Advancements in Automatic Vehicle Location (AVL) Technology
What is AVL

- Automatic Vehicle Location (AVL)- is the means to automatically transmit data real-time via cellular connected sensors installed on a piece of equipment.
- AVL not only tracks equipment locations, but also has the capability's to provide data on:
  - Fuel consumption
  - Idle time
  - Auxiliary inputs
    - Plow sensors
    - Salt sensors
    - Engine diagnostics
Benefits

- Historic comparisons
- Monitoring – allows managers and field staff to see picture of entire fleet
- Improved response time
- Better informed decisions
- Snow removal – when was a street last plowed or salted
- Billing – accurate accounting showing how long staff were at a site and what they were doing
- Accountability – hitting mail boxes, driving too fast, idle time, etc.
- Engine Diagnostics
- Sky’s the limit
Fishers Requirements for AVL

- City to own the data
- Track all DPW mobile equipment
- Flexible reporting
- Intuitive
- Real time two way information
- Monitor
  - Speed
  - Location
  - Breadcrumb trail
  - Plow/spinner status
How AVL Works

Data:
- Position
- Speed
- Alerts

Dashboard:
- Position
- Speed
- Alerts
- Reporting
- Geofencing
- Analysis

Device

Dashboard
- ArcGIS On-Line
- ArcGIS
- ArcGIS Server
- Arc SDE
- GeoEvent Processor
- Operations Dashboard
ArcGIS Server and GeoEvent

What?

- **ArcGIS Server (core)**
  Takes geographic content and makes it available over the web.
  Creates apps and views.

- **GeoEvent Processor (extension)**
  Has extra functionality to process real-time data streams (feeds from GPS devices).
  Gives the server data to useable into usable form.
<table>
<thead>
<tr>
<th>Device Type</th>
<th>OBD-II</th>
<th>Standard GPS</th>
<th>Advanced GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Type</td>
<td>Passenger Vehicles/Trucks</td>
<td>Any</td>
<td>Make/Model dependent</td>
</tr>
<tr>
<td>Speed</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Location</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Idle Time</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Engine Data</td>
<td>✅</td>
<td>Vehicle Dependent</td>
<td>Vehicle Dependent</td>
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<tr>
<td>Behavior Data</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
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<tr>
<td>Additional Sensors</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Wi-fi</td>
<td></td>
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</tr>
</tbody>
</table>
Tabs Focused on Needs
Interactive Graphs
Ways to Filter

Fishers AVL Demo Viewer

Filter options include:
- Department: engineering
- Department: Facility Maintenance
- Department: Parks
- Department: Street
- Department: Water Quality

Legend:
- Last Known Location
- Community Development
- Engineering
- Facility Maintenance
- Pesticide
- Parks
- Street
- Water Quality
- Other Vehicles
Last Known Location/Path
Zoom and Click
Highlight/Filter Paths
Vehicle Inquiry
# Vehicle Detail Log

<table>
<thead>
<tr>
<th>Last Known Location: 0075</th>
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</thead>
<tbody>
<tr>
<td><strong>Timestamp</strong></td>
</tr>
<tr>
<td><strong>Department</strong></td>
</tr>
<tr>
<td><strong>Vehicle Number</strong></td>
</tr>
<tr>
<td><strong>Year</strong></td>
</tr>
<tr>
<td><strong>Make</strong></td>
</tr>
<tr>
<td><strong>Model</strong></td>
</tr>
<tr>
<td><strong>Class</strong></td>
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<tr>
<td><strong>Heading</strong></td>
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<tr>
<td><strong>GPS Speed</strong></td>
</tr>
<tr>
<td><strong>Engine Ignition Sense</strong></td>
</tr>
<tr>
<td><strong>Plow UpDown</strong></td>
</tr>
<tr>
<td><strong>Spreader OnOff</strong></td>
</tr>
<tr>
<td><strong>Device Motion Sensor</strong></td>
</tr>
<tr>
<td><strong>Device Power State</strong></td>
</tr>
<tr>
<td><strong>Device Low Battery</strong></td>
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<tr>
<td><strong>Device High Temperature</strong></td>
</tr>
<tr>
<td><strong>Vehicle OBD</strong></td>
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<tr>
<td><strong>JBUS Speed</strong></td>
</tr>
<tr>
<td><strong>RPMs</strong></td>
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<tr>
<td><strong>Throttle Position</strong></td>
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<tr>
<td><strong>OBD Odometer</strong></td>
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<tr>
<td><strong>Fuel Level Percentage</strong></td>
</tr>
<tr>
<td><strong>Engine Coolant</strong></td>
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<tr>
<td><strong>Fuel Rate</strong></td>
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<tr>
<td><strong>Battery Voltage</strong></td>
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<tr>
<td><strong>Turn Signal Status</strong></td>
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<tr>
<td><strong>Calculated Trip Odometer</strong></td>
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<tr>
<td><strong>Mileage From Install</strong></td>
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<tr>
<td><strong>Current Idle Time</strong></td>
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<tr>
<td><strong>Current Trip Mileage</strong></td>
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<tr>
<td><strong>Trip Stop Time</strong></td>
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<tr>
<td><strong>Trip Idle Time</strong></td>
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<tr>
<td><strong>Trip Run Time</strong></td>
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<tr>
<td><strong>Total Trip Time</strong></td>
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<tr>
<td><strong>Total Trip Time Minutes</strong></td>
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<tr>
<td><strong>DTC Count</strong></td>
</tr>
<tr>
<td><strong>DTCs</strong></td>
</tr>
<tr>
<td><strong>Year</strong></td>
</tr>
<tr>
<td><strong>Month</strong></td>
</tr>
<tr>
<td><strong>Week</strong></td>
</tr>
<tr>
<td><strong>Day</strong></td>
</tr>
<tr>
<td><strong>Day of Week</strong></td>
</tr>
<tr>
<td><strong>Current Engine State</strong></td>
</tr>
</tbody>
</table>
Historic Views
Plow Status

Fishers AVL Demo Viewer

Plow Paths (last 8 hrs)
- 6154 (Facility Maintenance): 5 mi, 658 min running, 223 min idle
- T-2143 (Street): 13 mi, 238 min running, 394 min idle

Plow Paths (last 12 hrs)
- 6154 (Facility Maintenance): 25 mi, 5,763 min running, 906 min idle
- T-2143 (Street): 38 mi, 781 min running, 1,301 min idle
- T-4831 (Street): 2 mi, 6 min running, 7 min idle
Reporting

Fishers AVL Demo Viewer

Fishers AVL Demo Plow Operation View

Legend
- Last Known Location
- Community Development
- Engineering
- Facility Maintenance
- Fleet
- Parks
- Street
- Water Quality
- Other Vehicles

Plow Paths (all times)
- last 8 hrs

Total Miles Plowed
- Last 8 Hrs Total Miles: 18.15
- Last 12 Hrs Total Miles: 64.9
- Last 24 Hrs Total Miles: 584.7
- Last 48 Hrs Total Miles: 998.65
Pitfalls

- Multiple Stakeholders – to be successful, communications between departments and contractors outlining responsibilities is essential.
- Know your equipment and try to standardize vehicles and controls
- Not having an end goal
- Not giving your contractor remote access to the server that houses all the AVL data or vise versa
- Not being a mobile friendly work place
- Not getting staff buy-in
Future Goals

- Geofence areas (School property) to improve accuracy of invoicing
- Create plow/deicing routes - turn by turn directions
- Integrate sensor conditions and warnings into list of alerts
- Reporting - day-to-day, month-to-month, year-to-year
- Live mapping to share with public
- We don’t know what we don’t know…….
Questions?
Contact Info -

Sean O’Grady
City of Fishers Assistant Director of Public Works
ogradys@fishers.in.us
317-709-4980
@fishersDPW
@DriveFishers