Trust, Public-Private Partnerships and Transportation Safety

Applicability of the Aviation Model for Railroads

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MITRE

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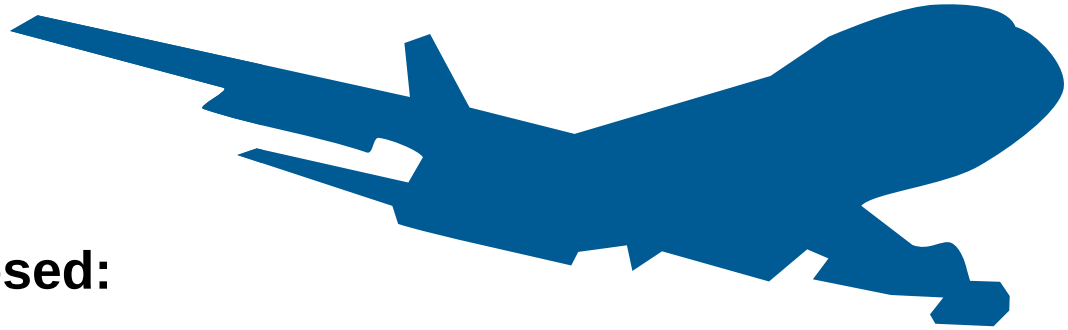
technology

Serve as channels of expertise to advance government missions

Introduction

- **MITRE is Currently Researching Parallels between aviation and the Railroad Industry**
  - DOT challenged FAA to assist other modal administrations applying lessons learned from aviation system safety model
  - MITRE's Center for Aviation System Development (CAASD) expertise in Safety Management System (SMS) sought by rail transit industry



- **Three Questions Posed:**

1. *Given the operational similarities between rail and air, could rail benefit from a collaborative safety partnership like air?*
2. *If so, can lessons learned from air accelerate the realization of these benefits?*
3. *Does the recent history of aviation safety contain any insights?*

Timeline of Recent Aviation Safety History

(Late 1990s to 2010s) Growing Partnerships

TWA 800 Mid-Air Explosion Long Island 1996

ValuJet 800 Crash Everglades 1996

1995

Gore Commission Goal: 80% Accident Reduction 1997

2000

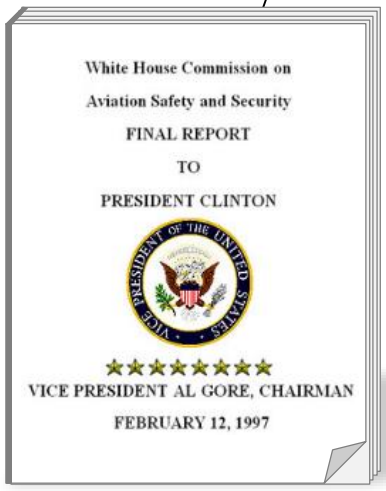
Commercial Aviation Safety Team (CAST) Aviation Safety PPP 1998

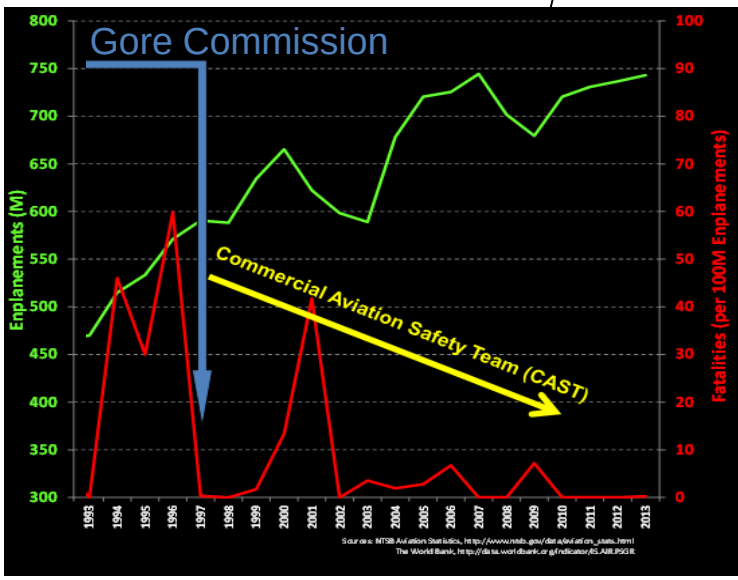
2005

Aviation Safety Information Analysis and Sharing (ASIAS) Program Formed 2007

2010

Aviation Accidents Significantly Decrease Post-CAST formation 2013


White House Commission on
Aviation Safety and Security
FINAL REPORT
TO
PRESIDENT CLINTON
VICE PRESIDENT AL GORE, CHAIRMAN
FEBRUARY 12, 1997



Government and Industry adopts Safety Management System both within US and Internationally

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Quick Overview of Safety Management Systems

Safety Policy

Establishes organizational processes and commitments.

Safety Promotion

Creates a positive safety culture to achieve safety objectives.

Safety Risk Management

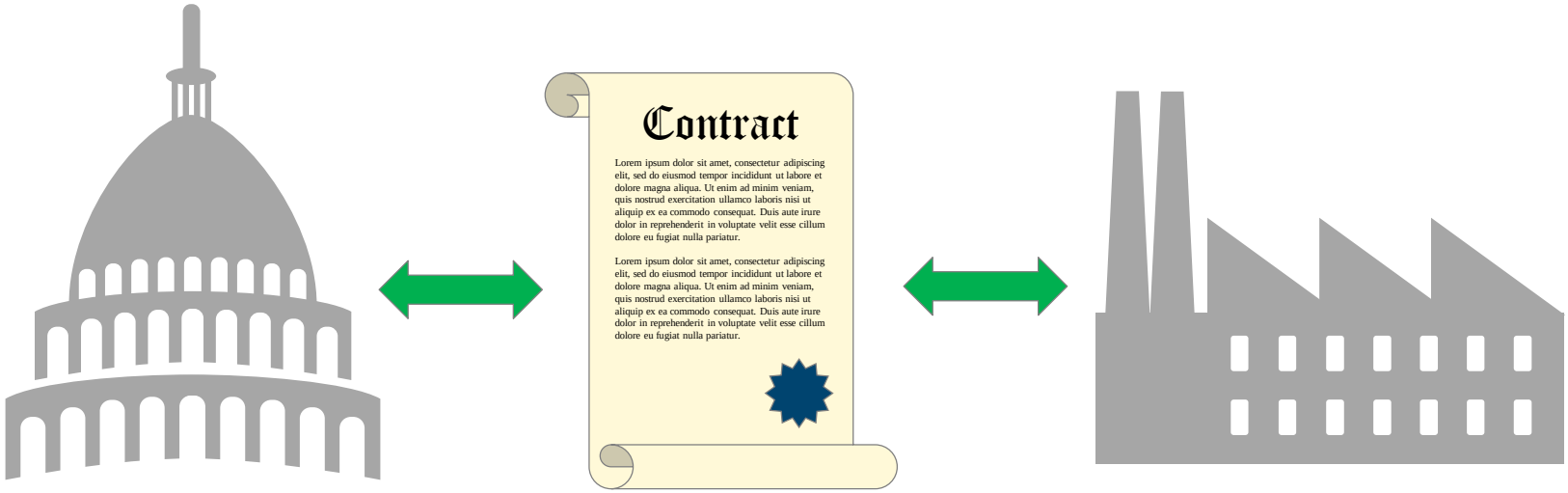
Formalized process to assess and control system risks.

Safety Assurance

Requires information capture to ensure risk controls throughout system life cycle.

Public-Private Partnership Defined

*A **public-private partnership** (P3) is a contractual arrangement between a **public agency** and a **private sector entity**.*



*Through this agreement, the **skills and assets** of each sector (public and private) **are shared** in delivering a service or facility for **the benefit of the general public.***

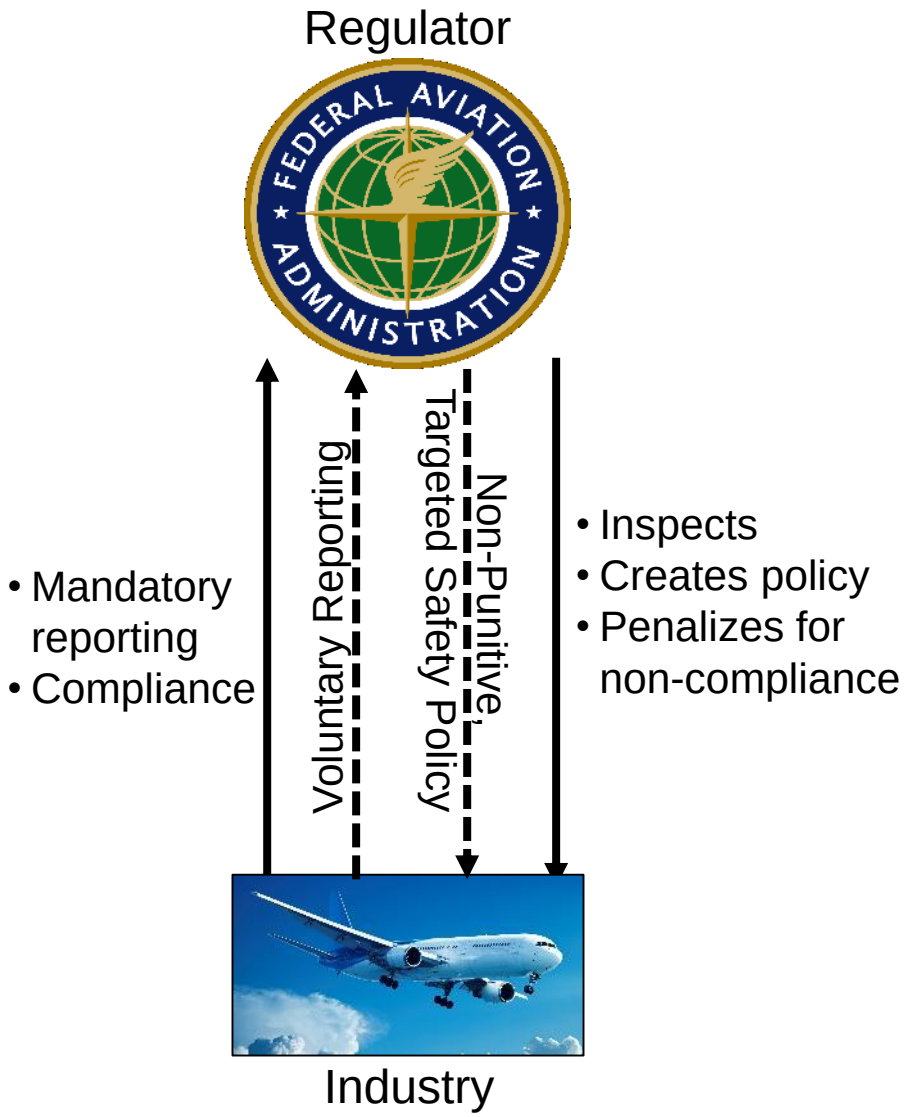
Evolving a Public-Private Partnership
Standard Regulator-over-Industry Model

- **Features:**
  - Regulator Inspects/Enforces
  - Industry Reports/Complies
- **Applied throughout last century**
- **Benefits:**
  - Ensures industry meets minimum safety standards
- **Drawbacks:**
  - creates “letter-of-the-law” attitude toward safety

Evolving a Public-Private Partnership

Regulator-over-Industry Model with Voluntary Reporting

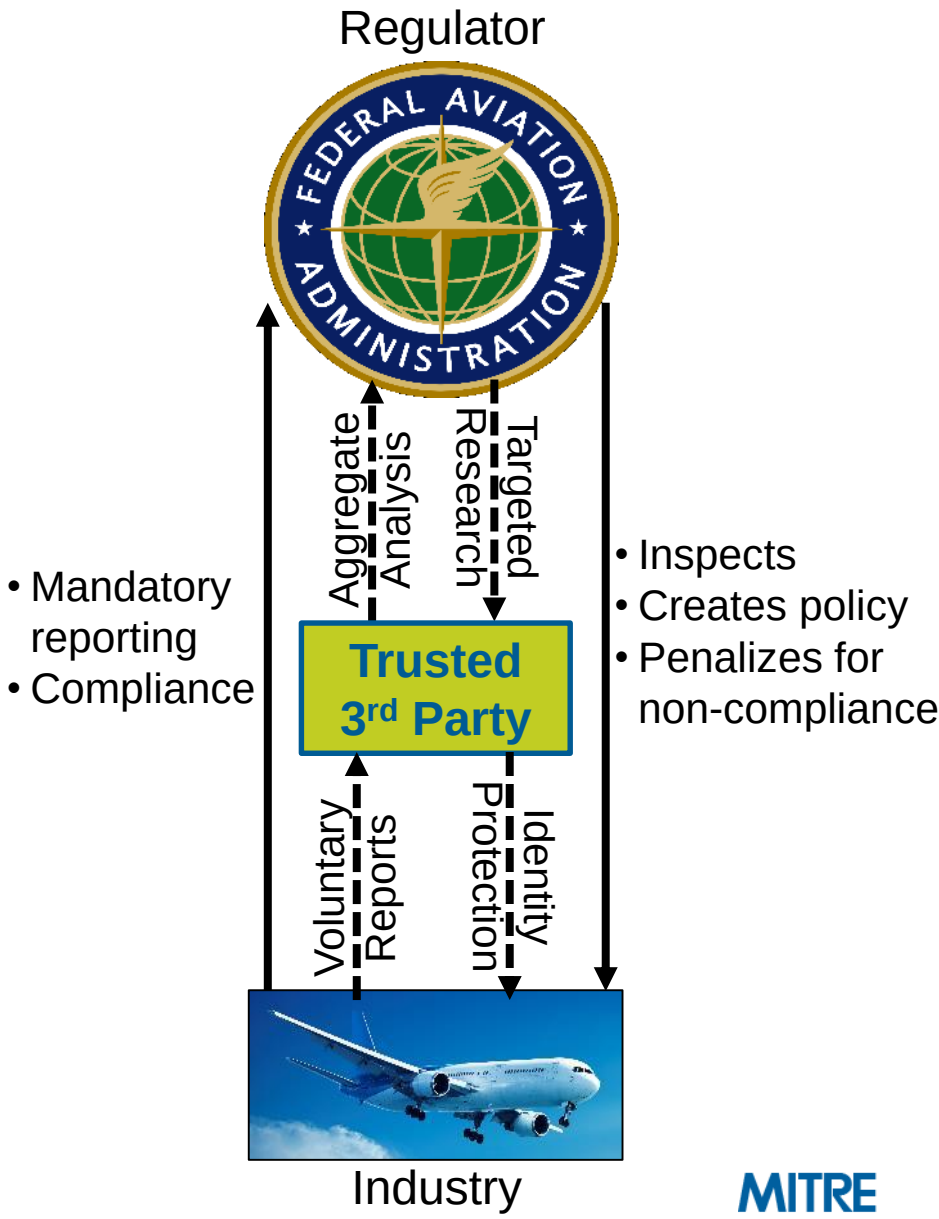
- **Examples of use:**
  - Mid-Air Collisions during 1960s
  - Initial Aviation Safety Reporting System (ASRS) late 1970s
- **Benefits:**
  - Ensures minimum safety standards
  - Provides additional data
- **Drawbacks:**
  - Creates “letter-of-the-law” attitude toward safety
  - Limited by industry’s trust of the regulator



Evolving a Public-Private Partnership

Regulator-over-Industry Model with Trusted Third-Party

- **Examples of use:**
  - Mid-Air Collisions during the 1960s via Flight Safety Foundation
  - ASRS during late 1970s administrated by NASA
- **Benefits:**
  - Ensures industry meets minimum safety standards
  - Provides safety data
  - Trust facilitated through third-party
- **Drawbacks:**
  - Limited by focal areas, duration, and legal protections for reporters
  - Limited by industry's trust of regulator and third-party



Early Public-Private Partnership (1998-2007)
Regulator-Industry Collaborative Model

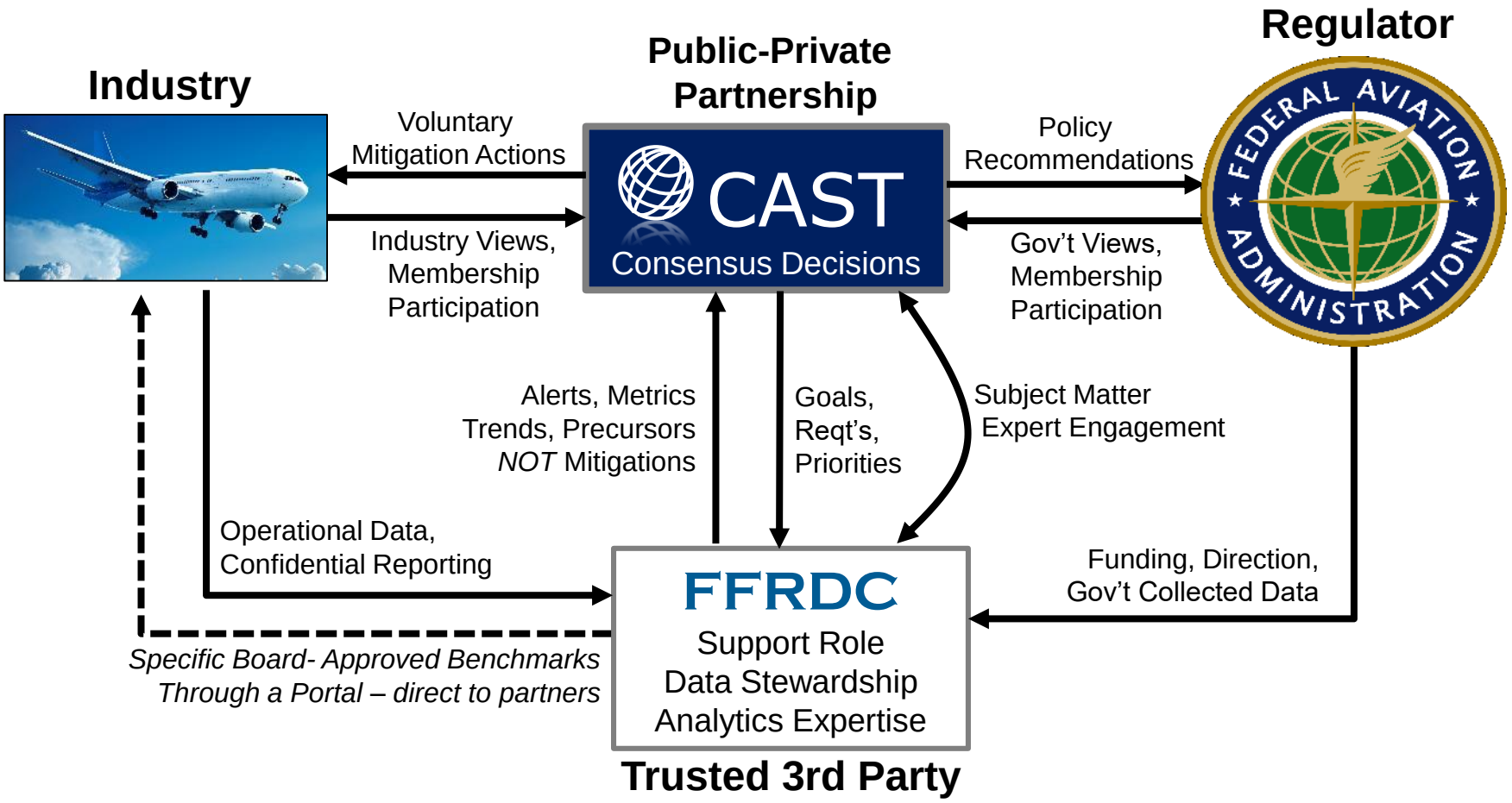
- **FAA Split Functions between Safety Inspection and System Safety**

- **Benefits:**
  - Allows industry to exceed minimum safety standards
  - Enables direct conversation between industry and regulators
- **Drawbacks:**
  - Limited by known risk areas, continued priority of P3 trust environment
  - Identified need to use flight and voluntary reporting data to find accident precursors

The innovation here is that FAA did not use a regulator-on-top model

Current Public-Private Partnership (2007- Pres.)

Regulator-Industry Collaborative Model with 3rd Party Analytics



The addition of third party support enabled data analytics and protected data stewardship

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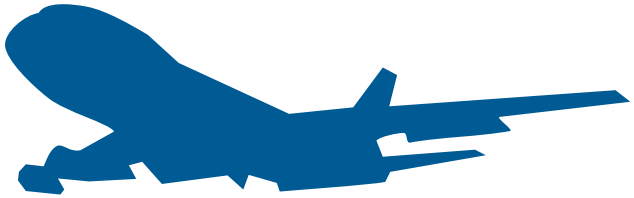
Comparison between Air and Rail Industries



- **Four major air carriers;**
- **Two major freight carriers;**
- **Approximately 15 minor air carriers; and**
- **Numerous regional airlines and air taxis.**

- **Seven major Class I freight railroads;**
- **Three intercity passenger railroads;**
- **Thirty five regional railroads; and**
- **Numerous short line railroads.**

- **Operational similarities between aviation and rail operations**
  - Railroads often operate on shared facilities, e.g., rails, yards (like flight routes, airports)
  - Mission: safe separation, capacity, passenger experience
  - Capital intensive, de-regulated industries
  - Role of Dispatchers and Air Traffic Controllers
  - Few manufacturers of cars, engines, technologies (ground & vehicle)

Assessment for Potential Applications in US Rail

- **SMS Experiences**
  - Canadian rail SMS has mixed outcomes mostly due to lackluster effort.
- **Confidential Reporting**
  - UK Rail's CIRAS system has been extremely successful
  - US Confidential Close Call Reporting System (C3RS) gaining momentum
- **Safety Culture in Railroads**
  - Recent court case wins by safety whistleblowers illustrated poor culture
  - Since, major US railroads made strong commitments to improving safety culture.
- **Examples of Successful Public-Private Collaboration in Rail**
  - Several safety and technological research organizations, but regulator still remains "top dog."
  - Examples:
    - Transportation Technology Center Inc. (TTCI)
    - Switching Operations Fatalities Analysis Group (SOFA)

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Rail Industry Current Safety Focus is Technology, But Focus is Changing

- **An AAR Strategic Research Initiatives objective: "Improve Safety" by "Reducing track and equipment-related derailments through technology development" (Source: TTCI)**
- **Beyond technology improvements FRA Broad Agency Announcement (Mar-2016) includes, a human factors/safety culture elements.**
  - FRA-HF-003 R&D Safety Culture Strategic Roadmap and Implementation Plan

Source: TTC, Inc.

Acoustic Sensors Measure Wheel Defects in Real Time

Innovative Materials and Designs in Rail Tie and Clips May Help Prolong Infrastructure Utilization

Non-Punitive Safety Reporting Comparison Aviation vs. Rail

(Gray fields indicates relative equivalency)

Aviation

NASA Aviation Safety Reporting System (ASRS)

- Carrier *Not Identified*
- Involved Personnel Contact Information
- Event Type, Time/Date Stamp
- Reporting Individual Experience/ Qualifications
- Weather Conditions
- Event Operating Environment
- Event Visibility/Limitations
- Aircraft Equipment Description/ Certification/Mission
- Flight Plan Filing (e.g., VFR, IFR, etc.)
- Location/Altitude/Airspace
- Nearest Airport or Navigational Facilities
- Operating Phase of Flight (e.g., Take-Off, Climb, Descent, etc.)
- Conflict Event Factors (e.g., Alerts Sounded)

Rail

NASA Confidential Close Call Reporting System (C3RS)

- Carrier Name
- Involved Personnel Contact Information
- Event Type, Time/Date Stamp
- Reporting Individual Experience /Qualifications/Location During Event
- Weather Conditions
- Event Operating Environment
- Event Visibility/Limitations
- Train Equipment Description/Certification/Mission
- Rules in Effect (e.g., Auto Signals, PTC, etc.)
- Location/Facility, Milepost
- Nearest Station
- Train Activity Phase (e.g., Departure, En Route, Station Arrival, etc.)
- Operation Type (e.g., Pulling, Push/Pull)

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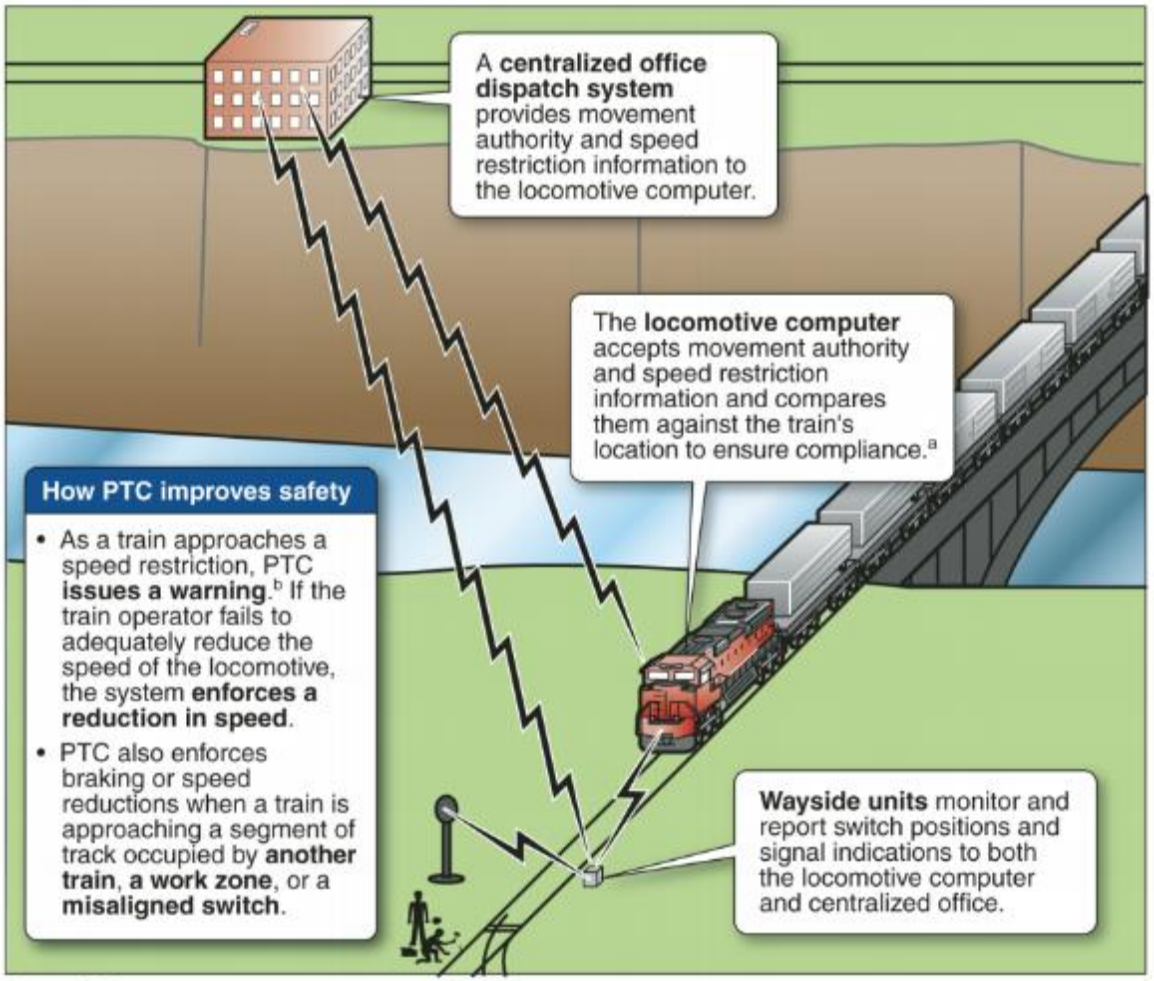
Railroads Developing Positive Trail Control (PTC) Systems



Source: GAO.

PTC will generate vast amounts of new operational data

Overview:

- **Congressional mandate for Dec 2018.**
- **AAR estimates cost at $10B, with $6.5 spent as of 2015 by railroads.**
- **FRA studies admit little industry benefit**
- **Implementation Challenges**
  - Requires new components and frequency spectrum
  - *All* sharing railroads must be interoperable
  - Largest RRs data systems suffer from scale
  - Hard for smaller railroads

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Example Accidents Considered Preventable by PTC

AMTRAK 188 Derailment
Frankford Jct, Philadelphia Fatal Accident (2015)

Source: National Transportation Safety Board

Occurred when engineer was distracted by window impact and entered a curve above the safe speed.

2 BNSF Trains Head on Collision
Near Amarillo, TX Fatal Accident (2016)

Source: Houston Public Media

A BNSF Train failed to slow at a yellow warning signal and continued past a red signal before striking an oncoming BNSF train.

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Example Accidents *NOT* Considered Preventable

Union Pacific Coal Trail Derailment
Northbrook, IL Fatal Accident (2012)

Source: National Transportation Safety Board

Occurred when maintenance crew failed to complete inspection and identify heat-related rail buckling, causing derailment.

Montreal, Maine and Atlantic (MMA) 2 Derailment
Lac-Megantic, Quebec Fatal Accident (2013)

Source: Transportation Safety Board of Canada

Occurred due to an improper break setting that gave a false impression that train was safely secured.

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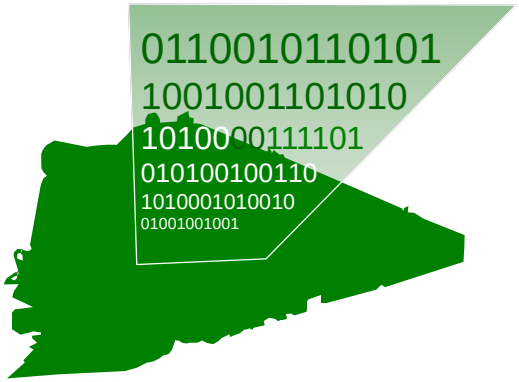
Data-Driven Train Control Environment Presents Opportunities for Collective Data Analytics



The Changing Rail Data Environment

PTC/CBTC/STC

Wayside Sensors

Rail Data Recorder

Dispatch/Signal Systems

Back Office Server System

Opportunities:

- **PTC Infrastructure Data Collection**
  - New infrastructure increases the electronic data collected across the system
  - Allows combination with
- **Archived data could allow for detailed analysis and predictions**

Challenges:

- **Lack of Standards**
  - Data collected in different formats by different systems
- **Interoperability Requirements**
  - May not require creating a common data set
- **Railroad Attitudes toward Data Sharing**
- **Trust between Regulator and Industry**

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Conclusions

- Rail industry could be in a position to benefit from applying a similar public-private partnership model.
  - Requires fostering trust between industry and regulator
  - Some advantages from *Lessons Learned* from aviation
  - But aviation safety history indicates development of trust takes time and commitment
- Common understanding of rail operations and emerging data environment is key to benefits for rail safety analytics.