

## Research and Development

As the cornerstone of its growth strategy, the Mitsubishi Electric Group will promote short-, medium-, and long-term R&D themes in a balanced manner.

In addition to promoting development toward strengthening current businesses and achieving innovation, the Company is striving to create further value through synergy of technologies and businesses by leveraging the Company's diverse technologies and businesses, while also working to realize sustainable growth through the development of future technologies.

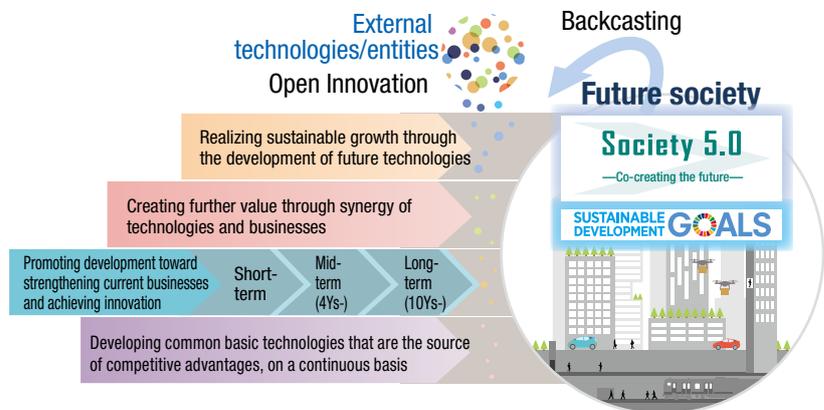
To support these efforts, the Company is developing common basic technologies that are the source of the competitive advantages of the Company's products, on a continuous basis.

Furthermore, the Company will promote enhancement of efficiency of development through proactive utilization of open innovation in collaboration with universities and other external R&D institutions.

During fiscal 2019, the total R&D expenses for the entire Group have amounted to 212.7 billion yen (1% increase compared to the previous fiscal year). Representative achievements are as follows.

### R&D policy

### Well balanced short-, mid- and long-term R&D



Society 5.0: It is contained in the 5th Science and Technology Basic Plan approved by the Government of Japan in Jan. 2016. SDGs: "Sustainable Development Goals" adopted by the United Nations as goals to achieve towards 2030

## Main R&D Achievements in Fiscal 2018 (consolidated results)

### Development of New Dot Forming Technology that Achieves High-precision Three-dimensional Metal Shaping

In recent years, there has been a growing demand for multi-product small-lot production. In order to shorten manufacturing processes and increase design flexibility, application of three-dimensional shaping technologies to metal parts have been spreading in various fields, primarily in the aircraft and automobile manufacturing fields.

The Company has developed a unique dot forming technology that realizes high-precision shaping by combining laser, computer numerical control and computer aided manufacturing CAM<sup>\*1</sup> technologies in 3D printers. The technology produces high-quality three-dimensional parts with few voids at high speed, employing a laser wire DED<sup>\*2</sup> method. With this new technology, the shape accuracy has improved by 60% (in-house comparison) compared to that of conventional consecutive forming technology.

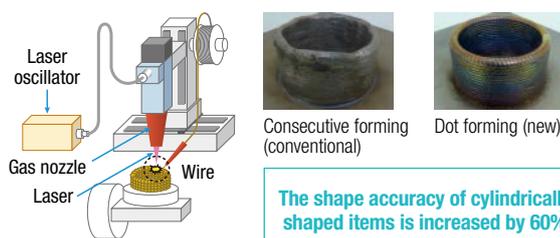
The technology will contribute to greater productivity in a wide range of applications, such as the "near-net" shaping<sup>\*3</sup> of aircraft and automobile parts and build-up repairs.

\*1 Computer Aided Manufacturing: A technology that uses input three-dimensional shape data to perform all production preparations, such as the creation of processing programs, on a computer

\*2 Directed Energy Deposition: An additive-manufacturing process that uses focused thermal energy to fuse materials as they are deposited, and add layer by layer to solidify

\*3 A manufacturing technique to produce the item in near-final form

### Laser Wire DED Type Metal 3D Printer



### Development of Seamless Speech Recognition Technology

Using its proprietary Maisart<sup>\*1</sup> AI technology, the Company developed "Seamless Speech Recognition," the world's first<sup>\*2</sup> technology capable of highly accurate multilingual speech recognition without being informed which language is being spoken. The technology can understand multiple people speaking either the same or different languages simultaneously.

Going forward, the Company will work to further improve the accuracy and applicability of automatic speech recognition in real environments.

\*1 Mitsubishi Electric's AI creates the State-of-the-ART in technology  
Mitsubishi Electric's AI technology brand aimed at making every device smarter

\*2 As of February 13, 2019 (based on the Company's research)

### Seamless Multilingual Speech Recognition

The advertisement features the 'Maisart' logo and a grid of diverse people's faces. Text describes 'End-to-End neural network distinguishes languages and recognizes the meaning of what is spoken'. It lists examples: 'こんにちは Hello', 'Bonjour Bonjour', 'Buon pomeriggio ...'. A callout box states: 'More than 10 languages are recognized with high accuracy'. A bottom banner reads: 'Voice recognition is possible even in situations where it is not known what languages will be spoken by an indefinite large number of users'.