,945,645 shares of treasury shares excluded from the shares of the major shareholders listed above.
2. The percentage of total shares outstanding is calculated by excluding the treasury share. Units less than that shown above are rounded off.
3. The total number of outstanding shares increased by 14,582 shares as a result of the issuance of common stock as stock-based compensation with restrictions on transfer on January 15, 2021.

■ Distribution of Shares by Shareholder



■ There is no information relevant to matters such as share options of the company.

■ Changes in Share Price



▼ For information about this report, please refer to the links below.

Financial Information
https://www.hamamatsu.com/jp/en/investor-relations/financial-information.html

CSR Information
https://www.hamamatsu.com/jp/en/our-company/sustainability-and-csr.html

Product Information
https://www.hamamatsu.com/jp/en/product.html

HAMAMATSU

PHOTON IS OUR BUSINESS

HAMAMATSU PHOTONICS K.K. www.hamamatsu.com

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Investor Relations Office

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[TEL] (053)452-2141

[FAX] (053)456-7889

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