PROJECT:
GPS MAPPING 70K MILES OF LOCAL ROADS IN 5 YEARS (Ai)

Mike Lewis
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Navstar Mapping Corporation (NMC)
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Navstar Mapping Corp. History

- Incorporated October 27, 1987
- Full time business operation since 1990
- Grown to 10 full time/3 part time employees

Customer List

- Tennessee Department of Transportation - Planning Division
- Tennessee Department of Transportation - Maintenance Division
- Alaska Department of Transportation and Public Facilities - Planning Division
- Alaska Department of Transportation and Public Facilities - Maintenance Division
- Nebraska Department of Roads - Planning Division
- Nebraska Department of Roads - Information Systems Division
- Washington State Department of Transportation - Planning Division
- Mississippi Department of Transportation - Planning Division
- Pike County, Mississippi - Mapping Department
- Pike County, Mississippi - 911 Office
- Warren County, Mississippi - Mapping Department
- South Dakota Department of Transportation - Planning Division
Customer Vehicle Installations
NMC/ TDOT History

- 1990 - First Contract to replace manual paper and pencil inventory updates

- 1997 -> 2003 - Sold 2 RoadMapper Systems for TDOT to collect and process @ 37,000 miles of Interstate, State Highways, and Functional Routes

- 2007 -> 2012 - Automated Inventory Local Roads Project

- 1990 -> 2012 - Under production and development contracts on continual basis
Automated Inventory (Ai)

Project Overview

1. Update existing 55K miles in TDOT database in 95 counties on a county by county basis
Automated Inventory (Ai) Project Overview

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2. Tag all database records with GPS
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7. Deliver updated data to TDOT in text format
3 Categories of Roadways in TN

1. Interstate/State Highways
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2. Functional Classification of Highways

Routes that carry vehicles between Interstate/State Highways to/from Local Roads
3 Categories of Roadways in TN

1. Interstate/State Highways

2. Functional Classification of Highways

   Routes that carry vehicles between
   Interstate/State Highways and Local Roads

3. Local Roads

   Residential/Neighborhood Roads
Tennessee Roadway Information Management System (TRIMS)

- Client/Server Application
- Linear Reference System Database (Oracle)
- Roadway Inventory, Structures, Crash, Traffic, Pavement, Photolog, etc.
- Development of Web Based E-TRIMS
5 DATABASE TABLES UPDATED

- Road System – *Parent table; Establishes routes*
- Route Feature – *Event Data*
- Geometrics – *Speed Limits, No. of Lanes, Land Use, 1 or 2 Way Traffic etc.*
- Roadway Description – *Road Cross Section (Left to Right)*
- Road Segment – *Functional Class, Road Name, In City, etc.*
Key Operating Principles & Approach

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- Always keep underlying data in sync with graphics during cartographic cleansing
NMC Field Inventory Vehicle

Two Person Crew

Driver – Safely drive and Operate Distance Measuring Instrument (DMI)
Operator – Update existing database on notebook controlled system
Positioning Hardware

- Numetrics Distance Measuring Instrument (DMI)
- Trimble AG332 DGPS
- NMC’s AuxBox
- OmniSTAR VBS L1 only, code phase pseudo-range solution
NMC AuxBox

- **Dead Reckoning System allows mapping in areas of GPS blockage**
  - Aircraft gyro for heading
  - Barometer for elevation
  - DMI Wheel Sensor and Targets for accurate elapsed distance
  - Dead reckoning computer to format and package the data at 5 p.p.s.
Voice Data Entry System

Notebook computer controlled field data collection system
Position information written to data file when action key is pressed

Action keys:

1st <Spacebar> keypress tags record under highlight with position and begins audio .wav recording

2nd <Spacebar> keypress turns off audio .wav recording and resets system for next feature

Hokey - Pressing the corresponding hotkey letter automatically inserts and tags pre-canned text description

<Enter> keypress automatically tags the current data record with position information
DIGITAL CAMERA ENHANCEMENTS

- JPEG's captured every 52.8 ft or .001 miles
- Each jpg labeled with route, date, time and elapsed distance
- Only store images that correspond with action keys (GPS tags)
- Office edit software automatically displays image to editor
INV_MAP (Inventory Map)
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Ai Project Workflow Description
Convert TRIMS Data

- Convert 5 export files to 6 working files
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Update TRIMS Data in Field

- Run routes in forward or reverse inventory direction
- Field software displays current database data
- Field Crews record hotkeys and digital voice notes
- Actions stamped with GPS time and DMI logmile values
- Collect continuous GPS and auxiliary sensor data
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Process Data in Office

- Update data based on the field crews’ voice notes
- Generate working files to use in post-processing
- Converge intersections
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<th>MM</th>
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<th>Lane Width</th>
<th>GPS Settings-d7 Key:</th>
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</table>

**Navstar Mapping Corporation Voice Data Entry System**

**VDES SCREEN**

**MILES** 000.109  **MPH** 40

**TDOT**

**LST File: 06051702**

**TRIMS LM**  **NEW LM**

**Rte Name:** OLD ALMAVILLE RD.
• Operator performs windshield survey
  - Changes or new features require voice notes
  - Unchanged existing TRIMS features are simply tagged
• Edit software plays voice notes automatically
Intersection Convergence

- Locates matching intersections based on a distance buffer
- Calculates/determines heading values of intersections
- Projects along heading values to a common lat/long value
- Relocates intersections and associated features to the common lat/long value
Before Intersection Convergence
After Intersection Convergence

• Converged intersection locations are automatically updated in both routes
INTERSECTION UNDER-SHOOT

RED = NON-CONVERGED
BLACK = FINAL CONVERGED
INTERSECTION OVER-SHOOT

RED = NON-CONVERGED
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INTERSECTION OVER-SHOOT

RED = NON-CONVERGED  BLACK = FINAL CONVERGED
TYPICAL CONVERGED ROADTRACK
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**Post-Processing**

- Verify the integrity of graphics
- Verify integrity of the data that will go back into TRIMS
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Output Data
  - Provide TDOT with:
    - Files for graphics generation
    - Five updated TRIMS files in text format
PROJECT STATUS

- 5 Year Project Ends in August 2012
- Field Data/Post Processing Completed
- Over 70k Miles of Roadway Inventory collected, processed, and delivered
- 2 – two person field crews, 2 vehicles
- 10 hour day – 4 days per week
- Average data miles collected per day = 67
- 135,000 local roads delivered
QUESTIONS?

We would like to work closer to home...

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