The railway is a means of mass transportation of passengers and freight. A core part of social infrastructure, its remit has always been to operate reliably, available, maintainably, safely and punctually. As trains began to carry more passengers than freight, so the source of their engine power changed from steam to diesel and on to electricity. Likewise, air brakes that use the power of compressed air to stop trains safely and reliably have also evolved into vacuum brakes, straight air brakes, automatic air brakes, automatic electromagnetic air brakes, electro-pneumatic straight air brakes and electric command brakes.

Automatic air brakes have been with us since the age of the steam locomotive. The brakes derive their power from compressed air produced by the locomotive’s compressor. Compressed air is distributed through a brake pipe in all train cars, which supplies compressed air via air valves into air reservoirs in each car. When the pressure in the brake pipe is reduced, the compressed air in the car’s air reservoir is sent into the brake cylinder, the tread brake unit and calipers, providing the power to apply the brakes and stop the car. Because the brake command is a reduction in pressure, any air leakage caused by damage to the brake pipe results in the automatic application of brakes in each train car. Even in a decoupling, the whole train will stop safely and reliably.

The invention of this automatic air braking system highly increased railway safety. Various new brakes with electric brakes or with regenerative brakes have been developed in sequence, and brake command has been improved from compressed air to electric. However, this concept of automatic air braking system is still used as emergency brakes in almost all rolling stock because of its excellent reliability.

MHI and Mitsubishi Electric started their air brake business for steam locomotives in 1924 in response to a government request for domestic production. It now supports the backbone of Japan’s railway network, from the E5 bullet train on the Tohoku Shinkansen all the way through to the N700A bullet train on the Tokaido Shinkansen and the westerly Sanyo and Kyushu Shinkansen, and has grown its share of the domestic air brake market to 50%.

MHI provides the technology that allows passengers to get on and off trains at predetermined points on platforms, a feat of braking precision that is taken for granted in Japan. It is no exaggeration to say that MHI has been intimately involved with the entire history of air brakes in Japan.

The simplicity and stability of air brakes continue to stop rolling stock safely.
Supporting Urban Infrastructure with Clockwork Precision and Reliability

Smooth braking control ensures passenger convenience, safety and comfort

The aluminum air circuit plate inside a brake control unit. The brakes are powered by the compressed air that flows through its intricately arranged paths.

Supporting Urban Infrastructure with Clockwork Precision and Reliability

The original role of air brake equipment was to stop trains safely and reliably. However, a higher level of performance is now required of newer brakes. The smooth operation of transit systems depends on the ever more efficient stopping and immediate restarting of rolling stock.

For example, deceleration control is evolving on a daily basis as a result of the improvements in the performance, reliability and endurance of all air brake equipment products. Enhanced deceleration control enables rapid braking at high speeds, thereby increasing the number of trains that can be operated.

To help passengers enjoy a pleasant and safe journey, MHI has reduced noise and vibration and also developed brakes that allow trains to swiftly resume their service after stopping due to a system failure.

The simplification of train maintenance also contributes to the improvement of the utilization rate of trains.

Thus, smoother braking supports the bedrock of transport infrastructure by safeguarding efficient and punctual travel.
A New Chapter for Brakes Begins

Advanced brake equipment created by collaborative R&D

MHI has been continuously responding to topical brake requirements for more than 100 years. It has applied its monodzukuri (manufacturing) R&D sophistication to not just railways, but also to land, sea, air and even space. Mihara is the development base for air brake equipment and other mechanical parts for railway rolling stock. The Transport Systems Center (including Hiroshima R&D Center and various other R&D centers within the Technology & Innovation Headquarters) closely supports the research, development and evaluation in technical fields such as materials, analysis, simulation and quality engineering. This R&D expertise is timely channeled into new products under practical collaboration. The air brake equipment for automated people movers (APMs) is also subjected to performance tests and pre-shipment inspections on MHI’s own test tracks.

In addition to air brakes, this monodzukuri-oriented R&D climate has spawned the design and development of many other advanced products, such as the scroll compressor that requires high-grade machining technology, technologically enhanced air pneumatic pressure calipers with improved reliability and maintainability and train car body inclining equipment with electromagnetic valves that succeed in reducing car weight thanks to optimized air pressure control.
Mihara Machinery Works was established in 1943 as a dedicated factory (called Mihara Rolling Stock Works) for steam locomotives and air brakes for rolling stock that had been produced at Kobe Shipyard since 1924. Since then it has not only designed and developed countless new products, but also retained a production structure capable of maintaining a stable supply of parts to support the average rolling stock life of 30 years.

More recently, MHI has been implementing production system innovation to advance quality by improving the work environment to allow employees to better concentrate on their work.

Quality has also been improved by an increased awareness on the part of both employees and suppliers that the air brakes whose parts they are manufacturing are the cornerstone of the safety of transportation systems around the world.

In 1949 MHI started to supply overseas commercial markets with air brakes, brake valves, control valves, etc., for the steam locomotives that were produced by Mihara Machinery Works for Thailand. It contributed to the building of overseas local infrastructure by exporting air brake equipment for the Taiwan High Speed Rail in 2007, and for APMs of airport transit systems and of urban areas in North America, South East Asia and the Middle East.

MHI’s air brake equipment continues to enrich the lives of people around the world. Its air brake technology has been handed down over the years ever since 1924, and this intergenerational succession is on track to continue unbroken into the future.