4AI Systems

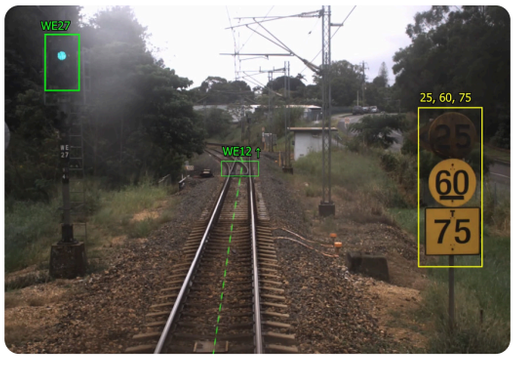
Front of Train Event Recording

Horus module for the recording and preservation of train control and performance data.

INTRODUCTION TO HORUS

4AI Systems' forward-facing perception system called Horus collects data from multiple sensors including cameras, navigation systems, accelerometers, radar and more. This data is fused onboard in real-time to create a situational picture. This picture is then compared to the reference infrastructure data for each line to identify any differences.

The system may identify previously learned objects or alert a train operator that an unidentifiable object or hazard on the track has been detected. Horus has many capabilities that may apply to any vehicle that travels on a rail track, including rail event recording.



RAIL EVENT RECORDING

Rail event recording is the process of logging specific controls, control performance, and other onboard systems. Train event recorders log data types such as train location, time, speed, direction of travel, brake commands, automatic train control data, and operational commands, among other recorded information.

Event recording is necessary for capturing key data for the investigation of train or operational incidents. Without a dedicated train event recorder, determining the sequence of events leading up to a rail-related incident can be quite difficult. With modern technology available, there are many forms and configurations in which an event recording solution can be built per application. The issue is procuring and maintaining these (usually) independent systems which may require more capital. In this regard, a solution that offers a more integrated approach can provide an always-on device and reduce the need for specialised maintenance.

HORUS FOR EVENT RECORDING

As Horus captures, processes, records and stores data, the system can be configured to interface with onboard hardware and software to act as an event recorder. This is a powerful add-on, software-only application for rail operators looking to complement their existing Horus application. The Horus onboard computer can even be built to crash worthiness standards. Overall, Horus can be configured as a high-grade event recording system and becomes an ideal solution for network operators who require a cost-effective event recorder, without the need for another specialised onboard device.

By centralising and logging data from Horus sensors, driver and train performance, as well as onboard controls, operators have greater awareness of events and occurrences onboard their trains. Collected data is configurable to an operator's business needs and any further Horus applications. All system log files, location and speed data, camera imagery, accelerometer, and navigation sensor data can be structured into an event sequence file that can be replayed for analysis and assessment, or archived as required. This data can also be encrypted for security purposes.

CORE BENEFITS

+ **Event replay:** Footage from Horus sensors (and other onboard systems as configured) can be played back in real-time to assist in back-end analytical processing.
+ **Crashworthiness:** The Horus onboard computer can be built to crash worthiness standards if required.
+ **Built for rail:** All system components are rail regulatory, ruggedised standards or as per a Rail Infrastructure Maintainer's requirements.
+ **One device, many applications:** One powerful hardware solution allows many parallel software applications to be operated with no more equipment being necessarily required.
+ **Communicate event information in minutes, not hours:** By linking communications functionality to a Horus system, selected information can be communicated to network operations as required. This enables faster response times and the ability to intervene in developing adverse situations.
+ **Configurable:** Event recording can continue post the event to capture information surrounding an incident. This can be configured to each applications' requirements.
+ **Rail vehicle agnostic:** Event recording can be used on any rail network, including passenger, freight, and specialty or rail work vehicles.

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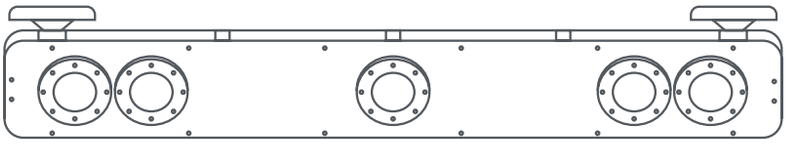
REAL-TIME DETECTION OF OBJECTS UP TO 2000M AHEAD

TRACK · SIGNALS · SIGNS · WORKERS · PEOPLE · ANIMALS · VEHICLES

SENSORBAR AND SUPPORTED SENSORS



SB HORUS SENSORBAR

COLOUR CAMERA · THERMAL CAMERA · GPS · INERTIAL NAVIGATION · RADAR

HORUS PROCESSING PIPELINE

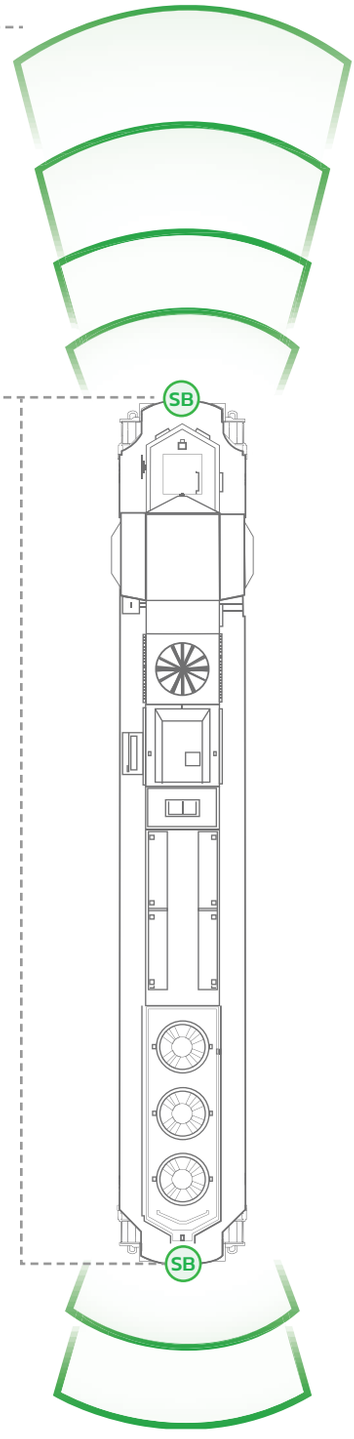
Detection
Using multiple sensors to understand the environment around the locomotive.

Localisation
Using what's measured to create a detailed localisation map.

Awareness
Interpreting the real-time virtual 3D environment around the locomotive for hazards, differences or anomalies.

Dynamics
Calculating optimal driving conditions within movement authorities given the infrastructure's condition, environmental conditions, and the train's dynamic characteristics.

Monitoring
Continuous checks are run to ensure the train is operating within its authority, and that the locomotive is operating normally.



ABOUT 4AI SYSTEMS

4AI Systems was founded in 2021 as a subsidiary company of 4Tel Pty Ltd, drawing on 25 years of experience in delivering industry-leading solutions to the rail industry. 4AI Systems builds machine learning vision systems that can empower people and organisations to make better, situationally aware, data-driven decisions for safer and more efficient rail operations. Based in Australia and the United States, we bring a global perspective to everything we do.

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