# The Future of Rail
## Technology & Relationships for Freight Rail Transportation

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WHO WILL MAKE BUSINESS HAPPEN?
**SPARTANS WILL.**

# Agenda

- Freight Rail – the nation's economic skeleton
  - Brief history and current overview
- How a 200-year old business looks at technology
  - Safety, efficiency, effectiveness, regulation
- Supply Chain Management
  - Relationships, data and information sharing
- Q&A

# Freight Rail – Economic Impact

- Scale – big, very big
- 160,000 track miles
- 7 Class 1 Railroads; 603 others
- Privately held
- Invest $25 billion/yr. on average
- Support over 11 million jobs
- $26 billion tax revenues
- $219.5 billion economic output
- $71.3 billion wages
- 1:8 job multiplier effect
- Ship 54 tons/person/year
- 150th Anniversary – golden spike





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# Brief History (North America)

- 1825 Start in North America
- 1861 Civil war & railroads
- 1868 First railroad brakes - Westinghouse
- 1869 Golden spike ceremony, Promontory Summit, UT
  - 6 years construction, 2,000 miles, dangerous landscape
  - Central Pacific Railroad and Union Pacific Railroad joined
  - Transcontinental travel reduced from months to < week
  - Irony – that line is now abandoned!
- 1870's Agricultural development, reefer cars
- 1883 Railroads create U.S. time zones

Picture courtesy of Union Pacific and AAR

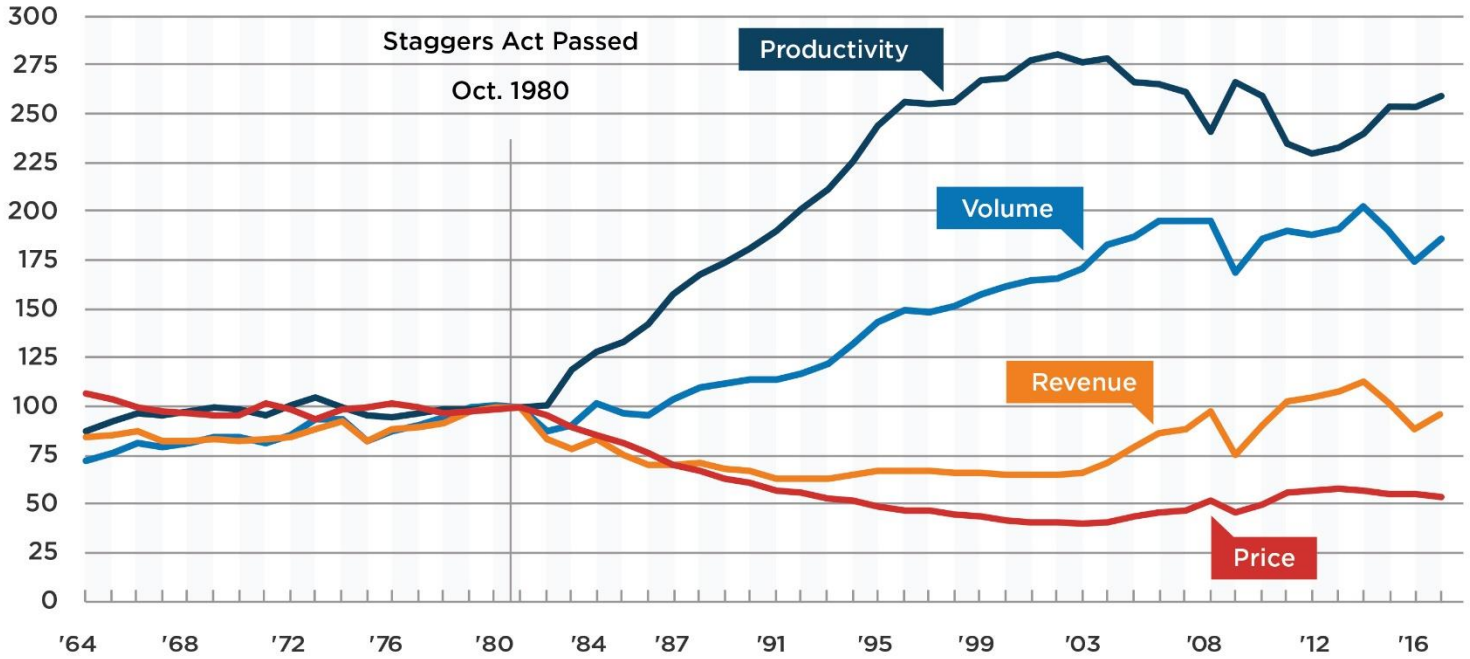
# Brief History (North America)

- 1893 Railroad Safety Appliance Act
  - Air brakes and automatic couplers
- 1900-1920 Passenger trains & stations dominate
- 1916 max. track mileage 230,468 miles
- 1917 railroads nationalized (WWI), ret'd 1920
- 1920's & 30's Cars, buses, trucks, great depression
- 1934 Diesel power (Burlington Zephyr)
- 1950's & 60's Freeways, airlines, passenger decline
- 1957-1975 Mergers, bankruptcies & standing derailments
- 1970 Penn Central RR bankruptcy
- 1971 Amtrak created – remove passenger burden

# 1980 Staggers Rail Act - Freight Railway's Renaissance

## U.S. FREIGHT RAILROAD PERFORMANCE SINCE THE STAGGERS ACT

Today's Balanced Regulatory System Has Benefited Railroads and Their Customers




By the 1970s, excessive regulations, intense competition from trucks and barges, and changing shipping patterns drove railroads to the brink of ruin. In response, Congress passed the Staggers Rail Act of 1980. With Staggers, Congress recognized that railroads faced intense competition for most of their traffic, but excessive regulations prevented them from competing effectively. In order to survive, railroads needed a new regulatory system that allowed them to act like most other businesses in terms of managing their assets and pricing their services. Thanks to the balanced regulatory system put in place by Staggers, railroad customers today are enjoying lower rates, better service and improved safety, while railroads have been able to invest more than $660 billion since 1980 into their infrastructure and equipment — greatly improving rail productivity and reliability.

ASSOCIATION OF AMERICAN RAILROADS

Source: Association of American Railroads

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# Current Situation

- Capacity constraints
  - Physical – hard to build new
  - Expensive to acquire land
  - Congestion getting worse
  - U.S. Freight volume to grow by 40% by 2040 – roads cannot cope

**Railways can use technology to unleash capacity (*Shift to Rail S2R)***

  - Improved system throughout = capacity dividend
  - Predict weather impacts and route traffic accordingly
  - Autonomous trains – should be easier than on the roads
  - Schedule track maintenance and replace at right time and cost
  - New business model with customer focus

# Technology - Safety

- Safety has always been the main driver of innovation on the railways
  - Brakes, couplers, signal systems, track circuits, telegraph, radio
  - Positive Train Control (PTC)
    - Chatsworth, CA 2008 (texting)
    - 25 dead, more than 100 injured
    - Preventable with 1960's technology
    - Rail Safety Improvement Act, 2008
    - Will stop the train if engineer doesn't
    - Step in right direction, not final solution
    - Expensive, est. $8 billion

Source: Associated Press

# Technology - Efficiency

- Efficiency (cost/price)
  - Longer trains with distributed power


  - 10,000 ft, 180 cars or longer
  - Limitation is braking – air brake system constraint
  - Electronically controlled pneumatic brakes

# Technology - Effectiveness

- Effectiveness (reliability)
  - Track and trace – proprietary apps, PTC 2.0
  - Maintenance from scheduled to predictive
    - Predictive analytics
    - Drones for bridges and remote structures
    - Fast track geometry inspection
    - IOT sensors in locomotives
    - Wayside detectors


- Environmental (sustainability)
  - Rail is already more energy efficient than road or air per ton-mile
    - Alternative motive power sources
    - Tier 4 compliant locomotives
    - Europe banning diesel for rail motive power by 2040
    - CA air quality focus
  - Big issue is grade separation

# Technology - Operations

- Operations (capacity = efficiency + effectiveness)
  - Locomotive power, fuel use and cost
  - Speed (faster = better?)
  - Velocity (less dwell time in yards)
  - Reliability (less disruptions)
  - Platooning or virtual/moving block

- Better knowledge (communication and planning)

**Sound familiar?**

# Technology meets Reality

- Regulation – Safety & Economic (Competitive) Benefits
  - Safety rules administered by Federal Railroad Administration, part of DOT
  - Economic by Interstate Commerce Commission (ICC), succeeded in 1995 by the Surface Transportation Board (STB)
    - Railways are a "virtual monopoly" – few suppliers (7 companies control well over 90% capacity by track miles)
    - Congress charged STB to:
      - Resolve railroad rate and service disputes
      - Review proposed railroad mergers
      - Approve abandonments

# Precision Scheduled Railroading (PSR) - E. Hunter Harrison 1944-2017

- Railway Age Magazine's Railroader of the Year 2002 & 2015
- Frisco, BN, Illinois Central, Canadian National, Canadian Pacific & CSX
- Application of Process Re-engineering and Lean/Six Sigma to railways
- Optimize asset utilization (locomotives, cars, track and people)
- Operate to a predictable schedule (a timetable)
- Provide regular, achievable service where practical
- Right size the network to minimize waste yet retain flexibility and resilience
- Accept that not every customer has same needs
- Work with short lines for first and last mile

**But … don't forget the customer!**

# Supply Chain Integration – Us & Them?

- Railway companies reportedly:
  - Don't listen to customers
  - Have a "you'll get it when we deliver it" attitude
  - Rarely share information
  - Are not very cooperative
  - Use their "economic" power and size unfairly
- Customers also say:
  - We can't find anyone to talk to
  - We're so frustrated, we'll pay more to move by truck
  - Service is way too unreliable
  - They always talk "railspeak"
  - Amazon can do it, why can't they?

**All of these are able to be resolved for mutual benefit, where the will exists**

# Relationships – The Future of Rail?

- Examples of Great Practices exist
  - Often short lines or regional railways lead the pack
  - Closer customer contact enables a personal connection
  - New services such as transloading
  - States support business development by grants to railroads
  - Short lines have tax benefits to invest in infrastructure improvement
  - Railinc (part of the Association of American Railroads) has masses of data
  - Rail can still move bulky goods over long distances better than other modes
  - Unit trains are excellent examples of efficient operations
  - Intermodal (containerized and TOFC – trailer on flat car) trains are today's express (priority) trains
  - Railways interchange nationwide to common standards

**Single car traffic still needs work**

# MSU CRRE Research

- Two main focus areas:
  - Supply Chain Management
    - Seeking examples of great ISCM practices to share anonymously for common good around areas such as:
      - Joint problem solving & creativity
      - End-to-end supply chain visibility
      - Long term trust & value creation
    - Explore different perspectives: shippers/customers, railroads, and investors
  - Alternative Motive Power Energy Sources
    - Environmental and sustainability impacts
    - Economic and business model implications

**For both, education is key.**

# Questions