Technology to Improve Inland Waterway Operations

- Assess current waterways practices
- Identify technology applications that can improve
  - Productivity
  - Safety
  - Security

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Technology In Transportation

- Commercial aircraft
  - Highly advanced technological infrastructure
- Commercial highway vehicles
  - Rapidly growing technological infrastructure
- Commercial railroads
  - Rapidly growing technological infrastructure
- Inland Waterways
  - Slow ad hoc adoption of technology
Intermodal Freight Transportation

• Waterways - Advantages
  – Low cost
  – Low environmental cost
  – Safe (compare to 4000+ annual truck deaths)
  – Reduces highway congestion

• Waterways - Disadvantages
  – Slow (COC ½% to 1% per month)
  – Low predictability
Improving Productivity

- Each technological infusion should
  - Provide an immediate productivity benefit
  - Build towards improved predictability
Productivity Barriers

• Navigational uncertainties and bottle necks
  – Poor visibility can stop river traffic

  – Locks
    • Frequent small locks slow traffic
    • Outages severely limit traffic
# Productivity Issues Within The Pittsburgh District

## Table 1: Ohio River Locks within the Pittsburgh District

<table>
<thead>
<tr>
<th>Lock</th>
<th>Pool size</th>
<th>Land Side Lock (ft x ft)</th>
<th>River Side Lock (ft x ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hannibal</td>
<td>42.2</td>
<td>110 x 600</td>
<td>110 x 1200</td>
</tr>
<tr>
<td>2 Pike Island</td>
<td>30</td>
<td>110 x 600</td>
<td>110 x 1200</td>
</tr>
<tr>
<td>3 New Cumberland</td>
<td>23</td>
<td>110 x 600</td>
<td>110 x 1200</td>
</tr>
<tr>
<td>4 Montgomery</td>
<td>18.4</td>
<td>56 x 360</td>
<td>110 x 600</td>
</tr>
<tr>
<td>5 Dashields</td>
<td>7.1</td>
<td>56 x 360</td>
<td>110 x 600</td>
</tr>
<tr>
<td>6 Emsworth</td>
<td>-</td>
<td>56 x 360</td>
<td>110 x 600</td>
</tr>
</tbody>
</table>
Productivity
Advanced Navigation Technology

• Navigation in poor visibility
  – Vision Enhancement Technology (Infrared, RADAR, LIDAR)
  – Collision warning (RADAR, LIDAR, GPS)

• Improved Locking
  – Instrumented Locking System (ILS)
  – Barge lashing system
  – Predictive lock maintenance
Productivity
Instrumented Locking System

Pilot Display

Approach Error

25 ft
10 ft/sec.
Productivity
Instrumented Locking System

• Real-time measurement of tow location and speed.

• Infrastructure based sensors
  – Video camera
  – Infrared camera
  – Lidar
  – Radar
  – Differential GPS
Productivity
Real Time Shipment Tracking

• Barge location technology
  – Global Positioning System (GPS)
  – Radio Frequency Tags
  – Line – of – sight radio
  – Satellite Communications

• Tracking software
  – Provide current location of shipment
  – Prediction of delivery (Include truck and rail)
Improving Safety

• While on the river
  – Onboard collision warning
  – Pilot monitoring system

• Collisions while locking
  – (ILS - collision warning)

• Collisions while navigating in port
  – Onboard collision warning
  – Port navigation system (similar to ILS)
Safety
Pilot Monitoring System

- Video based pilot monitoring
  - Mature technology (truck and rail)

- Activity based pilot monitoring
  - Mature technology (military and rail)

- Performance based pilot monitoring
  - e.g. Deviation from planned route
Improving Security

• Port and Lock/Dam Security
  – Water attach (USS Cole)
  – Ground attack (Okalahoma City)

• Open river security
  – Tow hijack
  – Run away barges
Security
Use Limited Resources Wisely

• Asses threat and prioritize
  – Vulnerability assessment
  – Public health consequences
  – Economic consequences
  – National security consequences

• Identify **cost effective** countermeasures
Security
Automated Video Surveillance
Technology to Improve Inland Waterway Operations

• Words of Caution
  
  – Carefully asses business case
    • Must have full participation of Ports, Waterway Operators, and USACE

  – Human factors are important!
    • Must have complete buy in from users
    • User centered design practices