Road Weather Management Stakeholders Meeting
Nevada IMO 2.0

July 16-18, 2013
Little Rock, Arkansas
Federal initiative promoting safety, mobility & productivity in transportation through Road Wx research

Nevada is striving to provide a safe and reliable transportation system to drivers
Evaluating Data & Communication Methods Via Multiple Projects

- IMO 1.0
- IMO 2.0
- IMO Telemetry
- MDSS
NIMO 1.0

- Develop communications utilizing the existing 800 MHz radio/EDACS system
- Connect 20 vehicles along the I80 corridor
- Capture weather and equipment related status for use by NDOT
- Project complete, although data is still being gathered on all equipped vehicles

NIMO Telemetry

- Evaluate communication methods with greater bandwidth for gathering mobile observations
- Develop a system that will allow multiple transmission modes
- Agreement fully executed. Work will be scheduled to complement IMO 2.0
Objectives of Next Generation Hardware

- **Weather Data**: Gather and report weather data for use in practical applications.
- **Maintenance Data**: Gather and report vehicle status data and road maintenance information.
- **Low cost hardware**: Explore cost vs. data quality and minimum per-vehicle installation costs.
- **Flexible data telemetry**: (cellular, EDACS radio, WiFi, satellite, etc.)
Nevada IMO 2.0 System Framework

PRIORITIZED MODE-SWITCHING TELEMETRY
- Cellular when available
- EDACS when cellular not available (rural)
- Store-and-forward when necessary

MULTI-MODE RECEIVING STATION
- Receives data from mobile stations
  - Cellular
  - EDACS radio
- Archives and forwards data
Off-the-Shelf Serial Devices:

Road Watch
- Air Temperature
- Surface Temperature

Also useable for:
- Vaisala Surface Patrol
- OBD Scan Tools
- EDACS Radios

Custom Sensors:

Pulse Counters
- Spreader shaft speed

Weather Sensors (I2C) (remote mount on vehicle)
- Air Temperature
- Barometric Pressure
- Relative Humidity
- Dew Point

Main Processor (Android-OS Cellular Phone)
- GPS (location, time)
- Cellular data link
- Accelerometers
- Compass
# NIMO 2.0 HTML Grid Display

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Home Location</th>
<th>Date</th>
<th>Time [UTC]</th>
<th>Speed [m/s]</th>
<th>Road Temp [°C]</th>
<th>Air Temp [°C]</th>
<th>Pressure [kPa]</th>
<th>Humidity [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GPS / Airmar</td>
<td>Canbus</td>
<td>Roadwatch / Vaisala</td>
<td>Airmar</td>
<td>Roadwatch / Vaisala</td>
</tr>
<tr>
<td>3319</td>
<td>Reno</td>
<td>06/13/2013</td>
<td>00:40:42</td>
<td>0</td>
<td>0</td>
<td>19</td>
<td>N/A</td>
<td>18 [RW]</td>
</tr>
<tr>
<td>3320</td>
<td>Reno</td>
<td>05/30/2013</td>
<td>14:16:02</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>N/A</td>
<td>11 [RW]</td>
</tr>
<tr>
<td>0702</td>
<td>Lovelock</td>
<td>05/30/2013</td>
<td>15:26:08</td>
<td>28</td>
<td>29</td>
<td>24</td>
<td>14</td>
<td>16 [RW]</td>
</tr>
<tr>
<td>0682</td>
<td>Elko</td>
<td>06/27/2013</td>
<td>20:11:40</td>
<td>0</td>
<td>Err</td>
<td>53</td>
<td>N/A</td>
<td>36 [RW]</td>
</tr>
<tr>
<td>0684</td>
<td>Wells</td>
<td>06/07/2013</td>
<td>20:52:57</td>
<td>33</td>
<td>34</td>
<td>51</td>
<td>31</td>
<td>32 [RW]</td>
</tr>
<tr>
<td>0706</td>
<td>Wendover</td>
<td>05/21/2012</td>
<td>19:14:46</td>
<td>Err</td>
<td>Err</td>
<td>Err</td>
<td>Err</td>
<td>Err [RW]</td>
</tr>
<tr>
<td>0752</td>
<td>Wendover</td>
<td>05/08/2012</td>
<td>17:55:30</td>
<td>0</td>
<td>N/A</td>
<td>38</td>
<td>19</td>
<td>24 [RW]</td>
</tr>
<tr>
<td>0671</td>
<td>Elko</td>
<td>07/02/2013</td>
<td>21:41:55</td>
<td>0</td>
<td>Err</td>
<td>22</td>
<td>26</td>
<td>25 [RW]</td>
</tr>
<tr>
<td>1327</td>
<td>Reno</td>
<td>07/02/2013</td>
<td>21:50:26</td>
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<td>0</td>
<td>47</td>
<td>40</td>
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<tr>
<td>0339</td>
<td>Fernley</td>
<td>04/30/2013</td>
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<td>0</td>
<td>17</td>
<td>14</td>
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</tr>
<tr>
<td>0761</td>
<td>Carson City</td>
<td>06/14/2013</td>
<td>14:57:28</td>
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<td>N/A</td>
<td>23</td>
<td>16</td>
<td>19 [RW]</td>
</tr>
<tr>
<td>0156</td>
<td>Elko</td>
<td>06/27/2013</td>
<td>19:42:07</td>
<td>0</td>
<td>No Data</td>
<td>57</td>
<td>N/A</td>
<td>34 [V]</td>
</tr>
<tr>
<td>1826</td>
<td>Elko</td>
<td>06/19/2013</td>
<td>01:31:46</td>
<td>24</td>
<td>23</td>
<td>29</td>
<td>N/A</td>
<td>28 [V]</td>
</tr>
<tr>
<td>3216</td>
<td>Elko</td>
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<td>14</td>
<td>13</td>
<td>43</td>
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</tr>
<tr>
<td>1828</td>
<td>Elko</td>
<td>06/11/2013</td>
<td>23:49:44</td>
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<td>37</td>
<td>N/A</td>
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</tr>
<tr>
<td>0342</td>
<td>Winnemucca</td>
<td>06/20/2013</td>
<td>19:35:51</td>
<td>1</td>
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<td>36</td>
<td>17</td>
<td>21 [RW]</td>
</tr>
<tr>
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<td>19:23:41</td>
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<td>25.6</td>
<td>N/A</td>
<td>27.5 [RW]</td>
</tr>
</tbody>
</table>

**Red Date** - Vehicle's most recent transmission exceeds one week

**N/A** - Vehicle does not have device

**No Data** - Data expected but not present in last received packet

**Err** - Device transmitted error value [-255, 127, etc.]
Value to Being “Connected”

- Real-time data will improve maintenance decisions via MDSS, MMS and in-vehicle info
- Increase reliability & mobility for drivers
- Increase efficiency
- Reduce roadway operating & maintenance costs
MDSS

- Evaluated different approaches to data transmission from remote sites and the use of the EDACS radio as well as vehicle integrations
- Evaluation of MDSS software and cost-benefit study.

Maint. Accountability Program

- Developing methods for measuring winter maintenance performance
- Future data would benefit the objectivity of the performance
- Automated data sources would increase the cost effectiveness of data collection

Weather Forecasting

- Schneider is interested in integrating IMO data into their weather and pavement decision support systems
Accomplishments

- Developed communications utilizing existing 800MHz radio system
- Reduced system/equipment costs
- Interest in data utilization within NDOT divisions and programs
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