



In rail safety, the AI bottleneck isn't the algorithm: it's the evidence

Railway electronics are becoming more complex and software-defined, and suppliers are exploring where AI can help. But rail certification runs on determinism and verifiability, while AI is statistical by nature. At InnoTrans 2026, international group Elemaster argues the real gap isn't the algorithm, it's the testing infrastructure needed to prove AI actually works. And that is why owning the physical chain of verification is critical.

Rail vehicles and infrastructure are absorbing more electronics every generation: safety functions, energy management, connectivity, data processing and control systems that must work reliably for decades, not years. These systems have to be innovative, but also safe, verifiable, industrialisable and maintainable over rail's unusually long lifecycles. Such a combination is pushing suppliers to rethink how they design, test and support what they build.



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That tension is sharpest around artificial intelligence. Rail certification frameworks, as IRIS, EN 50129 and EN 50657/50716, are built on determinism: a system should behave the same way, every time, under a given input. AI components, by contrast, are statistical by nature. In practice, that means artificial intelligence will enter the railway at the speed at which it can be verified, and verifying a system that doesn't answer the same way twice by design demands a different kind of testing.

Elemaster, an international engineering and manufacturing group headquartered in Italy with sites in eight countries across four continents, is one of the companies positioning itself around this shift. Hardware and software design work is carried out both from its Italian base and from the Group's site in Ulm, Germany, feeding into a chain that also covers PCB manufacturing, industrialisation, production and repair. In 2025, the Railway & Transport segment accounted for 28.2% of the Group's global revenue, with technologies deployed across five continents.

Rail has been part of the Group's work for years, through Eletech, the Head of the International Design Centres, R&D division of the Elemaster Group. Testability, in Eletech's approach, isn't verified at the end of a project, it's built in from the start. The flagship case is the Gap Hazard Detection System, a SIL3 control unit under development to detect a person trapped in the risk zone between train and platform and flag the danger in time: a redundant, dual-channel architecture backed by FMEA/FTA analysis, static analysis, unit testing, code coverage and a dedicated Hardware-in-the-Loop test bench built to reproduce different fault scenarios.

That same rigour continues after a product ships. In 2026, Elemaster extended its chain into the phases after production by integrating CR&C, acquired earlier in the year and now part of the Group's Repair Centre. Built on more than 40 years of repair and remanufacturing experience across telecommunications, energy and industrial electronics, the centre handles more than 25,000 units a year, applying testing know-how from development to trace the root cause of faults and confirm, once repair is complete, that a unit is fully restored. It also manages component obsolescence, which is a sensitive issue in rail, where equipment is designed to stay in service for decades.

When it comes to artificial intelligence, Elemaster's position is that, in safety-critical rail, the limiting factor for AI adoption isn't the algorithm, it's the evidence. Owning the physical chain of verification means owning the infrastructure that can generate and structure that evidence.

Today, the Group is moving from studying that problem to designing an approach to it: strengthening testing and repair, where the evidence already exists, rather than operating the railway system itself, where verification standards are still maturing. Eletest, its Automatic Test Equipment platform engineered and certified for SIL-rated boards, already applies AI analytics to test and signal-integrity data, pairing certified SIL testing with AI-driven diagnostics for railway maintenance, overhaul and manufacturing.

Elemaster will present this approach at InnoTrans 2026, the industry's main trade fair for transport technology, running in Berlin from 22 to 25 September (Stand 300, Hall 27).



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