AHTD TRC TRANSPORTATION RESEARCH COMMITTEE

TRC0508

Reporting of Crash Locations Using GPS Equipment

Ted English

Final Report

2006

ARKANSAS

FINAL REPORT

June 15, 2006

I. Identification

A. Job number J556

B. Reporting of Crash Locations Using GPS Equipment

II. History

A. Date Project Started – January 21, 2005

B. Duration of Entire Project – 14 months (March 21, 2006)

III. Responsibility

A. Agency Conducting Research – Arkansas State Highway and Transportation Department (AHTD) in conjunction with Arkansas State Police (ASP).

B. Office - Traffic Safety Section

C. Project Principal Investigator – Ted English, Administrative Officer III, AHTD.

IV. Progress

A. Traffic and Criminal Software (TraCS) has been programmed and a new crash report form was developed by ASP to receive and record GPS data from GPS units. Ten GPS units were tested for compatibility and usability with TraCS. The TraCS programming and testing process was elaborate and therefore extended the start time for actual testing of the various GPS units. GeoMedia software was purchased and provided to ASP for use in checking the accuracy of GPS data being acquired by TraCS through the use of GeoMedia's mapping capabilities as well as for information sharing with regards to crash data and locations with AHTD. (See Appendix A for example of TraCS form)

B. The following represents results of GPS/TraCS testing: (See Appendix B for technical specifications of GPS units tested)

Mouse Type GPS units tested:

Leadtek 9532
I-Trek S-1
Garmin GPS-18
Haicom HI-204E
Fortuna U2
Holux GM-210
Cirocomm A-01-0248

Leadtek 9532 - The Leadtek unit is the most promising. It has been easy to install and configure. Documentation and drivers are easily acquired from the manufacturer's website. This unit is currently being used in real world situations and is performing well.

I-Trek S-1 - The I-Trek unit is the first unit tested. Although the unit was fairly easy to configure, documentation and drivers were extremely difficult to locate.

Garmin GPS-18 - The Garmin GPS-18 unit will not work due to the way TraCS connects to GPS devices. This unit requires an external power source that is impractical in the current configuration.

Haicom HI-204E - This unit is recognized by Windows as a mouse. When the unit begins receiving data the cursor jumps around the screen uncontrollably. It is possible to block this behavior, but for our purposes this is more trouble than it's worth.

Fortuna U2 - The Fortuna unit had the same problems as the Haicom HI-204E.

Holux GM-210 - The Holux unit had the same problems as the Haicom HI-204E.

Cirocomm A-01-0248 - This unit hasn't been tested due to skepticism about the long- term availability of these units.

Handheld Type GPS units tested:

Garmin eTrex Legend.

Garmin eTrex Legend – This unit was extremely slow in acquiring data. Handheld units were ruled out due to complexity of operation, acquisition time, and past studies done by other states such as Kentucky.

Mouse Type GPS with Wireless Modems Tested:

Two types of wireless modems with GPS capability were tested. These were the Sierra Wireless MP775 and the Bluetree 5600 CDMA EVDO. These units are trunk mounted and would provide a means for transmitting data directly from the police vehicle to a server at ASP. They would also provide a means for police in the field to receive emails and other written messages and documents directly in their vehicle. These Wireless Modems both worked well with the Bluetree model being less expensive and easier to configure than the Sierra Wireless model. Using these type units would require a monthly cellular service fee per unit used. ASP is currently in negotiations with several cellular providers to determine what this monthly cost would be.

Conversion of Latitude and Longitude Data to Route, Section and Log Mile Data:

Conversion of Latitude and Longitude data to a Route, Section and Log Mile has been easily accomplished through the use of GeoMedia software

Server for TraCS:

A server for accepting the TraCS data through electronic transmission has been purchased by ASP and is being configured to accept TraCS data. Training for the Information Technology personnel at ASP will follow soon.

V. Recommendations and Summary:

The Arkansas State Police has completed all GPS hardware testing and recommends the Bluetree GPS wireless modem and the LeadTec GPS receiver hardware. The Bluetree device is recommended for any wireless applications due to its ease of configuration and its relatively lower price than other wireless type modems. The LeadTec mouse GPS receiver is recommended in applications not requiring wireless transmissions of data.

VI. Finances: (See Attached Table I)

VII. State Police Report (Attached)

VIII. Sample TraCS Report (Appendix A)

IX. Technical Information (Appendix B)

TABLE I

TRC-0508 (J556) 14 MONTHS
Reporting of Crash Locations Using GPS Equipment
Start Date: 1/26/05

FY 05

LINE ITEM	January	February	March	April	May	June	FY TOTAL	TOTAL	BUDGET	UNSPENT FUNDS
SALARIES	0.00	0.00	0.00	119.80	299.50	1,377.70	1,797.00	1,797.00	26,000.00	**24,203.00**
FRINGE BENEFITS	0.00	0.00	0.00	69.48	173.71	799.07	1,042.26	1,042.26	14,560.00	**13,517.74**
EQUIP/SUBCONTRACTS	0.00	0.00	2,366.79	0.00	48.79	7,176.22	9,591.80	9,591.80	10,240.00	**648.20**
SUPPLIES AND SERVICES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,200.00	**1,200.00**
TRAVEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2,000.00	**2,000.00**
TOTAL	0.00	0.00	2,366.79	189.28	522.00	9,352.99	2,556.07	12,431.06	54,000.00	**41,568.94**

FY06

LINE ITEM	July	August	September	October	November	December	January	February	March	April	May	June	FY TOTAL	TOTAL	BUDGET	UNSPENT FUNDS
SALARIES	2,154.24	3,015.94	1,723.40	1,477.20	1,661.85	1,723.40	1661.84	1,969.60	2708.2				18,095.67	19,892.67	26,000.00	**6,107.33**
FRINGE BENEFITS	1,249.46	1,749.25	999.57	856.78	963.88	999.57	963.86	1,142.37	1570.75				10,495.49	11,537.75	14,560.00	**3,022.25**
EQUIP/SUBCONTRACTS													0.00	9,591.80	10,240.00	**648.20**
SUPPLIES AND SERVICES													0.00	0.00	1,200.00	**1,200.00**
TRAVEL													0.00	0.00	2,000.00	**2,000.00**
																0.00
																0.00
TOTAL	3,403.70	4,765.19	2,722.97	2,333.98	2,625.73	2,722.97	2,625.70	3,111.97	4,278.95	0.00	0.00	0.00	28,591.16	41,022.22	54,000.00	**12,977.78**

Federal funds will be placed in General Fund after completion of Benchmark Report ($5000) and Final Report an additional $5,000 to $8,000

Traffic and Criminal Software (TraCS)
GIS Hardware Evaluation Report

May 18, 2006

Prepared By:
Information Technology Section
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OVERVIEW

The Arkansas State Police was contacted by the Arkansas Highway and Transportation to evaluated GIS location hardware within the TraCS (Traffic and Criminal Software) system. There where numerous devices The Arkansas Highway and Transportation requested The Arkansas State Police test.

PROJECT

The Arkansas State Police conducted tests on seven devices from Arkansas Highway and Transportation Dept, along with two devices acquired by the Arkansas State Police. The Arkansas State Police found similar issues with each device.

The following devices were tested using TraCS and also Microsoft Map Point 2004.

Garmin GPS 18 USB – This device was hard to configure. We had a major problem getting this device to take to the laptop. The device also wanted to always configure itself as a mouse. The GPS 18 would not use a standard COM port. If the manufacturer had a serial type interface for this GPS, it would be a winner.

I.trek Mouse GPS USB – This device worked within all tests. The device had a few configuration issues.

GPS HI-204E – The Arkansas State Police found this device to work correctly within the computer, but found that the Lat and Long output values were inaccurate. Configuration with the laptop was good. The device also would show up as a mouse.

Fortuna U2 – There were some configuration issues, but all in all this one worked ok. The device was not the best solution.

Holux GM-210 – This device had some configuration issues, but found it to work ok. There would be potential support issues with this device.

GM-11201 – This device had the same issues as the Holux GM-210. This also was a no name brand.

Leadtek – This device was found to work the best with the least amount of support. The Arkansas State Police currently has this device in operation.

Bluetree 5600 CDMA EvDO – This device is currently being used within four units. The data connection is fantastic along with the Trimble GPS. This device has no configuration issues from the PC or TraCS. The external antenna provides a better satellite connection than the GPS receivers that were placed within the vehicle.

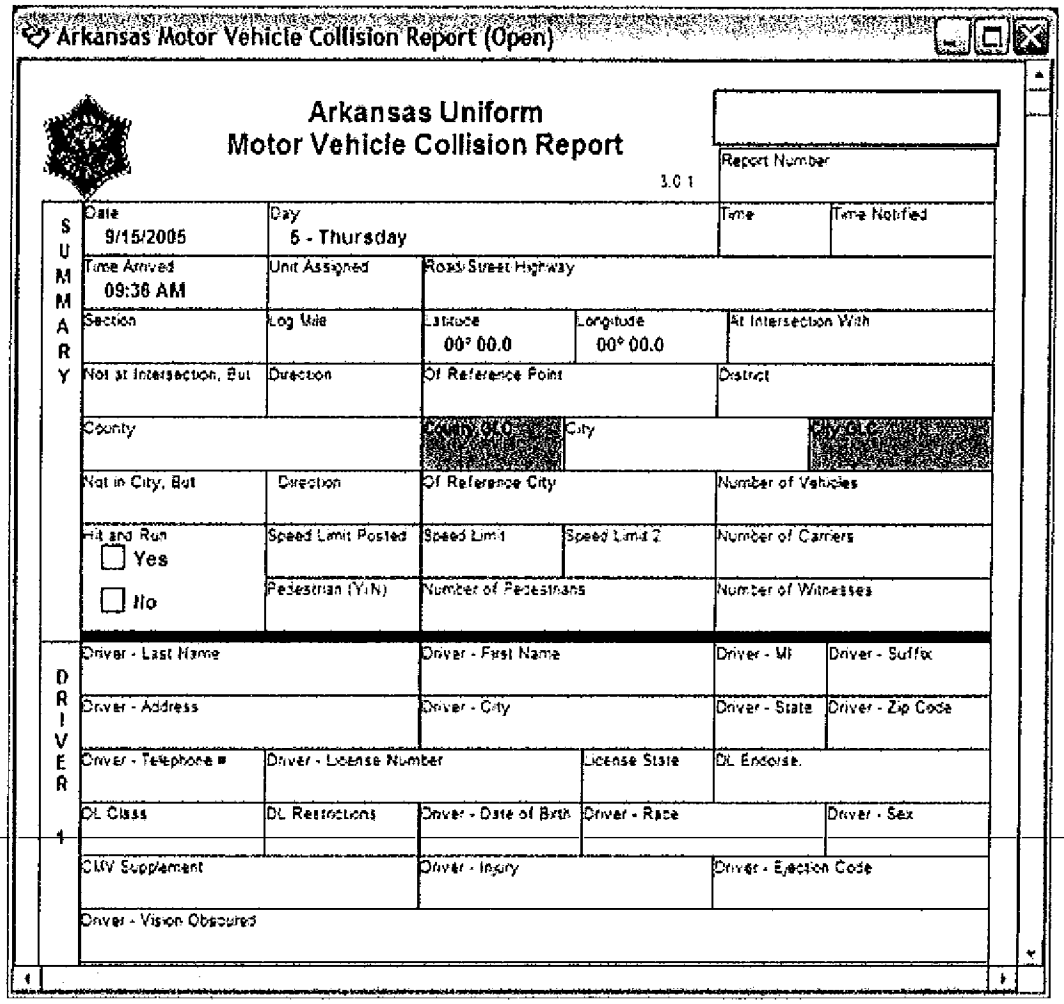
OTHER DEVICES

One other device tested was the Garmin GPS35. The Garmin GPS35 is a very good device for the TraCS system. Another device which is new was not tested is the Garmin GP 18 5Hz. The Garmin GP 18 5Hz has just been released by Garmin. From all the specs we have read the device makes it appear to be a good fit. The Garmin GP 18 5Hz can be purchased with a USB or Serial connection.

SUMMARY

The Arkansas State Police has completed all testing and recommend the Bluetree and LeadTec hardware. The Bluetree from the data interface side and the Trimble GPS, which provides a very accurate Lat and Long reading. The Arkansas State Police will be using the cellular wireless data. If the Arkansas State Police is not able to us this technology then GPS receivers themselves would have to be used. It seems like most of the devices tested had configuration issues. I believe it to be the USB mouse interface since GPS devices use a serial COM port to communicate with computers.

APPENDIX A



Arkansas Motor Vehicle Collision Report (Open)

Arkansas Uniform
Motor Vehicle Collision Report

3.0.1

Report Number

SUMMARY

Date: 9/15/2005	Day: 5 - Thursday			Time	Time Notified
Time Arrived: 09:36 AM	Unit Assigned	Road/Street/Highway			
Section	Log Mile	Latitude: 00° 00.0	Longitude: 00° 00.0	At Intersection With	
Not at Intersection, But	Direction	Of Reference Point		District	
County	County ORI	City	City ORI		
Not in City, But	Direction	Of Reference City		Number of Vehicles	
Hit and Run: ☐ Yes ☐ No	Speed Limit Posted	Speed Limit 1	Speed Limit 2	Number of Carriers	
	Pedestrian (Y/N)	Number of Pedestrians		Number of Witnesses	

DRIVER 1

Driver - Last Name	Driver - First Name		Driver - MI	Driver - Suffix
Driver - Address	Driver - City		Driver - State	Driver - Zip Code
Driver - Telephone #	Driver - License Number	License State	DL Endorse.	
DL Class	DL Restrictions	Driver - Date of Birth	Driver - Race	Driver - Sex
CMV Supplement	Driver - Injury		Driver - Ejection Code	
Driver - Vision Obscured				

Appendix B

Leadtek 9532

- 12 Channels "All-In-View" Tracking
- Cold/Warm/Hot Start Time: 45/38/8 Seconds
- Reacquisition Time: 0.1 seconds
- Support Standard NMEA-0183 and SiRF Binary protocol
- Support Accurate 1PPS Output Signal Aligned with GPS Timing
- Trickle Power Enabled for Power Saving
- Multi-path Mitigation Hardware
- Superior Sensitivity for Urban Canyon and Foliage Environment
- On-board RTCM SC-104 DGPS and WASS Demodulator
- Based SiRFstarII Architecture
- Field Software Upgrade Supported
- Fully water-proof
- Fully water-proof
- Cable availability:
  Compaq iPAQ 36xx/37xx, 38xx series
  HP Jornada 56x series
  Casio Cassiopeia E-125, E-200
  Palm Vx, M500 series
  Handspring Visor, Edge
- Magnet base for mounting on the car
- Various color upon request

APPENDIX B

I TREK S-1

Product Specification:

1. Tracks up to 12 satellites
2. Antenna Type: Built in active Antenna
3. Receiver:L1, C/A code
4. Minimum Signal tracked: -175dBW
5. Hot/Warm/Cold Start: 8/38/48 sec.
6. Dimension: 58 X 45 X 18mm ; Weight: < 70g
7. Update rate: 1HZ
8. Power consumption: <90mA at 4.5-5.5V input

APPENDIX B

Garmin GPS 18

GPS 18 features:
GPS 18 USB Specifications

- WAAS-enabled; 12 parallel channel GPS receiver
- Weight: 100.4 g
- Size: 61mm dia. x 19.5mm height
- USB 2.0 full-speed interface (also compatible with USB 1.1 Full Speed hosts)
- Powered through the computer's USB port

GPS 18 PC Specifications

- WAAS-enabled; 12 parallel channel GPS receiver
- Weight: 184.6g
- Size: 61 mm dia. x 19.5 mm height

Appendix B

Haicom HI-204E

FEATURES	DESCRIPTIONS
Receiver Type	12 parallel channel, L1 C/A code
Accuracy	Position: 5m CEP Velocity: 0.1m/sec
Startup Time	< 10sec hot start < 35sec warm start < 45sec cold start
Reacquisition	1s
Sensitivity	-137dBm acquisition -145dBm tracking
Update Rate	1Hz
Dynamics	4G (39.2m/sec2)
Operational Limits	Altitude < 18,000m or velocity < 515m/s (COCOM limit, either may be exceeded but not both)
Serial Interface	LVTTL level and RS-232 level
Protocol	NMEA-0183 V3.01 GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG, GPZDA 4800 baud, 8, N, 1
Datum	Default WGS-84 User definable
Interface Connector	Two 1.0mm pitch WTB S/R wafer 87213 SMT R/A type connector
Input Voltage	3.3V DC +/-100mV 3.8V ~ 12.0V
Current Consumption	90 ~ 110mA
Dimension	43mm L x 42mm W x 13mm H
Weight	23g
Operating Temperature	-40°C ~ +85°C

LED INDICATOR:

LED flashing 0.25Hz	Signal Searching
LED flashing 1Hz	Position Fixed

Appendix B

Fortuna U2 GPS

- WAAS(Wide Area Augmentation System) demodulator,
- Advanced power management
- power saving and stand-by modes.
- Improved multi-path rejection
- 12-channel parallel processing
- Cold start under 60 seconds
- Maximizes GPS position
- Superior urban canyon performance

FoliageLock for weak signal trak

APPENDIX B

Holux GM-210

- 1. Tracks up to 12 satellites.

2. Antenna Type: Built in Active Antenna

3. Receiver:L1, C/A code

4. Hot/Warm/Cold Start: 8/38/45 sec.

5. Update rate: 1HZ

6. Dimension: 64.5 ?42 ?17.8 mm; Weight : < 84g

7. Minimum signal tracked: -175dBW

8. Position Accuracy

Non DGPS (Differential GPS)
- Position : 5 - 25 m CEP without SA
- Velocity : 0.1m / sec
- Time : 1 usec sync GPS time

Appendix B

Cirocomm A-01-0248

Specifications:
Brand New in BOX---GPS Mouse with one year warranty!!!
Small, Light weight, high performance GPS mouse receiver.

FOR HP iPAQ 1937,2210, 38xx/39xx, 4150, 5450, 5550 Seires
This G.mouse can be configured to work with many types of hand-held PC, NB, Pocket PC, Palm devices or specialized systems. This item does not include mapping software.

APPENDIX B

Garmin E-Trex Legend (Handheld)

Navigation Features

Waypoints/Icons: 1,000 (with name and graphic symbol)

Tracks: Automatic track log; 10 saved tracks let you retrace your path in both directions

Route: 20 reversible routes with up to 50 waypoints

Trip computer: Current speed, average speed, time of sunrise/sunset, resetable maximum speed, trip timer, and trip distance

Map datums: More than 100

Position format: Lat/Lon, UTM/UPS, Maidenhead, MGRS, Loran TDs, and other grids

Performance

Receiver: WAAS-enabled, differential-ready, 12 parallel channel GPS receiver continuously tracks and uses up to 12 satellites to compute and update your position

Acquisition Times:

- **Warm:** approx. 15 seconds
- **Cold:** approx. 45 seconds
- **AutoLocate®:** approx. 5 minutes

Update Rate: 1 second, continuous

Accuracy:

- **Position:** <15 meters, 95% typical*
- **Velocity:** 0.05 meter/sec steady state

WAAS Accuracy:

- **Position:** less than 3 meters (10 feet) RMS
- **Velocity:** 0.1 knot RMS steady state

Dynamics: 6g's

Interfaces: RS232 with NMEA 0183, RTCM 104 DGPS data format and proprietary Garmin

Antenna: Built-in patch

Physical

Size: 4.4"H x 2.0"W x 1.2"D (11.2 x 5.1 x 3.0 cm)

Weight: 5.3 ounces (150 g) with batteries

Display: 2.1"H x 1.1"W (5.4 x 2.7 cm) high-contrast LCD with bright backlighting

Case: Waterproof to IEC 529 IPX7 standards

Temperature range: 5°F to 158°F (-15°C to 70°C)

Data storage: Indefinite; no memory battery required

Internal Memory: 8 MB

Power

Source: 2 AA batteries (not included)

Battery Life: Up to 18 hours (typical use)

Appendix B

Sierra Wireless MP 775

- Typical EDGE data throughput speeds between 100-130 kbps, capable of bursts up to 216 kbps
- Quad-band operation for EDGE, GPRS and GSM: 850 MHz, 900 MHz, 1800 MHz, and 1900 MHz
- Integrated GPS module for vehicle tracking
- Rugged US Military and SAE J1455 specs on shock drop, vibration and splash humidity
- Operating temperature range: -40C to +70C (-40F to +158F)
- 2 dedicated digital inputs, 2 configurable digital input/outputs, and 4 analog inputs for advanced alarming and reporting
- On-board UDP/TCP PAD
- RS232 serial and USB host connection support
- FCC, Industry Canada, and eMark certified (CE and eMark pending)
- Voltage range of 9 to 36 Vdc, for use with 12 volt and 24 volt automotive systems
- Threaded antenna connectors (TNC for RF; SMA for GPS)
- Standard 3-year platinum warranty with world-class technical support