



NTSB National Transportation Safety Board

*Office of Railroad, Pipeline and
Hazardous Materials Safety*

Automated People Mover Train Collision with Passenger Terminal Wall at Miami International Airport

November 28, 2008



NTSB Team

- Ruben Payan Investigator-in-Charge
- Dave Watson Mechanical
- Russ Gober Operations
- Chris Babcock Video Recorders





Parties

- Miami-Dade Aviation Department
- Johnson Controls, Inc.
- Bombardier – Automated People Mover Division





Automated People Movers

- Fully automated operations
- Exclusive right-of-way
- Smaller vehicles
- No operators or station attendants

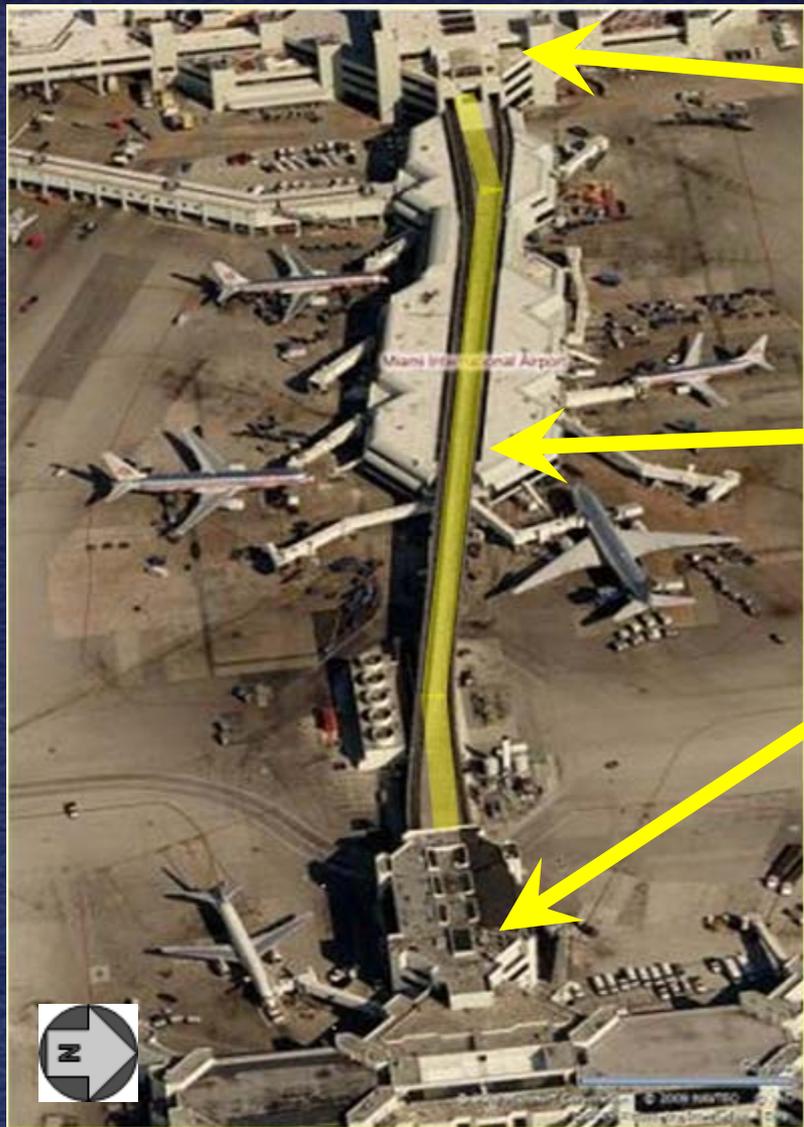




Automated People Movers



Miami International Airport



• Main E concourse building

• Guideway

• Satellite E concourse building

**Main
Concourse E
Building**

**Automated
People
Mover**

**Satellite
Concourse E
Building**





Injuries

- 1 passenger serious injury
- 2 passengers minor injuries
- 2 passengers treated and released
- 1 maintenance technician treated and released





Damages





Safety Issues

- Maintenance practices and procedures
- Safety oversight of fixed guideway systems





NTSB



NTSB National Transportation Safety Board

*Office of Railroad, Pipeline and
Hazardous Materials Safety*

Train Control System

Ruben Payan
Electrical Engineer



Automatic Train Control System

- Automatic Train Operation
- Automatic Train Supervision
- Automatic Train Protection



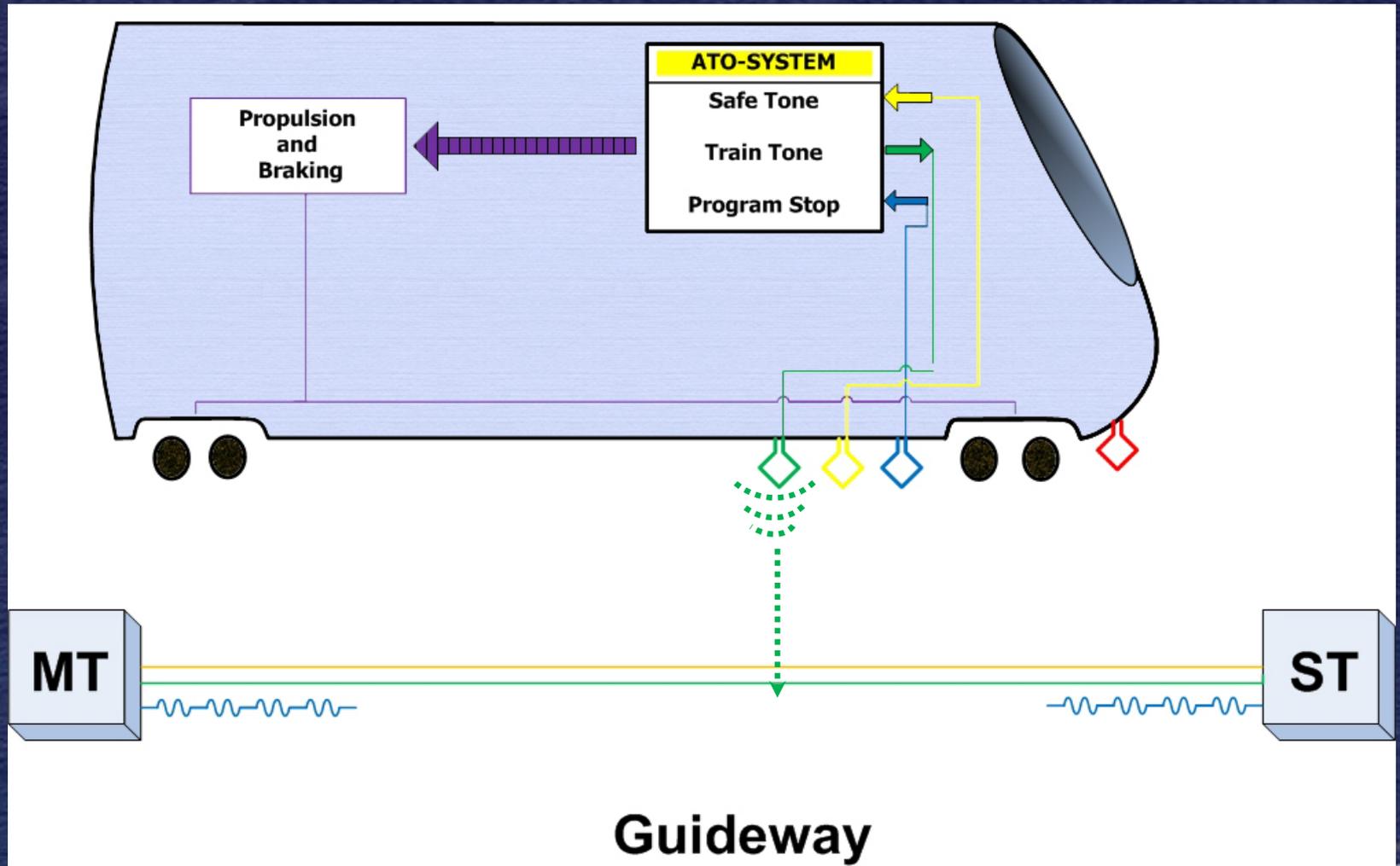


Automatic Train Operation

- Train Tone
 - Information from the train
 - Door operation
- Safe Tone
 - Commands to the train
 - Interfacing with propulsion power
- Program Stop
 - Station stop



Train Tone





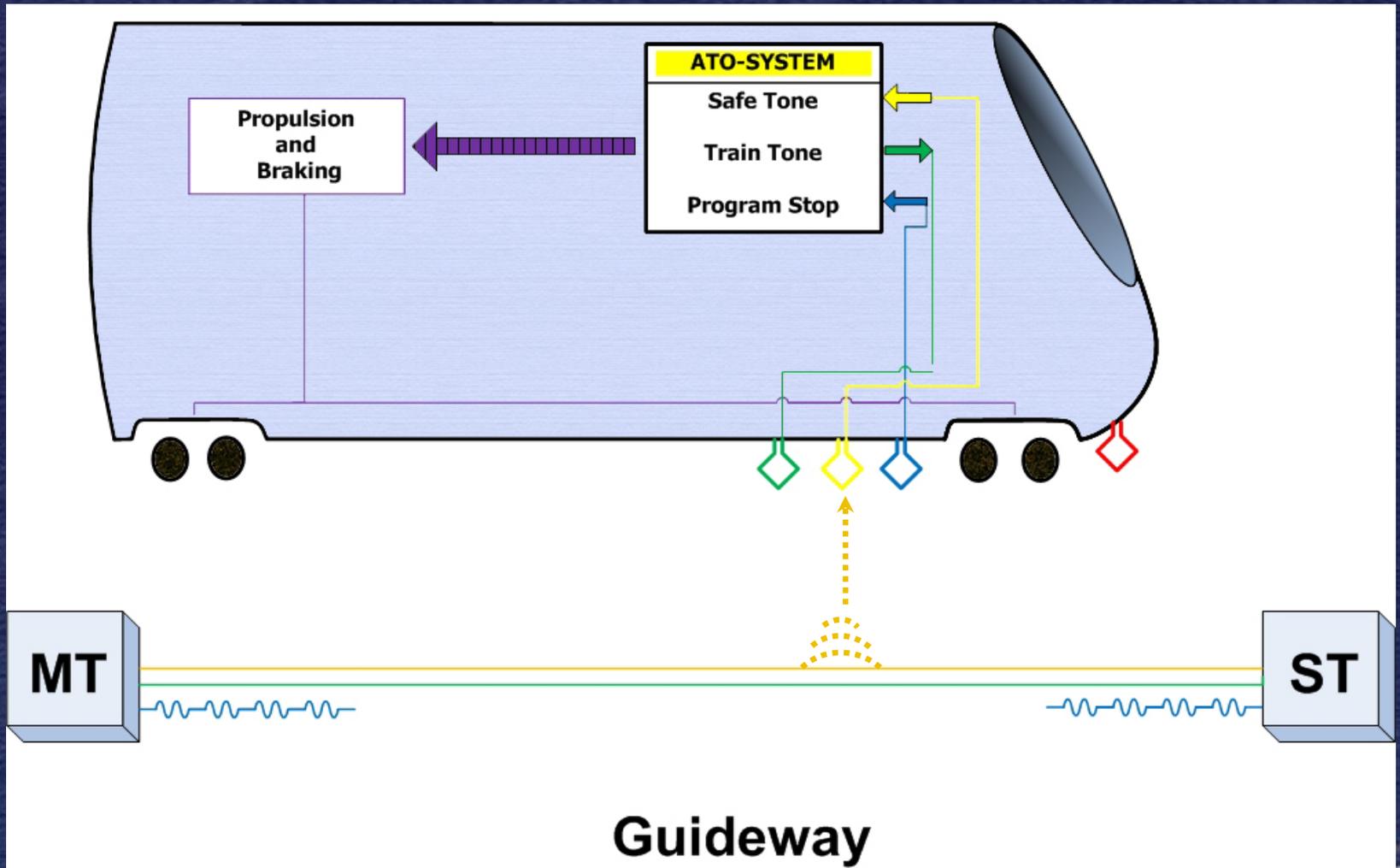
Train Tone



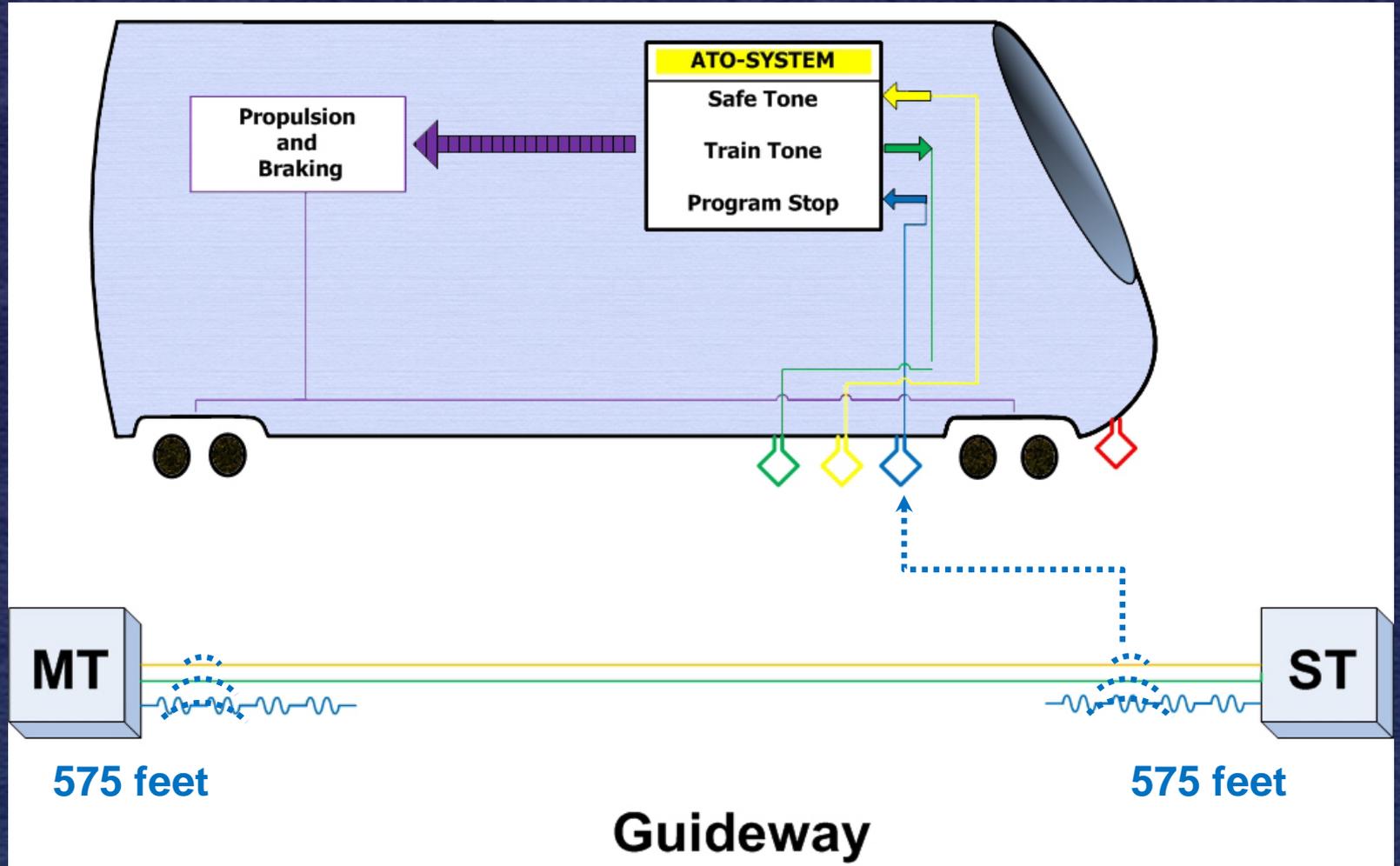
Antenna



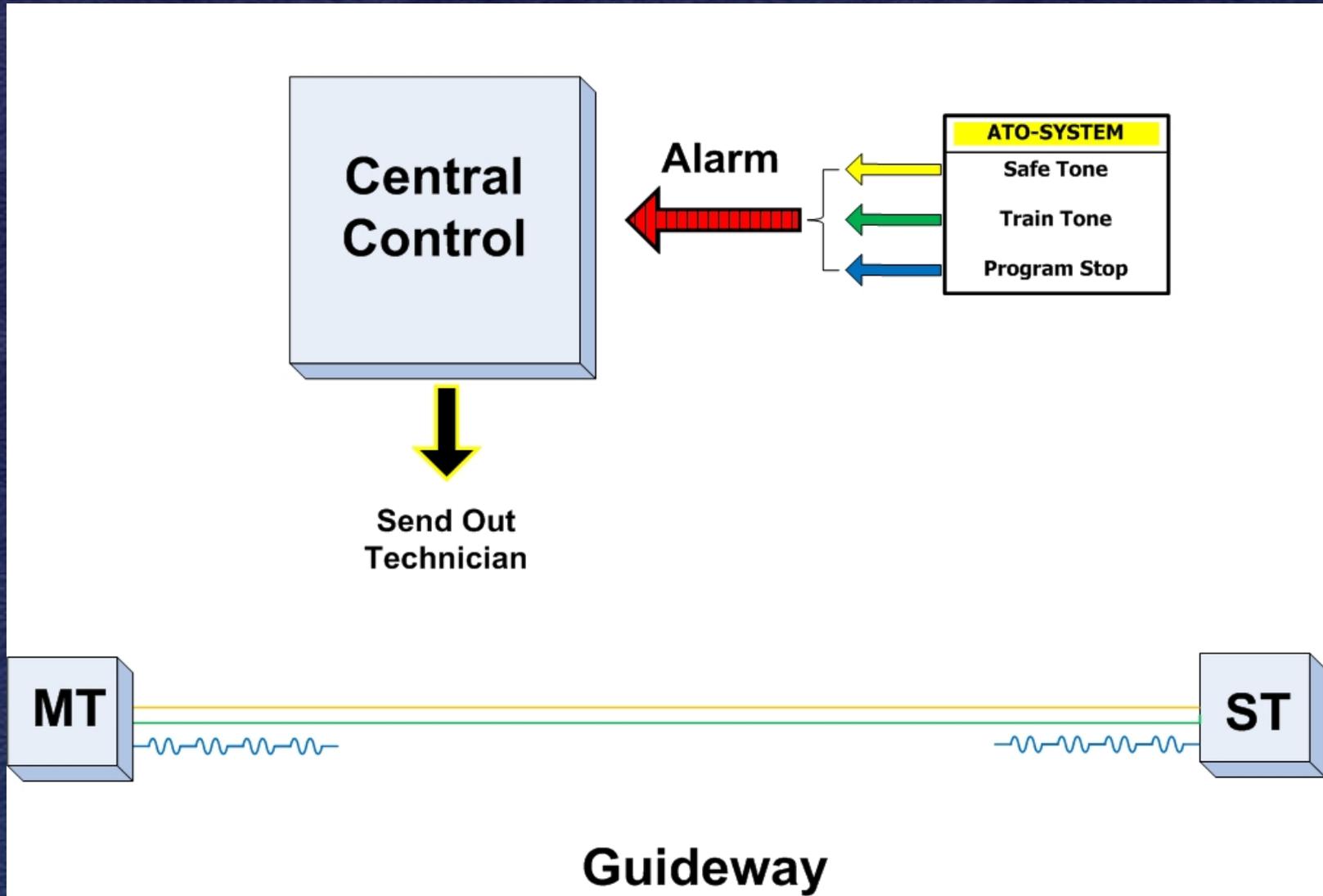
Safe Tone



Program Stop



Automatic Train Supervision

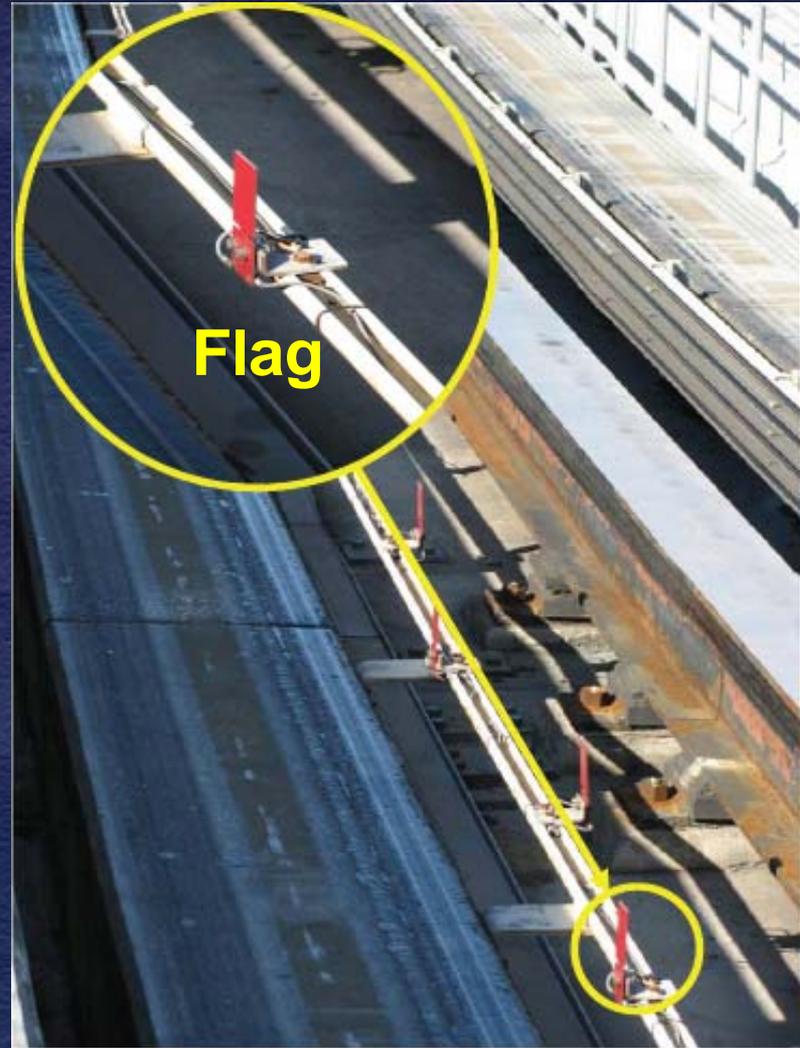




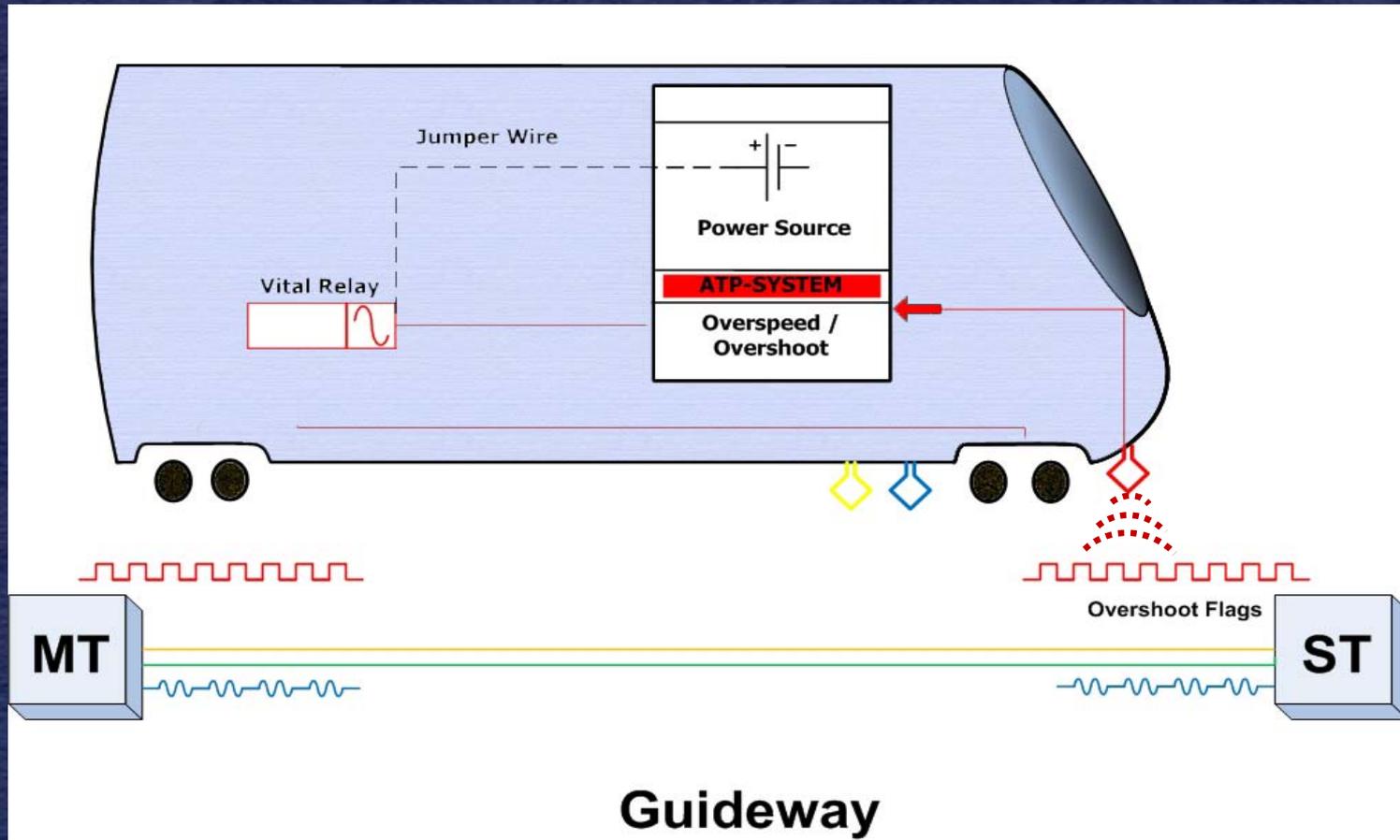
Automatic Train Protection

Overspeed/Overshoot system

- Vital system
- Monitor train speed
- Monitor brake air pressure



Automatic Train Protection



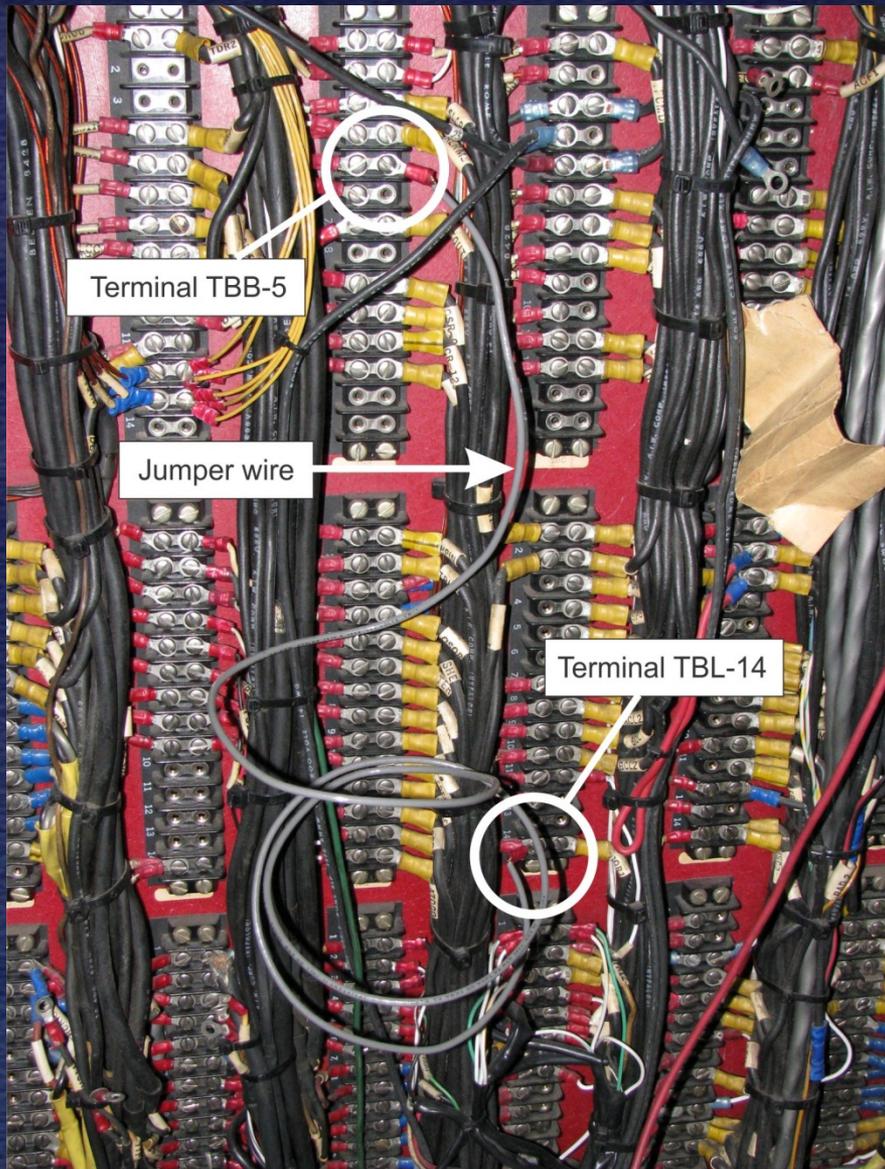


Events Preceding Accident

- South train experienced intermittent failures
- Train Tone antenna replaced
- South train stopped on guideway because of loss of train tone
- Maintenance technicians assigned to ride trains during passenger service

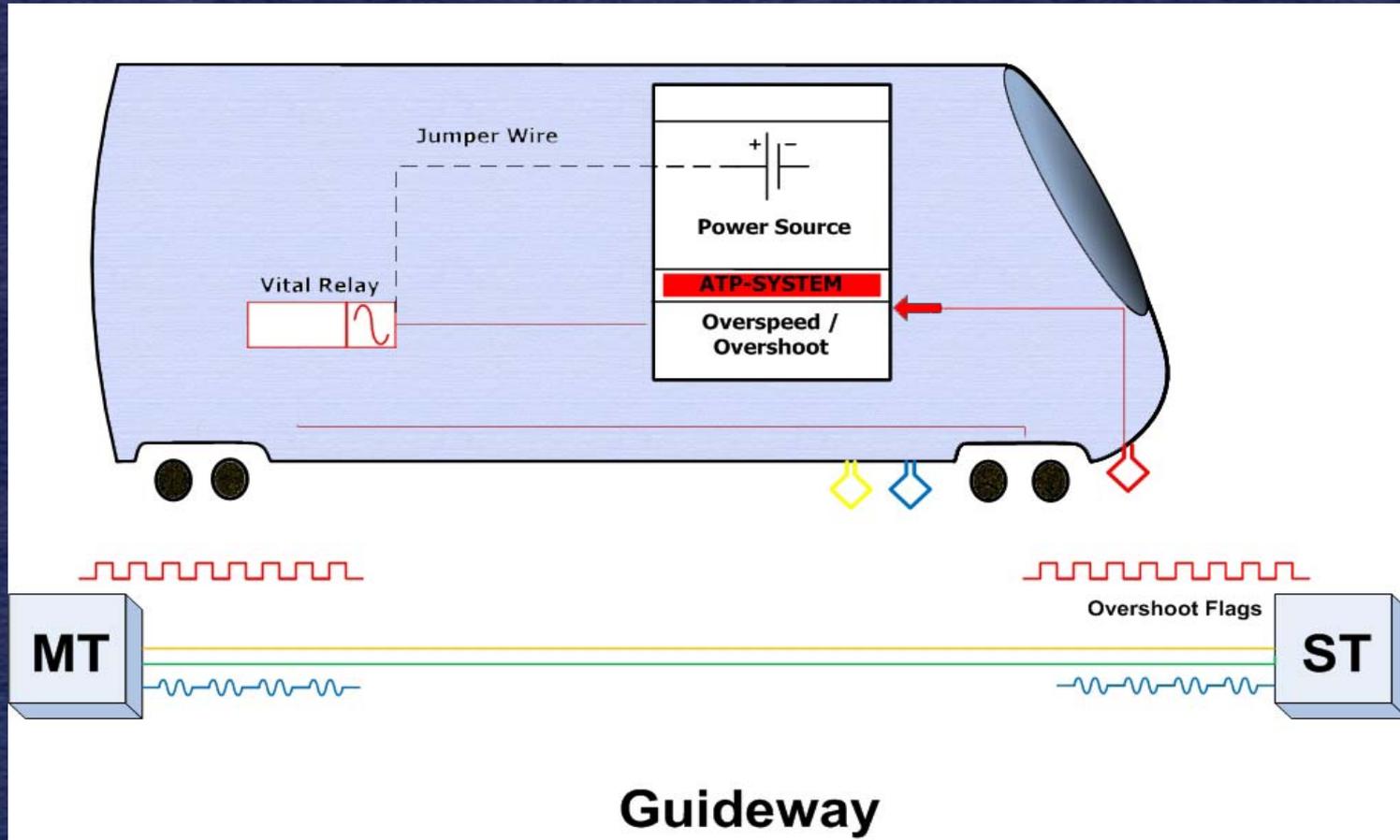


Events Preceding Accident



- Installed November 21, 2008
- Installed to keep south train in service
- Remained in place from November 21 to November 28

Investigation





Findings

- Overspeed/Overshoot relay testing determined relay was performing within manufacturer's specifications
- Program stop module testing determined a crystal failed, which disabled the program stop module





Findings

- Jumper wire prevented overspeed/overshoot system to function as designed
- System designed to command brake application if train goes above allowed speed or if train moves beyond stopping point





NTSB



NTSB National Transportation Safety Board

*Office of Railroad, Pipeline and
Hazardous Materials Safety*

Maintenance Practices & Procedures

Dave Watson

Mechanical Group Chairman



Events Preceding the Accident

- APM began operation in 1980
- Bombardier manufactured and maintained the system for 28 years
- Bombardier raised safety concerns
- Bombardier recommended APM operations be halted





Events Preceding the Accident

- MDAD consultants inspected and identified requirements to continue operations for 5 additional years
- Bombardier did not agree with the assessment
- MDAD issued invitation to bid for maintenance of APM system





Events Preceding the Accident

- Maintenance contract awarded to Johnson Controls, Inc. in 2008
- No coordination between Johnson Controls, Inc. and Bombardier prior to transfer of maintenance operations
- Incomplete transfer of maintenance records and spare parts





Vital Relay

- Vital relay previously disabled on north train
- Same solution applied to south train
- No evaluation of possible detrimental effects or plan to remove the jumper wire





Vital Relay

- Train could not stop under certain conditions
- Johnson Controls, Inc., maintenance technician instructed to leave jumper wire in place
- Johnson Controls, Inc., had no procedures against disabling safety-critical systems





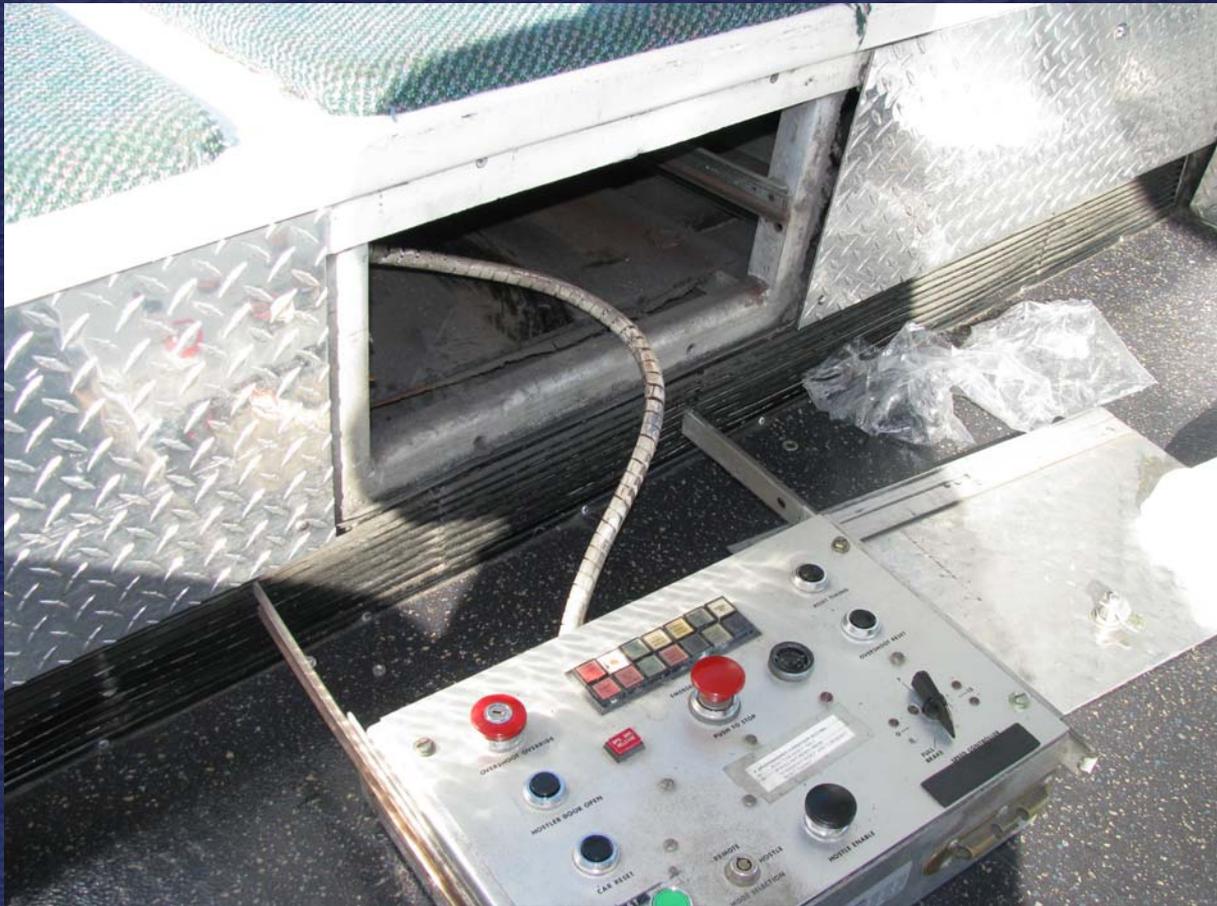
Train Maintenance Procedures

- Daily brake tests
- Program stop module testing
- Deactivation of safety-critical systems during passenger service
- Incomplete maintenance manuals





Train Maintenance Procedures



Auxiliary control panel



Postaccident Events at Miami Airport

- Johnson Controls, Inc., withdrew from Miami Airport maintenance operation
- Miami-Dade County Transit provides technical supervision
- North train continues in operation
- MDAD considering replacing south train





NTSB



NTSB National Transportation Safety Board

*Office of Railroad, Pipeline and
Hazardous Materials Safety*

Safety Oversight of Fixed Guideway Systems

Ruben Payan
Electrical Engineer



MDAD Safety Oversight

- MDAD operated the Miami International Airport for Miami-Dade County
- Investigation revealed that MDAD was not providing appropriate safety oversight





MDAD Safety Oversight

- Johnson Controls, Inc assumed maintenance responsibility 10 months prior to the accident
- Passenger risk increased when the overspeed/overshoot system was disabled
- MDAD was unaware of maintenance practices, failing to fulfill its safety oversight role



MDAD Safety Oversight

- Johnson Controls Inc., had no procedures for testing brake systems
- Brake tests were not being conducted
- Brake system test procedures were available in maintenance manuals



MDAD Safety Oversight

- Vital relays not tested
- Tests required every 4 years
- MDAD did not verify testing of vital safety-critical components



State of Florida Safety Oversight

- Florida Department of Transportation provides safety oversight of some fixed guideway systems
- The Miami-Dade airport APM does not receive Federal or State funds
- Florida does not provide oversight



Federal Safety Oversight

- Federal Transit Administration
 - No statutory authority to promulgate safety regulations
 - State safety oversight regulation requires each state to establish an oversight agency
- No direct Federal funds received for the APM at Miami Airport

Safety Oversight

- FTA does not provide oversight agency with any authority
- State oversight agencies limited in ability to compel fixed guideway systems
- Not all fixed guideway systems are subject to state oversight



Current Miami Airport APM Oversight

- E concourse, APM train operates without oversight
- Skytrain began service September 2010 without oversight
- Miami Mover began service September 2011 has Florida DOT oversight





NTSB