

FULLY  
AUTONOMOUS  
TRAIN CONTROL  
FOR MAINLINE RAIL SYSTEMS



**Ansaldo STS**

A Hitachi Group Company

# Rio Tinto granted accreditation for AutoHaul®

1st long-distance driverless Heavy Haul Railway in the world



**18 May 2018**

Rio Tinto granted accreditation by Australia's Office of the National Rail Safety Regulator approving the autonomous operation of trains at the group's iron ore business in Western Australia.

The AutoHaul® project continues to progress and is on schedule to be completed by the end of 2018.

Rio Tinto will take a phased approach to deploying autonomous trains across the network in the lead up to full commissioning.

# A true milestone for the global Railway Industry

RioTinto

## Rio Tinto achieves delivery of iron ore with world's largest robot

13 July 2018

Rio Tinto has achieved a significant milestone with the first delivery of iron ore by an autonomous train in the Pilbara, Western Australia.

The autonomous train, consisting of three locomotives and carrying around 28,000 tonnes of iron ore, travelled over 280 kilometres from Rio Tinto's mining operations in Tom Price to the port of Cape Lambert on 10 July.

It was monitored remotely by operators from Rio Tinto's Operations Centre in Perth more than 1,500 kilometres away.

The inaugural journey is a significant milestone for Rio Tinto's AutoHaul™ programme and follows regulatory approval in May.

AutoHaul™ is on schedule to complete by the end of the year, unlocking significant safety and productivity gains for the business, as well as optimising the company's iron ore system by providing more flexibility and reducing bottlenecks.

Rio Tinto Iron Ore managing director Rail, Port & Core Services Ivan Vella said

**"This safe first delivery of ore by an autonomous train is a key milestone for the AutoHaul™ program which will deliver the world's first autonomous, rail network."**

"This programme shows our absolute commitment to improving safety and productivity, as well as enabling greater flexibility across our operations."



Managing Director  
Rail, Ports & Services  
Rio Tinto  
**Ivan Vella**





# What is AutoHaul®?

1st long-distance driverless Heavy Haul Railway in the world

The diagram illustrates the AutoHaul system architecture and its project scope. On the left, a block diagram shows the system components: a top layer with five wireless signal icons, a central dashed box labeled 'AutoHaul®' containing four segments (Communications Infrastructure Segment, Trainborne Segment, Operations Centre Segment, and Signalling and Asset Protection Segment), and a bottom layer showing a railway track with a train. On the right, a red circle with a telescope icon is labeled 'Project Scope'. Below this, a red line connects the 'Automatic Train Operation (ATO) system' to the 'On Board, Office, and Wayside systems'. The ATO system is described as automatically driving trains on a remote 1,500km main line. The On Board, Office, and Wayside systems are described as controlling, monitoring, and ensuring the safe movement of driverless trains. A grey box at the bottom right states that this is a key part of the Rio Tinto – Ansaldo STS Framework Agreement (RAFA) to support iron ore mining expansion in the Pilbara, Western Australia.

**Project Scope**

**Automatic Train Operation (ATO) system** to automatically drive trains on remote 1,500km main line

**On Board, Office, and Wayside systems** to control, monitor and ensure the safe movement of driverless trains

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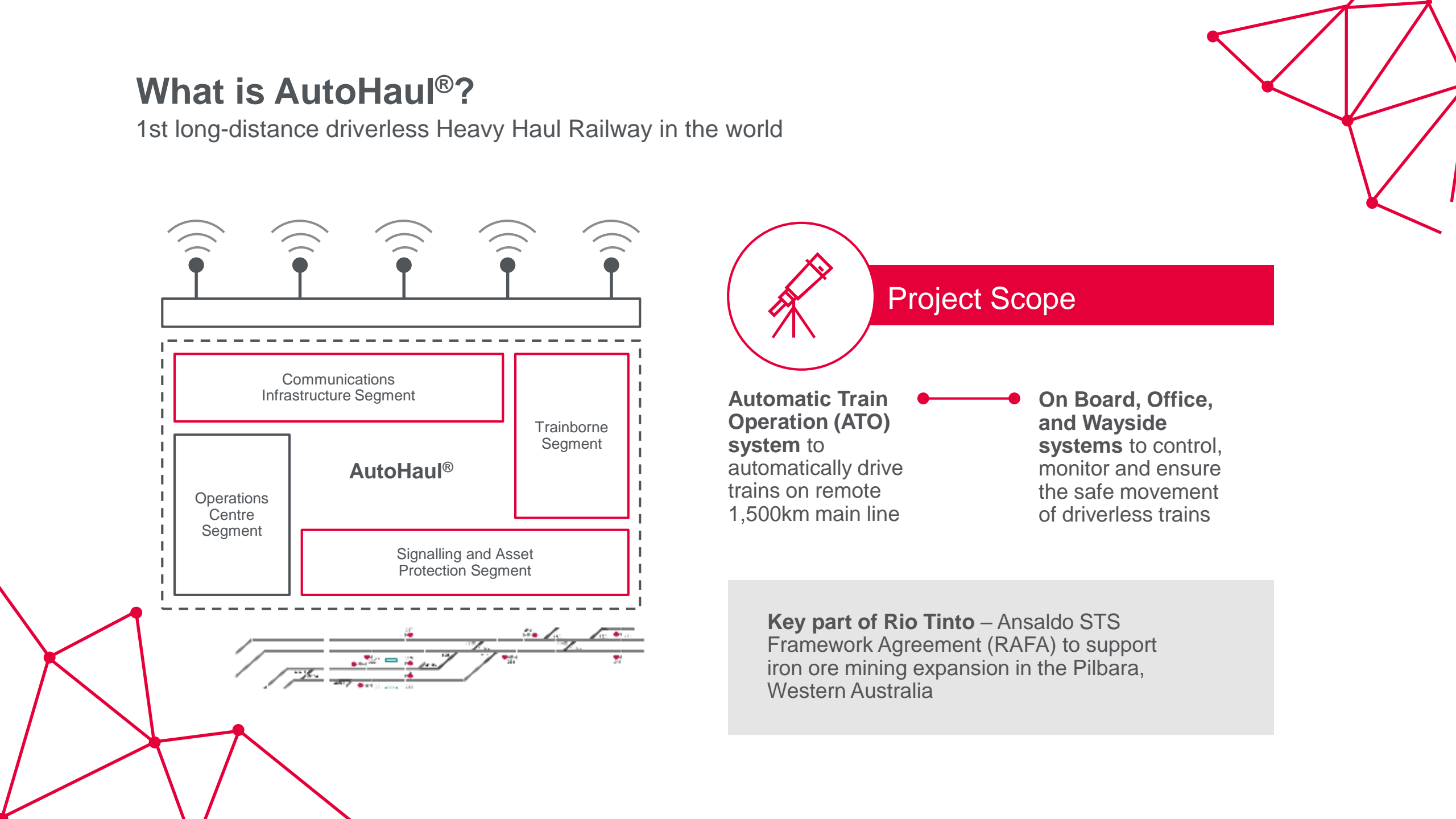
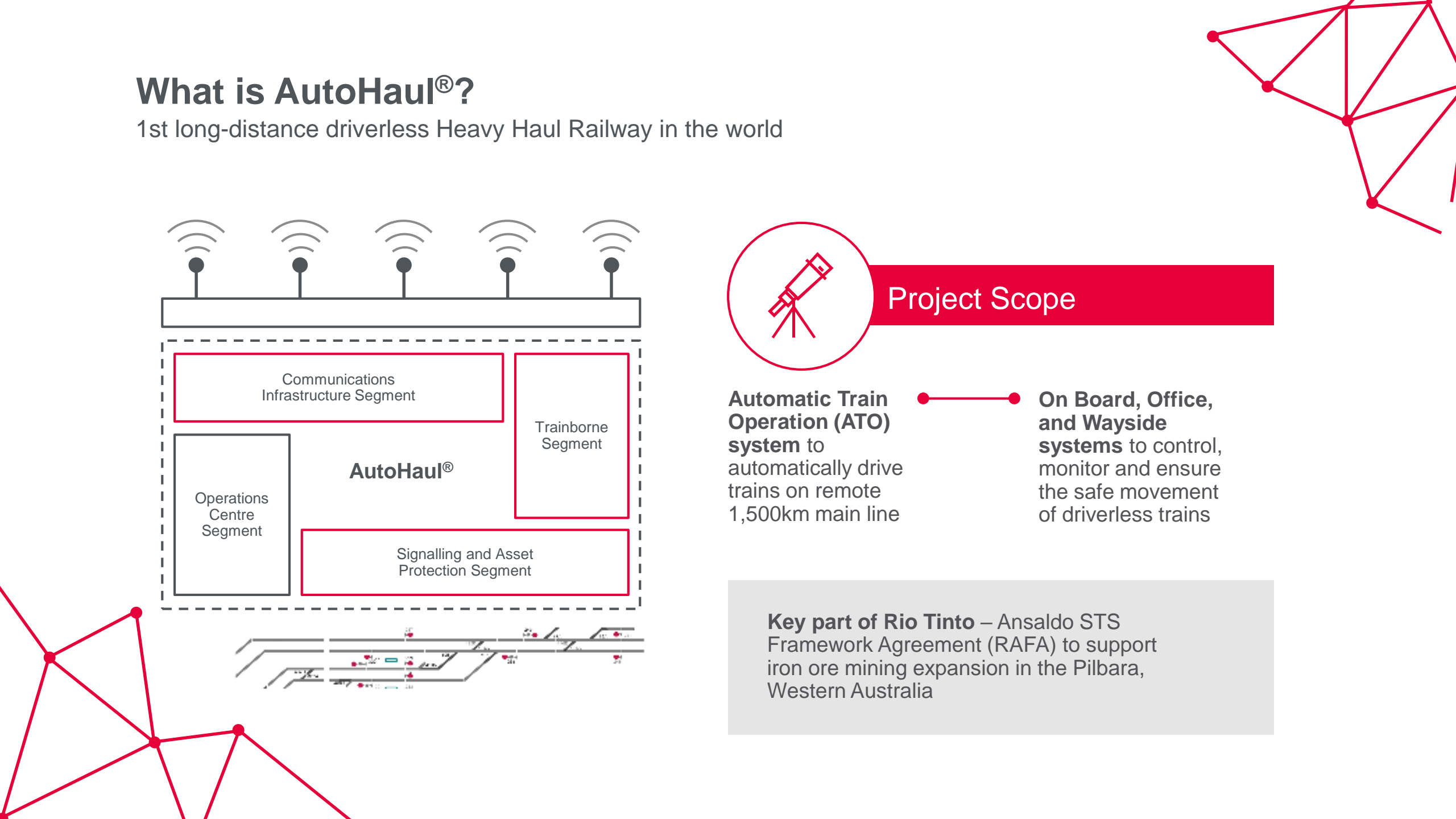
The diagram illustrates the AutoHaul system architecture and its application in a heavy haul railway. At the top, five wireless signal icons represent communication links. Below these, a dashed box encloses the core system components: the Communications Infrastructure Segment, the Trainborne Segment, the Operations Centre Segment, and the Signalling and Asset Protection Segment. The central element is the AutoHaul® system itself. Below the dashed box, a schematic of a railway track layout is shown, featuring multiple tracks, switches, and various signaling equipment, representing the physical infrastructure where the AutoHaul system operates.

## Project Scope

**Automatic Train Operation (ATO) system** to automatically drive trains on remote 1,500km main line

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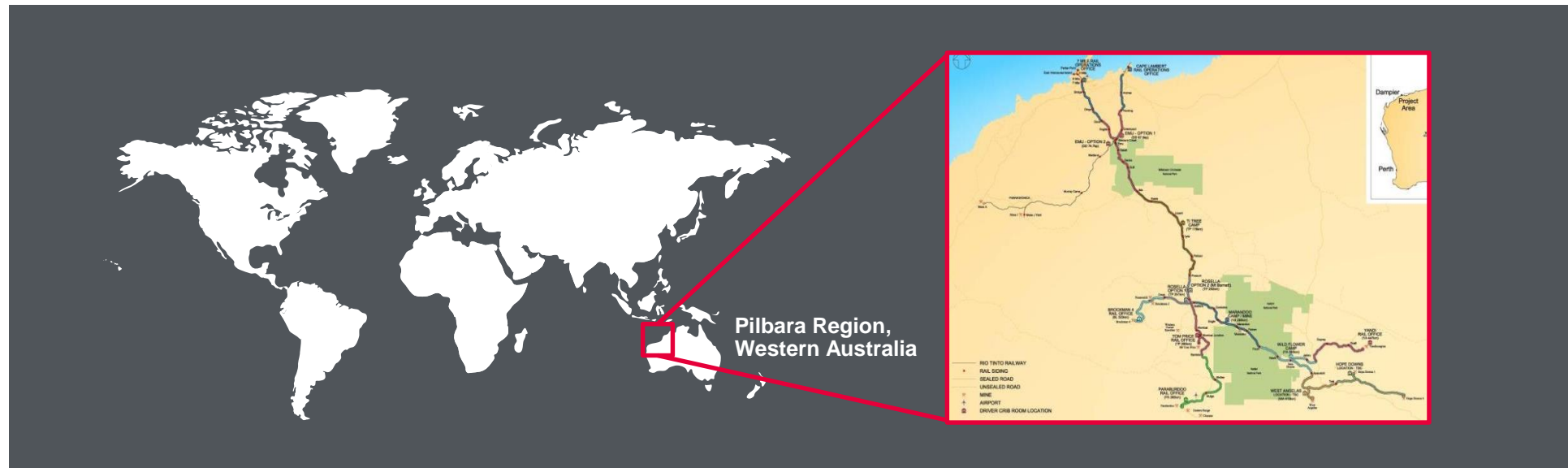
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# Where is AutoHaul® applied?

AutoHaul® – World's first long-distance driverless Heavy Haul Railway



Rio Tinto moves iron ore  
from mine to port via its

**1,700km** rail line

Each train has

**3** locos **+** **240** wagons

is

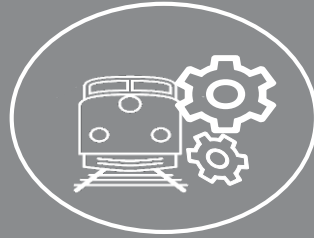
and weighs

**2.5km** long **28,000** tonnes

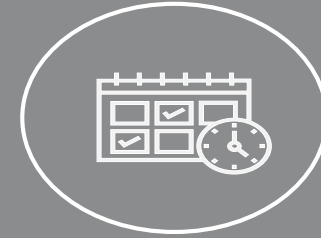
## AutoHaul® Efficiencies Achieved to Date



More than 750,000km in fully driverless mode completed safely and successfully



Over 11 million km in ETCS L2 mode completed safely and successfully



Six percent speed improvement  
Removal of driver change-over saving 1hr/journey cycle

# AutoHaul®'s Benefits for the Customer

## Value over Volume

Continuous  
flow

Schedule  
real-time

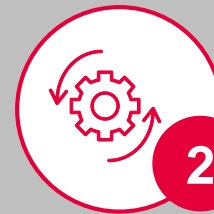
No human  
interaction

by means of a flexible, sustainable, fully automated Railway compliant to the highest safety standards and the highest productivity (driverless operation and trip optimised)



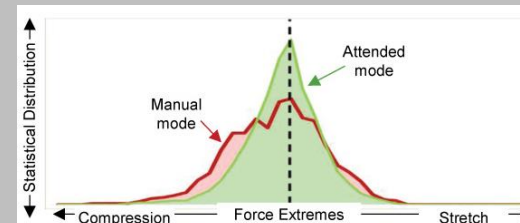
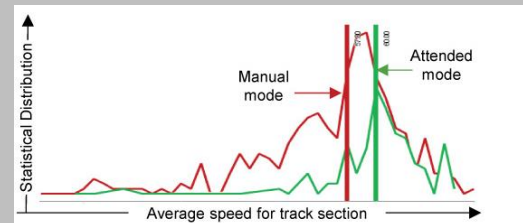
1

Shifts



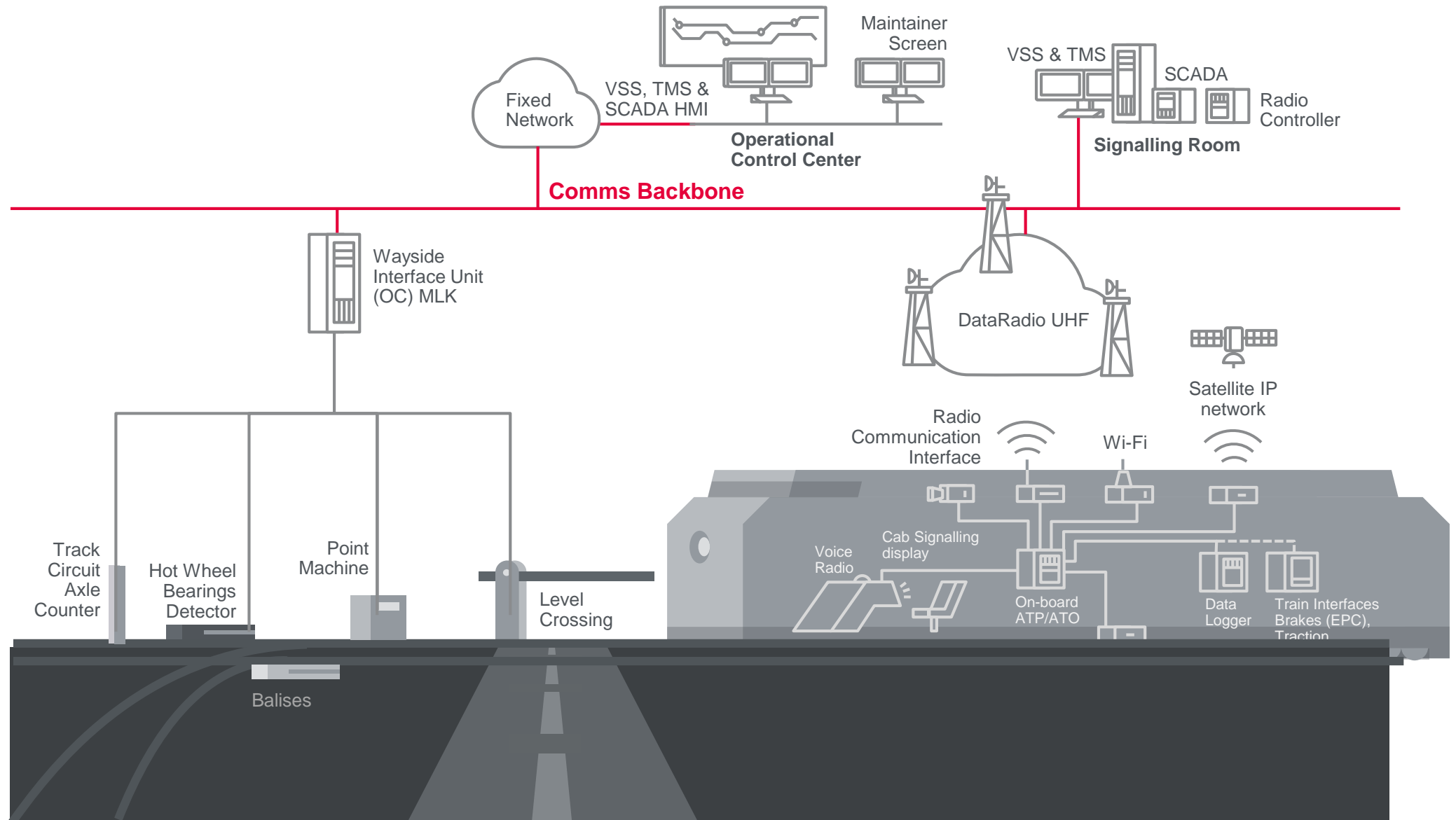
2

Efficiency





# AutoHaul<sup>®</sup> System at a Glance



# AutoHaul® ATO Strategy & Implementation



## Four Modes of Operation

1

### Passive

Drivers run the train, which is protected by the ATP system

2

### Driver Assist

Advises Driver of optimal driving commands to apply

3

### Attended

Automatic running with a supervising driver on board

Initially designed as a “transport” mode for staff, it has become a key part of the deployment and acceptance approach

4

### Driverless

Unmanned



# AutoHaul® Level Crossing & Asset Protection



## Obstruction Detection System (ODS)

Laser based system detects objects within level crossing boundaries



## Closed-Circuit TV (CCTV)

Provides surveillance coverage of each end of level crossing

Records vision via Digital Video Recorder (DVR)

Enables remote retrieval/viewing by authorised Operation Centre (OC) personnel



## Street Lighting

Provides consistent lighting for level crossing

Turns on each time crossing operates, is obstructed or when staff view live feed from CCTV



## AutoHaul® Remote Loco Monitoring



Monitoring activities previously performed by the driver while on board the train...

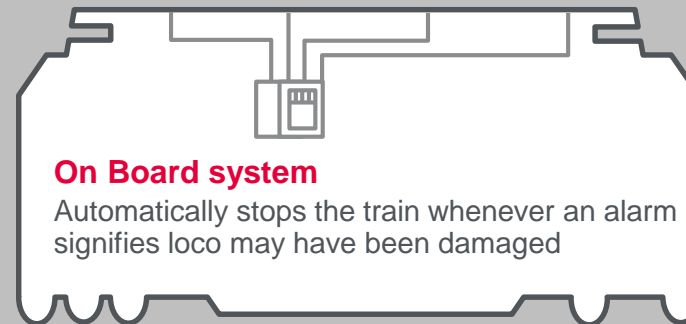


Now managed via:



### Rolling Stock Asset Health Evaluator

Remotely monitors On Board status of assigned trains throughout their journey and Processes all On Board alarms







31 October 2018

*Ansaldo STS Australia Pty. Ltd  
Freight Business Unit*

**Ansaldo STS successfully delivered into  
commercial service the world's first fully  
autonomous long-distance heavy haul rail  
operation for key client Rio Tinto**

Has been selected for

**Inspiration of the Year Global Award 2018  
“Japan, Korea and Oceania Region” 2<sup>nd</sup> Prize**

# Porting AutoHaul® to Freight: North America

PTC provides Authorities and TSRs, but not the following:



## Signalling System

- Vital Safety Server acting as Office Center
- Integrated Vital Possession Management
- Integrated Level crossings and Level crossing obstruction detection and protection
- Integrated Asset Protection devices
- Virtual & Moving Block



## Onboard

- ATO
- Collision Detection
- Motion sensors
- Video Monitoring



## Operations Centre

- Remote locomotive health monitoring
- Video monitoring
- ATO Mission Start/Stop

# Porting AutoHaul® to Freight: Europe, Africa, Asia

ETCS provides Authorities and TSRs, but does not currently the following:



## Signalling System

Integrated Vital Possession Management  
Integrated Level crossings and Level crossing obstruction detection and protection  
Integrated Asset Protection devices  
Virtual & Moving Block



## Onboard

ATO  
Collision Detection  
Motion sensors  
Video Monitoring



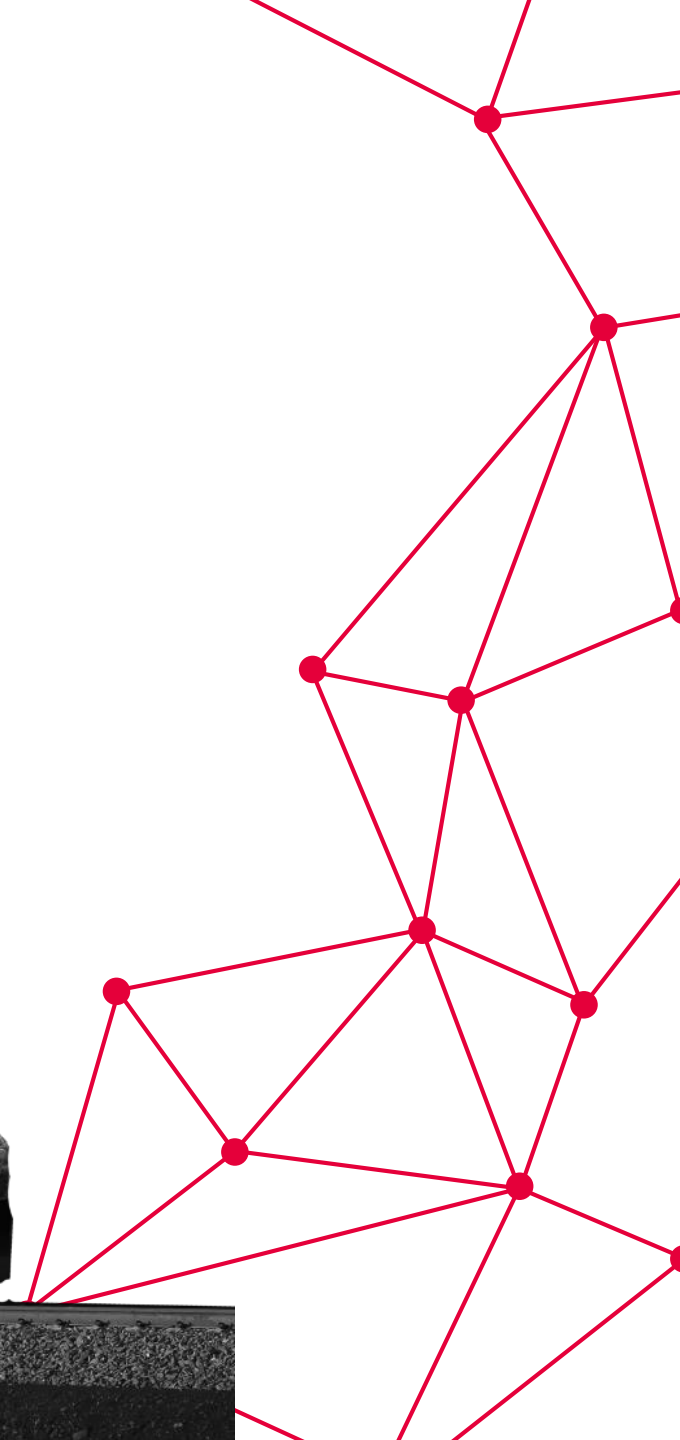
## Operations Centre

Remote locomotive health monitoring  
Video monitoring  
ATO Mission Start/Stop

# Beyond AutoHaul® - Roy Hill Project (WA)

Signalling and communications system that has equipped a 350km remote privately owned heavy haul iron ore railway for future autonomous operation

Roy Hill Mine





# Beyond AutoHaul® - Roy Hill Project (WA)

## A Series of Technical Firsts



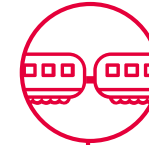
Communication Based Signaling on TETRA IP radio systems in Australia



Communications Based Signaling (CBS) using SIL4 GPS Localisation



Train and Hi-Rail with Driver Assist system at SIL2



SIL4 Moving Block on Freight System



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