



## Semih KALAY



**Semih Kalay is Senior Vice President, Technology, Transportation Technology Center, Inc. (TTCI), a wholly owned subsidiary of the Association of American Railroads. (AAR). He has 36 years of experience in railway research and research management.**

**He has managed and participated in a broad spectrum of research studies concerning railway vehicle and track performance and maintenance.**

**Mr. Kalay's current responsibilities include overall management of the North American Strategic Research program. Mr. Kalay currently is the North American member of the World Congress in Railway Research (WCRR) Organizing Committee. He also serves on the IHHA Board, representing USA.**

**Mr. Kalay has authored more than 200 professional articles, technical reports, presented several hundred speeches at professional forums nation-wide and internationally. He lives in Colorado Springs with his wife Grace.**



*Transportation Technology Center, Inc., a subsidiary of the Association of American Railroads*

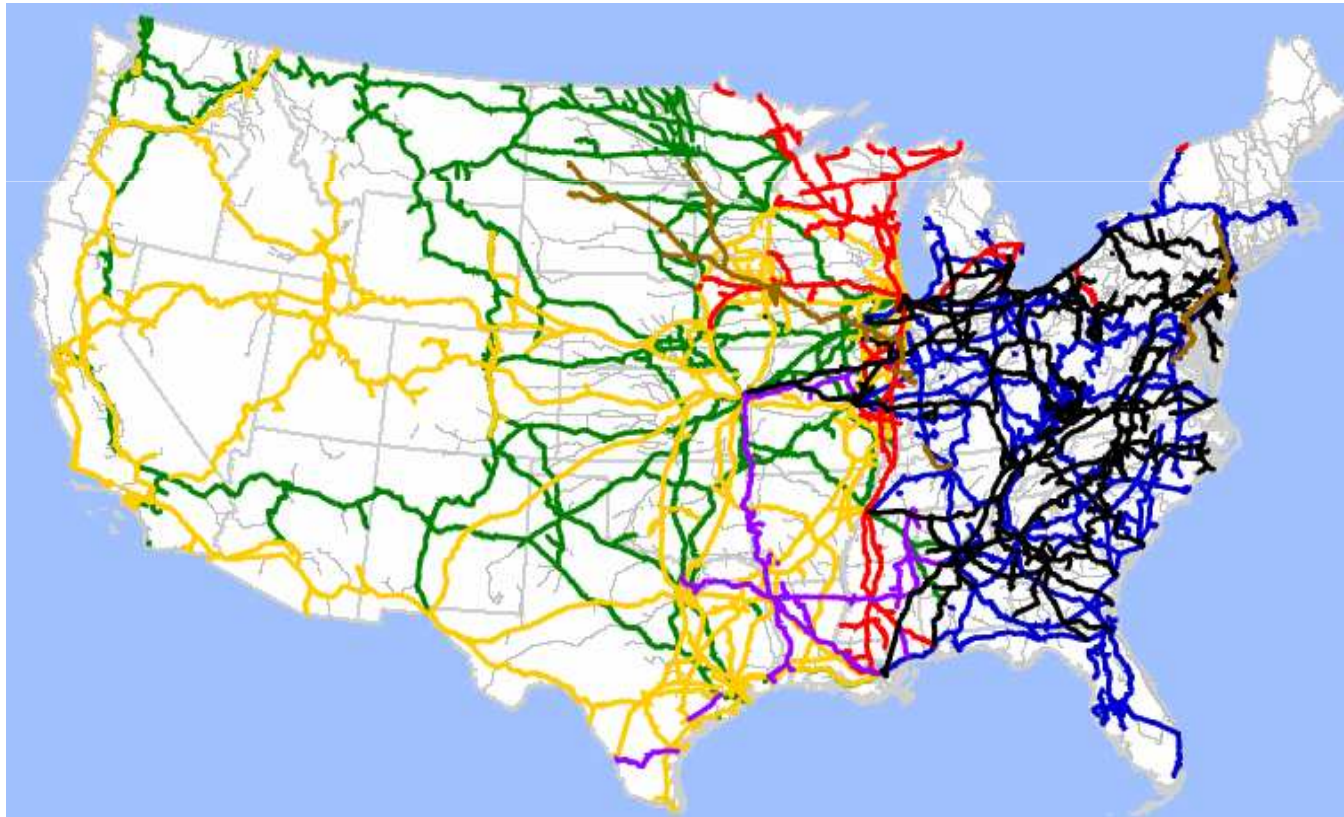


# ***AAR Strategic Research Highlights***



# Presentation Outline

- ◆ **TTCI and North American Railways**
- ◆ **Strategic Research Overview**





# Large and Small Railroads

## The US Freight Railroad Industry 2012

Type of Railroad	Number	Miles Operated	Employees	Freight Revenue (\$ Billions)
Class I	7	95,391	163,464	\$69.9
Non Class*	561	43,188	17,317	\$4
Total	568	138,579	180,781	\$73.9

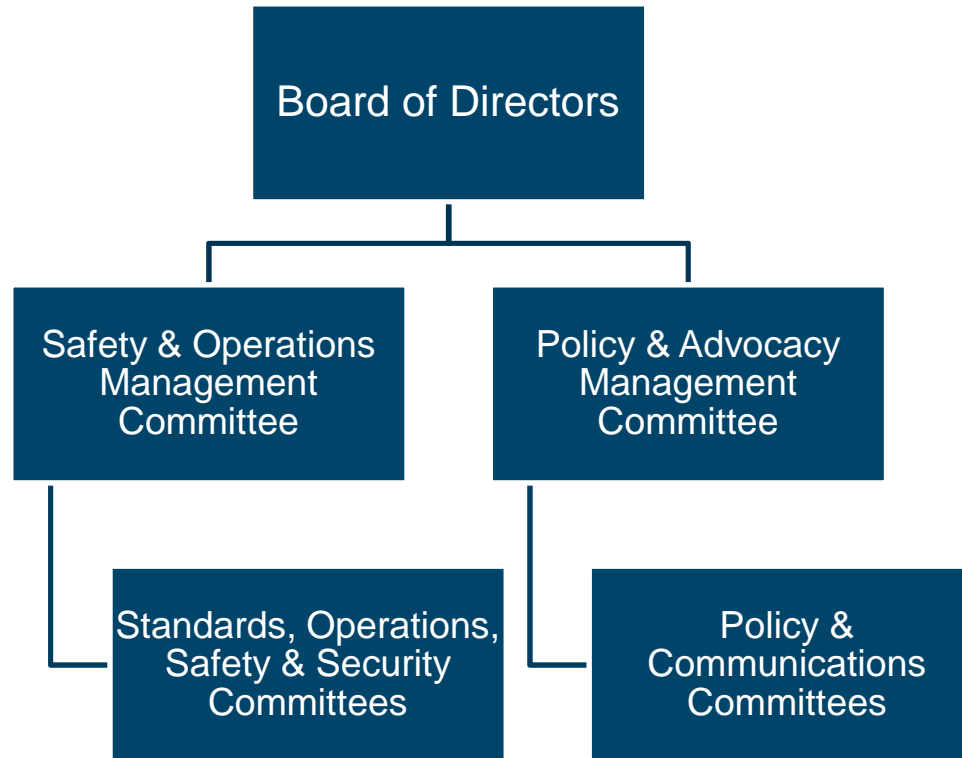


# Thank you!

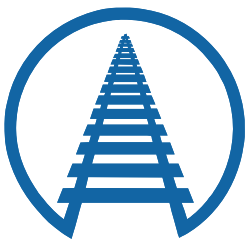




# AAR Governance

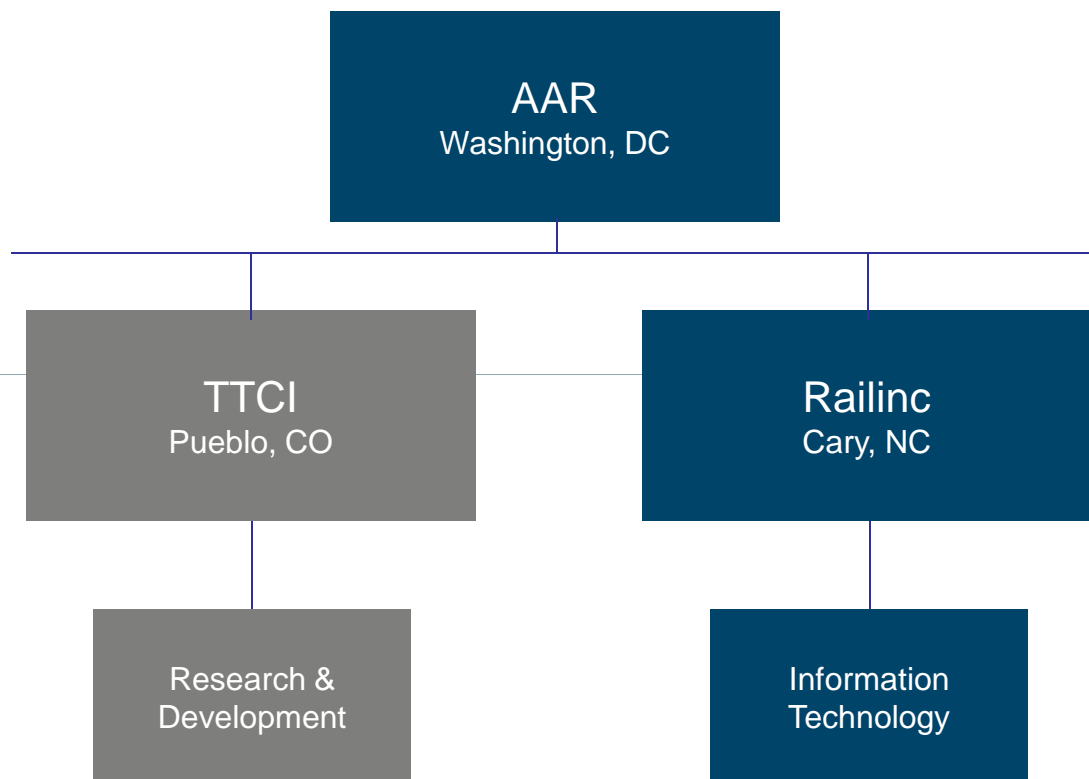


**AAR staff support the work of the committees through direct committee support, communications and lobbying**





# Railinc is the IT subsidiary of the AAR



# **TTC and TTCI: Two Different Things**

## TTC: The Facility



U.S. Department of Transportation  
Federal Railroad Administration

## TTCI: The Company

### *A Small Business Enterprise*

- ◆ Wholly owned subsidiary of the Association of American Railroads
- ◆ Headquartered at TTC
- ◆ Operated by an on-site management team
- ◆ Guided by an independent Board of Directors







## Basic Facts about TTC and TTCI

### Transportation Technology Center

- ◆ 52 Square miles
- ◆ Land is owned by the State of Colorado and leased to the FRA
- ◆ 48 miles of track
- ◆ Laboratory equipment capable of testing full size rail cars
- ◆ Training center with life size props

### Transportation Technology Center, Incorporated

- ◆ **270 Employees**
  - ◆ **100 Researchers**
  - ◆ **22 Test / Laboratory Engineers**
  - ◆ **52 Standards Engineers / Inspectors / Trainers**
  - ◆ **65 Operations Personnel**
  - ◆ **31 Administrative Staff**





# **AAR Strategic Research Program**

◆ **Strategic Research Program addresses current and future strategic issues relating to the North American Rail Industry.**

◆ **The Research Objectives are:**

Improve  
Safety

- Reduce track and equipment-related derailments through technology development

Improve  
Reliability

- Reduce or eliminate line-of-road failures

Improve  
Efficiency

- Productivity and cost reductions





# 2013 AAR Strategic Research Program

## ◆ Wheel/rail interface management

- Wheel/rail interface maintenance
- Root causes of rolling contact fatigue

## ◆ Improved car performance

- Integrated Freight Car Truck
- Dynamic load environment

## ◆ Vehicle/track performance

- Effects of superelevation on VTI

## ◆ Heavy axle load implementation

- **FAST/HAL Operations**
- HAL revenue service monitoring
- Track structure for HAL coal lines
- Very Heavy Axle Loads

## ◆ Improved braking systems

- Improved brake system performance

## ◆ Train condition monitoring

- Technology driven train inspection
- Automated cracked wheel detection

## ◆ Track integrity monitoring

- Phased Array rail flaw inspection
- Rail Stress management
- Automated Track Inspection

## ◆ Improved car components and materials

- Strategies to prevent wheel failure
- High performance car coupling systems
- Optimize HBD scanning

## ◆ Special trackwork

- Improved special trackwork designs and materials
- HAL effects on rail joints

## ◆ Bridge research

- Bridge life extension
- Advanced bridge designs and materials

## ◆ Improved track components

- Improved rail welding
- Improved rail performance

## ◆ Improved performance track

- Improved tie/fastener system performance

## ◆ New technology implementation

- Equipment health monitoring technology
- Equipment and track technology implementation



# Rail Flaw Inspection

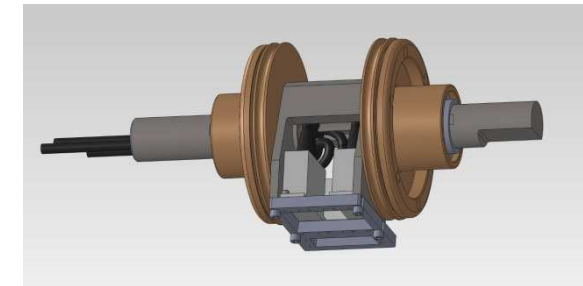


## ◆ Problem:

- Under high-tonnage HAL lines
- Increased defects on older rails
- More frequent inspections needed
- Potentially greater effects of undetected
- Defects masked by surface defects/RCF

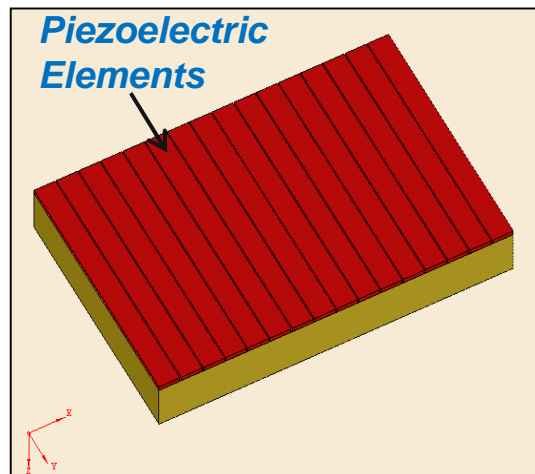
## ◆ Technology Solutions

- Improvements to existing UT technologies
- Laser-based inspection and phased array UT systems



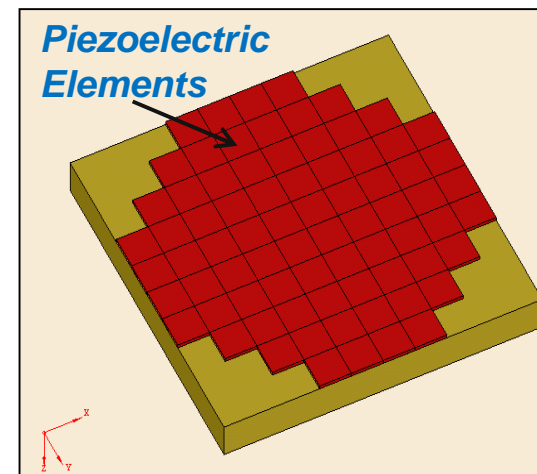
- Electronic scanning (rastering) possible without moving probe, beam steering and beam focusing possible
- Increased control of beam characteristics
- Simultaneous inspection with multitude of angles using one probe
- Can better inspect complex geometries or areas with limited access

Linear



Focusing and beam steering in the primary probe axis

2D Matrix

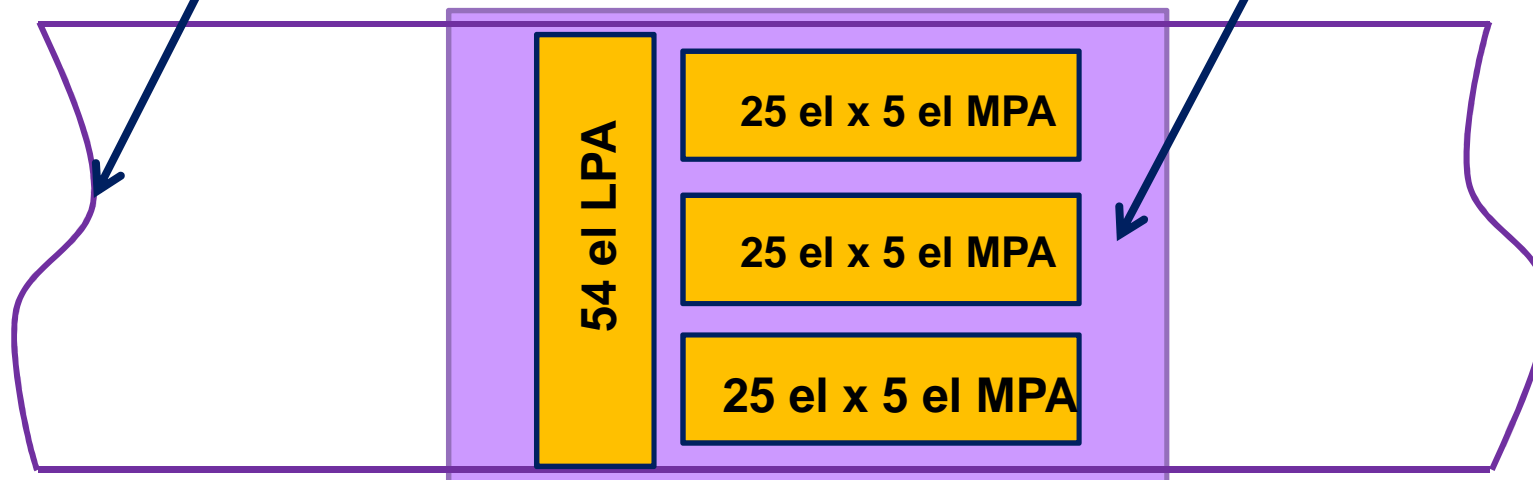


Focusing and beam steering in all directions

## Probe Layout — One LPA and Three MPA

Railhead (top view)

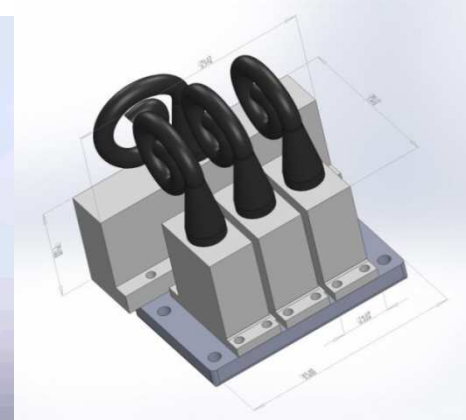
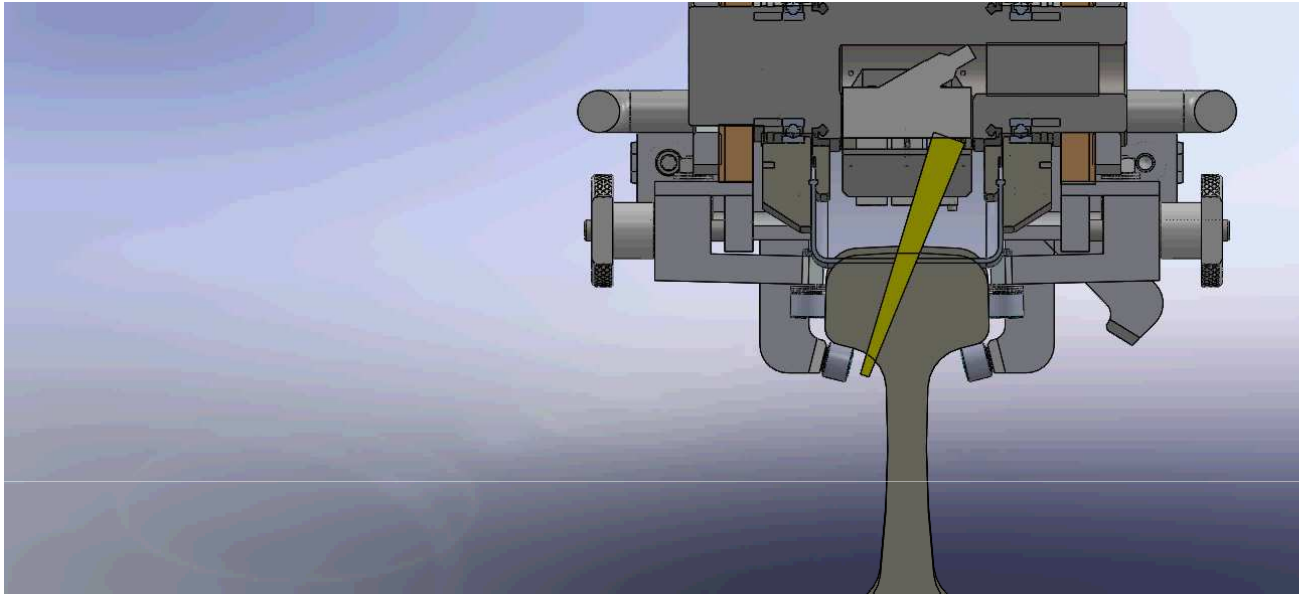
Probes in Roller Search Unit



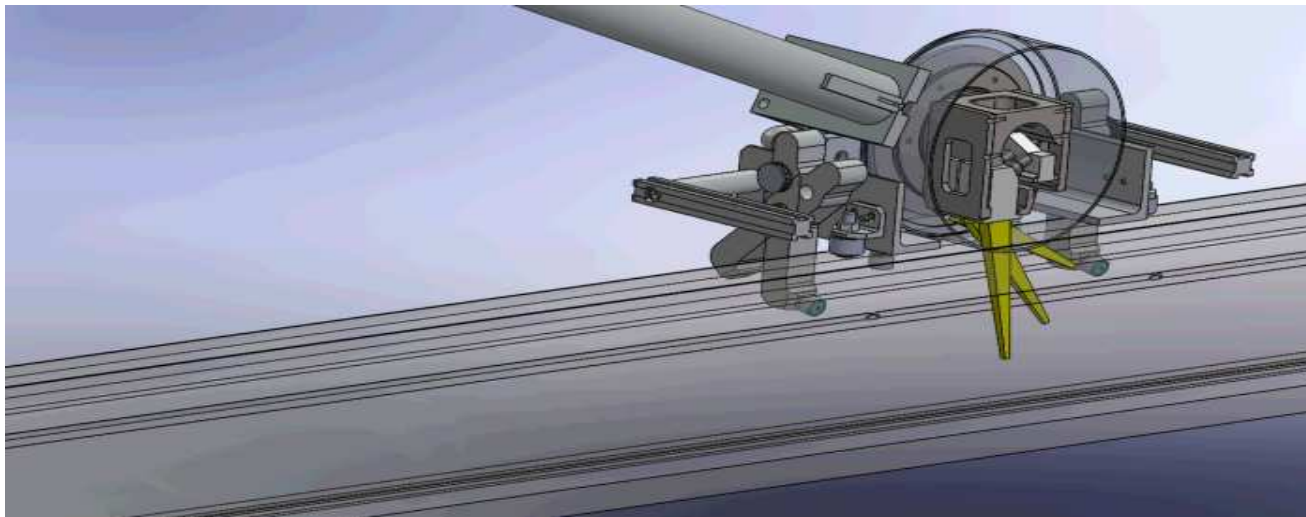


# Phased Array Rail Flaw Detection

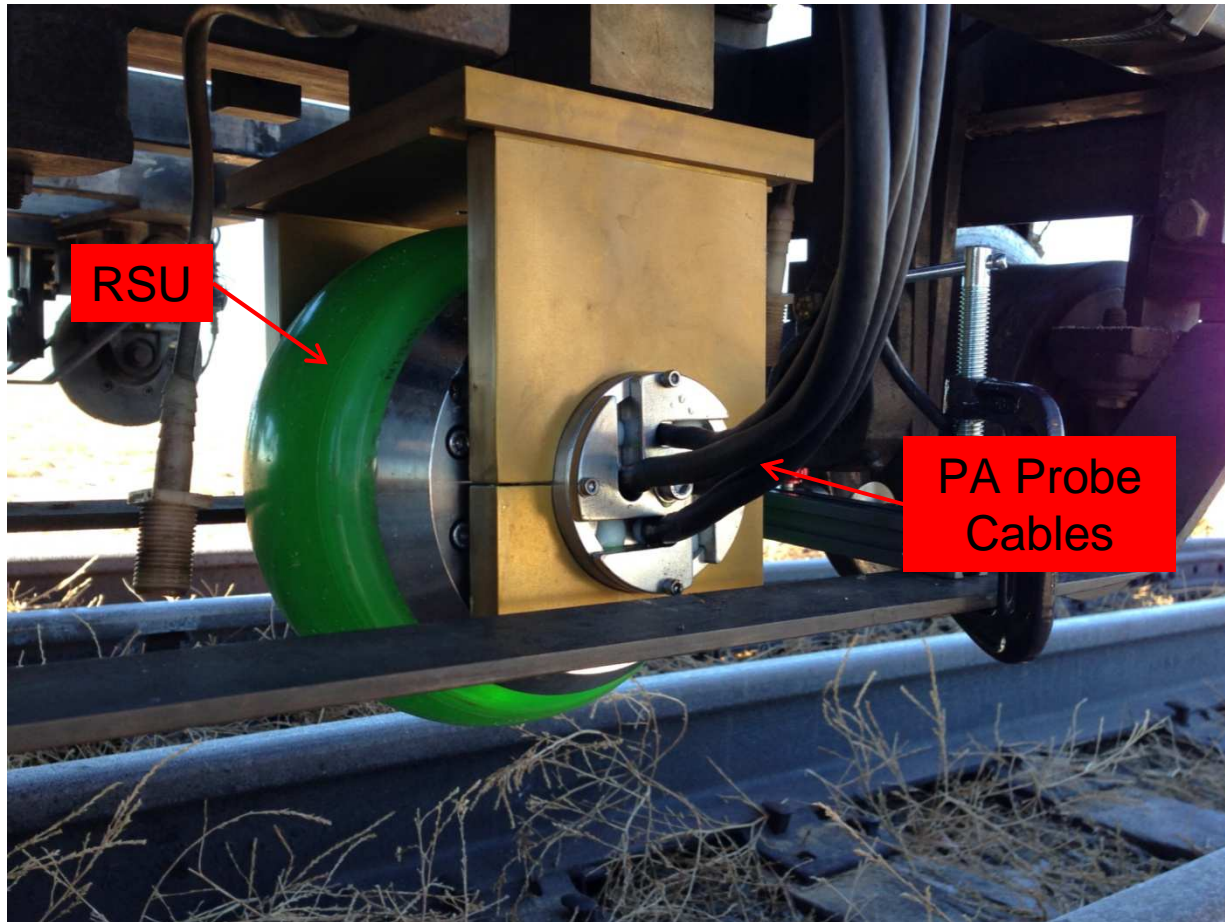
## Linear Probe Coverage



## Matrix Probe Coverage



## Custom Roller Search Unit — a familiar configuration







# Cracked Wheel Detection System Implementation

## ◆ Inspection Coverage

- Complete revolution of rim
  - ▲ Tread exposed using flange bearing track
  - ▲ Head sensors are pushed in and up to contact wheel
  - ▲ Head moves with wheel for about 15 feet





## **Vehicle Health Monitoring Systems: Next Generation Cracked Wheel Detection Systems**

- ◆ **Wheel-related Derailments Still a Major Concern**
- ◆ **Current Cracked Wheel Detection Systems are Very Complex & Maintenance Intensive: Prevented Many Derailments**
- ◆ **More Cost-effective, Less Complex Systems Needed**
- ◆ **TTCI Research Underway to Accelerate Development & Implementation of New Systems**





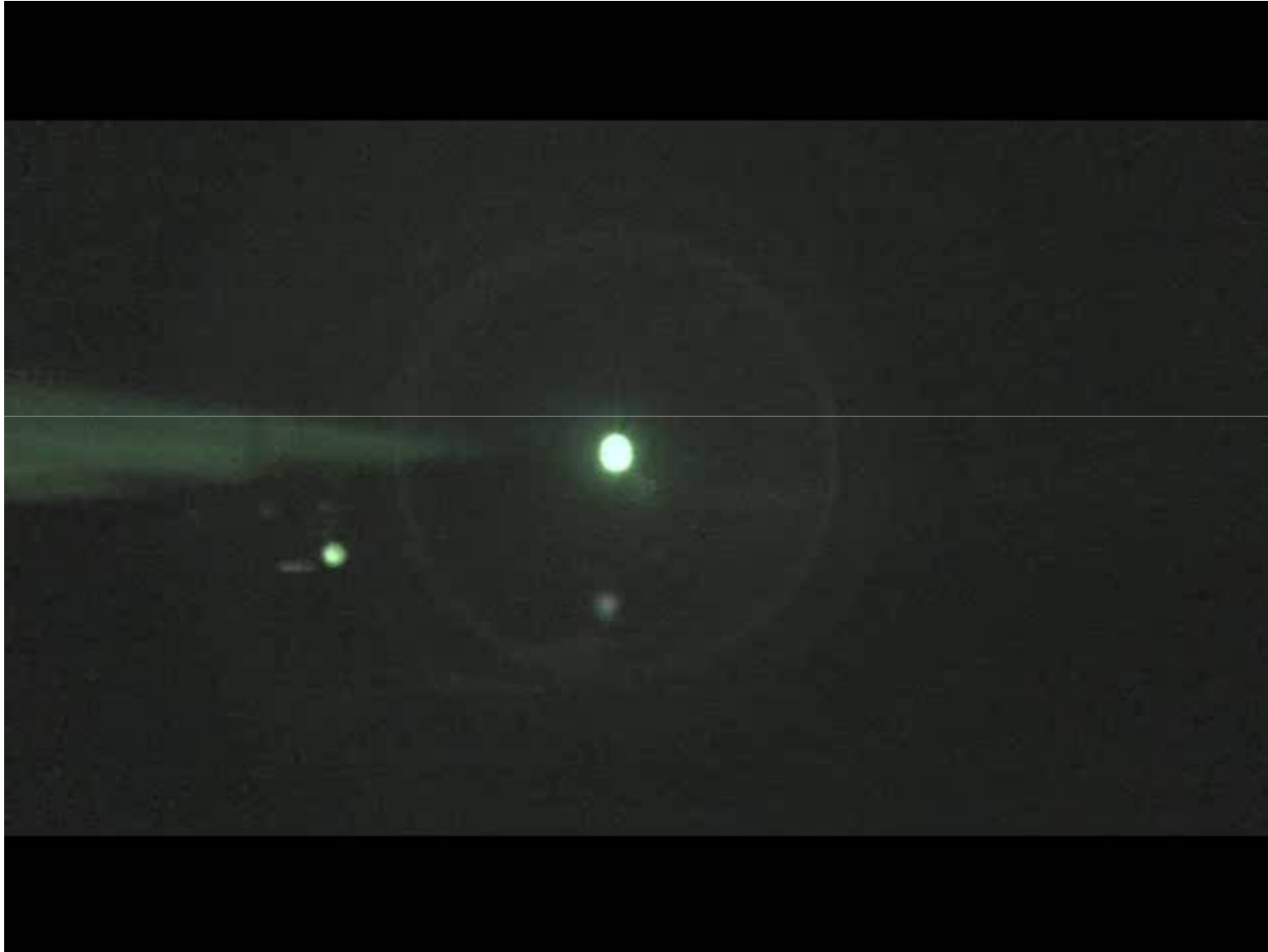
# Technology Driven Train Inspection Fully Automated Train Scanning System

## Fully Automated Train Scanning System:

- ◆ Imaging capabilities demonstrated by AS AIS and AISC prompted complete car imaging
- ◆ Ongoing applications include:
  - Car underbody
    - ▲ Truck component details
    - ▲ Coupler securement/draft pocket inspection
    - ▲ Brake rigging details
  - Top and side views
    - ▲ Shifted / imbalanced loads
    - ▲ Unsecured lading
    - ▲ Top chord condition
  - Security applications
    - ▲ Tank car inspection
    - ▲ Foreign object detection



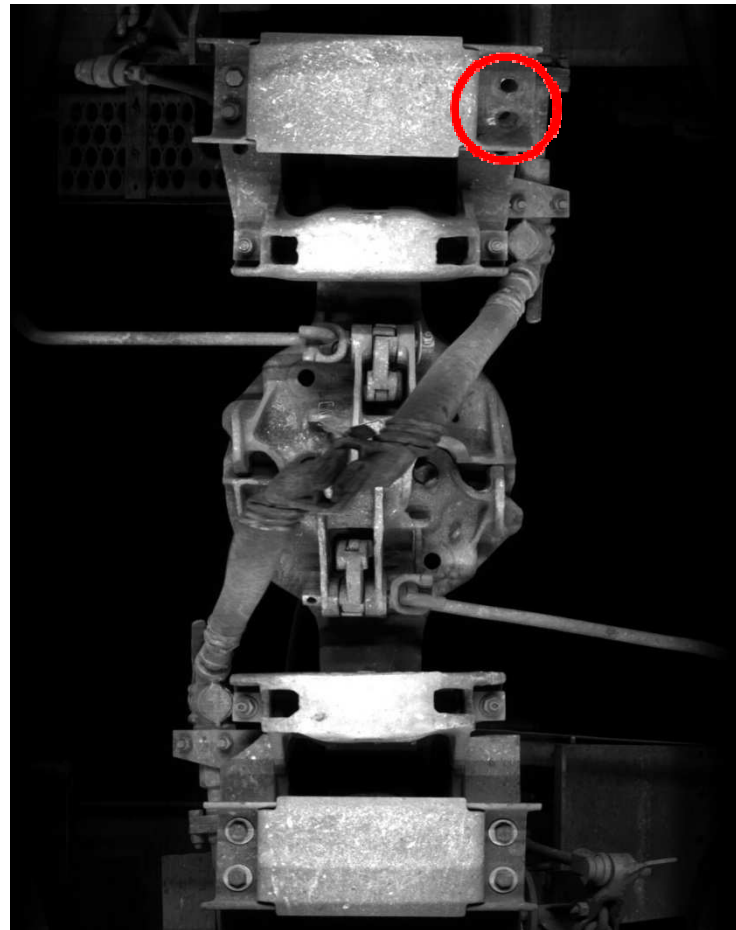
# Technology Driven Train Inspection FATSS





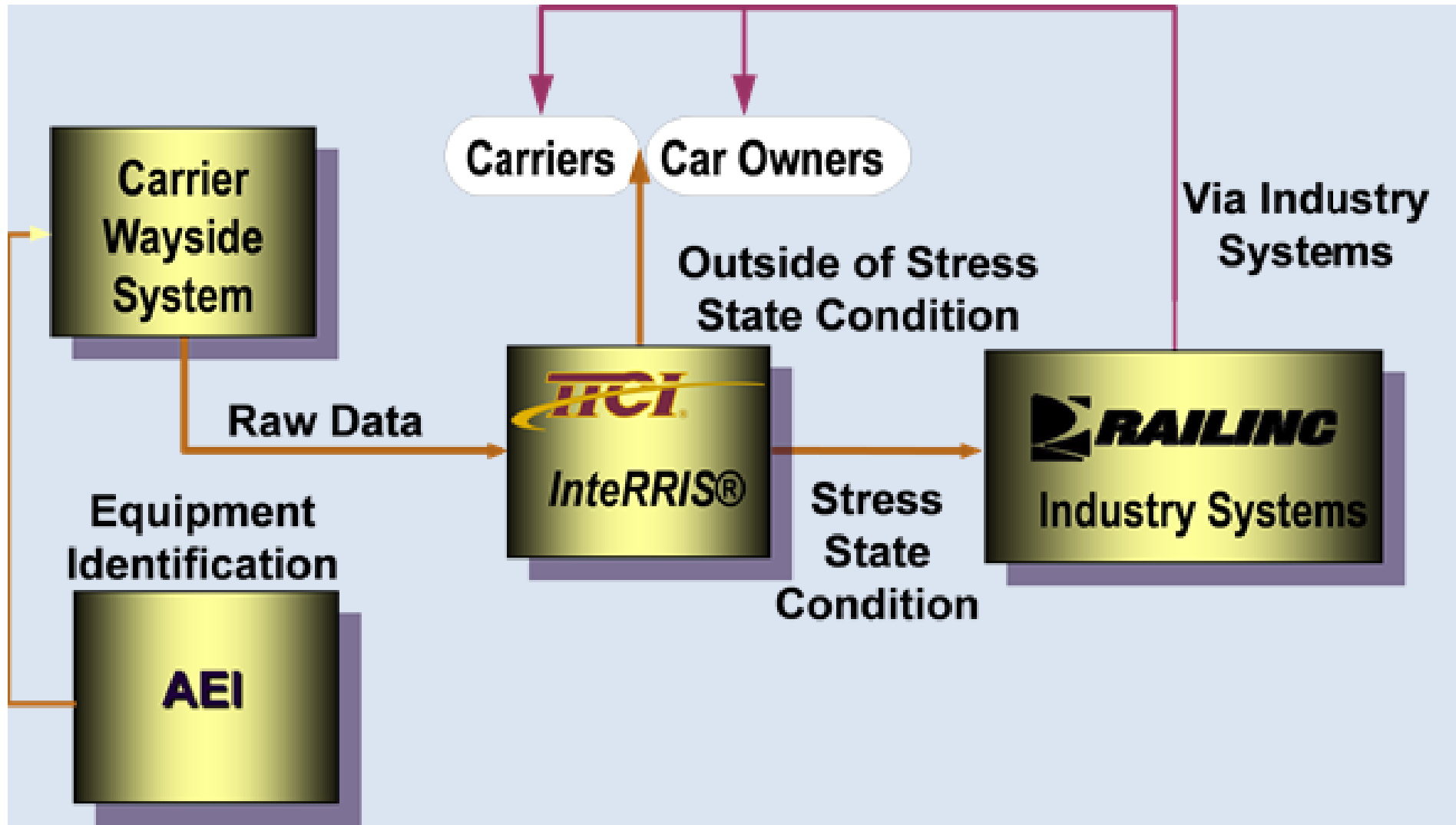
## Automated Inspection of Structural Components (AISC) — Revenue Service

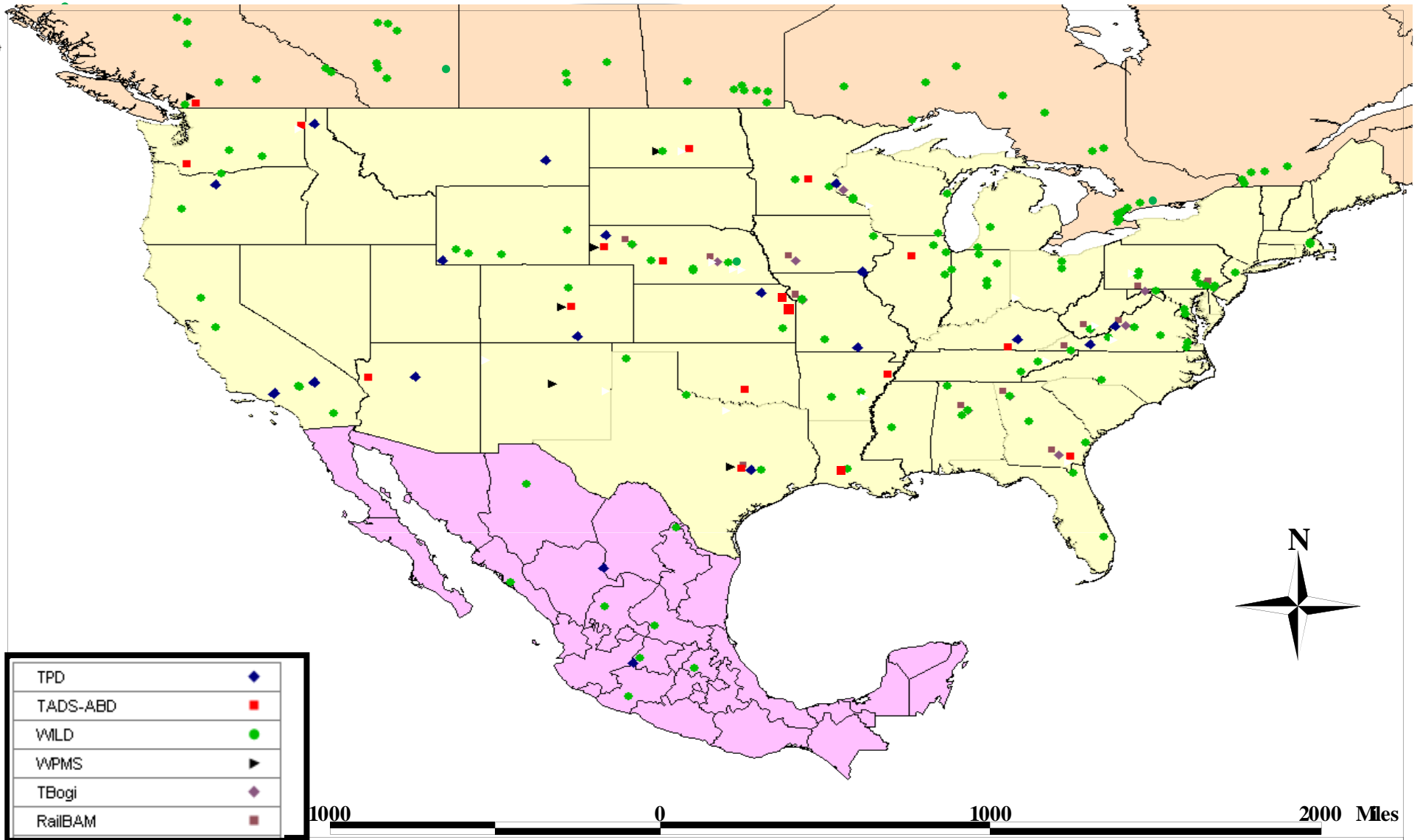
- ◆ Revenue Service Results at Gallup, NM
  - 7 coupler pin securement defects November–December, 2013





# Wayside Detector Management System





# Wayside Detector Distribution

02/02/2014

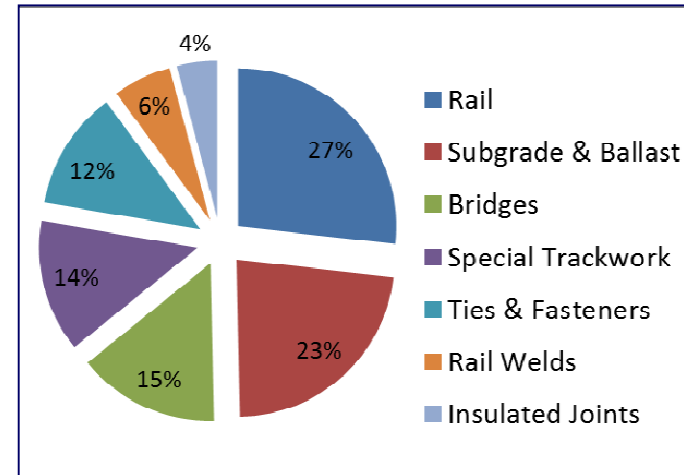
Based on USGS DLG. 1:25,500,000, Geographic Projection, DD.  
2014 (c), Transportation Technology Center, Inc.

- **FAST/Heavy Axle Load Implementation:**

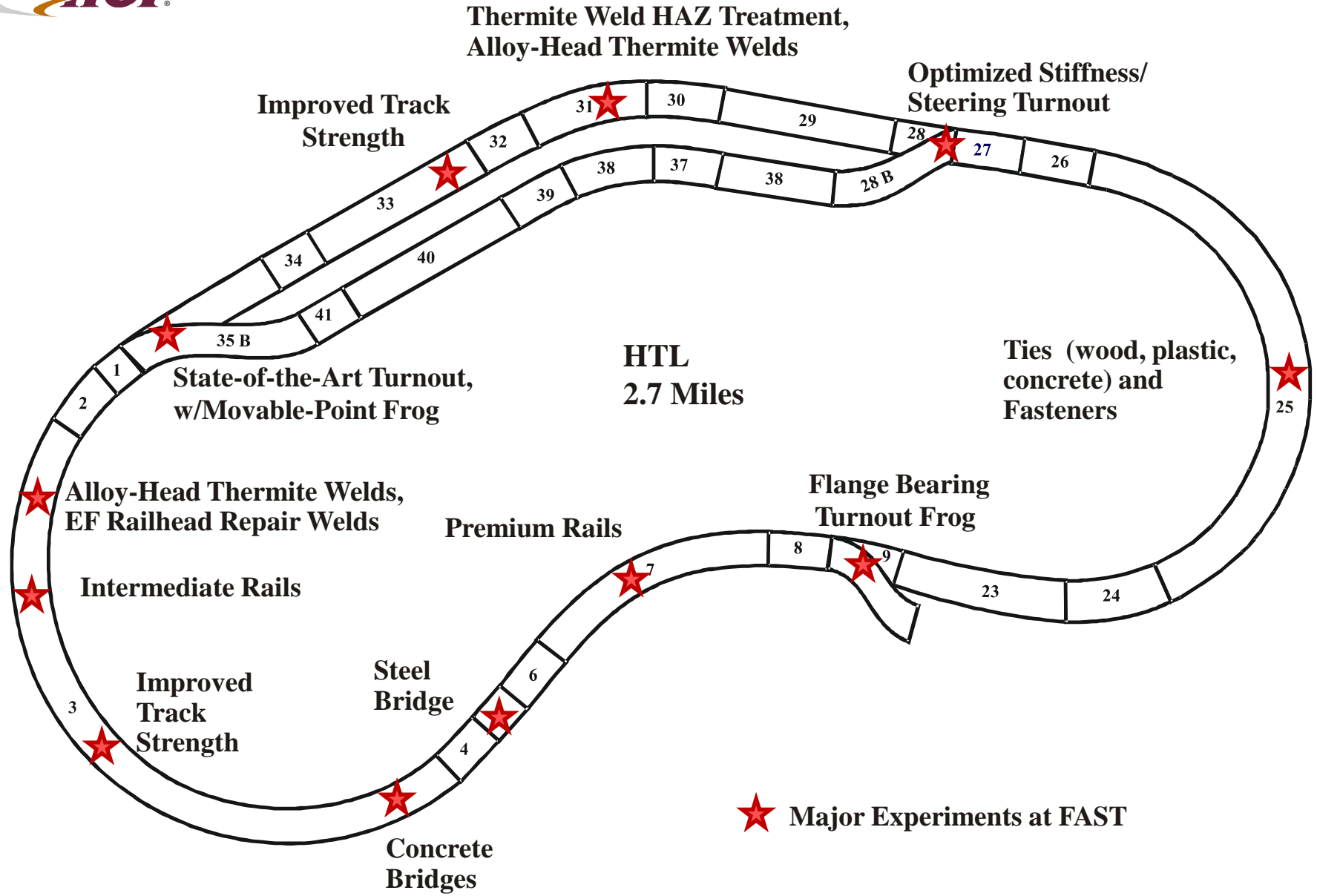
- Test and evaluate new and untried components before they are implemented in revenue service
- Mitigate adverse effects of HAL

- **HAL Operations**

- 16,000-tonne train with 110 cars
- Newer and more fuel efficient locomotives (3 SD70 locos)
- Operations under computer control
- Accumulated 140 MGT in 2013







**On Behalf of TTCI and AAR  
Thank You!**

