National Rural ITS Conference
Digital Technology’s Impact on Safety and Efficiency

Pullman Plaza Hotel
1001 Third Avenue
Huntington, WV 25701

August 03, 2010
Ingram Barge Experiences
Improving Towing Operations
on the River
Discussion Topics

- Global Positioning as a critical component
- Electronic charting – utilization, benefits & issues
- Transponder based technologies
- Asset tracking
- Integration into core user systems
- What next?
The Need for Real Time Data

...planning ahead and monitoring progress counts
In some ways, the wheelhouse looks a lot like it did 50 years ago.
Bring it all together
Global Positioning Systems

Electronic Navigation Charts

Radar Overlay

Vessel Tracking Management System
Electronic Charts

- Multiple Types
  - Raster
  - Vector
  - Bathymetric (Sonar)

- Multiple Sources
  - USCG
  - USACE
  - NOAA
  - Private parties

- All require integration with other components of system
Global Positioning Systems (Cont’d)

- Safety
  - Pinpoint accuracy day or night, all weather conditions
  - Track past positions and selected data points
  - Superimpose radar images onto navigation charts
  - Zoom in and out capability
  - Visual and audible alarms
  - Integration with other technologies
    - Depth sounders
    - Auto pilot
    - Transponders
    - Engine Monitoring, etc.
  - Aid post-incident investigations
Global Positioning Systems (Cont’d)

- Productivity improvements
  - Help meet growth demands (lack of more experienced people)
  - Transfer route knowledge for best possible routing
    - Vessel to vessel
    - Vessel to shore
    - Vessel to customer
  - User annotation capabilities
  - Accelerate training
  - Integrate with GIS databases of USCG and USACE
  - Monitor speed and regulate fuel burn
Radar Overlays

- Tight integration of multiple technologies
  - PC system
  - GPS
  - Digital mapping (raster or vector)
  - Real time radar imagery

- Latitude-longitude or D-GPS/GPS synchronization
Bathymetric (Sonar) Charts

- What advantages can they have?
  - Can they be digitized?
  - Integrated into PC system
  - Types of displays
- Latitude-longitude or D-GPS/GPS synchronization
Automatic Identification Systems

- Easy to operate
  - Operate on all navigable inland waterways
  - Transmission of data VHF
- Plug and play technology for replacements - no calibration
- Accurate with electronic charts
- Seamless integration into existing ECS -
  - On screen visibility
  - Not incorporated within radar - do not plot course / solutions
- No need to clutter display with useless information
  - MMSI # / DSCID #  ? Why ?
  - Latitude / Longitude of other vessels ?
  - UTC time ?
LAPTOP PC DISPLAY SCREEN
SHIP IS FOLLOWING THE CONSTANT-RADIUS TURNING ARC

Note: Ship is drawn to scale.
Tracking

- Recording past voyage tracks
- Asset tracking
- Allow use of Ingram’s standard tracks & marks
- Integration into core data systems
- Aid in post incident investigation
  - Replay pass track
  - DVR Radar & Camera Recordings
## Current Boat Positions

### Sort by: **Boat** | **River** | **River / MP**

<table>
<thead>
<tr>
<th>Boat Name</th>
<th>River</th>
<th>Mile</th>
<th>AS OF</th>
<th>River</th>
<th>Mile</th>
<th>AS OF</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.J. Morris</td>
<td>OH</td>
<td>927.2</td>
<td>3/4/2009 12:00:00 AM</td>
<td>OH</td>
<td>927.2</td>
<td>03/04 10:27</td>
</tr>
<tr>
<td>RAKONI BARKETT</td>
<td>OH</td>
<td>262.3</td>
<td>3/4/2009 12:00:00 AM</td>
<td>KAN</td>
<td>1.4</td>
<td>03/04 10:26</td>
</tr>
<tr>
<td>Ace 9</td>
<td>LMR</td>
<td>230.5</td>
<td>3/4/2009 12:00:00 AM</td>
<td>LMR</td>
<td>232.5</td>
<td>02/27 13:44</td>
</tr>
<tr>
<td>Addie</td>
<td>LMR</td>
<td>137.2</td>
<td>3/4/2009 12:00:00 AM</td>
<td>LMR</td>
<td>137.2</td>
<td>03/04 10:30</td>
</tr>
<tr>
<td>Alice J. Hooker</td>
<td>TEN</td>
<td>1.4</td>
<td>3/4/2009 12:00:00 AM</td>
<td>TEN</td>
<td>1.4</td>
<td>03/04 10:30</td>
</tr>
<tr>
<td>A.L. Johnson</td>
<td>OH</td>
<td>314.3</td>
<td>3/4/2009 12:00:00 AM</td>
<td>OH</td>
<td>312.2</td>
<td>03/04 10:32</td>
</tr>
</tbody>
</table>
Boat Details

The EDWIN L. KENNEDY, built 1975

Position: Mile 281.4 on the TENNESSEE RIVER
Net Tonnage: 413 Tons
Engine: GM 12-645-E70 | 4300 | 875 RPM
Tow Size: 20 Barge Maximum Tow
Boat Height: 42 FT (Highest Fixed Point: 40.8 FT)
Length Width: 134 X 25 FT
Boat Draft: 9.4 FT

Map This Vessel's Current Location

Back to Boat Positions
# Towboat Status

<table>
<thead>
<tr>
<th>Out of Service/Last Reporting</th>
<th>Tows</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Riv</td>
<td>934 F</td>
<td>03/18/1998</td>
</tr>
</tbody>
</table>

**Last Rep Date:** 01/07/2000 1236

**Current Position:**
- **River:** 0H
- **MP:** 934
- **Position:** N

**Last Position:**
- **River:** 0H
- **MP:** 934
- **Position:** N

**Miles in Last 24 Hours:** 45

**Barges in Tow:**
- **Loaded:** 8
- **Empty:** 7

**Fuel on Board:** 37155

**Fuel Used (Gallon):** 2440

**Lube on Board:** 410

**Lube Used:** 20

**Engine Hrs:**
- **Port:** 24
- **Cntr:** 0
- **Stbd:** 24
### Asset ING1969 Status History Report

(Latest 25 messages)
Friday, Mar 09, 14:01 (EST)
Total messages: 366; Today's messages: 0;
Please click "Location" to see it on map

<table>
<thead>
<tr>
<th>Latest Msg</th>
<th>GES Location</th>
<th>Speed(kmph)</th>
<th>Avg Level (n)</th>
<th>Level Bv St (n)</th>
<th>Level Bv St (n)</th>
<th>Level St St (n)</th>
<th>Level St St (n)</th>
<th>Leash(Tons)</th>
<th>Bow-Stan Tlm (min)</th>
<th>Pnt-St Tlm (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar08,12:37</td>
<td>GRAND RIVERS KY</td>
<td>0</td>
<td>18</td>
<td>23</td>
<td>20</td>
<td>12</td>
<td>15</td>
<td>3</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Mar08,10:33</td>
<td>GRAND RIVERS KY</td>
<td>0</td>
<td>18</td>
<td>23</td>
<td>20</td>
<td>12</td>
<td>15</td>
<td>3</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Mar05,05:00</td>
<td>RIVERSIDE,TN</td>
<td>0</td>
<td>20</td>
<td>22</td>
<td>14</td>
<td>15</td>
<td>36</td>
<td>11</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>Mar05,05:00</td>
<td>RIVERSIDE,TN</td>
<td>0</td>
<td>20</td>
<td>22</td>
<td>14</td>
<td>15</td>
<td>36</td>
<td>11</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>Mar04,18:38</td>
<td>OLD HICKORY,TN</td>
<td>10</td>
<td>20</td>
<td>22</td>
<td>14</td>
<td>15</td>
<td>36</td>
<td>11</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>Mar04,14:17</td>
<td>GALLATIN POSTAL,</td>
<td>0</td>
<td>10</td>
<td>24</td>
<td>14</td>
<td>15</td>
<td>36</td>
<td>11</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>Mar04,14:02</td>
<td>GALLATIN POSTAL,</td>
<td>0</td>
<td>19</td>
<td>24</td>
<td>14</td>
<td>15</td>
<td>36</td>
<td>11</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>Mar04,12:59</td>
<td>GALLATIN POSTAL,</td>
<td>0</td>
<td>18</td>
<td>24</td>
<td>14</td>
<td>15</td>
<td>36</td>
<td>11</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>Mar04,12:48</td>
<td>GALLATIN POSTAL,</td>
<td>0</td>
<td>84</td>
<td>35</td>
<td>14</td>
<td>15</td>
<td>36</td>
<td>11</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>Mar04,01:03</td>
<td>GALLATIN POSTAL,</td>
<td>0</td>
<td>132</td>
<td>129</td>
<td>132</td>
<td>129</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Mar03,19:10</td>
<td>GALLATIN POSTAL,</td>
<td>0</td>
<td>132</td>
<td>129</td>
<td>132</td>
<td>129</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Mar02,18:58</td>
<td>GALLATIN POSTAL,</td>
<td>0</td>
<td>133</td>
<td>130</td>
<td>133</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Feb02,12:30</td>
<td>OLE HICKORY,TN</td>
<td>10</td>
<td>133</td>
<td>130</td>
<td>133</td>
<td>130</td>
<td>1904</td>
<td>-80</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb02,06:58</td>
<td>EDENVOLD,TN</td>
<td>0</td>
<td>133</td>
<td>130</td>
<td>133</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb02,00:40</td>
<td>NASHVILLE RUB,TN</td>
<td>0</td>
<td>133</td>
<td>130</td>
<td>133</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb01,20:24</td>
<td>RIVERSIDE,TN</td>
<td>0</td>
<td>132</td>
<td>130</td>
<td>132</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb01,18:58</td>
<td>RIVERSIDE,TN</td>
<td>0</td>
<td>132</td>
<td>130</td>
<td>132</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb01,12:28</td>
<td>TORONIA,TN</td>
<td>0</td>
<td>132</td>
<td>130</td>
<td>132</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb01,06:58</td>
<td>ASHLAND CITY TN</td>
<td>0</td>
<td>132</td>
<td>130</td>
<td>132</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb01,00:40</td>
<td>ASHLAND CITY TN</td>
<td>0</td>
<td>132</td>
<td>130</td>
<td>132</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb28,18:58</td>
<td>ZINC,TN</td>
<td>0</td>
<td>132</td>
<td>130</td>
<td>132</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb28,00:40</td>
<td>ZINC,TN</td>
<td>0</td>
<td>132</td>
<td>130</td>
<td>132</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb27,10:59</td>
<td>DELRAY,TN</td>
<td>10</td>
<td>132</td>
<td>130</td>
<td>132</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Feb27,08:58</td>
<td>TESSUP,TN</td>
<td>0</td>
<td>132</td>
<td>130</td>
<td>132</td>
<td>130</td>
<td>1904</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

**Total messages**
What’s next?

- Enhance electronic chart functionality
- Seamless systems integration
- Enhanced Reality
  - More data clearly displayed
  - Simple to use & user friendly
- Connectivity is the key
  - Low cost
  - High band width
  - 5 - 9’s reliability
New video without forward instability
Docking Assistance

- Laser docking systems expensive and need 1 system per berth
- Advanced PPUs can measure position and velocity to nearly the same accuracy (2 cm/s)
- PPUs can also show additional information such as headway
- A PPU can be used at every berth in the port
Enhanced Reality

- Real Time data in multiple selectable layers
- Provide useful data in a user friendly format
### Barge Number: IB9530
**LMR (438.9)**

<table>
<thead>
<tr>
<th>Barge ID</th>
<th>Type</th>
<th>Cargo</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB9530</td>
<td>L</td>
<td>50% Caustic Soda-Memb</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ingram Job</th>
<th>Customer</th>
<th>Customer Order</th>
<th>Last Message Date</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>AcTraker Barge ID</th>
<th>AcTraker ESN</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11947</td>
<td>0-411109</td>
<td></td>
</tr>
</tbody>
</table>

#### Current Position
- **River:** LMR
- **Mile Point:** 438.9
- **Activity:** I
- **Status:** MT

<table>
<thead>
<tr>
<th>Facility</th>
<th>Custodian</th>
<th>Cover Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV HORTENSE B. INGRAM</td>
<td>MV HORTENSE B. INGRAM</td>
<td></td>
</tr>
</tbody>
</table>

#### Origin
- **River:**
- **Mile Point:**
- **Facility:**

#### Destination
- **River:**
- **Mile Point:**
- **Facility:** PLA, LA, BTR DRYDOCK

<table>
<thead>
<tr>
<th>LOAD Event</th>
<th>Date/Time</th>
<th>UNLOAD Event</th>
<th>Date/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETA Arrival</td>
<td></td>
<td>ETA Arrival</td>
<td></td>
</tr>
<tr>
<td>Actual Arrival</td>
<td></td>
<td>Actual Arrival</td>
<td></td>
</tr>
<tr>
<td>Actual TenderedCP</td>
<td></td>
<td>Actual TenderedCP</td>
<td></td>
</tr>
<tr>
<td>Start</td>
<td></td>
<td>Start</td>
<td></td>
</tr>
<tr>
<td>Finish</td>
<td></td>
<td>Finish</td>
<td></td>
</tr>
<tr>
<td>Release</td>
<td></td>
<td>Release</td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td>1500 T</td>
<td>Quantity</td>
<td>1500 T</td>
</tr>
</tbody>
</table>
Memphis - Lower Miss

Current Depth - 4.07
Flow Rate - 286

Notch Change - 1.50
Flow Rate Change - 67

Projected Depth 1 - 3.50
Projected Depth 2 - 2.80
Projected Depth 3 - 2.50

MISSISSIPPI RIVER AT MEMPHIS

Universal Time (UTC)

Latest observed value: 4.07 ft at 8:44 AM CST on Jan 26, 2009.
Projected stage in 14 days.

Observations courtesy of the US Army Corps of Engineers.
**Harahan Bridge**

The Harahan Bridge is a cantilevered through truss bridge carrying two rail lines across the Mississippi River between West Memphis, Arkansas and Memphis, Tennessee. The consulting engineer in charge was Ralph Modjeski. The bridge also carried motor vehicles from 1917 to 1946, when the Memphix & Arkansas Bridge opened. The bridge is currently owned by Union Pacific Railroad.

[View article on Wikipedia](http://en.wikipedia.org)
MEL PRICE LOCK and DAM
UMR (2007)

- Length: 1200
- Water: 384
- Lock Class: 3

- Delay Time: 1.3
- Expected Delay: 2

Lock Delays Report
From: routewatch@ingrambarge.com
To: LmrOperations; TriangleDispatch; MVAIH; MVDCB; MVJRO; MVYEAG
Subject: RouteWatch Weather Alert NDA

The NWS has detected Severe Hail, issued at: 2/27/09 7:20:19 PM EST or 2/27/09 6:20:19 PM CST, affecting the following WATERWAY segments:

LMR (535 to 750)

VESSELS currently on these segments of WATERWAY include:

TOWBOATS: ALICE I. HOOKER, B. JOHN YEAGER, DENNIS C. BOTTORFF, JOHN R. OPERLE Some BARGES on this WATERWAY

The dispatchers responsible for these segments are:
LMR Operations: ph. (270) 441-1606
Triangle Dispatch: ph. (615) 298-8317

Meteorologist Information:
Event Type:NDA
Issue Office:NQA 80 synrhail%
Issue Time (UTC):2/28/09 0:29:19
Buoy GWFM6

Time = 6/26/2009 07:00 am CDT
Loc = 30:21:00 N, 89:05:24 W
Air = 84 F
Winds = SE (130°) 6 kts (6 mph) (G 6)
Pressure = 29.87"
Custom Fuel Supply
Solar Powered
Cellular Point of Sale
WiFi Experiment
Discussion Topics

- WiFi Experiment
  - Connectivity is the key
    - Low cost
    - High band width
    - MESH repeater technology
    - 5 - 9’s reliability

- What next?
  - Proof of Concept
  - Multi carrier participation
  - USCG and USACE assistance
Solar Powered WiFi Repeater
riverNET
27 clients transferred 2.05 GB in the last day.
3 access points need your attention.

Map of hops to gateway

Usage over the last week

© 2010 Meraki, Inc.
## Access Points for Network: riverNET

### Access Points from Feb 1 08:02 CST to Feb 2 08:02 CST

<table>
<thead>
<tr>
<th>Status</th>
<th>Name</th>
<th>Contacted at</th>
<th>Usage</th>
<th>Clients</th>
<th>Connectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SD1-CCE-07</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-08</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-09</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-10</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-11</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-12</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-13</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-14</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-15</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-16</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-17</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-18</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-19</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-20</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-21</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD1-CCE-22</td>
<td>new</td>
<td>none</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Mesh speed**

- 366.2 Kbps
- 552.1 Kbps
- 515.6 Kbps
- 359.7 Kbps
- 684.5 Kbps
- 7.7 Mbps
- 1.3 Mbps
- N/A
- 3.1 Mbps
- 1.2 Mbps
- 725.6 Kbps
- 1.8 Mbps
- 5.1 Mbps
- N/A
- 2.7 Mbps
- 2.6 Mbps
- 2.7 Mbps
- 2.5 Mbps
- 843.5 Kbps
- 5.1 Mbps
- 5.2 Mbps
- (gateway)
- (gateway)
- (gateway)
Digital Technology’s Impact on Safety and Efficiency

August 03, 2010