Modernizing Rail Inspections for the US Army Corps

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Background

- DoD Railroad System
  - Critical asset
  - Peacetime facility functions
  - Mobilization in time of national need
- Army maintains > 1500 miles of track in U.S. and overseas
- Unique management and maintenance requirements
  - Lower speeds
  - Frequency of use
  - Nature of DoD cargo
Problem

- In support of IMCOM, ERDC manages inspection program for 70 Army facilities worldwide
- Current program is labor and time intensive
  - Paper forms
  - Mechanical measurement
  - Stationing
  - Post-field data entry
  - No GIS capability
  - Microsoft Access database
  - Limits support to change detection and critical maintenance decisions
Approach and Objective

- Automate inspection and reporting
- Use best-available COTS components and customized software
- Streamline RR inspection process
  - Reduce data collection time and staff by 30%
  - Reduce time to generate reports by 50%
  - System compatible with RAILER
ERIDS – Electronic Railroad Inspection Database System

Streamlines inspection and reporting with tools to:
- Detect and monitor changes
- Optimize facility maintenance programs
- Visualize and analyze data
- Integrate GPR, ultrasonic techniques, and stereoscopic photography

Hardware components of ERIDS selected for:
- Digital data collection
- Database building
- WiFi enabled
- 10-cm accuracy with GPS
- Easily portable
- Ruggedized
## Components of ERIDS

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>MANUFACTURER</th>
<th>MODEL</th>
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<tbody>
<tr>
<td>GIS-grade GPS unit</td>
<td>Trimble</td>
<td>GeoXH 6000</td>
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<tr>
<td>GPS antenna</td>
<td>Trimble</td>
<td>Zephyr 2</td>
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<tr>
<td>Vertical pole for Zephyr 2</td>
<td>Trimble</td>
<td>Range pole</td>
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<tr>
<td>Equipment case for GeoXH, Zephyr 2, accessories</td>
<td>Trimble</td>
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</tr>
<tr>
<td>Software for post-processing GPS data</td>
<td>Trimble</td>
<td>Trimble® Positions™</td>
</tr>
<tr>
<td>GIS software</td>
<td>ESRI</td>
<td>ArcGIS</td>
</tr>
<tr>
<td>Cart to transport equipment along RR</td>
<td>ERDC</td>
<td>Custom</td>
</tr>
<tr>
<td>Rangefinder for distance and angle</td>
<td>Trimble</td>
<td>TruPulse</td>
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<tr>
<td>Laser distance meter</td>
<td>Leica</td>
<td>Disto A8</td>
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<tr>
<td>Extended warranty for GeoXH</td>
<td>Trimble</td>
<td>--</td>
</tr>
<tr>
<td>Bracket and cable for connecting GeoXH and Zephyr 2</td>
<td>Trimble</td>
<td>--</td>
</tr>
<tr>
<td>GPS unit to guide repairs from database</td>
<td>Trimble</td>
<td>Juno</td>
</tr>
</tbody>
</table>
Architecture of ERIDS
ArcPad vs ArcGIS Mobile

Evaluation
• Needed true integrated data collection and editing capabilities
• End-users not GIS professionals

Decision
• ArcGIS Mobile with Trimble® Positions™ software suite
• Developed custom data collection application
  • tailored specifically to the inspection business process
  • enabled differential correction to increase GPS accuracy
    (process previously available only with ArcPad and GPSCorrect)
Field Use of ERIDS

1. Establish reference point with GPS
2. Walk track with GPS, range pole, antenna on rolling cart
3. Enter defect digitally on touch-screen
4. Photograph defect (geo-tagged)
5. Resume inspection

- Track mapped, inspected, and documented in real time
- On-board data from previous inspections
Data Flow in ERIDS

1. Engagement Scheduled
2. Establish Track Names/Locations
3. Create service for installation
4. Initial synchronization with trimble
5. Collect Inv/Ins data in the field
6. Scan with Ultrasonic Truck and Mark Defects on Rail
7. Connection Available?
   - Yes: Synchronize data with installation-specific service
   - No: Backup data to pc
8. Finished at installation?
   - Yes: Final Delivery
   - No: Create full inspection report (Several components)
9. Create Closed to Traffic Defect Report
10. Apply differential correction
11. Merge installation data into full enterprise database
12. Export Railer database
13. Export Geodatabase
Software to Achieve Data Flow From Field Input to Report

- Integrate sensing technologies
- Integrate new inspection tools
- Enhance report generation
- Data analysis and data mining
- Support maintenance decisions

Software under development by Geographic Information Services, Inc. and ERDC
## Inventory and Inspection Categories Addressed

### Inventory
- Track characteristics
- Track segment
- Appliances
- Turnouts
- Curves
- Bridges
- Grades
- Grade crossings
- Rail crossings
- Restrictions
- Drainage

### Inspection
- General
- Ties
- Fasteners
- Rail and ballast
- Appliances, rail crossings, and drainage
- Grade crossings
- Track geometry deviation
- Turnouts, general information
- Turnouts, switch and stand
- Turnouts, frog
- Turnouts, guard
- Turnouts, measurements
- Impaired (segment cannot be inspected)
Current Status

- Enterprise database designed/developed to manage collected data
- Data collection software developed and delivered
- ERDC inspectors trained to use hand-held equipment and data collection application
- Data collection software designed to reduce inspection time by 30%, testing underway
- Reporting component still under development to reduce time and cost of reporting by 50%
Questions?