GROUND TRANSPORTATION SYSTEMS

Intelligent Train
THALES INTELLIGENT TRAIN

**INTRODUCTION**

Intelligent Train is a decision support, asset performance and monitoring solution that enables passenger and freight operators to evaluate the condition and performance of their rolling stock assets remotely in real-time.

Intelligent Train monitors the key on-board systems including the Thales European Train Control System OnBoard System (ETCS OBS) and incident recorder and, where necessary, additional sensors can be fitted.

Thales’s approach provides an open, proven and robust solution that conforms to all the relevant industry standards using commercially off-the-shelf (COTS) products. This provides real benefits to the fleet operator through flexibility, user-friendliness and scalability.

Intelligent Train also reports on an infrastructure asset’s condition and the quality of communications signals (e.g. ETCS Eurobalise and 3G/4G) which would be passed to the infrastructure manager for maintenance planning.

Intelligent Train enables comprehensive analysis of on-board systems and failure prediction, leading to a more reliable railway.

**TYPICAL BENEFITS**

The Intelligent Train solution is flexible and easily configurable to enable individual teams or individual users to have a user interface designed specifically for their needs, prioritising the information in a preferred or familiar layout that they need for their role.

**OPERATIONS CONTROL**

Operations control can at any time see the location of any vehicle. The solution displays the train position on Google maps. Operations Control receive alarms and alerts if the onboard systems detects a degradation in performance or condition out of predefined tolerances. This information helps the engineering teams determine the best course of action. The alarm and alert system enables any user to subscribe to its service, defining the type of alarm, the assets of interest, the time of their shift and the method of delivery (SMS text, e-mail, etc).

This enables all key stakeholders in the organisation, together with associated escalations, to be notified of significant incidents effecting operations as they occur.

**FLEET ENGINEERS**

The on duty fleet engineer subscribes to the alarm system and is immediately on hand to assist Operations Control in the event of incidents that require their assistance. Fleet engineers receive alerts that relate to detected degradation patterns that are not yet significant enough to impact operations control, but that merit maintenance attention. Interventions are then planned in relation to the operational plan to maximise asset availability. The system maintains a complete history of all changes of data, alarms, alerts and events for all vehicles and has a very sophisticated storage subsystem that compresses the data by up to 98% to enable large volumes of historic data to be held for future analysis, trending and comparisons.

Data compression algorithms of this nature are a further illustration of the benefits of Thales’s approach of basing the solution on industry standard COTS products. The fleet engineers analyse the historical data and compare the performance of vehicles and on-board systems, with a view to refining their maintenance regime, advising on driver style, reviewing performance of consumables and reviewing and refining the effect of fleet modifications.

**MAINTENANCE ENGINEERS**

The system maintains a historical log of all alerts, alarms and significant events. The maintenance planner uses this list to ensure that all necessary preventative maintenance is performed at the right time, while the locomotive is in the depot. The maintenance engineers have the opportunity of reviewing the logs again as the train enters the depot for maintenance.
HELP LINE
The system helps the train operator’s Help Line in a number of ways. Firstly, it provides a real time “driver’s view” of the cab controls, so that the Help Line sees the switches and gauges as if they were in the cab and provide help and assistance quickly and effectively. This removes the need for the driver having to describe gauge and switch settings over the phone at critical times.

The train operator’s Help Line also creates fault diagnosis trees on the system to ensure that fault diagnosis consistently follows a logical path and less experienced staff benefit from the captured expert knowledge.

ETCS OBS
The system enables Thales’s ETCS On-Board system diagnostic messages to be downloaded and analysed in real-time, enabling the accurate root cause analysis to be available promptly following any incident believed to be related to the ETCS.

PLANNING
The planning team has access to more up to date information including rolling stock location, lifetime mileages and running hours in order to aid the allocation of locomotive to routes and to plan the optimum time for routine maintenance.

THE THALES SOLUTION
The Thales solution utilises the following technology:

- Generally available industry standard routers, which constantly capture data from the ETCS, the on-train incident recorder, the engine management units (EMU) and other sensors, transmit the changes to the “shore” based central system.
- A COTS industrial automation software solution that has been configured to receive, store, analyse and report on the data in a manner that supports the business operation of a rail rolling stock operator. Real-time alerts and alarms are raised and historical data is available for trend analysis and performance comparisons.

THE RELEVANT DATA STANDARDS

- MIMOSA (An international standard protocol for sharing data in SCADA type environments and back office enterprise systems)
- InteGRail (A European project which aims to create a holistic, coherent information system, integrating the major railway sub-systems, in order to achieve higher levels of performance of the railway system in terms of capacity, average speed and punctuality, safety and the optimised usage of resources.)

Thales customers can be confident that whatever European wide initiatives are developed or whatever advances are made in condition monitoring sensors, their new system will be able to keep pace and easily integrate, enabling them to lead the market in embracing new technology and new ways of working.

WHAT DOES ENTERPRISE CLASS MEAN TO FLEET OPERATORS?

The term is used for software solutions that are deployed throughout an organisation, integrating with existing or new enterprise applications including maintenance planning and enterprise resource planning systems, where the continued business operation is entirely dependent on the operation of the system. In this environment the impact of the software is so far reaching, the volumes of data so large and security and stability so important that certain characteristics of the solution become a base pre-requisite. These required characteristics can be summarised as robustness, flexibility, user friendly, scalability and future proofing.

Thales customers can be confident that the system has the flexibility to be configured to reflect the way that they work, including defining user interfaces that are specific to the different types of vehicle and are user targeted. Deploying a COTS solution that is widely used throughout the world in many different industrial environments, Thales customers know that the solution is robust and proven, and will easily accommodate the large volumes of data that systems of this nature invariably generate.
There are so many critical infrastructure users of the base COTS solution throughout the world that Thales customers need not have any concerns about ownership, longevity of support and development and keeping up to date with the latest technology advances.

**WHAT DOES ENTERPRISE WIDE MEAN TO FLEET OPERATORS?**

Many of the asset condition monitoring solutions in use today are provided by the asset manufacturer and are specific to the asset manufacturer’s range of asset types. This means that multiple systems often have to be developed, commissioned, configured, integrated and supported. Thales’s solution supports any asset type, regardless of manufacturer that is used throughout the enterprise. This enables economies of scale on the services associated with the system, as the same people deal with any asset type in a familiar environment. The approach enables a centre of excellence to be developed where good practice from one asset type is deployed to the benefit of all asset types. Holding asset data in one system in a consistent way enables a level of reporting and analysis that would be difficult, complex and expensive to implement with disparate systems. For example performance comparisons can be obtained for similar assets provided by different manufacturers. A further example is that data collected from one asset can be “fused” with data from other assets to report on a third type of asset. An example of this is where vehicles can identify problems with the infrastructure.

**FUTURE DEVELOPMENTS**

As the knowledge base develops, increasingly sophisticated alarms and alerts can be developed to ensure that potential problems are identified and reported, helping customers to develop a sophisticated targeted predict and prevent maintenance regime. Specific alarms can be integrated with the customer’s work management system, so that inspections or work orders can be created automatically from the data from the system. The existing workflow module will be key to this as it will provide an automated, auditable approve and review process as an alert is actioned with an appropriate work order.

As sensor technology advances, it will become cost effective to monitor items, which at the moment are too inaccessible or too expensive to do so. As the Thales Intelligent Train system is highly configurable and standards based, new sensors monitoring new metrics are easily added, without having to change any existing implementations.

Thales’s Intelligent Train is designed to utilise the information and data from existing on-board systems as this significantly reduces the implementation costs and timescales. The metrics that can be monitored are therefore dependent on the available data of the specific on-board systems and any specialist sensors that are installed on any given fleet.