Research and Development

R&D Initiatives

The Mitsubishi Electric Group's R&D network consists of the Advanced Technology R&D Center, Information Technology R&D Center, and Industrial Design Center in Japan as well as laboratories in the United States, Europe, and China. These centers operate under the umbrella of the Corporate Research and Development Group working in collaboration with the development departments of individual Mitsubishi Electric business groups.

The Mitsubishi Electric Group adheres to a balanced R&D approach that embraces short-, medium-, and long-term perspectives. In addition to making growth drivers and other key businesses even stronger, the Group is striving to better leverage its accumulated strengths as an innovative, diversified electrical equipment manufacturer that boasts a wide range of businesses and technologies. By doing so, the Group will realize technological and business synergies aimed at creating new value.

Promoting future-focused R&D that takes a long-term perspective, the Group incorporates the "backcasting" planning method, which starts with defining a desired future and then working backward to identify the technologies necessary to realize said future.

At the same time, the Group is actively engaged in research into fundamental technologies that support all of its products.

Furthermore, the Group is committed to promoting open innovation in collaboration with universities and other external R&D institutions, thereby reaching a next growth stage.

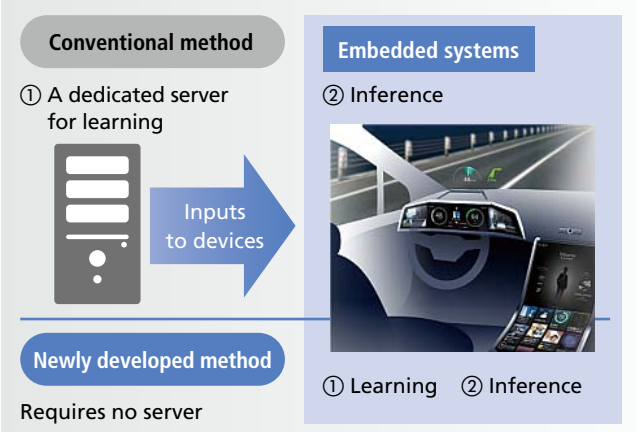
R&D Achievements in Fiscal 2017

Development of High-Speed Training Algorithm for Deep Learning

Mitsubishi Electric Corporation has developed a high-speed training algorithm for deep learning. This algorithm drastically reduces pre-training time and memory requirements necessary for identification and prediction within embedded systems such as vehicles, industrial robots, and other machinery.

Installing this algorithm into Mitsubishi Electric's Compact AI* enables embedded systems to learn by themselves and realizes highly precise identification and prediction according to the operating environment. Since servers and network facilities will no longer be required for this system, it can reduce the cost for installing AI, thereby enabling AI to be used in more diverse fields.

*Artificial intelligence that can be installed in embedded systems by using Mitsubishi Electric's proprietary technology to reduce computational volume.



Enables embedded systems to perform rapid learning and precise identification and prediction

Development of World's Smallest SiC Inverter for HEVs

Mitsubishi Electric Corporation has developed an ultra-compact silicon carbide (SiC) inverter for hybrid electrical vehicles (HEVs) with the world's smallest volume* at just five liters, using full-SiC power semiconductor modules and a superior heat dissipation structure.

Demand for EVs and HEVs has increased in recent years as fuel efficiency regulations have grown increasingly stringent in the automotive market. EVs and HEVs, however, require space for installing electrical apparatus for the purpose of electric conversion, thus inverters must be miniaturized in order to secure the amount of on-board space.

This development will contribute to an expanded on-board space and more freedom for inverter placement, as well as improved fuel economy of EVs and HEVs.

*As of March 9, 2017. World's smallest SiC inverter with a two-inverter and one-converter unit configuration compatible with two-motor HEVs (survey conducted by Mitsubishi Electric Corporation).

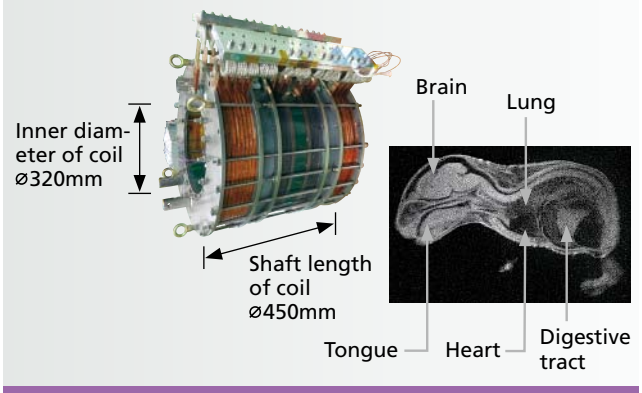
Helps EVs and HEVs secure more on-board space and improve their fuel efficiency

Success in the World's First 3 Tesla Magnetic Resonance Imaging with High-temperature Superconducting Coils*1

Mitsubishi Electric Corporation has succeeded in the world's first*2 3 tesla*3 Magnetic Resonance Imaging (MRI) with high-temperature superconducting coils installed in a small model MRI. The high-quality images made possible at this magnetic field strength will contribute to earlier detection of illnesses.

High-temperature superconducting coils do not require cooling with liquid helium, depletion of which has been a concern, and are able to generate the same magnetic field with smaller coils compared with conventional systems, which allows for the size of electrical instruments to be reduced. Therefore, this technology is expected to have applications in practice. Although advanced design and manufacturing technology is required to make these coils, Mitsubishi Electric Corporation has produced high-temperature superconducting coils that can be installed in small model MRIs by developing high-precision winding technology necessary for coil production.

Mitsubishi Electric Corporation will proceed with research and development aimed at practical application, with the goal of early commercialization.



Greater magnetic field strength means higher resolution and the improvement of diagnostic accuracy

*1 This new technology was the result of joint development with Kyoto University and Tohoku University with the support of the Ministry of Economy, Trade and Industry's (METI) "Fundamental Technology Development for High Temperature Superconducting Coils" and Japan Agency for Medical Research and Development's (AMED) "Project for Research and Development of Medical Devices and Systems to Realize Future Medical Care: Research and Development of High Stability Magnetic Field Coil System Foundation Technology."
*2 As of May 24, 2016. World's first for instruments equipped with high-temperature superconducting coils (survey conducted by Mitsubishi Electric Corporation)
*3 Tesla: A unit representing magnetic field strength

Intellectual Property

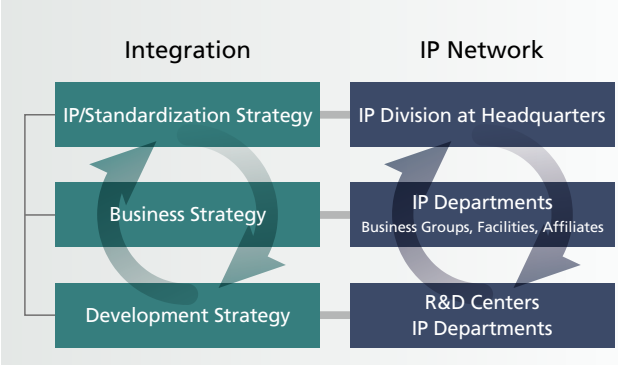
Mitsubishi Electric Group's Intellectual Property Activities

The Mitsubishi Electric Group recognizes that intellectual property (IP) rights represent a vital management resource essential to its future and must be protected. Through integrating business, R&D, and IP activities, the Group is proactively strengthening its global IP assets, which are closely linked to the Group's business growth strategies and contribute to both business and society.

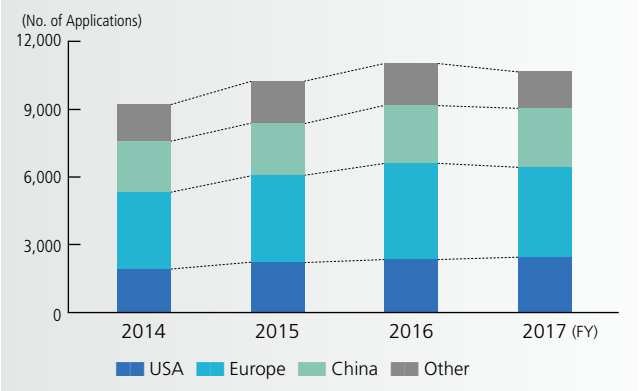
Structure of the Intellectual Property Division

The IP divisions of the Mitsubishi Electric Group include the Head Office IP Division, which is the direct responsibility of the president, and the IP divisions at the Works, R&D centers, and affiliated companies. The activities of each IP division are carried out under the executive officer in charge of IP at each location. The Head Office IP Division formulates strategies for the entire Group, promotes critical projects, coordinates interaction with external agencies including patent offices, and is in charge of IP public relations activities. At the Works, R&D center, and affiliated company level, IP divisions promote individual strategies in line with the Group's overall IP strategies. Through mutual collaboration, these divisions work to link and fuse their activities in an effort to develop more effective initiatives.

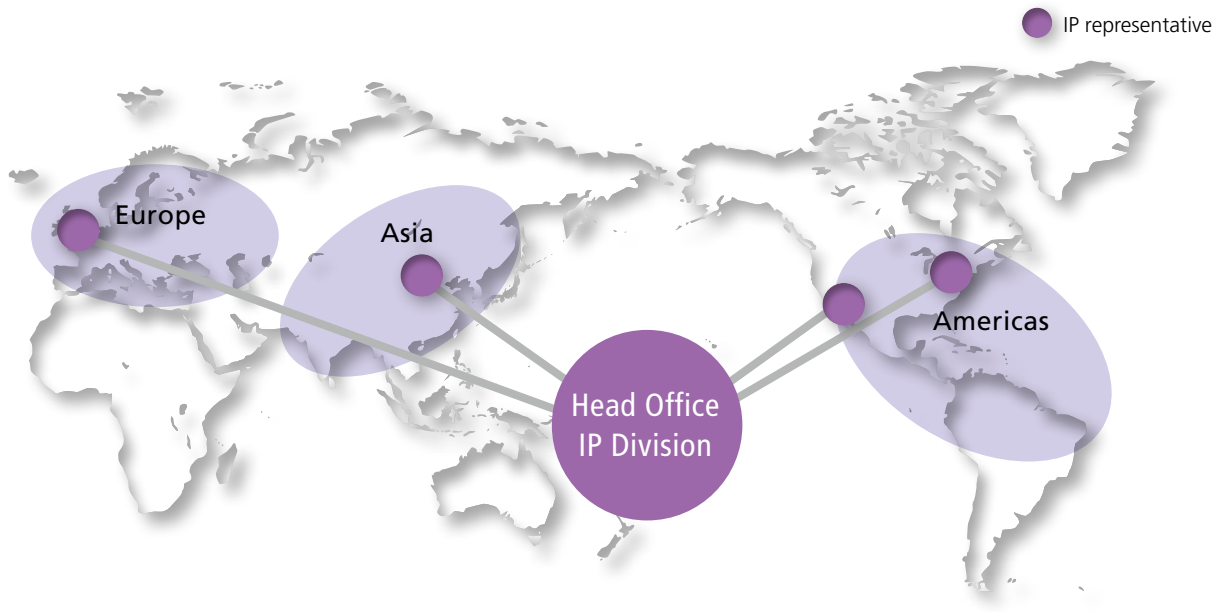
Integrating Business, R&D and IP Activities



Annual Trends in Overseas Patent Applications by the Mitsubishi Electric Group



Further Strengthening Global IP Capabilities



- Protecting products through IP rights
- Acquiring international standard-related patents
- Counterfeit product countermeasures

Global IP Strategy

The Mitsubishi Electric Group identifies critical IP-related themes based on its mainstay businesses and important R&D projects, and is accelerating the globalization of IP activities also by filing patents prior to undertaking business development in emerging countries where an expansion of business opportunities is expected. Furthermore, resident officers are assigned to Mitsubishi Electric sites in the United States, Europe, and China to take charge of IP activities and strengthen the IP capabilities of business offices, R&D centers, and affiliated companies in each country. Through these initiatives, we strive to create a robust global patent network.

IP Strategy for International Standardization

In order to expand business in global markets, the Mitsubishi Electric Group is actively promoting international standardization. Activities to acquire patents that support international standards (e.g., standard essential patents) are openly promoted. As the member of an organization in which patent pools for Digital Broadcasting, MPEG, HEVC and Blu-ray Disc™* collectively control standard essential patents, the IP revenues obtained through the organization are contributing to improvement and growth in business earnings. The Group is also working to increase activities for acquiring patents in competitive fields involving international standards, and promoting IP activities that contribute to increasing product competitiveness and expanding market share.

*Blu-ray Disc™ is a trademark of the Blu-ray Disc Association.

Activities Aimed at Preventing Infringement of the Group's IP Rights

The Mitsubishi Electric Group works diligently to prevent any infringement of its IP rights by other companies. In addition to in-house activities, the Group places particular weight on collaborating with industry organizations while approaching government agencies and other entities in Japan and overseas as a part of a wide range of measures to prevent the counterfeiting of products.

Respecting the IP Rights of Others

The Mitsubishi Electric Group recognizes that the infringement of another company's IP rights has the potential to significantly impair its continued viability as a going concern. The resulting potential impairments include being obliged to pay significant licensing fees, being forced to discontinue manufacturing of a certain product, or other related actions. To prevent the infringement of another company's IP rights, the Group provides education and training—centering on engineers and employees responsible for IP affairs—to raise awareness and instill the utmost respect said rights. At the same time, the Group has put in place a set of rules to facilitate appropriate actions, such as surveying other companies' patent rights at every stage from product development to sales, and ensuring strict adherence to these rules.