Vital Overlay System

• ‘Sits Atop’ Another System
• System Safety
  – Vital, Safety-Critical
• Integrated Operation
  – Preserve Underlying System
Positive Train Control

• Need
  – Improved System Safety
  – Collision Avoidance

• FRA 49 CFR 236 Subpart I
  – Major Accidents
  – Implement 12/2015
ASCES II

- Advanced Civil Speed Enforcement System II
  - Type Approved 27-May-10
Type Approved ACSES II

- Solution *NOT* Answer
- Railroad
  - Vehicle Types
  - Track Configurations
  - Operating Rules
- Interoperability
  - Tenants
  - Rail Corridor
Applying Systems Engineering

- Disciplined, Mature Model
- Whole Systems Thinking
- Existing System
- Final Operation
- Performance
- Functionality
- Sustainability
PTC PUZZLE

FRA Regulation
• Implementation Plan
• Complete To Schedule
• Safety Certification

Operation & Maint
• PTC Functionality
• Tenant Integration
• Training

Implementation
• Operating Railroad
• Railroad Commissioning
• System Maintainability
Reliable PTC Functionality

• Functional Needs
  – Gap Analysis
  – Mitigate Functional Hazards
  – Operational Analysis
  – Segmentation
  – Interfaces / Interoperability

• Success
  ✔ Commissioning
  ✔ Performance Demonstration
<table>
<thead>
<tr>
<th>Reliable Tenant Integration</th>
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<tbody>
<tr>
<td><strong>Interoperability</strong></td>
</tr>
<tr>
<td>- Passenger / Freight</td>
</tr>
<tr>
<td>- Interoperable Systems</td>
</tr>
<tr>
<td>- Message Protocol</td>
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<tr>
<td>- Temporal Separation</td>
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<tr>
<td><strong>Success</strong></td>
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<tr>
<td>✓ Host / Tenant Agreements</td>
</tr>
<tr>
<td>✓ Inter/Intra Railroad Operation</td>
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Commissioning

- Segment Implementation
  - Fully Operational Pilot
  - Segment Deployment
  - Vital Database
  - Test & Commissioning Tools
  - Change & Variance Management

- Success
  ✔ Full Operation Acceptance
Staffing & Training

• Operators and Maintainers
  – Staffing Plan
  – Training Program
  – Curriculum
  – Trainers
  – Tools

• Success
  ✔ Proficient Staff
  ✔ Proficient Instructors
Acquisition Plan

- Complexity
- FRA & Railroad Needs
- Safe Service Delivery

Systems Engineering

- Stakeholder Needs
- Requirements Early
- Existing Operation
- Performance
- Life-Cycle Processes