Heavy-Haul Train Automation

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**Caterpillar Automation**

**FLEET** analyzes operational and equipment data up and down your value chain—so you can run a leaner operation and improve everything from equipment scheduling and material movement to fuel monitoring and cycle times.

**TERRAIN** gives you and your operators guidance tools and live feedback to boost utilization, reduce variability and work according to plan—so you can drill, dig, load and grade more safely, accurately, consistently and efficiently.

**DETECT** helps prevent collisions and increase operator confidence—so you can send people home safely and reduce the costs of lost time and damaged equipment.

**HEALTH** delivers machine condition data for your fleet—so you can head off small problems while they’re still small, run machines as efficiently as possible for as long as possible and keep unplanned downtime to a minimum.

**COMMAND** lets you apply the right level of automation, from operator assistance and remote control to semi- and full autonomy—so you can keep your people safe, your operation efficient and your equipment running.

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*Milestone achieved in 2018 – 1 billion tons hauled with Autonomous trucks.*
*Number of deployed trucks > 400 in 2020.*
Progress Rail Offerings

ROLLING STOCK

LOCOMOTIVES
- New Locomotives
- Locomotive Parts & Service
- Power & Marine

TRANSIT
- New Passenger Locomotives
- Transit Maintenance

FREIGHT CAR
- Wheels, Axles, Bearings & Parts
- Freight Car Repair
- Leasing

TRACK
- Trackwork & Fasteners
- Rail Welding
- Maintenance-of-Way & Vegetation Equipment

SIGNAL
- Signal Engineering
- Signal Infrastructure

INFRASTRUCTURE

Advanced Rail Technologies
Recycling
Rail Automation Overview

Energy Management (EM)
- Ability to model the train operating environment to build an optimal control strategy.
- Automation of Throttle and Dynamic Brakes.
- Limits operation variability.
- Improves fuel/energy consumption.

Advanced Train Operation (ATO)
- Attended Automation of EM, Air Brake, and stop to stop.
- Eliminates operation variability and increases network velocity.
- Provides a platform for additional ATO ecosystem technologies e.g. network planning/optimization.
- Requires safety overlay and advanced signaling functions.

Progress Rail is building the Next Gen Train Automation enabling better and faster EM and ATO deployments.
Initial projects
Descriptive & Predictive Analytics

Challenges to deployment of train automation

- Data acquisition
- Signal conditioning
- Communication links
- Freight operation traction and braking complexities
- Locomotive variability display & control
- Operation Variability - weather, trains, track conditions, etc.
- Labor relations & change management

Initial deployments focused on providing train physics information about ITF, AB, Train Location, Track Profile
Passenger Trains Automation Milestones:

- The first line to be operated with Automatic Train Operation (ATO) was London Underground's Victoria line, which opened in 1967.

- The first fully automated driverless mass-transit rail network is the Port Island Line in Kobe, Japan opened in 1981.
Challenges to deployment of train automation

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- Communication links
- Freight operation traction and braking complexities
- Locomotive variability display & control
  - Operation Variability - weather, trains, track conditions, etc.
  - Labor relations & change management

Industry harmonization: Locomotive Command and Control interface, Locomotive Interface gateway, train models.
Automated Train Operation
Attended & Driverless ATO

Challenges to deployment of train automation

- **Operation Variability** - weather, trains, track conditions, etc.
- **Labor relations** & change management.
- **Sensor Fusion** (camera, Lidar, radar, etc.)
- **Machine Vision**
- **Safety requirements**

2020s and beyond

Attended ATO is the goal for the Class Is. Mining are interested in driverless train operation.
Artificial Intelligence Engine

Instead of a rule-based approach, Progress Rail’s AI-based approach excels due to:

- Automated system
- Improved operation
- Faster deployment
- Adaptable and scalable
- Better quality and safety

TALOS® Overview Video
Automation Business Case

- Network Capacity & Velocity
- Asset Utilization (Track and Equipment)
- Fuel Savings
- Emissions credit
- Ability to meet customer expectation of “owning” the performance of our fleets
- Reliability improvements (reduced operator variability)
- Greenhouse gas reduction
- Enhanced Safety

Rail Automation requires upgrades to the locomotives, the signaling system, and wayside equipment. PR has the technologies and the expertise to fully handle the Automation deployments across all GoA.
THANK YOU