



## KEN ERICKSON INNOVATION AWARD (2022) ENTRIES

PROJECT: **Train Examination System (TRES)**

ENTRANT: **Future Maintenance Technologies**

### **Summary:**

Future Maintenance Technologies (FMT) is an Australian company focused on developing innovative solutions that leverage robotics and artificial intelligence to automate industrial activities.

FMT has developed the Train Examination System (TRES), which is an autonomous inspection robot for rollingstock. This novel solution uses state-of-the-art robotics and proprietary sensor technology to conduct autonomous inspections of rail assets.

TRES offers a unique approach for automating underframe train inspections that requires no civil work or modification to the Maintenance Facilities. It is also adaptable to other transport assets in different industries.

To view TRES in action, please [CLICK HERE \(VIDEO LINK\)](#)

TRES improves safety, streamlines operations, and reduces overall lifecycle cost - making it a valuable strategic investment for rail clients looking to optimize their maintenance operations.

### **Key objectives:**

The main objectives of TRES are to provide

- consistent quality maintenance through repeatability and accuracy of data,
- streamline operations for efficiency,
- and considerably improve safety.

### **Unique design:**

TRES is a novel inspection platform that has proven the capability of performing dynamic inspections of train components in their true environment. It brings together artificial intelligence and robotics with the ability to add complex activities over time into a fully automated mobile solution.

The robot is designed with FMT's proprietary sensor kit that performs inspections from within the maintenance pits and around the train using the latest Light Detection & Ranging (LiDAR), Laser and Optical technology. No civil work or modification to the Maintenance Facilities is required. It has a selection of pre-built inspections including measuring and profiling wheels (a time consuming inspection that often results in inconsistent data) as well as the ability to add custom inspections. It also allows other maintenance works to continue simultaneously on the train.

### **Industry Challenges:**

TRES focuses on addressing the following industry challenges:

- Increasing demand for passenger rail transport places **stress on existing maintenance facilities** as infrastructure grows and existing rolling stock ages. Some competing methods to address this issue include gantries which provides fixed inspections, however, require large infrastructure investments - **FMTs platforms are mobile systems and do not require**

extensive infrastructure changes to be implemented. This reduces time for implementation and overall lifecycle costs. Additionally, multiple robots can be deployed to avoid bottlenecks and scalability issues found in typical fixed infrastructure inspection solutions.

- **Ongoing skilled labour shortage and inflationary pressure on labour costs.** - Transitioning some of the tasks to an automated capability that compliments existing skilled labour is an effective way to protect the business and ensure its long-term sustainability.
- **Employee exposure to hazardous environments** - Delegating tasks to be performed in a hazardous environment (e.g., around high voltage electrical power, in confined spaces, etc.) to an automated workforce is one of the most effective risk controls to reduce exposure.
- **Inconsistencies in measurement data** - Using artificial intelligence and machine learning to capture data with a high degree of accuracy (<1mm) and repeatability

#### ***Overcoming difficulties:***

A few challenges that FMT had to overcome through this project were:

- **Developing an autonomous navigation system in an industrial setting.** FMT was able to create autonomous navigation through the maintenance pit as well as automated movement of the robot arm in the complex underframe environment.
- **Developing algorithms using a combination of sensors to detect, classify and measure components to the required accuracy:** FMT used rapid prototyping methods to develop and trial machine learning algorithms within 3 months.
- **Manufacturing during covid (supply chain issues):** FMT sourced local suppliers for manufacturing to minimise supply chain risks.
- **Finding an organisation willing to trial** – Downer combined 3 train fleets into a single maintenance facility putting a strain on their maintenance resources and train depot movements which resulted in their willingness to try new technology to alleviate these pressures. FMT successfully trialled TRES through Downer in Dec 2020 - April 2021.

#### ***Contribution / Impact to rail:***

A key objective for TRES is to work synonymously with skilled workforce to enhance their capabilities. TRES focuses on capturing consistent and accurate data autonomously, allowing skilled workforce to focus on making the critical maintenance decisions. This in turn allows organisations to achieve more throughput in the maintenance depot to keep up with availability demands. In addition, it integrates with the customer's maintenance management system through FMT Insight's Platform to identify faults and raise corrective maintenance work orders. **The trial through Downer estimated that 30% of routine inspection tasks can be automated with TRES.**

Some of the commercial benefits of TRES are highlighted below:

##### Safety:

- Reduction of personnel at dangerous or risky situations during inspections
- Reduced product safety risk due to better quality of data.

##### Systems Assurance:

- Ensures that all Rolling Stock measurements are performed with high accuracy and repeatability
- Recording of all historical data that can be interrogated without manual handling ensuring ease of access and data integrity.

##### Operations Optimisation:

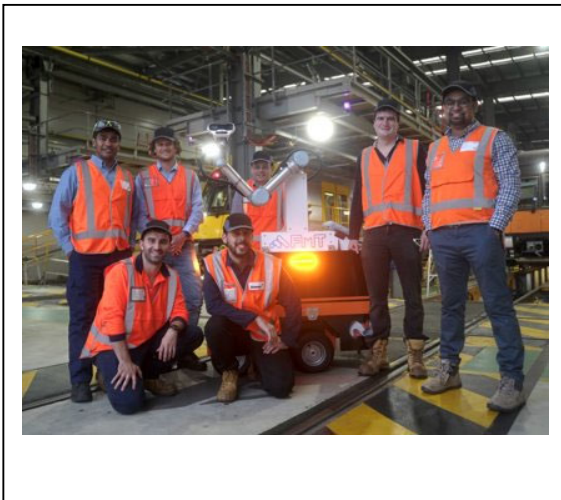
- Detection of Infrastructure & Rolling Stock faults before failures - **minimises downtime and corrective maintenance costs**

- Overall reduction of tasks to be performed inside the maintenance shed - **leads to additional capacity and increased resilience**
- Reduction of downtime of Trains - **unlocks opportunities to provide more Trains to the end customer (ad-hoc availability)**
- Automation of repetitive labour-intensive inspection tasks – **minimises inconsistencies and labour cost**
- Automated data analytics and inspection history through FMT’s Insight Platform App – **Optimised management of key-subsystems**

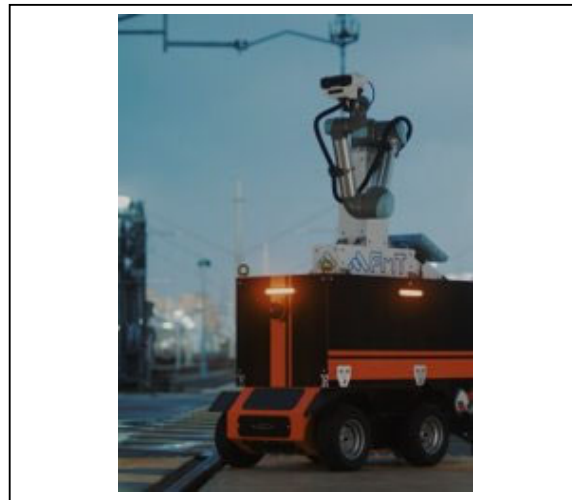
***Degree of innovation in rail aspects:***

TRES represents a high degree of innovation in the rail industry due to its unique approach to automating underframe train inspections. It does not require any civil work or modification to existing Maintenance Facilities, making it a versatile and adaptable solution. TRES’s sensor technology has been developed specifically for the global rail industry however its capability can easily extend to other transport assets in industries such as mining and freight.

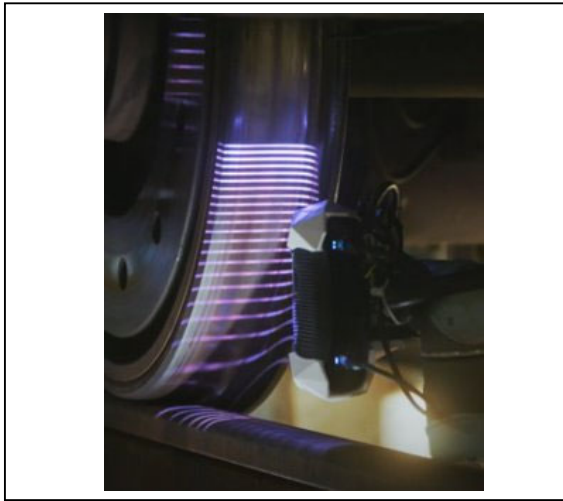
TRES is delivered as a managed service which includes implementation, data analytics and support. This holistic and innovative technology lends itself to high quality inspection, lowered obsolescence risk, adaptability to future operations changes and scalability for additional fleets. This makes TRES a highly sought candidate for future asset management, inspection, and maintenance activities in the rail industry.



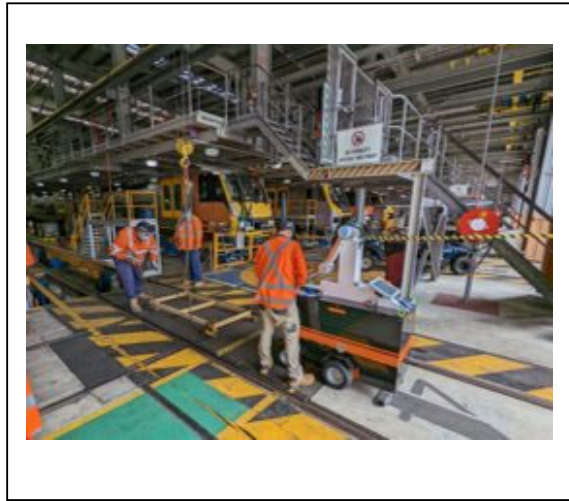
[FMT team with TRES robot]



[TRES robot]



*[TRES robot performing inspection]*



*[TRES robot during Trial at Downer]*