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

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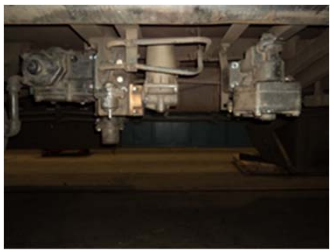
Key Presentation Take-Aways

- 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

Amtrak
Mechanical Department
Bureau of Rolling Stock Engineering

SPECIFICATION

for

PRIIA Bi-Level Passenger Rail Car

PRIIA SPECIFICATION No. 305-001
AMTRAK SPECIFICATION No. 962

Revision C.1

Release Date: September 20, 2012

Initial Release: Approved Issue Date: August 31, 2010

Approved Date

PRIIA Board Member

Chief Mechanical Officer

Deputy Chief Mechanical Officer - Engineering

Originator

Originator: Tammy Lee Krause

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

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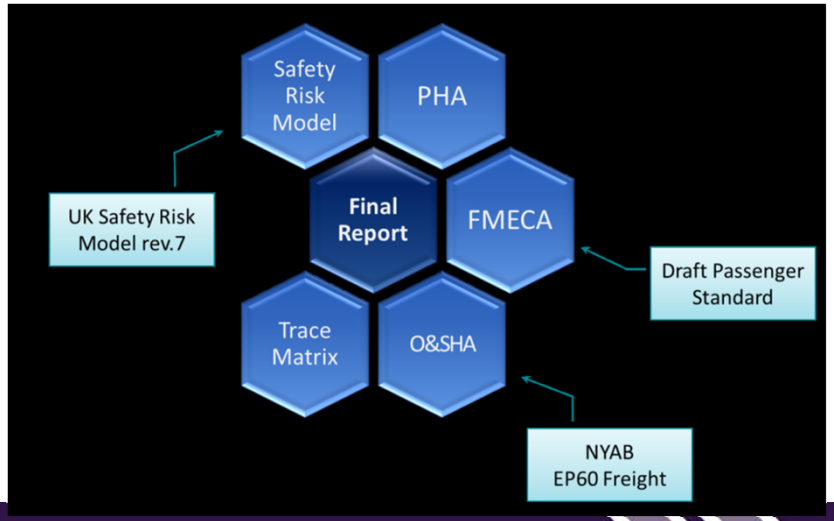
Performance Standard Development

- 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



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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

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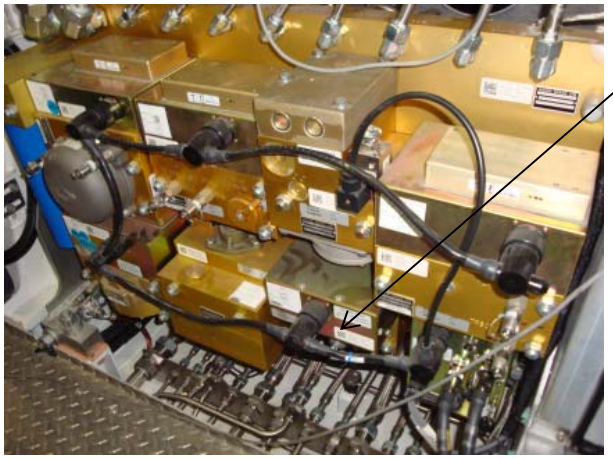
Equipment Installation

Amtrak ACS-64 #670

Last unit shipped from Siemens



NYAB CCBII
&
ECP
&
Display

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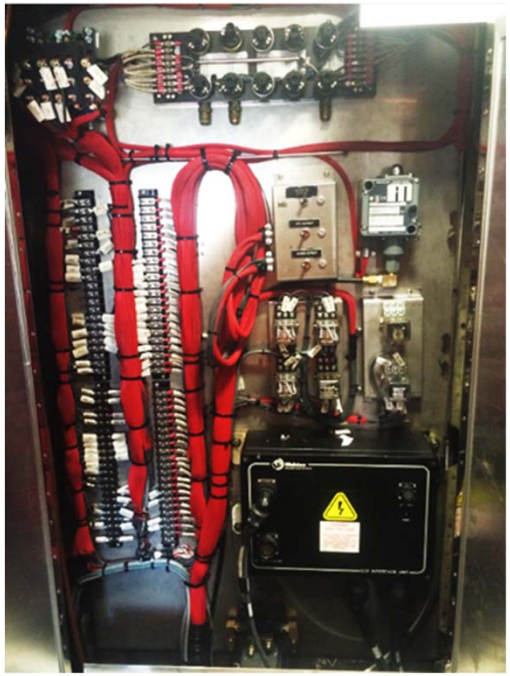
Equipment Installation – Cab Car #9644

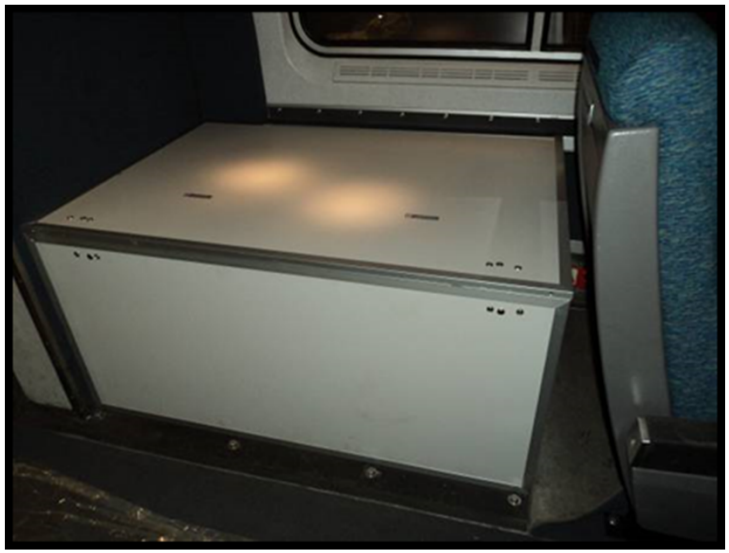
Wabtec FastBrake Equipment



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

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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

NYAB Installation

Wabtec Installation

Static Train Testing

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

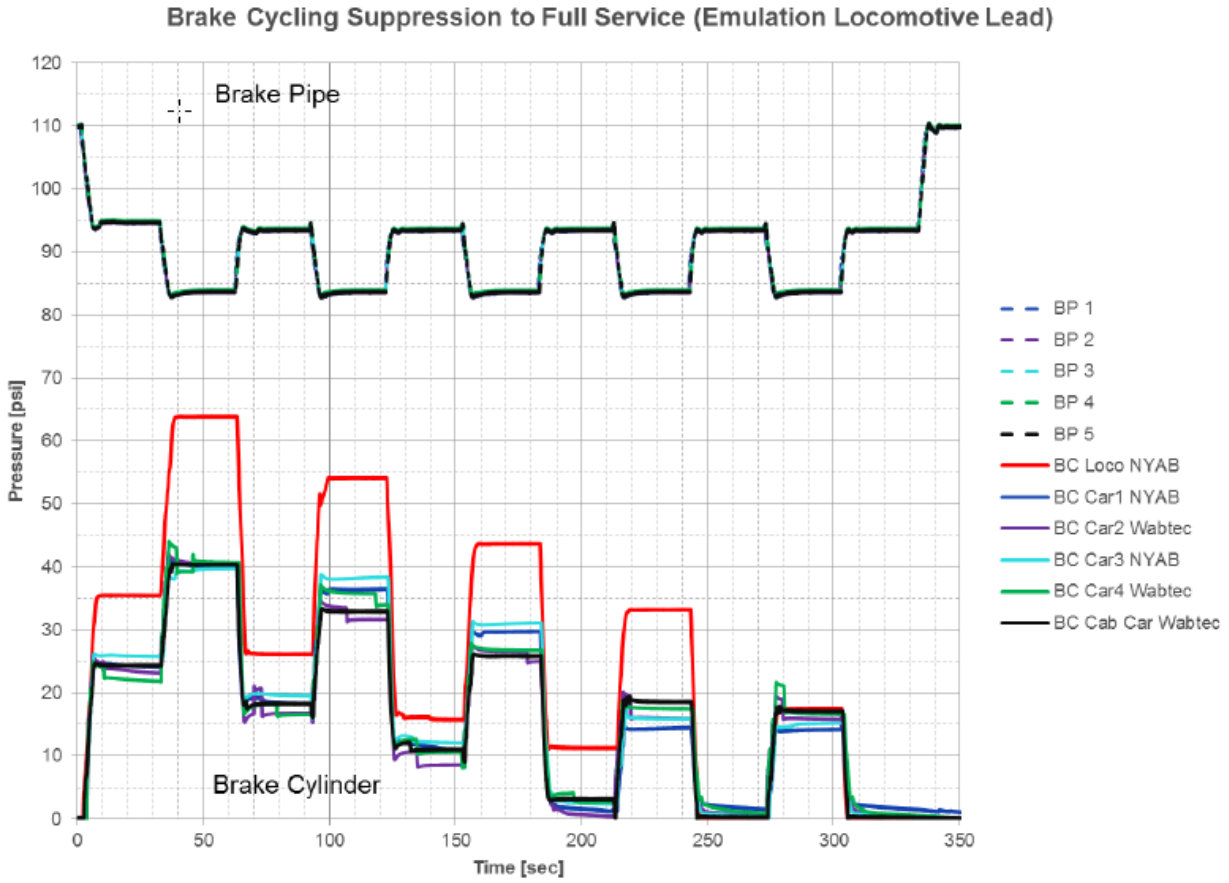
- All coach cars passed their respective single car test procedures as defined in APTA PR-M-S-005 including ECP operation
- Cab car and locomotive passed their respective test procedures including ECP operation

Static Train Testing

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

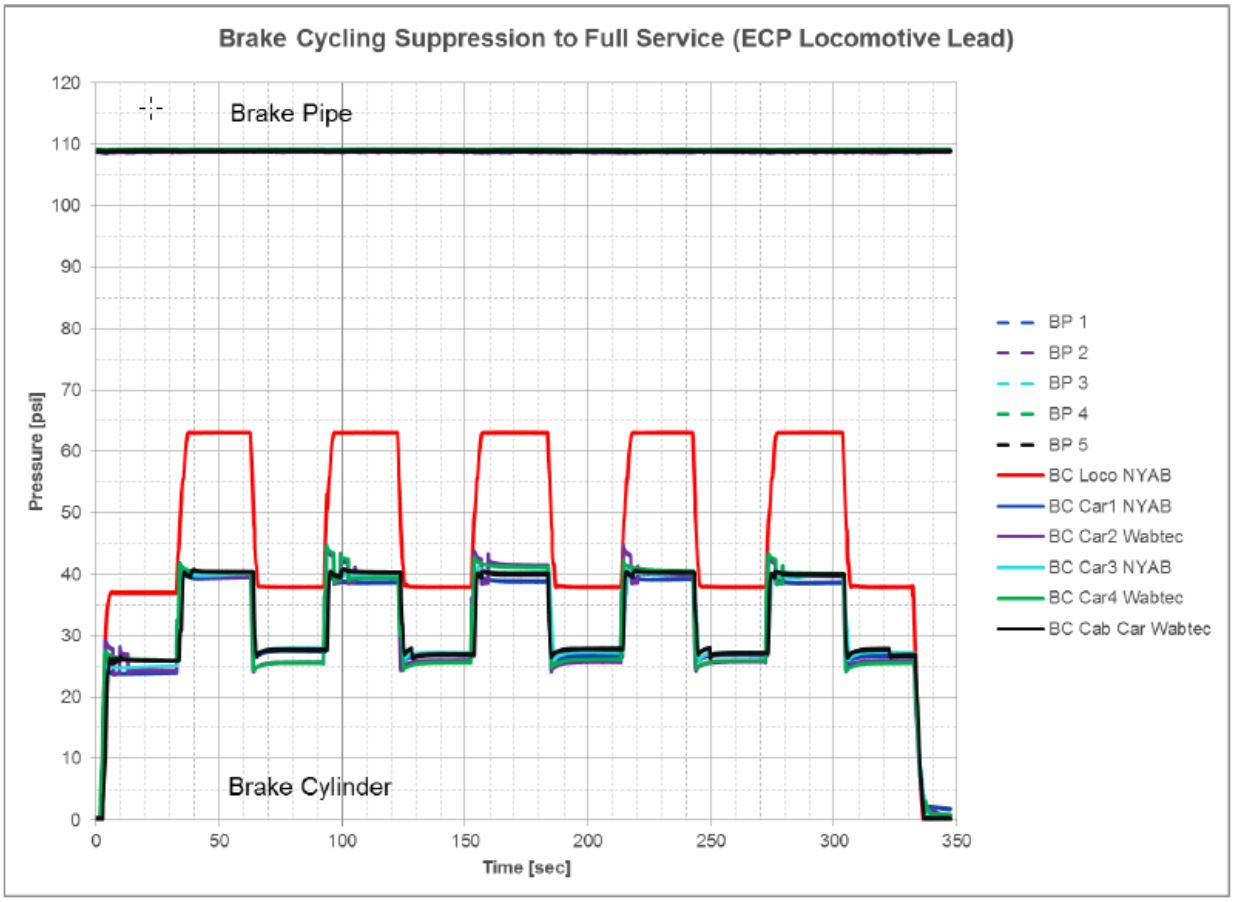
- Minimum service application/release
- Suppression application/release
- Full service application/release
- Emergency application/release
- Handle off application/release
- Graduation application/release
- Brake cycling (back to back application/release)
- Penalty brake application/release
- Break in two protection

Static Train Testing



Brakes respond to changes in BP and BC pressure degrades with multiple sequential applications.

Static Train Testing



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

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Dynamic Testing

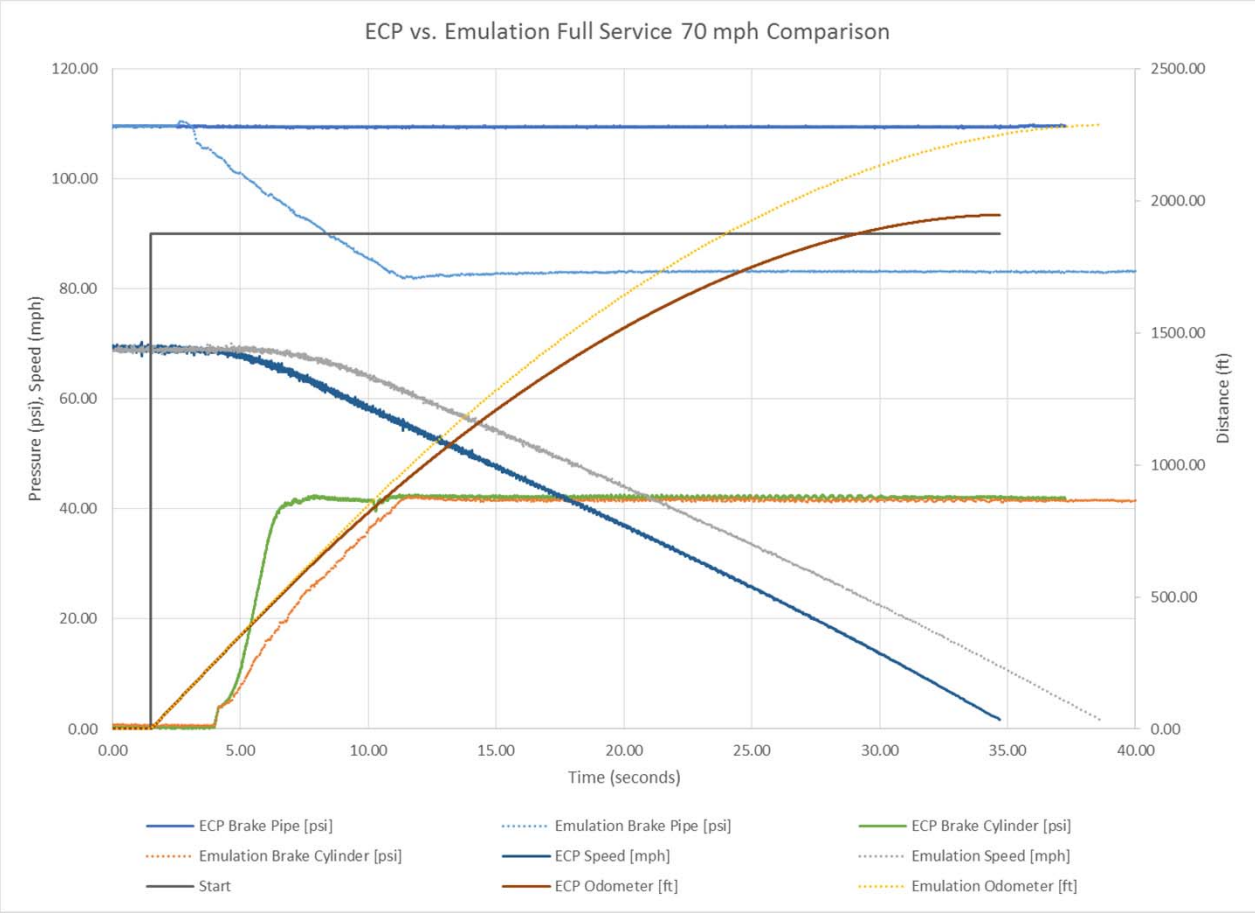
- Testing was conducted on November 4 – 6, 2016 on the NEC near Perryville, MD
- All equipment used was previously qualified for service based on pneumatic operation
- Participants included representatives from:
  - Amtrak Engineering
  - Amtrak Operations
  - FRA
  - APTA (SNC-Lavalin)
  - New York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

Dynamic Testing

- Testing was conducted in emulation mode and ECP mode
- Tests conducted:

Speed	Braking Command		
	Min Service	Full Service	Emergency
5	X	X	X
30	X	X	X
70	-	X	X
90	-	X	X
110	-	X	X
125	-	X	X

Dynamic Testing



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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

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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

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Revenue Service Demonstration
ECP Mode

February 7, 2017
Second Revenue Day

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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

Acknowledgements

- Adam Eby – Amtrak Equipment Engineering
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- Andrew Pressley – Wabtec Passenger Transit
- Lou Sanders - America Public Transportation Association
- Narayana Sundaram – America Public Transportation Association
- Ron Truitt – Amtrak Senior Mechanical Air Brake Engineer (retired)


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