The Mitsubishi Electric Group and the SDGs
—*Solution of social problems by means of autonomous driving technologies*—

The Mitsubishi Electric Group

1. Initiatives to Address the SDGs

As set forth in the corporate strategy, the Mitsubishi Electric Group positions itself to become a "Global, Leading Green Company". As such, we contribute to the realization of a prosperous society that simultaneously achieves "sustainability" and "safety, security and comfort" as an embodiment of the Group's corporate mission. This policy corresponds to what the globally shared goals of the SDGs aim to achieve.

Through the Group's diverse businesses and corporate activities related to the environment, society and governance (ESG), we believe we can make a contribution toward accomplishing the 17 globally shared goals of the SDGs.

However, to contribute further, we need to identify goals to which we are particularly well positioned to contribute.   As a comprehensive electronics manufacturer, we can contribute significantly to Goal 7 "Affordable and clean energy", Goal 11 "Sustainable cities and communities," and Goal 13 "Climate action" are areas that correspond to our vision of becoming a global, leading green company. We will contribute even more to achieving the SDGs by creating value in these areas via technology synergies and business synergies and prioritizing the initiatives we advance.

In these ways, the Mitsubishi Electric Group will integrate the concept of the SDGs into its management strategy and continue to promote company-wide awareness of the SGDs.

As part of this, we now introduce our autonomous-driving technologies, which realize "Safety, security and comfort" and contributes to Goal 11 of the SDGs, "Sustainable cities and communities."

■ **Figure 1: SDGs for the Mitsubishi Electric Group to prioritize**
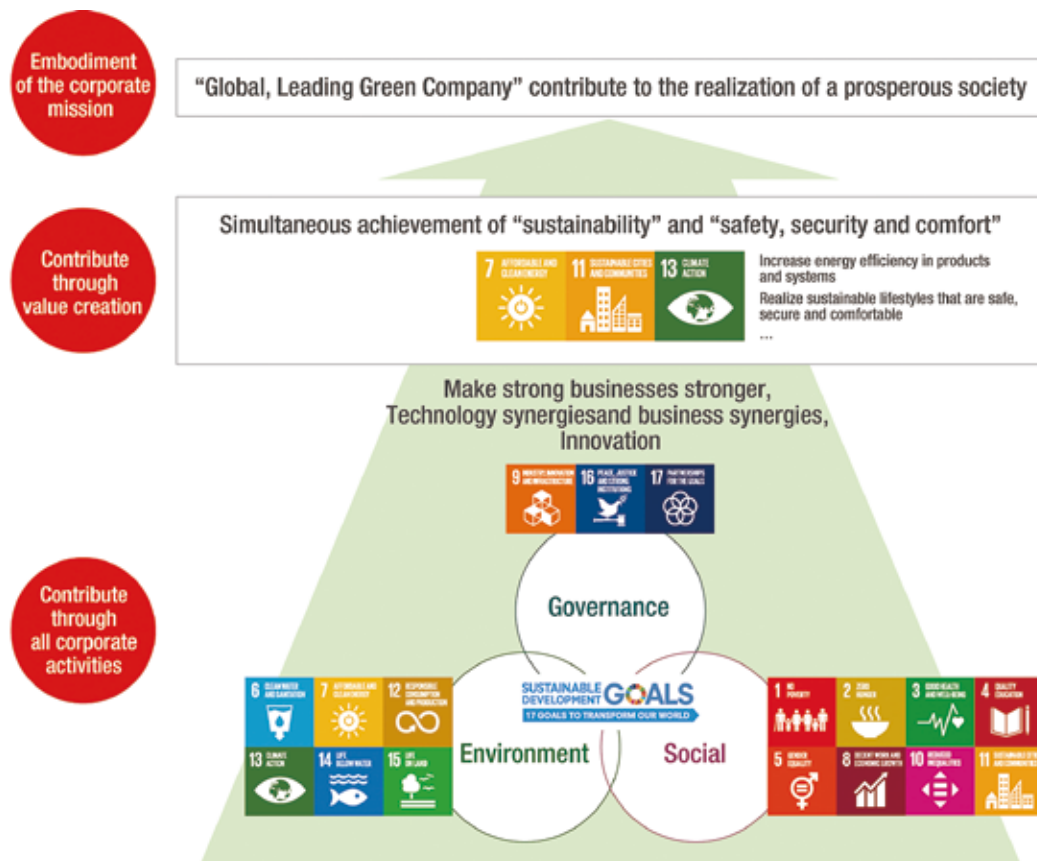
2. Towards the solution of traffic issues via autonomous driving technologies —bringing together core Mitsubishi Electric technologies—

Traffic accidents and traffic congestion are responsible for enormous economic and social losses. In Japan, where a declining birthrate and an aging population are seeing accidents caused by elderly drivers becoming a social problem, these are urgent issues. The Mitsubishi Electric Group is working to realize high-precision autonomous driving systems through the fusion of two technologies: self-sensing driving technologies and network-based driving technologies.

We anticipate that this will realize solutions to societal issues, such as reducing traffic accidents, easing traffic congestion, and improving access to transport in remote areas.

3. Autonomous driving mechanisms and the Mitsubishi Electric Group technologies that support them

3.1 Self-sensing driving technologies

Self-sensing driving technologies will enable vehicles to operate autonomously using a variety of onboard sensors, including cameras, millimeter-wave radar and sonar. Applying sensing technologies fostered in a broad range of fields, the Mitsubishi Electric Group is working to develop new products that assist drivers in recognition, judgment, and vehicle operation.

Mitsubishi Electric will continue to polish these technologies into the future, at the same time as advancing applied development in the area of integrated control systems that will be key to the realization of safer, more secure and more comfortable autonomous driving, with the company's core AI technology Maisart as a central element.
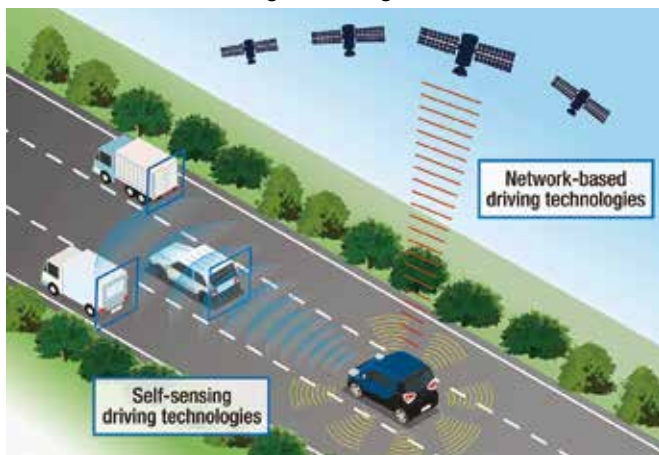
3.2 Network-based driving technologies

Network-based driving technologies are new technologies that seek to enable more precise autonomous vehicle operation by means of cooperation between the vehicle and infrastructure in the surrounding environment. In order to realize these systems, a diverse range of technologies must be integrated, allowing us to make use, apart from the vehicle itself, of systems three-dimensional maps, and intelligent transport systems.

3.3 The Quasi-Zenith Satellite System: Satellites that provide high-precision position data

Three satellites of the Quasi-Zenith Satellite System were launched in 2017. Mitsubishi Electric was responsible for the design and manufacture of this satellite system, which provides high-precision position data services. The use of these services will make it possible to realize autonomous driving in a range of road environments and conditions in which visibility is poor, such as heavy fog or snow. Mitsubishi Electric commenced proving trials of autonomous driving on Japanese expressways from September 2017, and we have demonstrated that the use of high-precision positioning terminals that receive position data signals from the Quasi-Zenith Satellite System makes it possible to identify the position of the subject vehicle at the level of centimeters.

3.4 High-precision 3D maps

Dynamic maps are essential to accurately identifying the position of the subject vehicle on a map. In addition to static data on lanes and road edges, these digital maps include dynamic data that changes moment to moment, such as data on congestion and traffic signals. The Mitsubishi Electric Group is continuing research and testing in this area, and has been commissioned by

■ **Figure 2: Self-sensing driving technologies and Network-based driving technologies**

■ **Figure 3: Onboard sensors and vehicle control technologies**

■ **Figure 4: High-precision positioning data & Road status data**
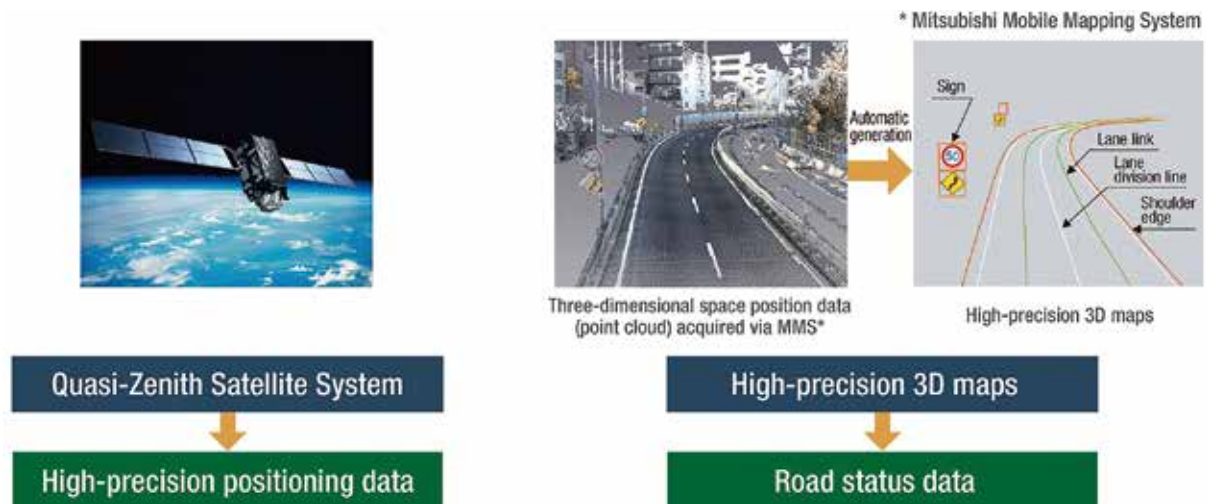
a government agency to conduct and manage large-scale proving trials towards the creation of digital maps. In addition, in June 2017, Mitsubishi Electric joined together with an industrial innovation network, mapping companies, surveying companies, and Japanese automotive manufacturers to launch Dynamic Map Platform Co., Ltd., which is moving ahead with the formulation of data to create a dynamic map platform covering approximately 30,000km of Japanese expressways and vehicle roads.

3.5 Anticipatory data provision

Anticipatory data provision is a system that assists in making advance lane changes, etc. by providing the driver and the vehicle with information that cannot be obtained from the vehicle itself, including data on accidents ahead, data on traffic congestion, and data on traffic regulations (anticipatory data).

Mitsubishi Electric is working towards the practical realization of anticipatory data provision, conducting test course trials in the provision of support for lane changes by providing autonomously operating vehicles with anticipatory data for each lane using road-to-vehicle communication.

3.6 Technological synergy × open innovation: blazing a path to the future

Autonomous driving technologies necessitate the integration of diverse and wide-ranging element technologies. The Mitsubishi Electric Group is advancing initiatives to create innovative technologies, for example by forming project teams across different divisions of the company and promoting open innovation that crosses industry boundaries.

In March 2017, we successfully developed a technology able to efficiently create and modify high-precision 3D maps using AI and Mitsubishi Mobile Mapping System (MMS) technology.

In October 2017, we formed a partnership with Holland's HERE Technologies. By bringing together HERE's global high-precision maps and cloud-based position data services and Mitsubishi Electric's high-precision positioning technologies, our aim is to provide user-friendly position data services.

The Japanese government is seeking to realize fully-autonomous driving with no human input on expressways by 2025. By means of these initiatives, the Mitsubishi Electric Group is contributing to the realization of a society that allows safer, more secure and more comfortable lifestyles.

4. Future Initiatives

In seeking to realize autonomous driving systems, in addition to considering the safety, security and comfort of passengers, we believe that it will also be important to realize vehicle control that is able to reproduce natural driving, operating the vehicle as an experienced driver might. This would further boost the sense of security and the comfort of the passengers.

Given this, Mitsubishi Electric is advancing development that will enable us to integrate self-sensing driving and network-based driving with a high degree of sophistication. We are engaging in a process of trial and error in order to ensure reliability in actual road environments by means of tests on public roads using our experimental vehicles.

Changes in the environment of the domestic and overseas automotive industry are accelerating, and one of the demands on us is to further advance and distinguish driver assist and autonomous driving technologies. Against this background, it is our goal to make our automotive society and even more appealing one through the advanced technologies that only Mitsubishi Electric is able to realize.

In these ways, the Mitsubishi Electric Group will continue to contribute to solving the wide range of social issues targeted by the SDGs, with innovative technologies and services that help realize sustainable society.