Iowa DOT’s Mobile Truck Cameras and GPS Experience

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Iowa DOT
Agenda

• Iowa DOT Overview
• Our GPS Past
  • Initial GPS/AVL Development
  • Early products
  • Lessons learned
• Current System and Capabilities
  • System overview
  • Timeline
  • Projects for this winter
• 24,122 lane miles of roadway
• 6 different winter service levels
• 102 Maintenance facilities
• 1,100 Permanent staff
• 400 Seasonal staff
• 892 Snowplows
• 12 Tow Plows
• 5 year Avg Salt usage – 123,000 tons
• 18.6 Million gallons brine/year
Our Plow Data Story
So it begins -- 2010 RFP

• Purpose was to understand & visualize
  • Fleet Movement
  • Material Usage

• Provide
  • Tools for managers to direct fleet
  • Less paperwork for drivers
  • Public a better winter driving experience

• Turn plow data into information we could use to become more efficient

• Access to raw data for custom reporting

• Selected LTI as a vendor (https://www.loctech.com/)
Trial Deployment – 2011/12

• Wanted
  • Driver to log into the system
  • Report road conditions
  • Integrate with resource system

• Deployed
  • Modem with sensor inputs
  • Computer to manage touch screen
  • Custom database

• But in the end we learned
  • Touch screens were troublesome
  • No driver interaction is easier
Full Deployment -- 2012/13

• Used the simpler modem (LT6 unit)
• Made the system invisible to the driver
• Standardized spreader controllers
• Install on all ~900 plows
• More robust database architecture
• Began integration with existing resource management systems

~$3,000 per truck for AVL equipment
$7 per month per truck for data plan
$43,000/year for data hosting
Data Collected

- Truck location
- Speed
- Heading
- Front and wing plow up/down
- Spreader data
  - Set rate
  - Instantaneous rate
  - Material type
  - Prewet/anti-ice rate
  - Cumulative ‘storm totals’ of applied materials
- Odometer (sometimes)
- Pavement and air temperature

Data flows ‘real time’ – when changes are made or at least every 2 min.
First Version AVL Websites

• Started with Internal website (WOPR) for 2012-13
• “Basic” plow data posted to a public website for Winter 2013-14
• Added external mobile-friendly page as more supervisors got iPads (WOPR Mobile)
...Also in 2013-14 – The Plow Cam!
iPhone Plow Cams

**What**
- iPhones with suction-cup windshield mounts
- Custom app snaps a photo of road every 10 minutes if truck is moving

**Why**
- A picture is worth a thousand words
- Road condition monitoring for managers and public

**How**
- Phone sends picture and GPS coordinates to server
- Photo posted on website map with location
Why iPhones?

• Could not just plug a regular camera into our current GPS/AVL system
• Has its own connectivity and data transfer
• Cheap (free with data plan ~$35/mo.)
• Nice photos
• Easily available
• Can design custom programming
• Multi-functional
• Simple
1-hour of photos available to Internal AVL website

½ hour available to public plow page
2014-2015 AVL/Plow Cam Timeline

- WOPR and WOPR Mobile sites were merged and renovated
- Public site (dubbed Track a Plow) renovated
- Expanded to ~420 plow cams
  - Currently don’t believe all plows must be equipped
- IT fixed some bugs that were causing the app to crash
- PlowCam code and documentation made available to share with other agencies
Special Weather Statement

Click Here for More Info

...BURST OF SNOW DURING MORNING COMMUTE... BANDS OF SNOW ARE MOVING ACROSS THE AREA EARLY THIS MORNING...WITH SNOW FALLING FAIRLY HEAVILY AT TIMES AND REDUCING VISIBILITY. DUE TO THE SNOW ONLY LASTING A FEW HOURS ACCUMULATIONS WILL BE GENERALLY LIGHT...ONLY AN INCH OR TWO IN MOST AREAS...HOWEVER ROADS WILL BECOME SNOW COVERED DURING THE
Public Response: Extremely positive!
Involving the Public

• Communications staff used images and plow counts extensively
  • Multiple posts per day
  • Before, during, and after storms
• Fewer calls from public and law enforcement “wondering if we were out”
• ~500,000 photo/info requests per day in some large storms
What We Learned

• It is much easier to collect data than it is to provide good information
  • Had to learn the hard way what data we really need – and for what purpose
  • Must try to fill gaps or summaries won’t be accurate
• Plow photos are much more useful than we thought at first
• Careful and proactive communication with public seems to really help
  • How much to communicate is always under debate!
• It is an iterative process
What We Learned

• We need more engine data
• Cell coverage gaps/data drops are problematic
• Need different data at different frequency to support Resource Management System
• Seemed silly having 2 cell systems (one for AVL, one for plow cam) in the truck
• Need easier/deeper automated reporting capabilities
• Our plow sensors are not accurate
GPS/AVL RFP 2015 – The Current System

- Vendor-hosted analytics/website
  - Many automated reports and visualization tools for summarizing plow data
  - More historical play-backs
- Engine fault alerts and idle reports
- External feed to support public pages and DOT analysis
- Internet connectivity to support plow cam and other
- More frequent spreader data
- Better cell coverage
Next Generation GPS/AVL Proposed Timeline
(Briefed to Management on 1 May 2015)

- RFP Released NLT July 1, 2015
- OCIO Meeting: June 30, 2015
- IP Steering Committee Meeting: May 29, 2015
- New Equipment Training: January 15, 2016
- Installation begins on 500 trucks: Oct 15, 2015
- Installation Complete: Aug 1, 2016
- Installation begins on remaining 400 trucks: July 1, 2016
- Purchase remaining 400 new systems: June 30, 2016
- LTI Contract Ends: Aug 1, 2016

As of 1 May 2015
Next Generation GPS/AVL Contract

• RFP released in July 2015
• Awarded in September 2015 to Blue Ocean Satellites (Contract value = $1.028 million)
• Base contract is one year with 5 option years
Training

✓ Installer training @ Waterloo Garage (Oct 27-28, 2015)
✓ Initial System User training conducted with all Districts during the week of Nov 16th
✓ System User Training (January 19-22, 2016)
Installs

- Began on November 9th
- By 16 Dec - 453 trucks completed

**Phase I (FY16): 530 Trucks**
- District 1
- District 2 (Waterloo)
- District 4
- District 5 (Martensdale, Leon, Osceola, Oskaloosa, Sigourney)
- District 6
- New Trucks coming into the fleet

**Phase II (FY17): ~400 Trucks**
- District 2
- District 3
- District 5
Skyhawk Antenna

- Mounts inside the cab on the passenger side
May 1, 2015

Feb 22, 2016

July 30, 2015

Next Generation GPS/AVL Timeline (Actuals)

RFP Released

June 5, 2015

OCIO Approval

IP Steering Committee Meeting

May 29, 2015

New GPS/AVL Contract Awarded

Sept 30, 2015

Phase II Install training completed

Phase II Installs begin

Oct 27-29, 2015

Phase I Install training completed

Phase I Installs begin

Oct 6, 2015

Project Kick-off Meeting

Sept 30, 2015

New GPS/AVL Contract Awarded

July 30, 2015

RFP Released

June 5, 2015

OCIO Approval

IP Steering Committee Meeting

May 29, 2015

May 1, 2015

Oct 4, 2016

System Test

Sept 28, 2016

Skyhawk Refresher Training

July 2016

Installs Complete

May 3-5, 2016

Phase II Install training completed

Phase II Installs begin

Feb 22, 2016

Approval to proceed w/Phase II Purchases

Dec 31, 2015

Phase I Installs complete

Oct 15, 2016

As of 8 July 16

Oct 6, 2015

New Equipment Training

All Districts

As of 8 July 16

As of 8 July 16

As of 8 July 16
New Capabilities

• “Storm total” cumulative material and spreader status outputs every 10 seconds
• In-truck WiFi
  • Plow cams are now on this WiFi instead of a cellular plan
• Remote connection to International’s On-Command engine diagnostics
  • Mechanics can look at engine status remotely as if plugged in with their laptop/software
• Hosted Skyhawk website
  • Reports
  • Crumb trails
  • Geofencing
  • Alerts
Current and Historical Crumb Trails

**History Report: A30151**

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<th>#</th>
<th>Date (yyyy-mm-dd hh:mm:ss)</th>
<th>Processed (yyyy-mm-dd hh:mm:ss)</th>
<th>Message</th>
<th>Location (* Invalid GPS Fix)</th>
<th>Network</th>
<th>Speed (m/h)</th>
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<td>06:09:58 am CST</td>
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**All Data Loaded (2834 Data Points)**

**Report Parameters**

- **From:** 2016-02-14 00:00
- **To:** 2016-02-14 12:00
- **Or:** Select Range

**Generate Report**
Historical Storm Playback
Custom Geofence Setup

- Select your own areas
- Get alerts or reports by geofence
Reporting Features

• Winter operations material/hours summaries by trip, truck, time, and geofence

Export to Excel, PDF, or email
Engine Info

- Query MIL alert history
  - When and where codes fired
- Email alerts

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From: "no-reply@connectanywhere.co" <no-reply@connectanywhere.co>
Date: March 2, 2016 at 7:56:10 AM CST
To: "Wolf, Ronald [DOT]" <Ronald.Wolf@dot.iowa.gov>
Subject: MIL Alert: A32859

Trouble Code(s):
SPN: 8321  FMI: 7  CM: 0  OC: 0
Occurred: 2016-Mar-02 07:56:08 CST
http://goo.gl/lS1emg
Projects For This Winter

- Bluetooth ‘plow on’ sensors
- Hydraulic plow lift on/off
- New pavement temperature sensors
Thanks!

Any Questions?

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