Freight rail is technology.

From the first locomotive that helped build our nation nearly two hundred years ago to the artificial intelligence integrated into today’s modern operations, America’s freight railroads continue to innovate to solve current transportation challenges while anticipating those of tomorrow.

Integrated teams of data scientists, software developers, and engineers play a pivotal role in freight rail’s continuous transformation. They develop and apply cutting-edge technology across every facet of the freight rail network. Smart sensors continually monitor the health of rail infrastructure and equipment, drones and other tools empower employees, advanced software provides clear customer insights, fuel management systems reduce emissions, and advancements in first responder training and grade crossing safety help safeguard communities.

Importantly, sustained railroad infrastructure investment, adoption of new inspection technologies, the development of better track components, and advancements in inspection and maintenance practices have decreased two of the leading causes of accidents: track and equipment failures. Proactive maintenance helps keep the rail network safe, which drives better service and reliability. Class I railroads’ mainline train accident rate is down 48% since 2000. Additionally, the equipment-caused accident rate is down 21% since 2000 and 2022 marked the lowest-ever rate of track-related accidents.

This amalgamation of advanced technologies positions America’s freight railroads at the forefront of the future, ensuring they remain adaptable and resilient in addressing the constantly evolving needs of customers and consumers.
Keeping Infrastructure & Equipment Safe
Wheel Profile Detectors (WPDs) use lasers and optical scanning to measure moving train wheel profiles, helping identify wheels that may need removal. Hot bearing detectors and wheel impact load detectors placed along the right-of-way identify overheating bearings and wheels heavily pounding on tracks, allowing railroads to promptly address issues and reduce broken rails and failures. Ultrasound technology and Automated Track Inspection (ATI) systems with lasers and cameras on locomotives, along with track inspection vehicles, enhance overall safety by proactively detecting flaws in tracks and ties.

Empowering Employees
The rail industry is one of America's safest workplaces, with lower employee injury rates than most other industries. Advanced training centers with simulators and virtual reality enable employees to practice real-life skills in a safe, rigorous and controlled environment, while innovations like remote control locomotives and high-definition cameras allow employees to perform their jobs effectively from a distance where possible, keeping them out of harm's way.

Meeting Customer Needs
Over 630 North American freight railroads ensure safe and sustainable transportation through advanced software, mobile apps, and tools that optimize efficiency and communication. Like air traffic control systems, dispatching software analyzes system-wide train schedules, speed restrictions, and crew schedules, reevaluating train management plans every two minutes. This allows dispatchers to respond in near real-time to changing conditions, including delays, weather events and unplanned maintenance work.

Specialized tools, including APIs integrated into customer platforms, provide detailed insights, from the precise location of products on the rail network to information about rail car availability and ordering.

Reducing Emissions
With freight demand expected to surge by 30% by 2040, railroads are intensifying efforts to combat climate change through strategic investments and technology adoption. As the most fuel-efficient land freight option — three to four times more efficient than trucks — railroads continue their commitment to emission reduction. Innovative technologies like locomotive fuel management and anti-idling systems contribute to improved fuel efficiency, with modern locomotives showing up to a 14% enhancement. Railroads also focus on minimizing emissions and community impact in rail yards through streamlined processes and operational adjustments.
Safeguarding Communities

The freight rail industry extends its safety commitment beyond tracks, integrating technology to enhance community safety. Initiatives include training tens of thousands of first responders each year and developing the AskRail app, which provides hazmat information to responders. To help keep the public safe near tracks, railroads have worked with federal regulators and private technology companies to improve safety around railroad tracks and rights of way, including through the Waze app and smart crossing signals. Thanks to efforts like these, collisions and incidents involving pedestrians, vehicles and trains have declined in recent years.

Protecting Digital Networks

For nearly two decades, the nation’s freight and passenger railroads have collaborated with government agencies, security, law enforcement, and intelligence professionals to monitor the extensive 140,000-mile rail network, leveraging various forms of technology to identify potential physical and digital threats.

Moving Forward

MxV Rail and Railinc, two AAR subsidiaries, are enhancing safety and efficiency in rail operations. MxV Rail is the premier rail research and testing facility, driving innovation in emerging technologies, while Railinc provides pivotal IT services and real-time data to North America’s railroads. These subsidiaries’ scientists, researchers, technologists and transportation experts are moving freight rail into the future.