

Green Forklift Truck and Logistics System of Mitsubishi Nichiyu Forklift Co., Ltd.



Mitsubishi Nichiyu Forklift Co., Ltd.

Nippon Yusoki Co., Ltd. (Nichiyu) and the forklift truck section of Mitsubishi Heavy Industries, Ltd. (MHI) have merged to establish Mitsubishi Nichiyu Forklift Co., Ltd. (MN) on April 1, 2013. With this merger, MN will make advances toward becoming a global leading company as a forklift truck manufacturer, offering a full lineup ranging from electric and engine forklift trucks to logistic systems under a new corporate vision and management policies (Figure 1). Our main sales and production sites are shown in Figure 2.



Figure 1 Corporate philosophy and management policies



Figure 2 Production and sales network

We will establish the world-wide sales and production network, and realize the most efficient production supplies and support.

1. Profiles of former companies

Nichiyu developed Japan's first electric forklift trucks, and expanded its business in small and medium-sized electric forklift trucks and logistic systems focusing on the domestic market. The company has also devoted itself to the development of environmentally-friendly storage and material handling technologies for the improvement of our customers' management and the environment.

The MHI forklift truck section had deployed its business of forklift trucks with small to large-sized engines all over the world, and small electric forklift trucks focusing on Europe and North America. The company has responded to a wide variety of customer needs with high technologies, including the development of an array of key components such as diesel engines and

transmissions.

The major events in the product development history of both companies (Nichiyu: 76 years, MHI forklift truck section: 42 years) are shown in **Figure 3**.

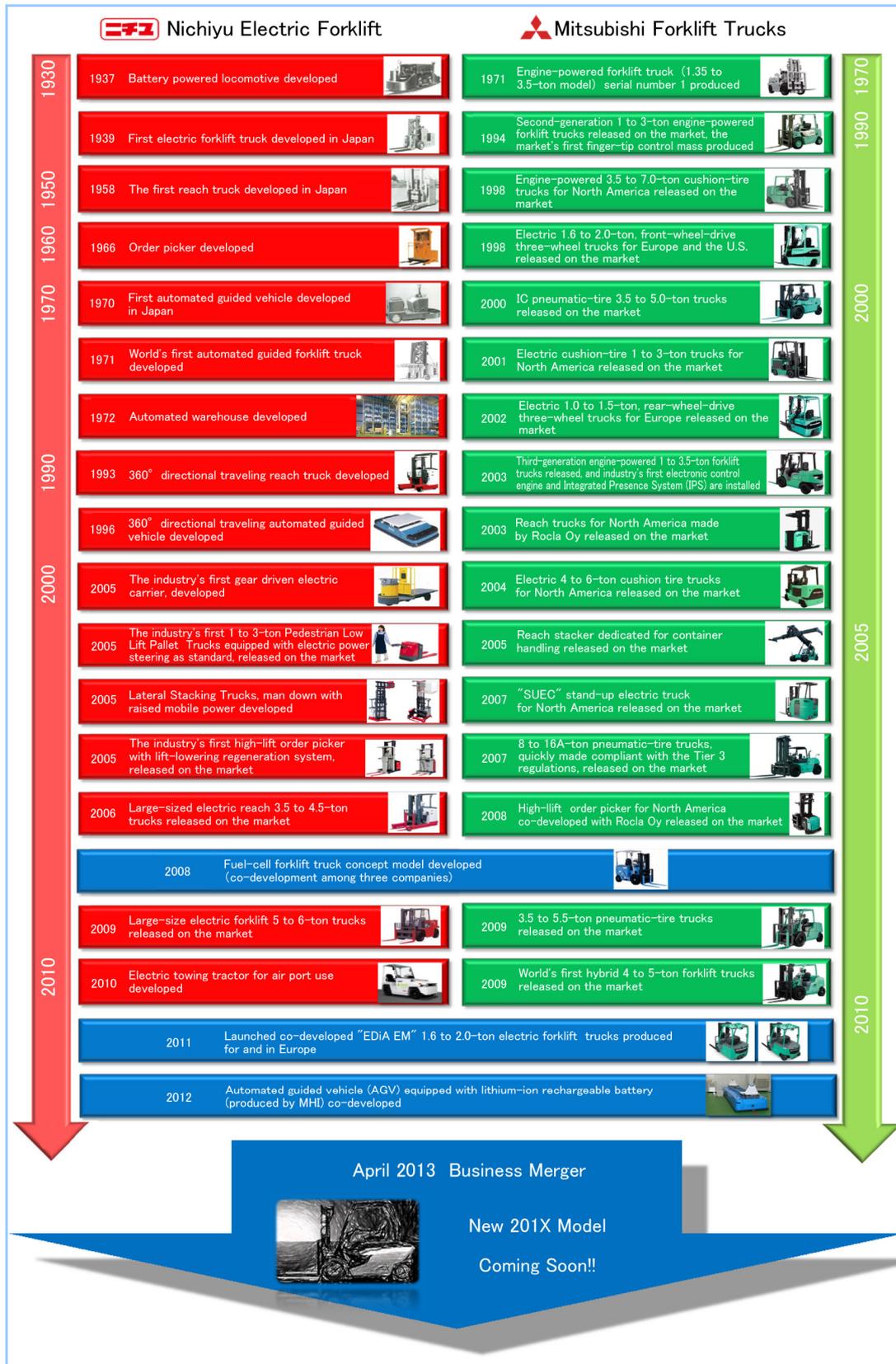


Figure 3 History of product development

2. New challenge as a new company

The following contents introduce the co-development efforts of the two companies and current developments to optimize the synergy effect of the integration in the technical division.

2.1 Co-developed vehicles until now

(1) General-purpose fuel-cell forklift truck (Figure 4)

This truck was co-developed by the three companies of MHI, Nichiyu and JFE Container in 2008.

Features: The world's first portable cassette type hydrogen supply unit developed by JFE Container Co., Ltd. was adopted for supplying hydrogen to the fuel cell. This supply unit makes a large-scale infrastructure installation (such as a hydrogen charging station) unnecessary, and therefore a small-scale user can introduce the truck without difficulties.

(2) Electric forklift trucks (1.6 to 2.0-ton models) produced for and in Europe (Figure 5)

These trucks were co-developed by MHI and Nichiyu, and launched in 2011.

Features: Electrical drive steering using a steer-by-wire system allowed the reduction of steering effort through the employment of a small diameter steering wheel. These trucks were also equipped with an automatic parking brake. (See MHI Technical Review Vol. 49 No. 2 for details.)



Figure 4 Fuel-cell forklift truck

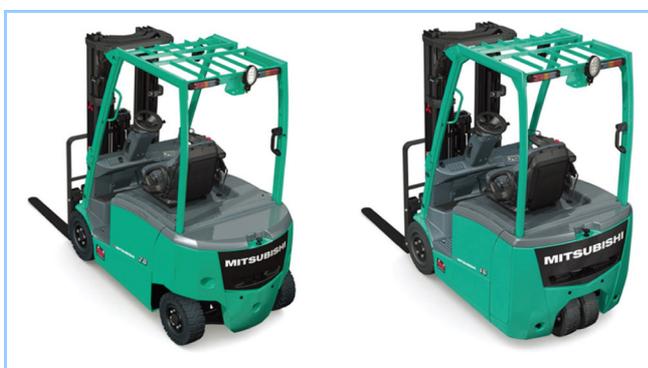


Figure 5 Electric forklift trucks (1.6 to 2.0-ton models) produced for and in Europe

(3) Automated Guided Vehicle (AGV) equipped with lithium-ion rechargeable battery (produced by MHI) (Figure 6)

This vehicle was co-developed by MHI and Nichiyu, and launched in 2012.

Features: Automatically inductive-charged, 24-hour-operative and maintenance-free AGV



Figure 6 Automated Guided Vehicle (AGV) equipped with lithium-ion rechargeable battery (produced by MHI)

- (4) Counterbalanced electric forklift truck concept model equipped with lithium-ion rechargeable battery (produced by MHI) (**Figure 7**)

This truck was co-developed by MHI and Nichiyu, and exhibited as a demonstration at Logis-Tech Tokyo 2012.

Features: This forklift truck is a smart-truck with a high-performance lithium-ion rechargeable battery, which allows flexible fast charging and discharging. This truck would realize energy saving and the reduction of carbon emissions, allowing advanced energy management. This truck is also capable of supplying electricity as an additional power source to a home power generation unit. The charging system is also compliant with the CHAdeMO integrated fast-charger standard, which has been adopted by domestic EV manufacturers.



Figure 7 Forklift truck equipped with lithium-ion rechargeable battery (produced by MHI) (concept demonstration model)

2.2 Vehicle development in the new company

The first truck developed after the merger is the electric carrier, which is mounted with a lithium-ion rechargeable battery (produced by MHI), and is now in operation at the Tsukiji Market. (**Figure 8 and 9**)

Features: This carrier has a higher hill-climbing speed compared to conventional carriers, reduces electrical energy consumption, and is maintenance free.

This model was co-developed from the time before the merger. The components were developed sectionally in each company before the merger. After the merger, however, total optimization of the carrier could be carried out without sectionalism, and the development speed was also accelerated through the integration of the project members.

This is one example of the effects of the merger, and the same kind of major changes will happen in all of the new company's products.

In the new company, we will proceed with the development of forklift trucks and logistics that will be environmentally-friendly, and will satisfy all of our customers around the world by integrating the former companies' technologies and expertise of the engine and electric forklift truck specialists, MHI and Nichiyu.



Figure 8 Electric carrier equipped with lithium-ion rechargeable battery (produced by MHI)



Figure 9 Lithium-ion rechargeable battery pack