Wabtec Corporation

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End of Train Telemetry(EOT) System for Freight Train Control and Operational Efficiency

(With slide each on ECP, RFDP & Video Recording on Locomotives)

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Wabtec RAILWAY ELECTRONICS

Wabtec TrainLink

Product History, Overview and Features

Wabtec RAILWAY ELECTRONICS

Wabtec EOT History

- Our product has been in use since 1977 – Over 4 Decades
- Sold over 25,000 units
- Partial list of countries where our EOTs have been in use:
  - Australia,
  - South Africa
  - USA & Canada
  - Mexico, Chile & Argentina
  - Saudi Arabia
  - New Zealand

TrainLink End of Train Systems

Locomotive Control Unit
HOTD

TrainLink ATX
End of Train

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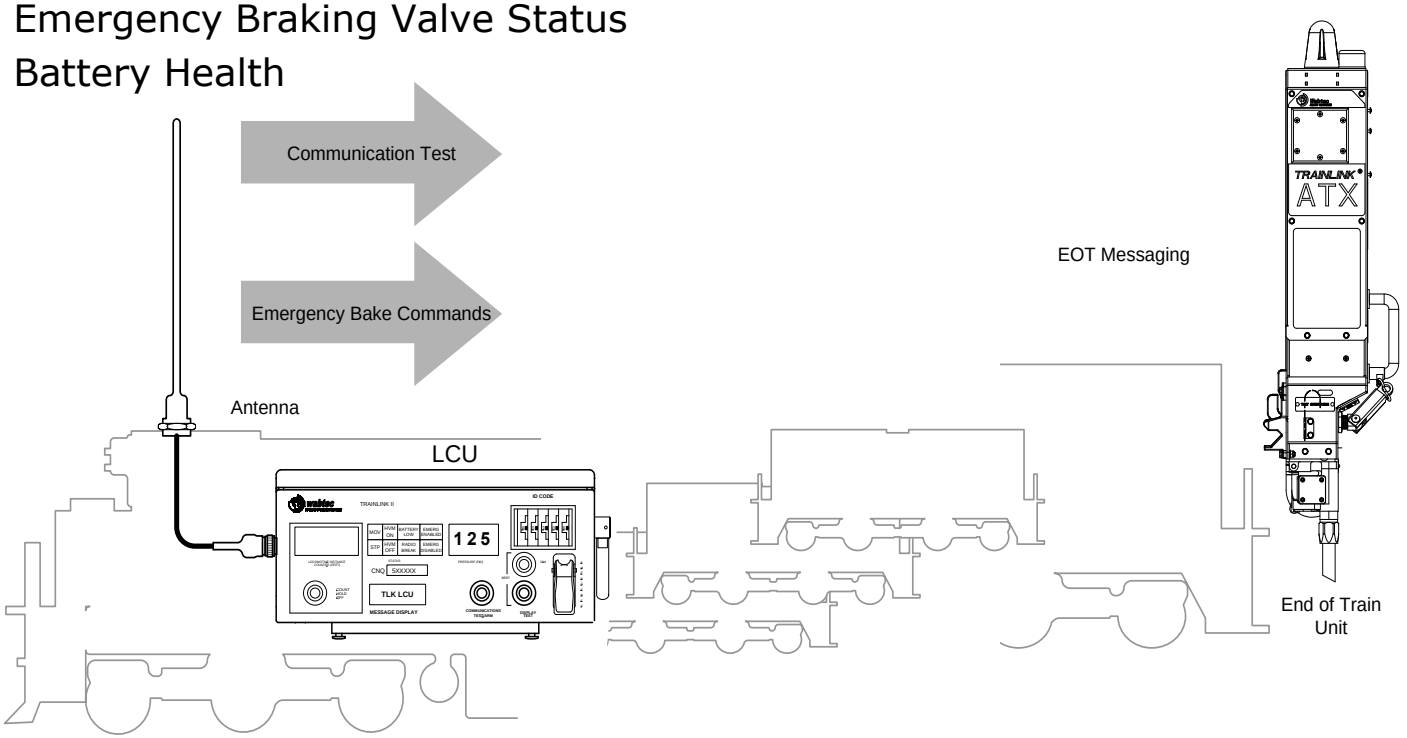
TrainLink System Communication

- EOT automatically sends the status of several functions every minute to the HOT or if Brake Pipe Pressure Changes
  - Last Car Brake Pipe Pressure
  - Motion Status
  - Marker light status
  - Emergency Braking Valve Status
  - Battery Health



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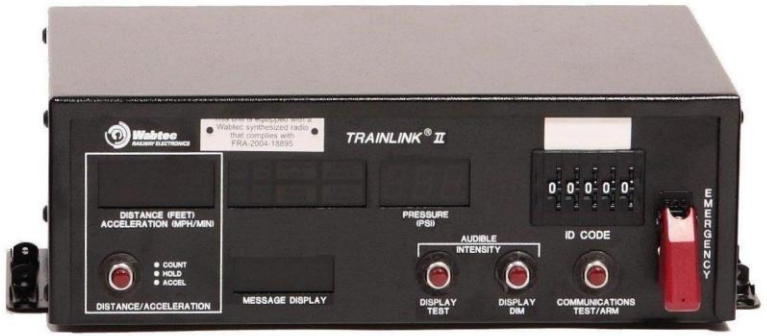
Head of Train – Stand Alone

- Installed on control stand of locomotive cab
- Self contained two-way radio that communicates with the EOT
- Displays brake pipe and other information from the EOT to the locomotive engineer
- Red toggle switch for Emergency brake command
- Dial-In sets EOT ID number so that HOT communicates with specific EOT
- Provides RF communication status between HOT and EOT



Stand Alone HOTs

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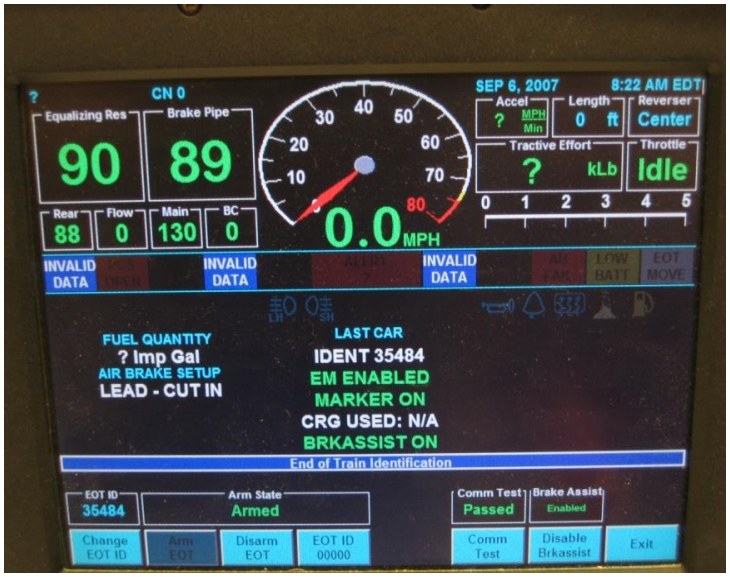
Head of Train - Integrated



Screen Shot from onboard computer

- An integrated cab HOT is controlled through the locomotive computer and has no operator controls on the HOT itself
- All operator controls are integrated into the standard locomotive cab displays
- User interface controlled by the OEM builder
- Same functions as stand alone system

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Traditional EOTs

- Standard EOT
  - Air Turbine Powered
  - Introduced by Wabtec in 2002
  - Air generator provides power for radio, electronics and light
  - Small backup battery provides power when brake pipe is zero
- GPS Cellular Tracking EOT
  - Extra feature on current/future EOTs
  - Monthly service charge per EOT
  - Web Based back office to track asset's GPS position
  - Can provide GPS data feed in addition to back office access.
  - Currently only available in North America

NG3 EOT

NG3 Tracking EOT

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Newest Design 4G ATX EOT

Light Weight
New plastic enclosure design

Reduced weight components

Internal foam isolation system reduces need for brackets and fasteners

Approximately 6 LB weight reduction

Improved Electronics
New generation electronics

Accelerometer replaces tilt switch and motion sensor

PC board mounted pressure sensor

Dual high intensity LEDs

Lower power consumption improves battery life

Serviceability

Vastly simplified disassembly/reassembly decreases service time

Open enclosure design allows easy access to PC boards and air generator

External air filter accessible from outside of EOT

All components are available for purchase so customers can maintain their own EOT fleet

Automatically programs all customer configurable features based on EOT part number

Dual Mode ECP/RF EOT

- **Dual Mode EOT**
  - **Concept**
    - **Designed to support Rio Tinto Overlay ECP system**
    - **Develop an EOT that can function as either a conventional EOT with RF comms to the locomotive HOT, and can function as an ECP EOT with comms over the trainline to the locomotive HEU**
    - **Stay within the envelope of the existing EOTs**
  - **Notable unique feature**
    - **Provides ability for a conventional pneumatic brake Helper Locomotive to push an ECP train**
    - **Dual Mode EOT converts ECP TBC commands into a pseudo BP drop. Pseudo BP data is sent to Helper Locomotive over traditional RF transmission**
    - **Looks like a conventional train to Helper Locomotive**

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Wabtec EOT Customers

- Wabtec is the leading supplier of EOT and HOT devices in North America
- We typically sell 1000-1500 EOTs per year and over 1000 HOTs per year
- Class 1 railroads using Wabtec EOTs:
  - Union Pacific Railroad
  - Norfolk Southern Railway
  - CSX Transportation
  - BNSF Railway
  - Canadian National Railway
  - Canadian Pacific Railway

Authorizing Agency

- Wabtec EOTs and HOTs comply with the industry standard AAR S-9152
- No EOT or HOT can be sold in most countries without proven compliance to AAR S-9152
- Wabtec participates in AAR technical committees focused on continuous improvement of EOT/HOT performance to meet the challenges of heavy freight rail operations

Benefits to Indian Railways

- Fail safe
- Motion detection
- **Increased payload revenue due to addition of normal wagon at the end of rake in place of guard van**
- No human error
- Forced instant Emergency Brake from front and rear of rake

Electronically Controlled Puenamtic Brakes - ECP

- Indian Railways want to run train lengths of 1.5 KM+…..DFC?
- Not easy with UIC brake system
- Can run if air brake system to AAR valves but that is not convenient.
- Easiest solution ECP
- ECP advantages: Shorter stopping distance, Fuel Saving, Better Train Handling, improved safety

RFDP-Radio Frequency Distributed Power

1. **Wabtec open RF protocol allows industry standardization of RFDP communications**
   - **Other systems not open protocol**
2. **Radio frequency tuned to customer requirements in different countries**
3. **Tower Mode - availability of remote control of the train from a tower control station in loading or unloading areas**
4. **Lower cost**
5. **Field proven reliability and flexibility**
6. **Easily expandable to include ECP functionality**

Wabtec RAILWAY ELECTRONICS

Video Recoding Systems

Videotrax™ Locomotive Video Recorder
15,000+ units installed

Customers include Union Pacific, BNSF, Canadian National, KCS, Amtrak and supplied to GE and EMD for OEM installation

Integrated Data Analysis Software (DAS) for time synchronized playback

Crash Worthy

In case of accident event prior to accident was be reviewed

Thank You

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