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# Engine & Turbocharger Development Center to Accelerate Efficient and Interactive Development of Engines and Turbochargers

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Mitsubishi Heavy Industries  
Engine & Turbocharger, Ltd.

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Mitsubishi Heavy Industries Engine & Turbocharger, Ltd. (MHIET) started as a company controlled by Mitsubishi Heavy Industries, Ltd. (MHI) in July 2016. The company handles engines and turbochargers under the umbrella of Mitsubishi Heavy Industries Forklift, Engine & Turbocharger Holdings, Ltd. (M-FET). At the same time, the Engine & Turbocharger Development Center was established as a virtual organization integrating four technologies: MHIET's engine technology and turbocharger technology, gasoline engine technology owned by UniCarriers Corporation (hereinafter UC) under the umbrella of M-FET and technology owned by the Research & Innovation Center, a research division of MHI.

## 1. Background of establishment of Engine & Turbocharger Development Center

In July 2016, MHIET was established as a company controlled by MHI, handling diesel engines, gas engines and turbochargers under the umbrella of M-FET. On the other hand, M-FET was founded in March 2016, a little earlier than MHIET and owns Global Components Technologies Corporation (hereinafter GCT), which handles gasoline engines and LPG gas engines. MHI also owns the Research & Innovation Center, which has a research division for internal combustion engines. Concurrently with the start of MHIET in July 2016, the Engine & Turbocharger Development Center, a virtual organization, integrating all four technologies described above, was set up to accelerate efficient and integrated development.

## 2. Organization of Engine & Turbocharger Development Center

The divisions of the Engine & Turbocharger Development Center are introduced in this report.

### (1) MHIET

MHIET consists of two divisions, the Engine & Energy Division and Turbocharger Division. The Engine & Energy Division is engaged in the development, manufacturing and sale of diesel engines, gas engines and gasoline engines featuring an output lineup ranging from about 7 kW to 5750 kW. The Turbocharger Division carries out the development, manufacturing and sale of turbochargers for automobile engines and industrial engines. **Figure 1** shows the product lineup.

### (2) GCT

UC, a logistics machinery division under the umbrella of M-FET, conducts the development, manufacturing and sale of industrial vehicles such as forklifts, special vehicles such as transfer cranes and construction vehicles such as skid-steer loaders. Furthermore, GCT under the umbrella of UC carries out the development, manufacturing and sale of gasoline engines, LPG engines and diesel engines of up to about 64kW. **Figure 2** shows some of the products of UC and GCT.



Figure 1 Example of MHIET's product lineups

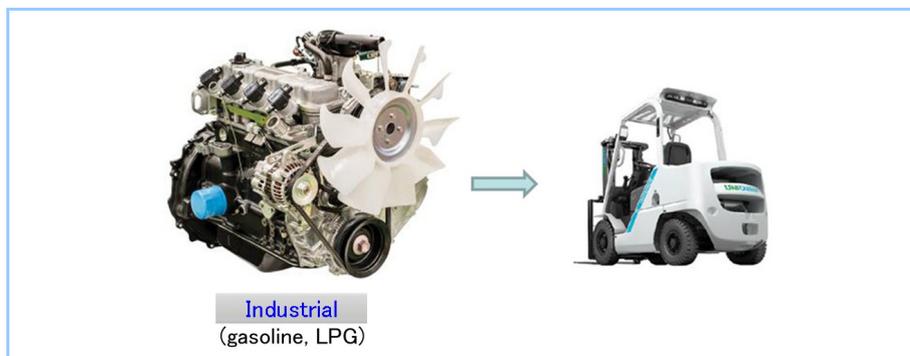


Figure 2 Example of UC and GCT products

(3) MHI Research & Innovation Center

The Research & Innovation Center consists of 10 research divisions for individual technology fields. The Research & Innovation Center has been making efforts to grasp quickly changing social needs and develop new technologies and products toward the next generation based on the technical capabilities MHI has cultivated. The Engine System Center, a project team that crosses research divisions, provides technical support for enhancing the competitiveness of existing products, development support for succeeding products and the development of key technologies toward future engines in close liaison with MHIET, which is in charge of product development. In addition to research and development, the Research & Innovation Center also provides support for all aspects of manufacturing including sales, design, materials, production, services, etc., through the utilization of its own technical and scientific approaches.

(4) Engine & Turbocharger Development Center

Through the establishment of M-FET and MHIET, the development of diesel engines, gas engines and gasoline engines and the development of turbochargers mounted on engines can be conducted within the same organization. Accordingly, the Engine & Turbocharger Development Center was established as a virtual organization integrating the above four technologies. **Figure 3** shows an overview of the organization of the Engine & Turbocharger Development Center.

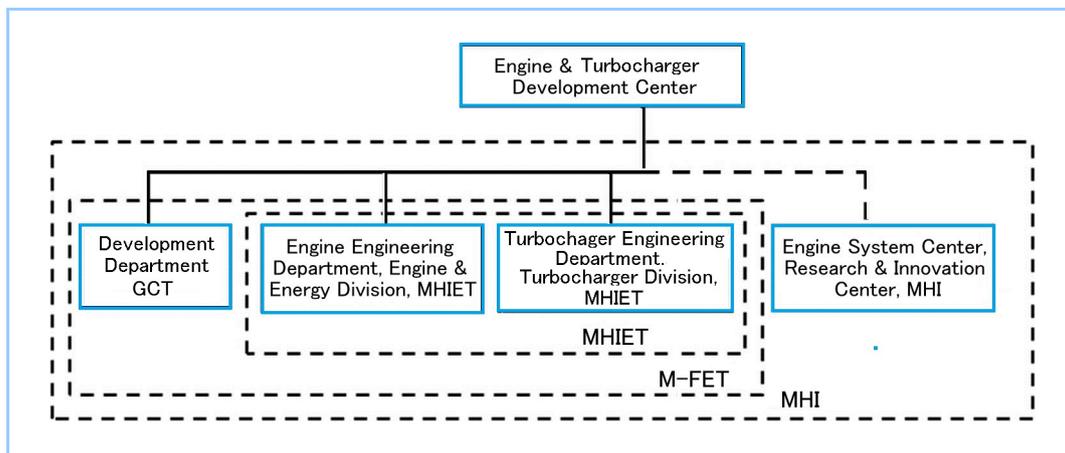


Figure 3 Overview of the Organization of the Engine & Turbocharger Development Center

### 3. Effects of Engine & Turbocharger Development Center

Through the establishment of Engine & Turbocharger Development Center, four strengths can be brought together: MHIET's engines offering a wide output range and holding an edge in terms of diesel engines and gas engines; MHIET's turbochargers featuring the world's top-class performance; GCT's leading gasoline engines and LPG engines for forklifts; and the MHI Research & Innovation Center, which has an advantage in terms of elemental technologies. Through the synergistic effects of the combination of four technologies, it is expected that the acceleration of development by virtue of concentration associated with the optimum allocation of development resources, increased marketability represented by improved performance through complementary strengths, the early generation of of new demand from a technical perspective, etc., will be promoted, and both the engine and energy business and the turbocharger business can be rapidly expanded. Figure 4 shows an image of the synergistic effects of the integration of the four product technologies.

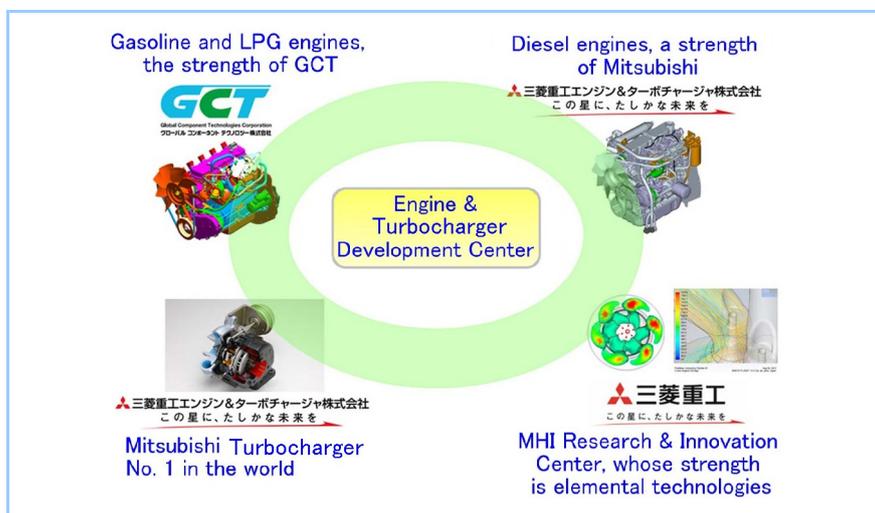


Figure 4 Synergistic effects of Engine & Turbocharger Development Center

### 4. Future development

The Engine & Turbocharger Development Center began operations concurrently with the establishment of MHIET. UC's gasoline engine technology, MHIET's diesel engine and turbocharger technologies, and the technologies in each special field of the MHI Research & Innovation Center, which are the strengths of the individual divisions, are shared, thereby accelerating the development of engines and the horizontal development of technologies. In the future, greater synergistic effects can be expected through the optimization of the development method including the unification of design tools such as 3D-CAD and the construction of a database for the prevention of the recurrence of problems that occurred in the past in each division, and thus we will offer customers attractive and marketable engines.