Next Generation Passenger Brake Equipment Development Update Light at the End of the Tunnel

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Key Presentation Take-Aways

- APTA Involvement
- Performance Standard Development
- Safety Analysis
- FRA Waiver
- Equipment Installation
- Static Testing
- Dynamic Testing
- Revenue Service Demonstration
- Next Steps to Completion
- CFR 238 Recommendations
- Future Activities
What is Passenger ECP?

- Existing passenger pneumatic brake technology was developed in the 1950’s
- Diagnostics expected in today’s equipment would be difficult if not impractical to apply to 26C Technology
- Technology shall be based on the successful implementation of AAR S4200 ECP
- Technology adapted to passenger service
- Emulation - Compatible to existing brake pipe control technology

Passenger ECP Technology – NYAB & Wabtec
NGEC Origins

- During the initial technical specification development, the need for a replacement for the 26C brake controls with a modern system was identified.
- The mechanical group realized that a product performance standard was required but not available.
- The following text was placed in the initial technical specification:

  **7.2 Brake - General Requirements**

  All cars shall be equipped with provision for an electrically controlled pneumatic (ECP) brake system. This provision shall consist of a discrete conduit and wiring per AAR Standard S-4200, and particularly AAR Standard S-4210, for redundant implementation of ECP cable-based system in this Specification. The installation shall include a terminal box at each end of the car (for installation of the inter-car jumper cables), a terminal box at the brake manifold, conduit connecting them, as well as, armored cable wiring. The Contractor shall provide appropriate clearance on brake manifolds and adjacent structure to permit installation, servicing and removal of ECP modules. The Contractor shall provide a wiring diagram showing connections of brake controls with the two car end junction boxes to implement ECP braking.
APTA Involvement

• APTA represents the passenger/commuter railroads that are subject to the FRA regulations
• APTA PRESS was established to develop safety standards related to passenger/commuter cars and equipment
• APTA was selected to participate in the development
Performance Standard Development

• Two APTA PRESS safety standards have been developed
  – ECP Performance (based on AAR S4200 modified for passenger service) PR-M-S-021-17
  – Emulation Performance PR-M-S-020-17
    http://www.apta.com/resources/standards/press/Pages/default.aspx

• These two standards are complementary to permit ECP equipped cars to operate with existing brake pipe control and exclusive ECP train configurations
Safety Analysis

• A qualitative analysis was performed against the draft PRESS ECP Performance Standard
• Funded by an FRA Office of Research, Development, and Technology (RD&T) grant
FRA Waiver

- Waiver request was submitted July 14, 2015
- Decision letter was issued February 9, 2016 under docket FRA-2015-0078
- Decision letter confirmed the waiver request with one additional requirement that the train only operate on Amtrak NEC & Harrisburg, PA lines
- Test committee was established consisting of APTA, Amtrak, NGEC members, labor, and other railroads
Equipment Installation

Amtrak ACS-64 #670
Last unit shipped from Siemens

NYAB CCBII & ECP & Display
Equipment Installation – Cab Car #9644

Wabtec FastBrake Equipment

Cab and Brake Controller

Electrical Locker
Equipment Installation–Cab Car #9644

Wabtec FastBrake Electronics and Pneumatics installed in seating area
Equipment Installation – Coach Cars

NYAB/Wabtec CCD’s and CIB’s installed on Amfleet 1 Coach

NYAB Installation – 2 cars

Wabtec Installation – 2 cars
Static Testing - Lab

• Interoperability Test
  – Week of September 26, 2016 - NYAB Watertown, NY
  – Demonstrated that the NYAB and Wabtec equipment meet the performance standard requirements and could operate in a train configuration
  – Test results were presented to the test committee and agreement reached to proceed to static testing phase
  – Participants included representatives from:
    • Amtrak Engineering
    • Amtrak Operations
    • FRA
    • APTA (SNC-Lavalin)
    • New York Air Brake – Knorr Bremse
    • Wabtec
Static Testing - Lab

Testing elements included:

- ECP entry and exit including:
  - ECP initialization
  - Train sequencing
- Brake Control:
  - Service/Emergency braking
  - Cycle Braking
  - Penalty Braking
- CCD cut-in and cut-out
- CCD critical loss
- Fault response and recovery
- System diagnostics
- Coach car as EOT (end-of-train)
Static Testing - Equipment

Each locomotive’s electronic brake control and ECP equipment shall be tested to manufacturers’ requirements.
Static Train Testing

Train Consist – Loco 670, 4 ECP coaches and Cab car 9644 – completed

- All coach cars passed their respective single car test procedures as defined in APTA PR-M-S-005 including ECP operation
- Cab car and locomotive passed their respective test procedures including ECP operation
Static Train Testing

Testing elements included the following in both 26C Emulation and ECP:

- Minimum service application/release
- Suppression application/release
- Full service application/release
- Emergency application/release
- Handle off application/release
- Graduation application/release
- Brake cycling (back to back application/release)
- Penalty brake application/release
- Break in two protection
Brakes respond to changes in BP and BC pressure degrades with multiple sequential applications.
In ECP brakes apply without changes in BP and BC pressure is consistent across multiple sequential applications.
Dynamic Test Release

• Test data were reviewed by the technical working group
• Static test results were presented to the test committee
• Test committee agreement to proceed to dynamic tests – 11/03/2016
Dynamic Testing

- Testing was conducted on November 4 – 6, 2016 on the NEC near Perryville, MD
- All equipment used was previously qualified for service based on pneumatic operation
- Participants included representatives from:
  - Amtrak Engineering
  - Amtrak Operations
  - FRA
  - APTA (SNC-Lavalin)
  - New York Air Brake
  - Wabtec
Dynamic Testing

• Testing was conducted in emulation mode and ECP mode

• Tests conducted:

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<th>Emergency</th>
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Dynamic Testing

![Graph showing ECP vs. Emulation Full Service 70 mph Comparison](image)
Revenue Service Demonstration

- ECP test committee reviewed and approved the final test reports:
  - Interoperability
  - Static train
  - Dynamic train
- The reports were submitted to the FRA as provided in the waiver request
- FRA supported the request to enter the ECP Revenue Service
Revenue Service Demonstration
Emulation Mode

• Four ECP Emulation Amfleet cars have been in revenue service (Keystone service) for 2 -1/2 years

• Total mileage for the four coach cars in Emulation.
  1,874,840 miles

• All cars have completed eleven 120-Day Preventive Maintenance intervals successfully
Revenue Service Demonstration
ECP Mode

February 7, 2017
Second Revenue Day
Revenue Service Demonstration
ECP Mode

• FRA did not take exception to the Revenue Service Demonstration – ECP Mode notification
• The ECP train entered revenue service on Monday, February 6, 2017
• Accumulated mileage through May 5, 2018 – 699,126 miles for loco, four coaches and cab car
• One reported ECP related fault to date
• Trainset is operating in Keystone Service between Harrisburg, PA to New York, NY on a daily basis
• Trainset is under continuous maintenance demonstration
Next Steps to Completion

- Monitor and report ECP train performance
- Issue a final FRA report in Q3 2018
- Develop the maintenance interval for ECP equipment
- Update 2 standards and complete 6 standards required for the ECP equipment
- Provide recommendation for 49 CFR 238 updates
CFR 238 Recommendations

• 238.5 Definitions
  – Add Passenger ECP definitions

• 238.15 Movement of defective equipment
  – Applicable to emulation mode

• 238.139 Modifications to standards
  – New based on 232.307

• 238.309 Periodic brake equipment maintenance

• 238.nnn Passenger ECP brake system
  – New subpart based on 232 subpart G freight ECP
Future Activities

• Request FRA to change the test waiver to a conventional waiver to allow the ECP train to continue in revenue service until the CFR is updated

• Continue continuous maintenance on the four coach cars to justify the 8 year overhaul cycle

• Implement an end change process to simplify turnaround times for push-pull operations
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