

William W. Hay Railroad Engineering Seminar

Implementation of Positive Train Control at the Belt Railway of Chicago and other non-Class I Railroads: Challenges and Solutions



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**Belt Railway
Company of Chicago**

Date: Friday, February 17, 2017

Time: Seminar Begins 12:15pm

Location: Newmark Lab, Yeh Center, Room 2311
University of Illinois at Urbana-Champaign

**Students welcome and
encouraged to attend!**

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The Belt Railway Company of Chicago

The PTC Files

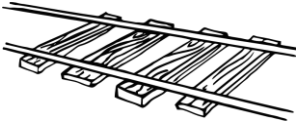


Agenda

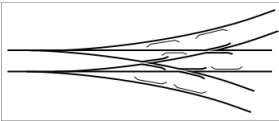
- BRC Overview
- Update on PTC at the BRC
- Industry-wide PTC Developments



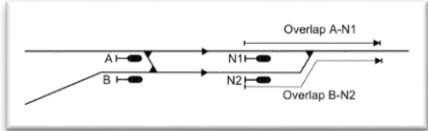
BRC – Established 1882



Main Track – 28 Miles



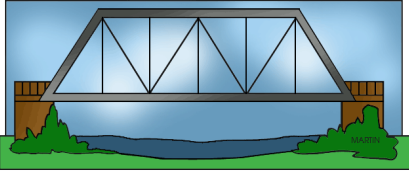
Other track – 265 miles



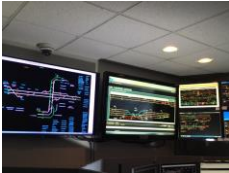
16 Interlockings



430 Employees



84 Bridges



Traffic - Wabtec



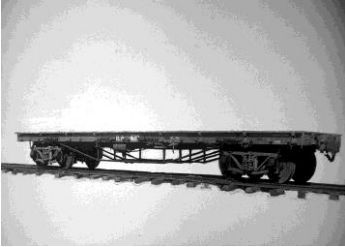
Bi- Directional Hump - Train
Yard Tech. Hump control system



4 Caboosees



29 Locomotives



4 Gondolas/Flats



2 Air Dumps

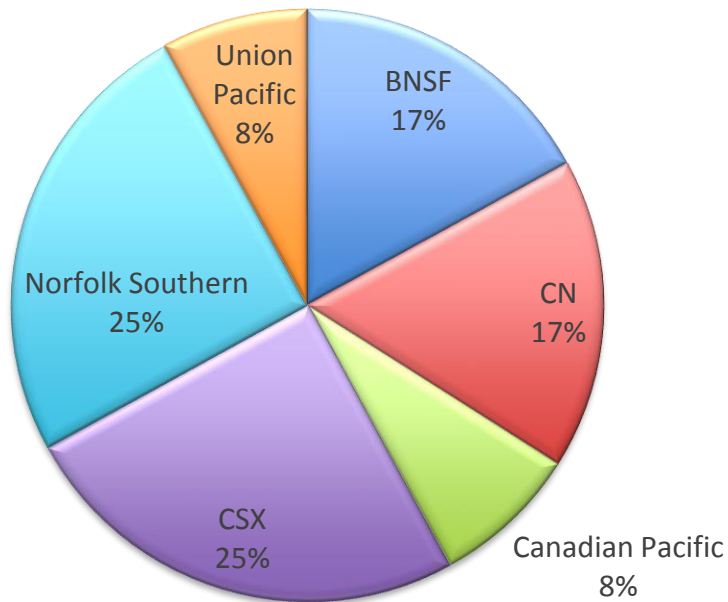


22 Ballast Cars



BRC Partners

Ownership



We Service

Chessie System CSXT

Norfolk Southern NS

Burlington Northern Santa Fe BNSF

Canadian National CN

Canadian Pacific Rail System CPRS

Union Pacific UP

Amtrak AMTK

Chicago Rail Link CRL

Chicago South Shore CSS

Indiana Harbor Belt IHB

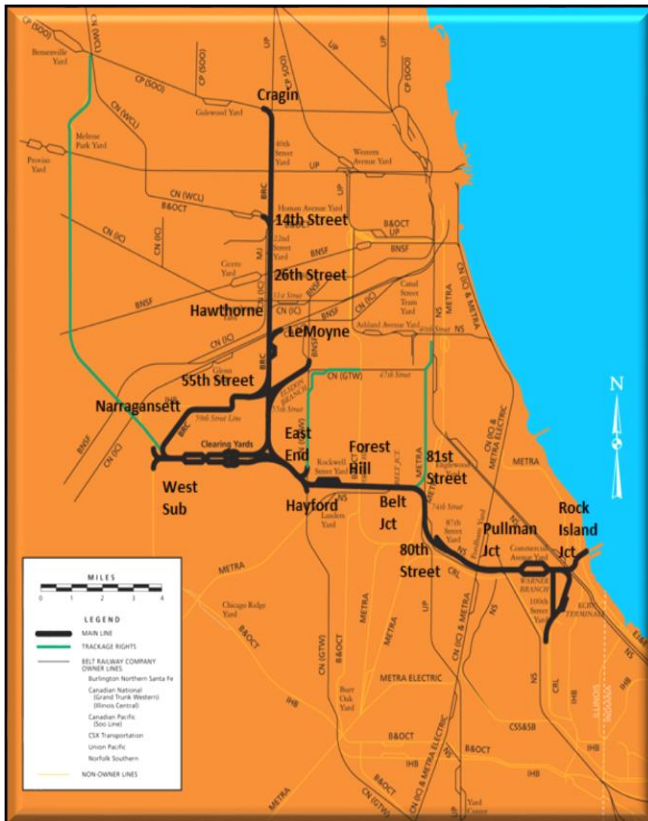
Metropolitan Rail Corporation METRA

South Chicago & Indiana Harbor SCIH

Wisconsin & Southern Railroad WSOR



BRC Facts



Kenton Subdivision

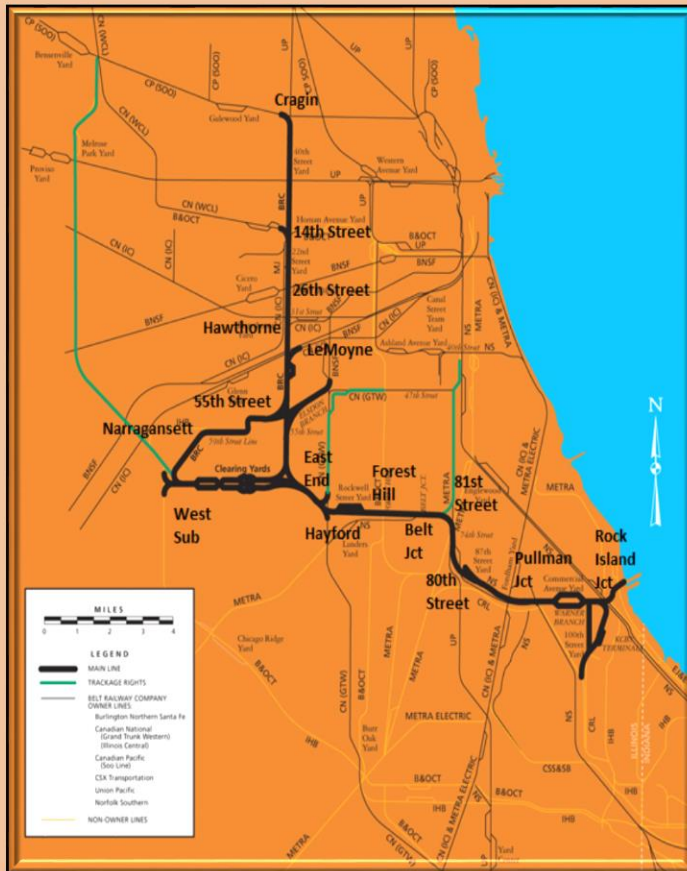
Cragin to Hawthorne	51
Hawthorne to 55th Street	57
55th Street to East End	42
East End Interlocking	80
Hayford Interlocking	70
Hayford to Western Avenue	60
Belt Junction Interlocking	87
Belt Junction to 80th Street	58
80th Street - to / from UP	34
80th Street to Pullman Jct	34
Pullman to Rock Island Jct.	34
Rock Island Jct - to / from NS	26

59th Street Subdivision

55th Street to West Sub	26
Proviso Lead	11
Blue Island Leads	17



Chicago and the BRC



- Cragin: CN, CP, WSOB
- 14th St: CN, CSX
- 26th St: BNSF
- Hawthorne: CN
- Nerska: BNSF
- LeMoynes: CN
- 55th St: BNSF, CN, NS
- Bedford Park: CSX, UP, BNSF
- Hayford: CN
- Forest Hills: BNSF, CSX, UP
- Belt Junction: Metra
- 80th St: CSX, UP, Amtrak
- 81st St: NS, Metra, Amtrak, UP
- 95th St: CN, CSS&SB, CRL
- Pullman Jct: NS
- RI Jct: CP, CSX, NS, CRL, CSS&SB, SCIH, UP
- West Sub: CP, CSX, IHB, UP
- Narragansett: BNSF, IHB



Positive Train Control

PTC is a predictive and proactive technology that detects upcoming conditions and is able to stop the train when needed. PTC technical architecture comprises four key segments:

The office segment has PTC servers and databases which store track information, train locations, work zones, and speed restrictions.

The Wayside segment monitors and reports switch position, signal indications, status of other monitored wayside devices directly to the Locomotive Segment and office segment

The on-board segment is an independent onboard hardware, software and devices that interface with locomotive control equipment (e.g. air brakes, train line)

- Train Management Computer (TMC)

- Computer Display Unit (CDU)

- Locomotive ID module

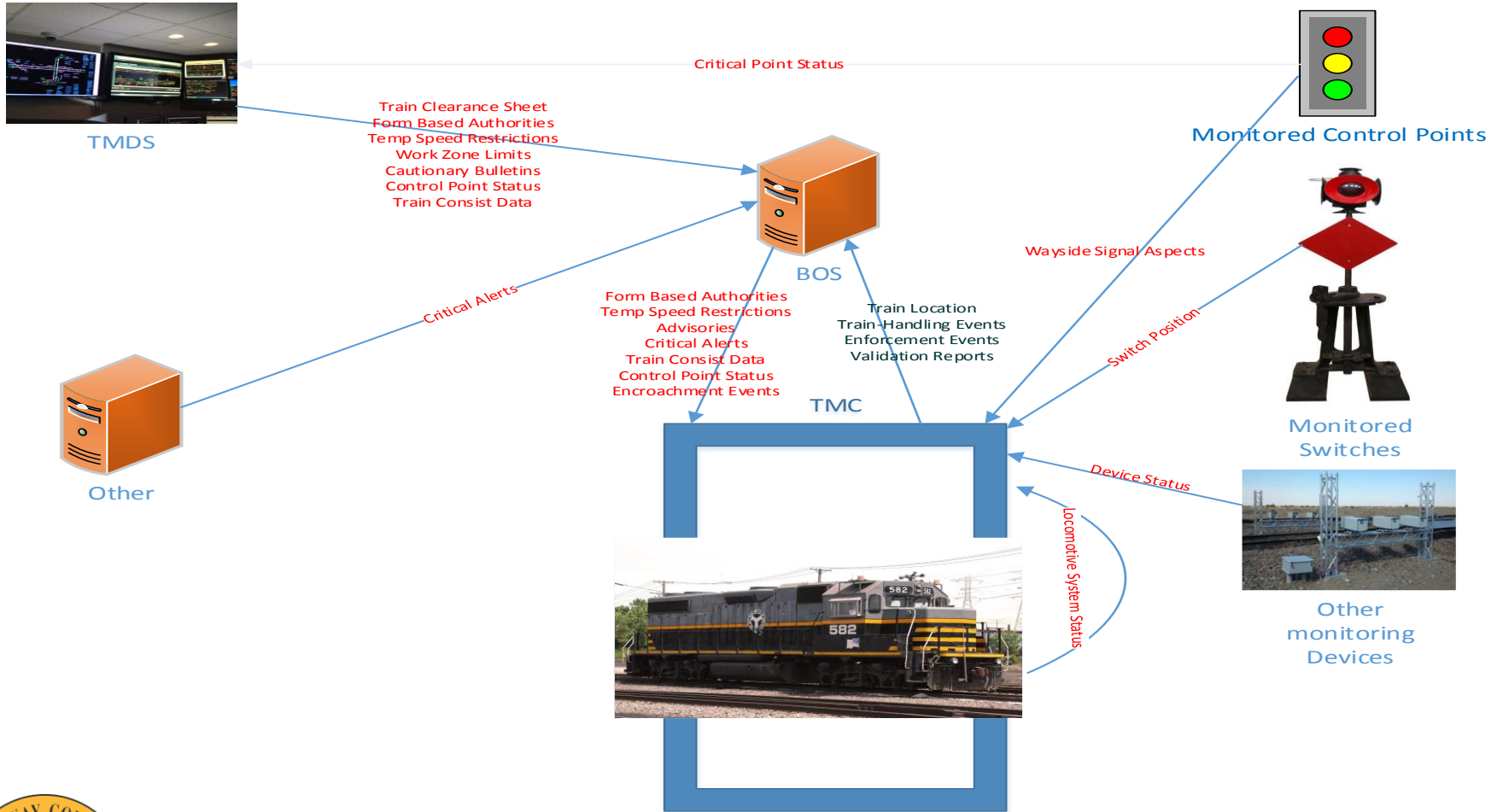
- GPS receiver

- A brake cut-out

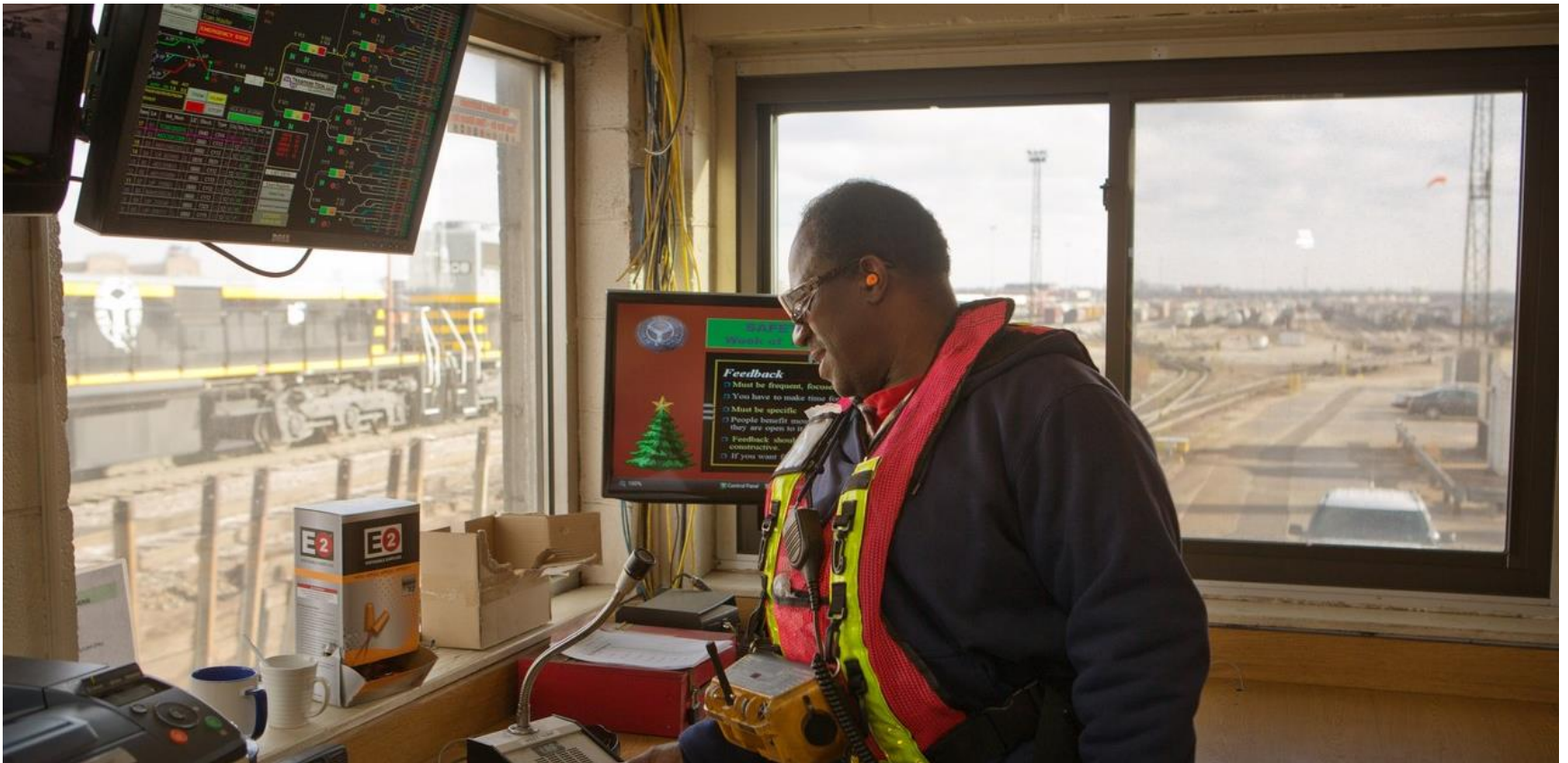
The communications segment includes the fiber optic cables, cellular network, 220MHz radio system, Wi-Fi 802.11 and GPS. The communications segment provides the communication path between the office, track elements, trains, and roadway workers.



Positive Train Control



PTC at the BRC



TENANT
PARKING
ONLY

Tenant Vs. Host Railroad

Tenant Railroad

- Maintain ability to initialize on host railroad PTC systems via the ITC Federated Network
- Have the ability to provide crew and consist information to the host railroads PTC system
- Ability to obtain reports from the host railroad on enforcement events, software revisions and other changes via a secure link
- Address all software updates and configurations on their equipment to assure operation on the host railroad's system
- Maximize uptime to assure operation on the host railroad's system.
- May utilize a host railroad back office system account of resources
- Maintain interoperability with the host railroad(s) PTC system(s).

Host Railroad

- Maintain back office system with appropriate resources to support full operation of the carrier's trains and those of tenants.
- Maintain change management system to ensure tenants are properly updated to allow for compliant operation.
- Develop and maintain radio spectrum capability to support operation on the host railroad's tracks
- Develop & maintain Wayside PTC components
- Maintain a fleet of equipped locomotives with all required record keeping.
- Maintain PTCSP for territory & reporting
- Maintain PTCDP for territory & reporting
- Maintain PTCIP and required updates and reporting for territory.

BRC is a Host Railroad

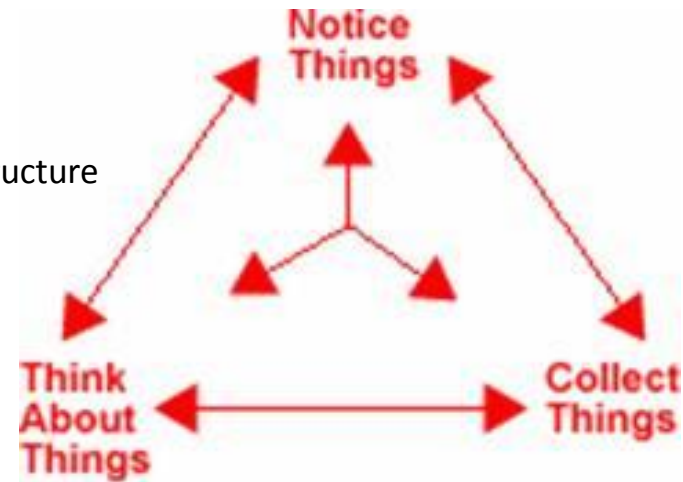


BRC Methodology for PTC

- Phase 1 – Conceptual Design/Discovery



- Gather requirements
- Scope
- Existing assets and infrastructure
- Impacts
- Dependencies
- Timelines
- Regulations



Engage Vendors to assist in the process and ascertain impacts on your RR

Wabtec...Alstom...OnX...Bartlett&West...



BRC Methodology for PTC

- Phase 2 – Implementation

Choose Vendors/Partners:

- BOS
- Wayside
- On-Board
- ITCM

Vendors for Phase 1 and Phase 2 can be selected independently



Engage System Integrators

- Manage Project Plan, Timelines
- Manage dependencies
- Manage installations
- Manage connectivity
- Co-ordinate testing activities
- Provide documentation (system & FRA)
- Train staff
- Other activities



How does BRC Tackle PTC

Discussions with FRA



Industry conferences on PTC

- Engage with other Railroads – Class1s, short lines, Commuters
- Information/experience sharing
- Other PTC related forums

Determine Detailed Scope

- Short line responsibility Vs. Class 1
- Vendor Responsibility



Major Change

- Cultural
- Technical
- Process



RR Specific Decisions

Ex. Federally mandated section vs. Entire RR



Decision – Fed Mandated or Entire Mainline?

Understand

- Gov't required only two interlockings to be PTC equipped

Risk Analysis

- Fluidity of main line – PTC track → non-PTC → PTC Track → non-PTC..

Formulate

Cost Analysis by Wabtec (Mandated vs. Entire Track):

- Considerable cost for protecting interlockings where the Class 1 track will be PTC equipped
- Majority of cost is related to BOS which is needed regardless of the number of interlockings in question

Strategic Fit

- Standardization
- Operational Integrity
- Future state

Decision

PTC equip entire BRC mainline



Decision – Fed Mandated or Entire Mainline?

Fluidity is the main Reason Class 1's are pushing shortlines to be PTC equipped as tenants

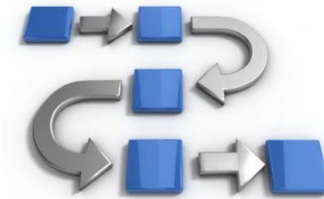
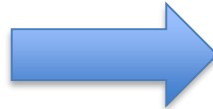


Project Planning

- A PTC Host should follow a two-phased approach



Discovery/Conceptual Design



Implementation



Get assistance with contract negotiations

- Leverage other RRs with experience
- Use outside firms like Infotech and Forrester that excel in negotiation strategy

Take ample time to objectively evaluate contracts. Do not rush contract negotiations

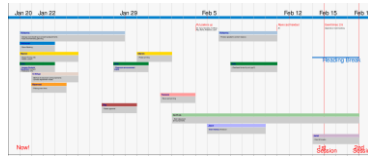


Project Planning – Other Considerations



Involve your Class 1 Partners in the process

Ascertain Class 1 timelines for PTC in your area to understand dependencies



Review your PTC design with them



Leverage Class 1 infrastructure for any major tasks such as testing, training etc



Use the output from Phase 1 (Discovery/Conceptual Design to Plan Phase 2:

- For RFP process (whole project or in parts/phases)
- For a reasonable estimate on the scope
- Better fit/gap analysis
- Estimating timelines
- Estimating costs accurately
- Understanding skill set needed for resourcing
- Keeps the systems integrator engaged



BRC - PTC Staffing

- BRC determined in 2015 that internal competency had to be built to support current PTC implementation as well as future needs of PTC (production support & enhancements)
 - Decision was made to ramp up a dedicated team to manage various segments of PTC
 - Ultimately the BRC is Responsible for PTC Program, operational integrity and ensuring safe operations – a responsibility that cannot be pushed to the vendors
 - BRC opted for a phased approach over time to meet strategic objectives

Attributes	Crawl	Walk	Run
Capabilities	Basic	Maturing	Advanced
Scope	Non-Critical	Critical	Critical-Strategic
Operations	Launch	Control	Integrated
Interactions	Transactions	Discussions	Partnership
People	Responsive	Responsive/Proactive	Proactive



BRC - PTC Staffing



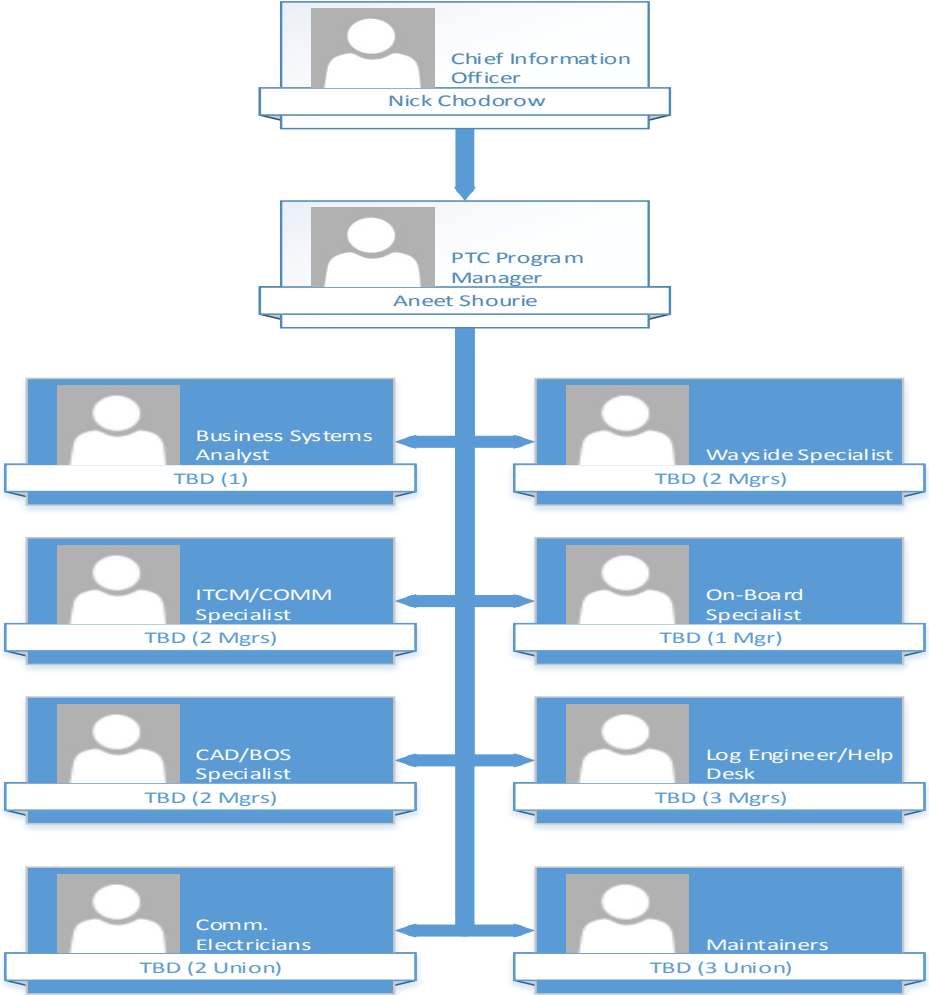
Organization was staffed from 2016 onwards with the minimum number of positions required for sustainable substantive operations and to fulfil the demand for PTC Program

- Initial Team Composition

- PTC Program Manager
- Business Systems Analyst
- Senior Communications/Network Engineer
- Senior PTC Systems Engineer – Onboard Systems
- Senior PTC Systems Engineer – Waysides
- Senior PTC Systems Engineer – Back Office (CAD/BOS)
- Operations Engineer



PTC Program – BRC PTC Organization



BRC PTC Steering Committee

- Support
- Guidance
- Oversight
- Final Escalation
- Scope Creep
- Budget Creep
- Ultimate decision maker for
 - Political
 - Legal
 - Organizational
 - Technical
 - Cost Management
 - Cultural & Personnel issues

- **Nick Chodorow**
(Chairperson)
 - *Chief Information Officer*
- **Dennis Warford**
 - *Chief Financial Officer*
- **Mark Ferguson**
 - *Chief Engineer*
- **Frank Izzo**
 - *Superintendent (Transportation)*
- **Hugh Simon**
 - *Superintendent (Mechanical)*





IT and your Railroad

Create a Roadmap based on your vision for technology

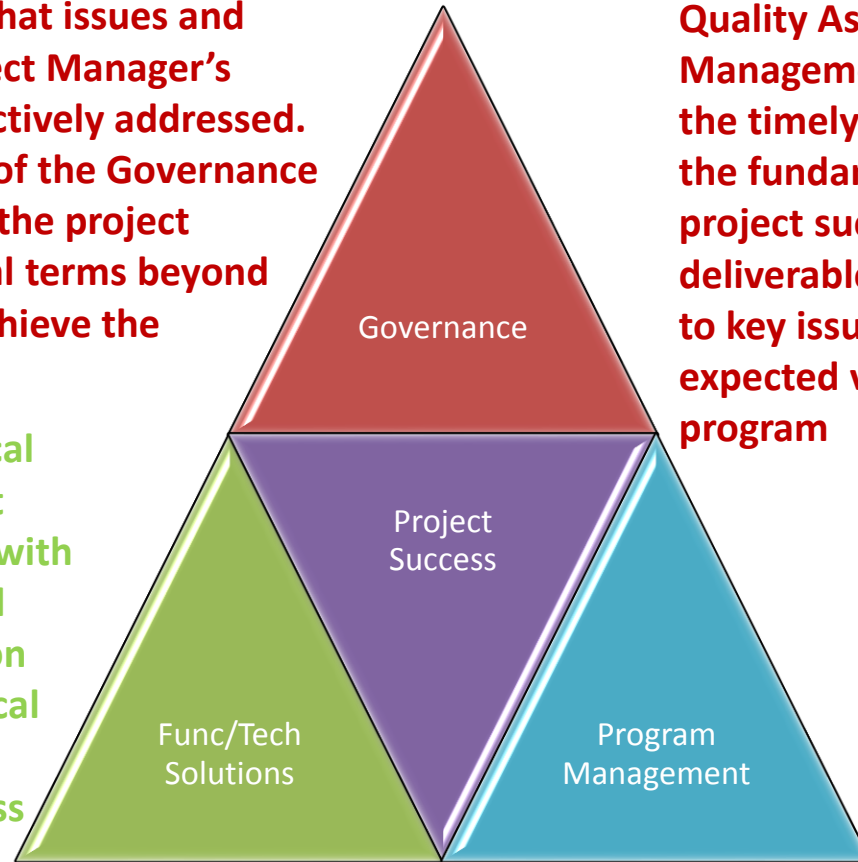
Significant
Portions of
PTC are IT
based



Program Success

Governance ensures that issues and risks beyond the Project Manager's control are being effectively addressed. This is the active role of the Governance team to help manage the project against the contractual terms beyond the PM's control to achieve the expected outcome.

Functional and Technical components that meet business requirement with the simplest functional design while residing on sound, scalable technical platform enable implementation success and continuous improvement



Quality Assurance and Risk Management periodically validates the timely and effective workings of the fundamental components of project success. This ensures key deliverable completion and visibility to key issues and risk to the expected value realization for the program

Program Management is the application of knowledge, skill, tools and techniques to forecast activities to meet project requirements



Looking back.....

How PTC started at BRC



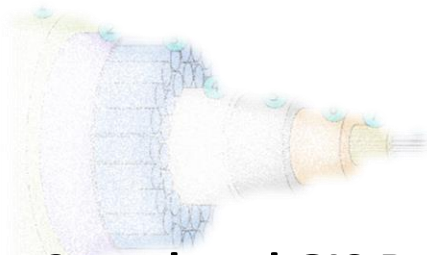


2013



- **Bartlett and West was engaged to :**
 - **Develop and maintain a GIS Database for BRC**
 - **Develop a change management process**
 - **Work with PTC Integrator to Create Subdiv File**
- **Work Began to Upgrade BRC Network and Systems Infrastructure to Support PTC and BRC Operations**
- **Began Building Relationships with Class 1 Partners**
- **RFP for PTC Systems Integrators**





2014



- **Completed GIS Database, Website, and a Change Management System for the BRC**
- **Completed Upgrade of BRC Systems Infrastructure to Hosted Environment**
- **Continued Work on BRC Network (LAN and WAN)**
- **Obtained Board Approval to Install Fiber Along Entire Mainline**
- **Met with Class 1 Partners**
- **Selected Wabtec as PTC Systems Integrator for Discovery/Conceptual Design Phase**
- **Went through a several month long and arduous period Negotiating Contracts with Wabtec**





2015



- **Discovery/Conceptual Design work was completed in 10 months**
 - Reviewed PTC Design with Class 1 Partners
- **Validated Ability to Recover Dispatch System at Remote Data Center**
- **Began Upgrading Wabtec Dispatch System to be PTC Enabled**
- **Significant Work on BRC Network (LAN and WAN) was done**
- **Phase 1 of the Mainline Fiber Project completed on schedule**
- **Discussions with Shortline Partners and a Few Other Commuter Hosts regarding areas of common interest in PTC**
- **Completed 3 Separate RFPs for the Implementation Phase**





2016



- Start of building in-house PTC capability
 - PTC PM
 - Senior Network Engineer
- Issued Implementation RFP's (Hosted ITCM, Hosted BOS, Systems Integration)
 - Discussions with Finalists around their key capabilities, methodologies and competitive advantage
 - Evaluating and Determining Winner – In Process
 - Expected Decision by end of 2016
- Phase 2 of the Mainline Fiber Project underway



2017: Where we are today



- Vendors have been selected (Hosted ITCM, Hosted BOS, Systems Integration)
 - Project planning for implementation is done
 - Hardware has been acquired and being staged
 - ITCM Design completed and being reviewed
 - Back Office System under design
 - Verification of critical features and data collection on mileposts has been completed and creation of sub-division file is underway. First version of the sub-division file is expected to be completed by end of first quarter.
- Upgrade of Wabtec Dispatch System underway
 - PTC Enabled (Bulletins)
- On-going Initiatives
 - Dispatch System (technical & functional improvements)
 - Change Management & Document Management
- Phase 3 of the Mainline Fiber Project underway
- Start of building in-house PTC capability
 - Final phase of hiring Systems Engineer for Wayside
- Final discussion on Concepts Such as Joint PTC Labs and Training Plans with Vendors and Railroads underway



Lessons Learned

Governance Issues

Consistency	Consistency in implementation of business decisions Ex. Lack of RACI, Lack of KPIs
Transparency	Decision process that is visible to all stakeholders Ex. Lack of documented key decisions, key decisions not communicated, Lack of clarity in integrated topics
Accountability	A clear line of authority and responsibility

Project Management Issues

Human Res. Management	Active planning and management of in-house resources including SMEs and super users
Business Requirements	Blueprint documents, incorporating business requirements and solution design – Ex. Business requirements inadequately defined



Lessons Learned

People	
Organizational Change Management (OCM)	OCM Strategy and Plan Ex. Lack of business impact analysis, Late or limited communications, Roles & Resp. not well defined
Change in skill set	All non-transportation employees will need to be retrained
Knowledge Management	Knowledge Transfer Ex. Lack of tools, weak documentation
External communications	Engage Class 1 RRs - be assertive if you have to, in order to start a dialogue
Invest in the team	Use all possible means to educate PTC team and keep them updated
Partner Relations	PTC requires several partners who need to be managed actively



Lessons Learned

Technology	
Infrastructure	Large scale investment needed
Supporting Tools	Doc. Management, Change Management, Incident Management
Architecture	Need reliability and redundancy

PTC has no end date....



Industry Wide PTC Developments



- **ASLRRA**
 - Executive PTC Task Force
 - Working Together to Find Appropriate PTC Services for PTC Tenant Railroads
- **AAR/TTCI**
 - TTCI PTC Test Lab
 - Focus is to Provide a Shared Service PTC Test Lab for Railroads
 - Host and Tenant Railroads
 - Lou Sanders (APTA) and Nick Chodorow Working With TTCI, Class 1's and FRA on Project
- **PTC Vendors**
 - Hosted ITCM/CI BOS/G BOS Services
 - Hosted CAD
 - Testing as a Service
 - More Players as Time Goes By



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QUESTIONS

