



**National  
Transportation  
Safety Board**

# Head-on Collision between Two CN Freight Trains Two Harbors, Minnesota September 30, 2010

**Mike Flanigon**

# NTSB Team

Mike Flanigon

IIC and Report Writer

Ted Turpin

Operations

Rick Narvell

Human Performance

Dave Watson

Mechanical

Gena Evans

Editor

Cassandra Johnson

Event Recorders

Ben Xu

Cell Phones

Mike Hiller

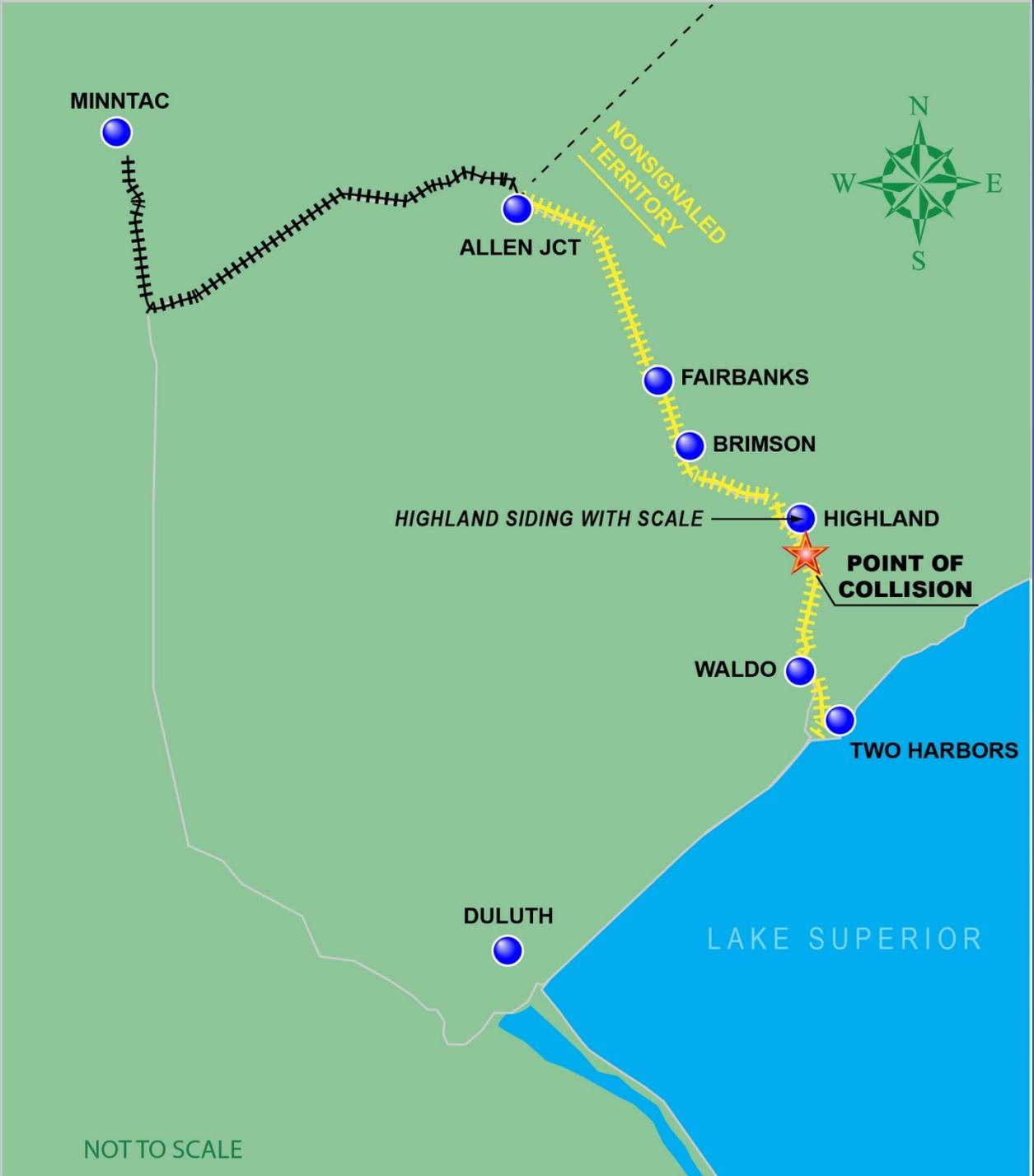
Graphics & Technical Support

Robert Turner

Graphics

# Parties

- Federal Railroad Administration
- Canadian National Railway Company
- Brotherhood of Locomotive Engineers & Trainmen
- United Transportation Union



Time: 3:47 p.m.

Southbound train has **“conditional”** authority after the arrival of the northbound train

Scale House



Southbound Train

Highland Siding

Northbound Train

Northbound train has **main** track authority 10 miles away

North



Toward Two Harbors



Time: 4:02 p.m.

Southbound train has **“conditional”** authority after the arrival of the northbound train



Northbound train **main** track authority extended beyond Highland. **2.5 miles away**

North

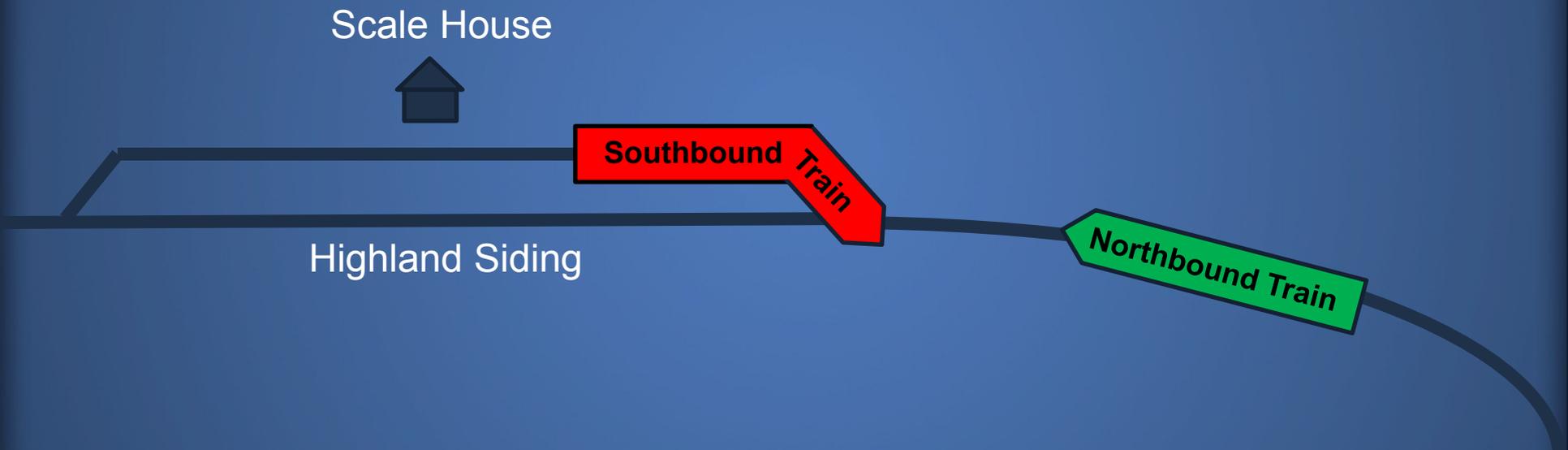


Toward Two Harbors



Time: 4:04 p.m.

Southbound train has **“conditional”** authority after the arrival of the northbound train



Northbound has **main** track authority less than 1 mile away

North

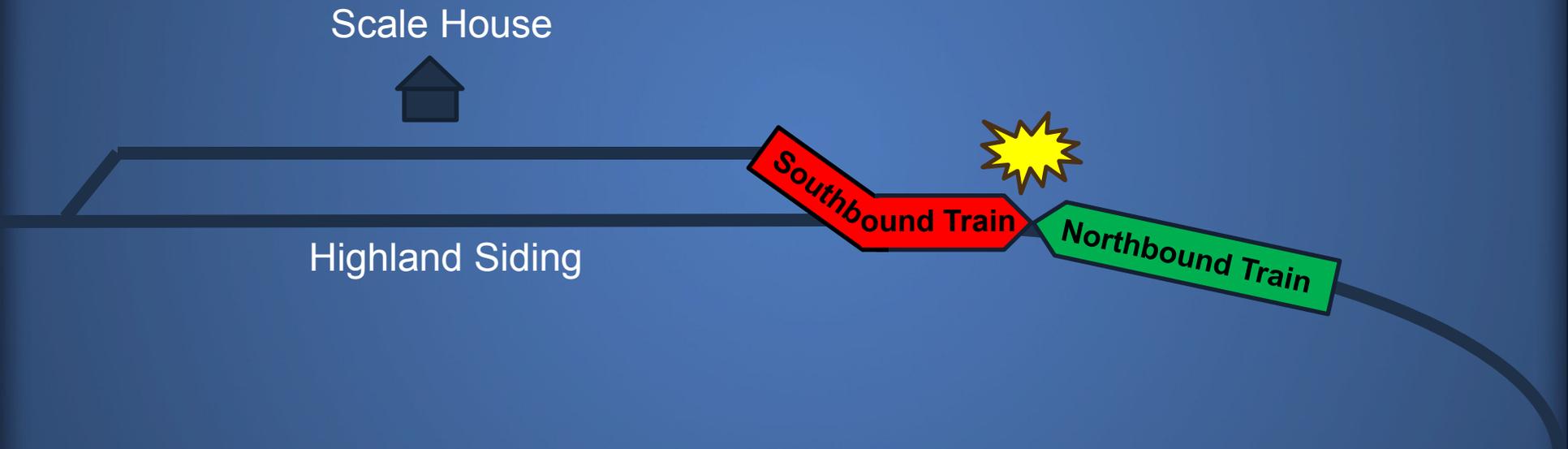


Toward Two Harbors



Time: 4:05 p.m.

Southbound train has **“conditional”** authority after the arrival of the northbound train



Northbound had **main** track authority

North



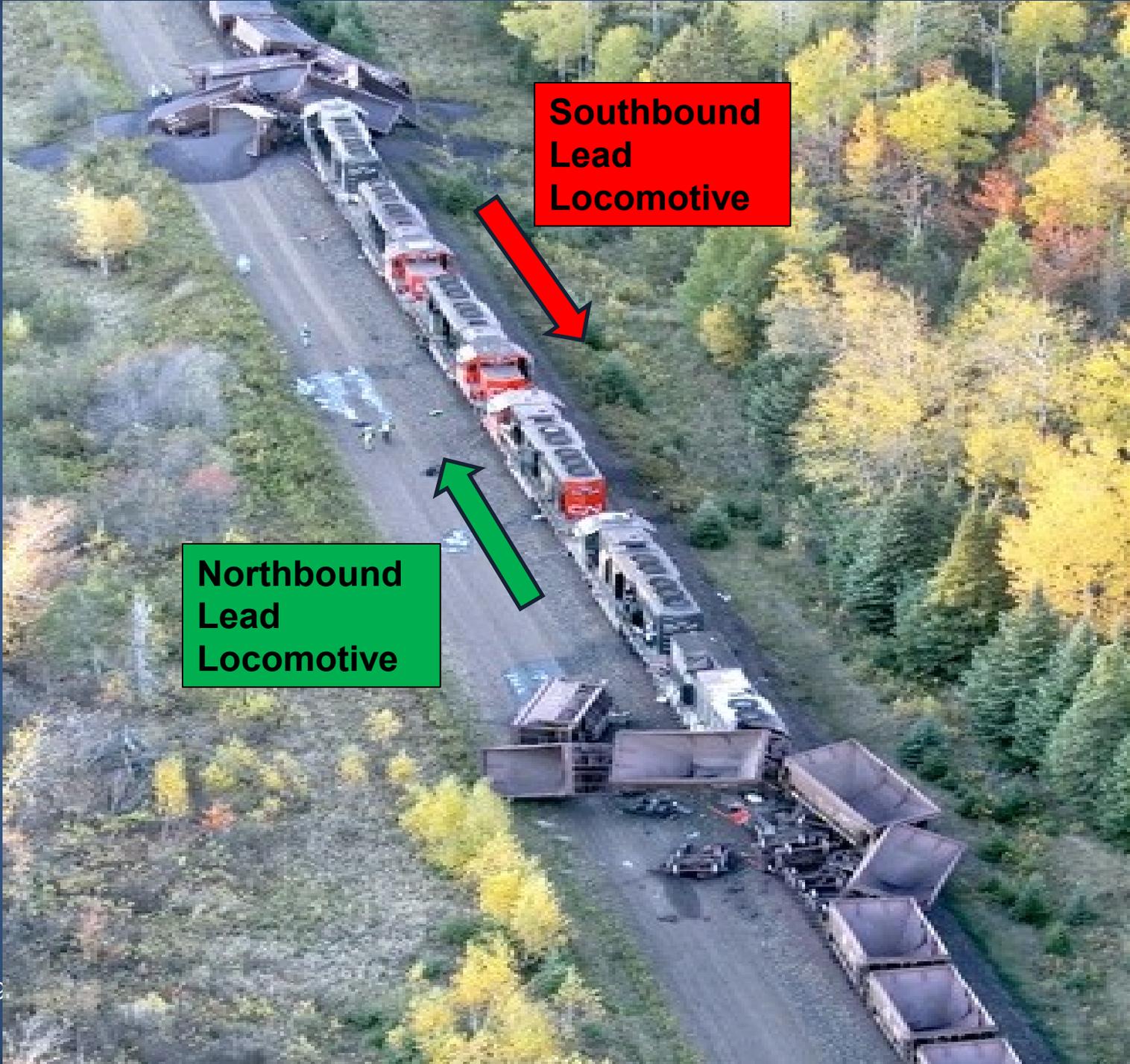
Toward Two Harbors



**Southbound  
Lead  
Locomotive**



**Northbound  
Lead  
Locomotive**



# Safety Issues

- After-arrival track authorities on nonsignaled tracks
- Prohibited use of portable electronic devices
- Fatigue
- Crew resource management
- Safety management and regulatory oversight



# National Transportation Safety Board



**National  
Transportation  
Safety Board**

# After-Arrival Track Authorities

Ted Turpin

# Nonsignaled Territory

## After-arrival fatal accidents:

- Crew:
  - Smithfield, West Virginia, 1996
  - Clarendon, Texas, 2002
  - Gunter, Texas, 2004
- Dispatcher:
  - Devine, Texas, 1997
- 8 fatalities, 10 injuries, ~ \$20m damage

# Human Error and After-Arrival Track Authorities

- Human error increased by:
  - Multiple steps
  - Unexpected interruptions
  - Fatigue

# Track Authority Issuance and Execution

## Track authority issuance:

- Dispatcher tells conductor
- Conductor completes form
- Conductor reads contents to dispatcher
- ➔ • Conductor gives form to engineer
- ➔ • Conductor discusses form contents

# After-Arrival Track Authority Execution

## Track authority execution:

- ➔ • Stays at indicated location
- ➔ • Maintains lookout for other train
- ➔ • Visually identifies and makes contact with other train crew
- ➔ • Confirms train ID by radio contact
  - Proceeds

# After-Arrival Track Authority Execution

- Each step requires:
  - Vigilance
  - Accurate visual detection
  - Effective verbal communications
  - Correct decision making
- Other demands may interfere with ability to successfully complete steps

# Accident Crew Actions

- Southbound crew expected to terminate at Highland siding
- Crew had multiple tasks and interruptions
- Job briefing, as required, could have prevented accident



# National Transportation Safety Board

# Portable Electronic Devices

- Used by 4 of 5 crewmembers while on duty
- Violated CN rules
- Violated Federal regulations
- Primarily text messaging
- Distraction to safe operation

# Previous NTSB Rail Investigations Involving PED Use

- Clarendon, Texas
- Gunter, Texas
- Boston, Massachusetts
- Chatsworth, California
- 27 fatalities, 177 injuries,  
~ \$31.6 million

# PED Use

- PEDs are part of our culture
- PED use not deterred by:
  - Rules, regulations, policies, or punitive consequences
- PED use difficult to detect
- Detection technology is available

# Previous Safety Recommendations

- Chatsworth, California
  - Recommendations on inward- and outward-facing cameras
  - Use recordings to verify compliance
- FRA has not acted
- PED use remains safety hazard



# National Transportation Safety Board



**National  
Transportation  
Safety Board**

# Fatigue and Crew Resource Management

**Rick Narvell**

# Fatigue Risk Factors

Work schedules caused physiological fatigue:

- Restricted hours of sleep
- Disrupted circadian rhythms
- Continuous hours of wakefulness

# Restricted Hours of Sleep

- Loss of sleep causes:
  - Impaired performance
  - Reduced alertness
- Conductor and student engineer:
  - Reduced sleep opportunities

# Disrupted Circadian Rhythms

- Disrupted by irregular work schedules
- Crews had irregular work schedules
- Causes increased sleepiness

# Continuous Hours of Wakefulness

Determined by:

- Total time awake
- Total time on task
- Crew awake 13-14 total hours
- Accident occurred on final hour of 12-hour shift

# Crew Resource Management

- Countermeasure to fatigue
- Fosters:
  - Effective communication
  - Situational awareness
  - Positive leadership

# Crew Resource Management

Engineer and  
conductor did not  
discuss  
**track authority**

Engineer and  
student engineer  
did not discuss  
**track authority**

Student engineer  
did not inquire  
about  
**track authority**

# CRM in Railroad Industry

- CRM recommendation after Butler, Indiana - 1999
- CN lacks dedicated CRM training
- Crew demonstrated poor CRM
- CRM may have prevented this accident



# National Transportation Safety Board



**National  
Transportation  
Safety Board**

# Safety Management and Regulatory Oversight

Ted Turpin

# Railroad Oversight

Test	2009	2010	2011	Total
Test 11	1	1	5	7
Test 56	0	0	1	1

- Test 11: Check for proper track authority
- Test 56: Check for improper PED use

# Oversight by CN

- In all 8 tests, employees passed
- Numbers reflect limited number of operational tests
- CN program ineffective

# FRA's Audit Process

- FRA periodically inspect railroads
- In the 21 months prior to accident:
  - 9 operating rules inspections
    - 7 involved observations of PED use with 1 recorded as a violation

# In-Depth Audits

- In-depth audits include:
  - Written summary
  - Recommendations
- 4 in-depth audits in 2006-2007
- None in accident area



# National Transportation Safety Board