



U.S. Department of Transportation
Federal Railroad Administration

Electronically Controlled Pneumatic (ECP) Brakes

Briefing for Release of ECP Implementation Report and
Announcement of Regulatory Initiative

August 2006



How Are ECP Brakes Different From Current Train Brakes?

- Electronically Controlled Pneumatic (ECP) brakes are a tested technology that offers major benefits in freight train handling, car maintenance, fuel savings, and network capacity.
- Their use could significantly enhance rail safety and efficiency.

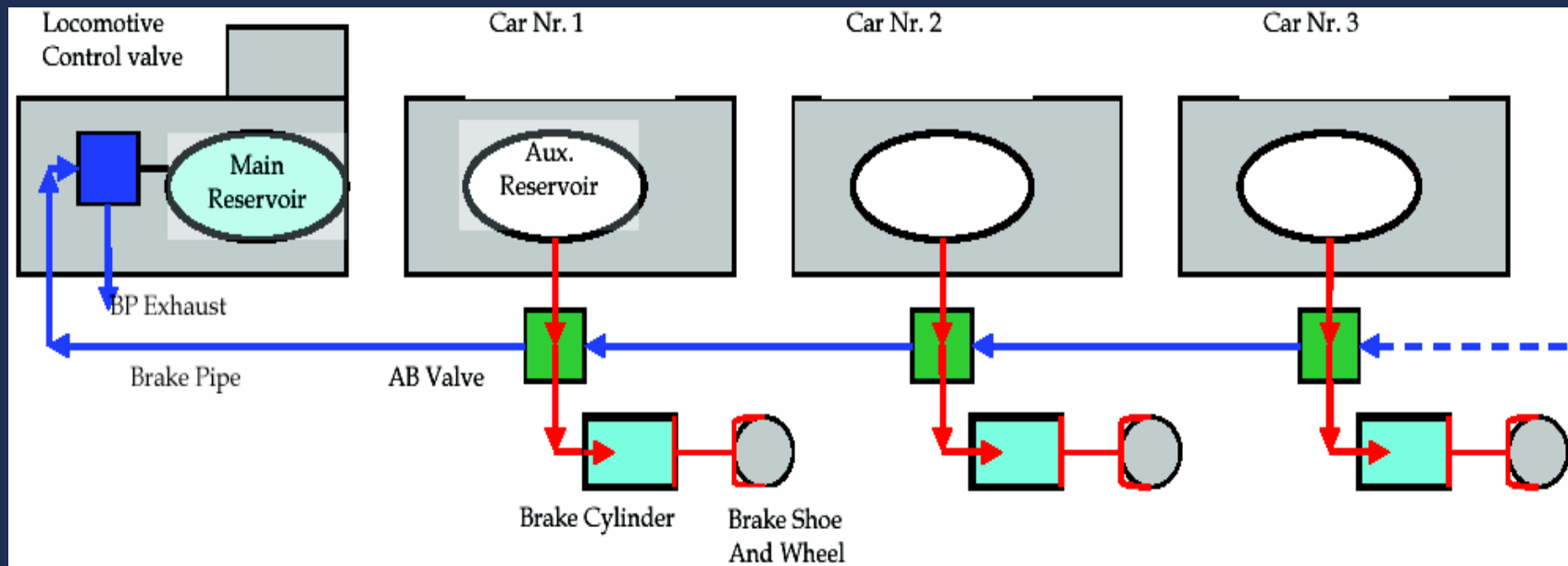


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- With the present system (developed in the 1870's), freight train cars brake individually, at the speed of the air pressure moving from car to car, along trains that are often well over a mile in length.
- This conventional braking contributes to excessive in-train forces, challenges in train handling, longer stopping distances, and safety risks of prematurely depleting air brake reservoirs. These problems are greatly reduced in the ECP brake mode of operation, during which all cars brake simultaneously, driven by an electronic signal.



How Are ECP Brakes Different From Current Train Brakes?



With current braking systems, after the brakes are applied in the front of the train, the rear of train is still waiting for the signal to travel to put the brakes on, and the rear of the train is still running without brakes applied causing in-train Forces.



How Are ECP Brakes Different From Current Train Brakes?

- ECP systems *simultaneously* apply and release freight car airbrakes
 - Through a hard-wired electronic pathway down the length of the train.
 - No delay, and no run-in of slack from the rear of the train.



How Are ECP Brakes Different From Current Train Brakes?

- Brake releases cannot be operated in a graduated manner with current brakes.
- ECP brakes allow the engineer to “back off” braking effort to match track grade and curvature, without completely releasing the brakes.
 - Saves fuel and reduces emissions
 - Reduces wear/stress on wheels and brake shoes
 - Reduces chance of run-away from overheating of the brake shoe/wheel interface



How Are ECP Brakes Different From Current Train Brakes?

- Current train handling procedures require anticipation of draft (pulling) and buff (compressive) forces within the train, particularly in hilly terrain.
 - Any misstep can result in derailment.
- ECP brakes provide a tool to manage in-train forces and reduce train handling derailments.



How Are ECP Brakes Different From Current Train Brakes?

- Current brakes are operated through use of brake pipe pressure reductions, which signal valves to release air from individual reservoirs into the brake cylinders on each car.
 - Repeated brake pipe reductions can deplete the brake pipe and cause a run-away train.
- ECP-braked trains are controlled by electronic messages, so that the brake pipe is not depleted of air and is constantly being charged during the brake application.



How Are ECP Brakes Different From Current Train Brakes?

- Current brakes are very complex and subject to failure, which is a maintenance challenge and a safety concern. For instance, current brakes—
 - Are prone to causing undesired emergency applications (UDEs), which can result in delay and even derailment;
 - Can stop working on individual cars en route without the locomotive engineer being aware.
- ECP brakes are not susceptible to UDEs, and the health of the braking system on all cars is reported to the locomotive engineer in real time.



What does this mean for Safety?

- Shorter stopping distances, in the range of 40-60 percent.
 - Reduced number and severity of collisions with obstacles on the railroad, including vehicles stuck on grade crossings; and
 - Reduced or less severe train-to-train collisions.
- Reduced chances of runaway trains, reduced train handling derailments.
- Wiring the train provides a platform for the gradual addition of other train performance monitoring devices using sensor-based technology to maintain a continuous feedback loop on train condition for the crew.



Why hasn't this been done already?

- ECP brake technology was developed in the 1990's by the railroads and brake suppliers, but...
- Cost-effective applications will require "stand alone" ECP brakes, which will have only limited compatibility with conventional systems.

ECP Tests and Conversions

- 1995: BNSF testing of ECP on selected unit coal, taconite and doublestack trains
- 1995: CR testing of ECP on one unit coal train
- 1995: CP testing of ECP on one intermodal train
- 1998: Quebec Cartier Mining begins converting its iron ore trains to ECP
- 2000: CSX and Southern Companies conduct limited tests of ECP on unit coal trains, which are hampered by the inability to match ECP power to ECP cars



Why hasn't this been done already?

- ECP brakes are a major capital investment (on the order of \$6 billion for all locomotives and cars).
- The majority of costs will fall on car owners (most cars are privately owned by shippers or leasing companies); however, the majority of benefits will flow to the railroads.
- Moving from conventional to ECP brakes will be logistically difficult, and small railroads will face significant costs downstream.
- All North American freight railroads will eventually need to convert.

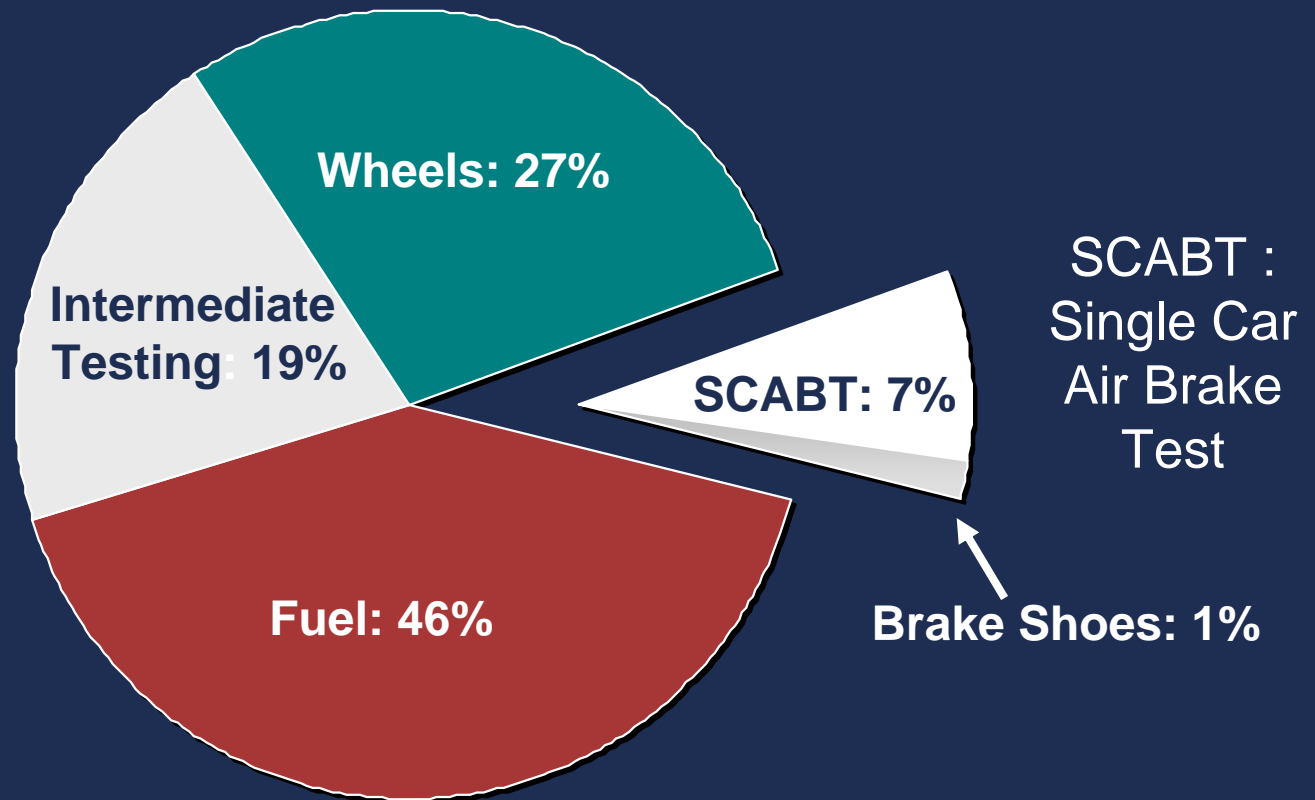


Why should it happen now?

- In the interest of safety, FRA commissioned a report by Booz Allen Hamilton to describe a path to ECP implementation. The Report suggests that—
 - ECP technology can return substantial benefits;
 - As applied to western coal service, the business case is substantial; and
 - ECP implementation in other market sectors appears plausible as industry gains confidence.
- Rail capacity issues are critical
- Non-capacity related ECP savings lie in three areas: fuel, wheel wear and avoiding the necessity of an intermediate brake test (regulatory adaptation)



US Class I Railroad Major ECP Cost Savings



Total = \$650 million per year

Source: Booz Allen analysis



Preliminary financials for Powder River Basin coal service implementation indicate a 3-year payback, an internal rate of return of 47%, and a net present value of almost \$700 million

One-Time Costs	Amount (\$ million)	Annual Benefits	Amount (\$ million)
Locomotive Conversion @ \$40,000 per unit	112	Fuel Savings	78
Freight Car Conversion @ \$4,000 per car	320	Reduced Wheel Defects	45
		Brake Inspection Savings	45
		Brake Shoe Savings	2
Total	432	Total	170

Source: Booz Allen analysis, using a discount rate of 12%



How do we know it's ready and will work as advertised?

- ECP brakes have previously been tested and demonstrated in the U.S., and they have been adopted in revenue service by railroads in Canada, Australia and South Africa.
- South Africa's Spoornet has embraced ECP for its huge export coal operations, reporting savings in train energy consumption of 23%.
- Electronic monitoring on Spoornet's ECP-equipped trains has increased capacity, reducing turn times by 9%.





How do we know it's ready and will work as advertised?

- Growth in demand for U.S. coal and for import goods, coupled with limits on motor carriers' ability to expand due to driver shortages and other factors, indicate that North American rail network congestion will be a major concern for the foreseeable future.
- ECP-braked trains will move more efficiently.
- Higher velocity will result in greater network capacity.
- Industry-wide equipment savings of up to \$2.5 billion will result from a 1 mph gain in network velocity.



Rail network capacity and operational benefits of ECP brakes



- Better braking performance will provide railroads the opportunity to increase consist lengths, but actually reduce the need to block road crossings for long periods of time.
- Increased braking efficiency will support reduced train spacing.
- Locomotive engineers can operate their trains more effectively knowing their air supply will not need as frequent charging and their stopping distances are reduced.



What do we need to do to make it happen?

- Provide regulations that fit
- Start where the benefits are clear
- Build confidence
- Prepare for the transition
- Roll out by market sector





What do we need to do to make it happen?

- Provide regulations that fit
 - Industry and FRA have studied ECP brake safety issues, and a substantial body of standards and analysis is already available
 - FRA is developing a Notice of Proposed Rulemaking that will describe safety requirements for ECP-braked trains
- Issue NPRM in May 2007
 - Many requirements of existing regulations will be inapplicable
 - New regulations will address acceptance of electronic systems using a performance-based approach



What do we need to do to make it happen?

- Start where the benefits are clear

Intermodal

Grain



Coal



High Mileage
Dedicated Trains
High Traffic Percentage

Non-metallic minerals



Ores



Set-up Automobiles





What do we need to do to make it happen?

- Build confidence
 - Need to take data from initial implementations and validate the business case
- FRA role with railroads and shippers
 - Shippers need reassurance that service will remain stable through carrier provision of ECP-equipped locomotives
 - Locomotive and train crew members will need to have training and gain experience using this technology to the best effect



What do we need to do to make it happen?

- Prepare for the transition
 - Immediate shift to ECP brakes is not possible
 - Obstacles include capital requirements and logistical difficulties
 - Adoption of industry interchange standards that make new equipment ECP-ready (e.g., more easily converted) will be critical
 - Association of American Railroads already has proposed standards changes under consideration
 - FRA will work with parties to help overcome other obstacles



What do we need to do to make it happen?

- Roll out by market sector
 - Railroads and major shipping communities need to define relevant sectors and begin making plans
 - Practical obstacles must be identified and overcome





Who will benefit from ECP Brakes?

- ***Railroads***, through more efficient operations
- ***Rail shippers and car owners***, through improved asset utilization, improved service, and reduced costs
- ***Railroad employees and the public***, through improved safety on the railroad and by keeping shipments on the rails that would otherwise burden congested highways
- ***The National economy and the environment***, by making better use of fossil fuels and contributing to transportation capacity