HA-NDGPS

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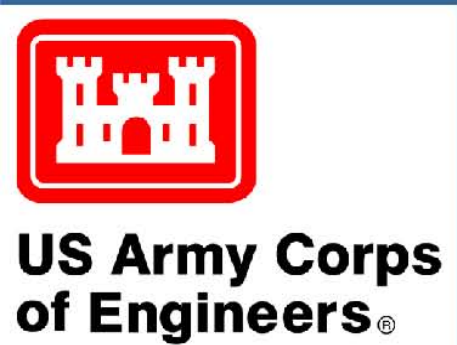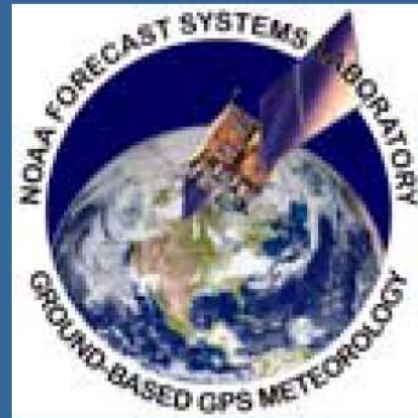
Problem and Program Objectives

Problem: Submeter resolution with integrity for vehicle position needed for many applications – Transportation,

Program Objective: Assess the implementation feasibility for improving the accuracy of the NDGPS service, using existing infrastructure, to meet the requirements of additional applications without decreasing availability and integrity and still meeting the needs of existing users.

- Examine ways to enable 3-D dynamic positioning at the centimeter level throughout the US,

- Coexist with existing infrastructure,

- Minimize deployment costs.

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Enabler for Transportation

- Existing data indicates several safety applications require:
  - 0.3 meter vehicle position solution
  - High resolution maps
    - Data indicates subcentimeter accuracy
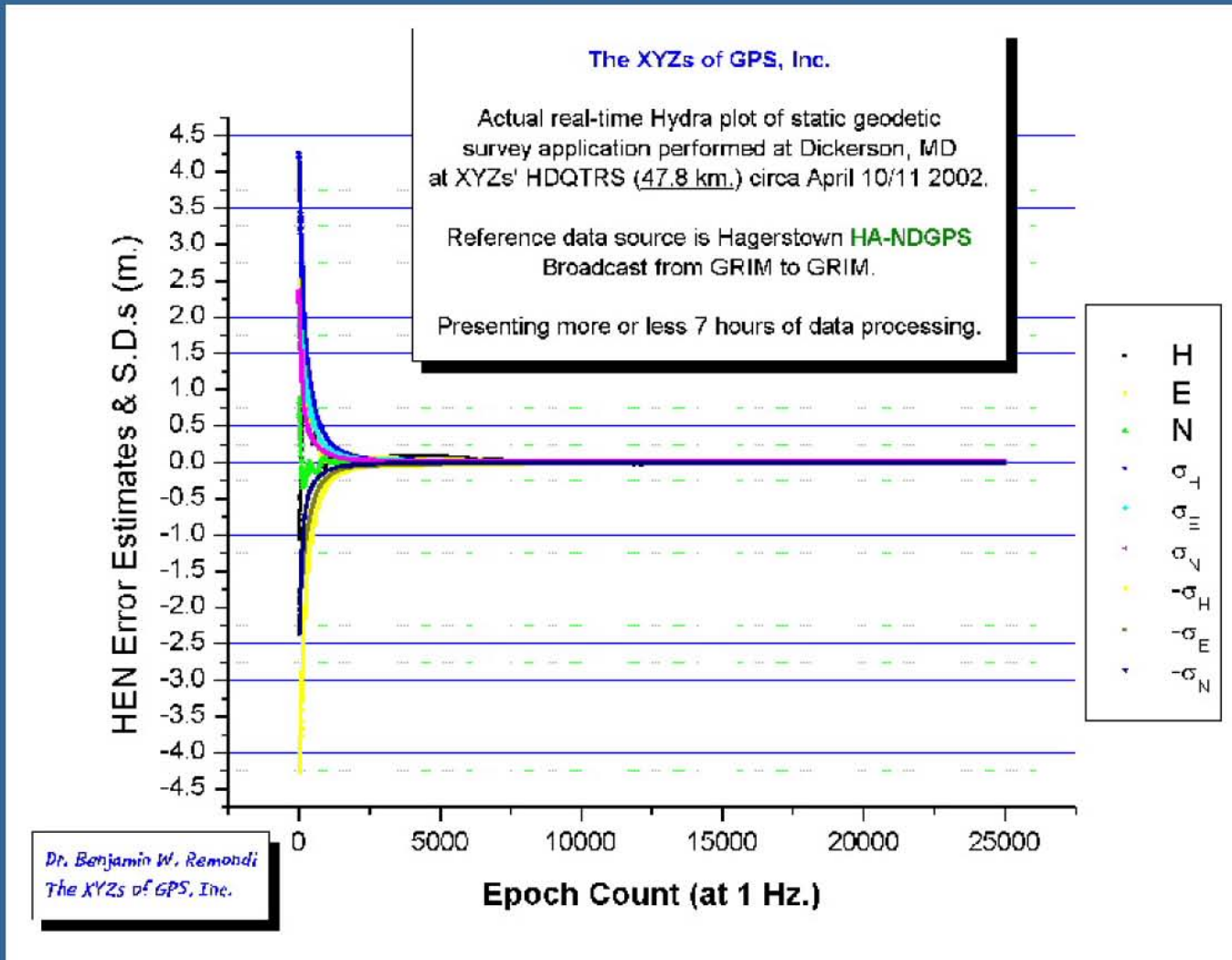 - High Integrity
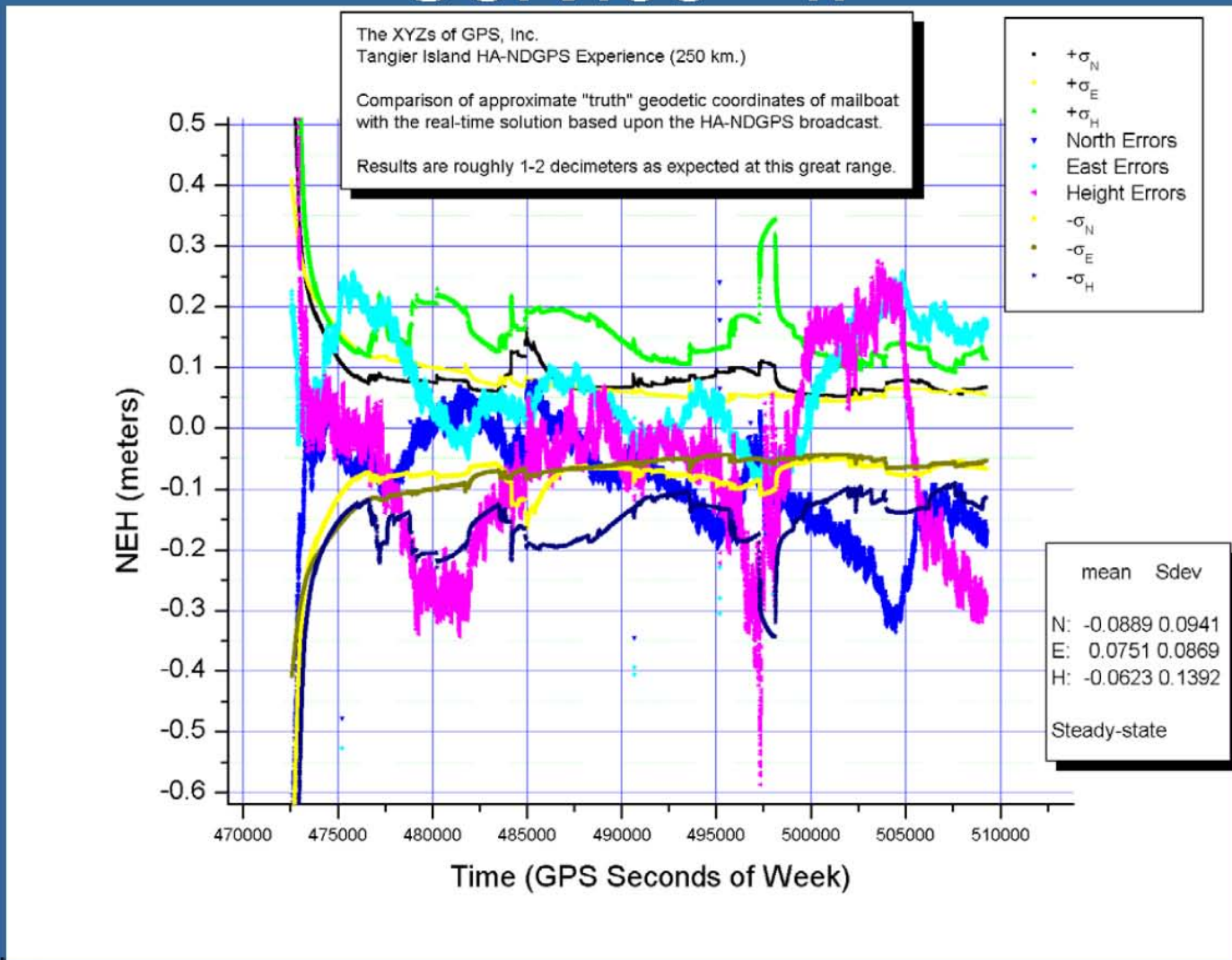 - High Availability

Approach

- **Examined existing delivery mechanisms**
  - Availability
  - Coverage
- **Identified Opportunities**
- **Built an approach**
  - Used off-the-shelf algorithms
  - Developed new iono/trop models
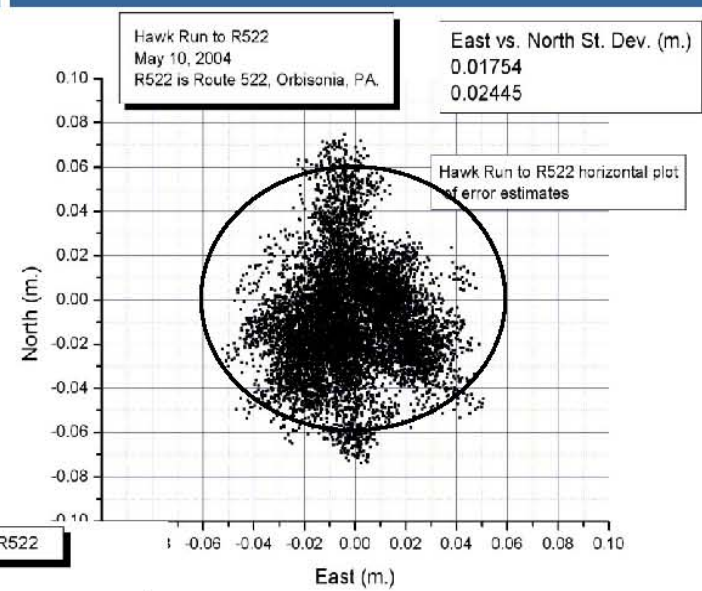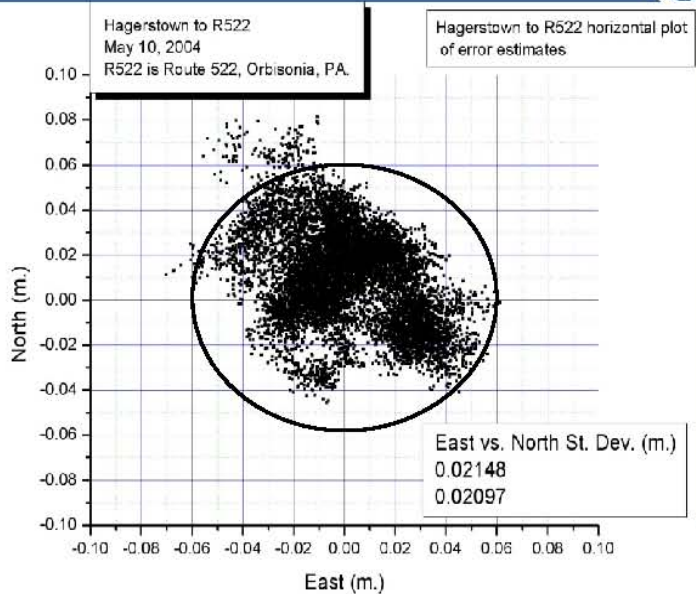 - Investigated integrity approaches

Real-Time Precise Positioning Service - I

Real-Time Precise Positioning Service - II

The XYZs of GPS, Inc.
Tangier Island HA-NDGPS Experience (250 km.)

Comparison of approximate "truth" geodetic coordinates of mailboat with the real-time solution based upon the HA-NDGPS broadcast.

Results are roughly 1-2 decimeters as expected at this great range.

Legend:
- $+\sigma_N$
- $+\sigma_E$
- $+\sigma_H$
- North Errors
- East Errors
- Height Errors
- $-\sigma_N$
- $-\sigma_E$
- $-\sigma_H$

	mean	Sdev
N:	-0.0889	0.0941
E:	0.0751	0.0869
H:	-0.0623	0.1392

Steady-state

Y-axis: NEH (meters)
X-axis: Time (GPS Seconds of Week)

Real-Time Precise Positioning Service - III

Hagerstown to R522
May 10, 2004
R522 is Route 522, Orbisonia, PA.

Hagerstown to R522 horizontal plot of error estimates

East vs. North St. Dev. (m.)
0.02148
0.02097

Hawk Run to R522
May 10, 2004
R522 is Route 522, Orbisonia, PA.

East vs. North St. Dev. (m.)
0.01754
0.02445

Hawk Run to R522 horizontal plot of error estimates

Weighted Average of Hagerstown & Hawk Run to R522

May 10, 2004
Weighted Average, Orbisonia, PA.
Horizontal plot of error estimates

East vs. North St. Dev. (m.)
0.01783
0.02080

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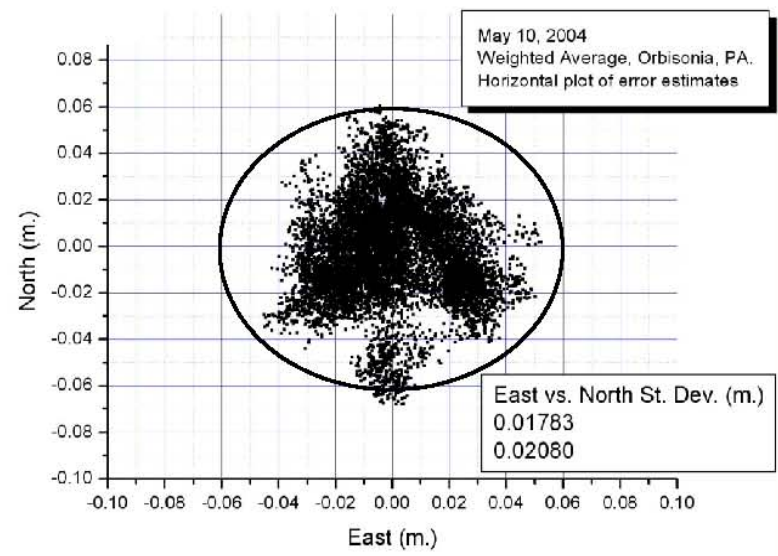
Weather Prediction - I

NOAA ZWD MAY 2004

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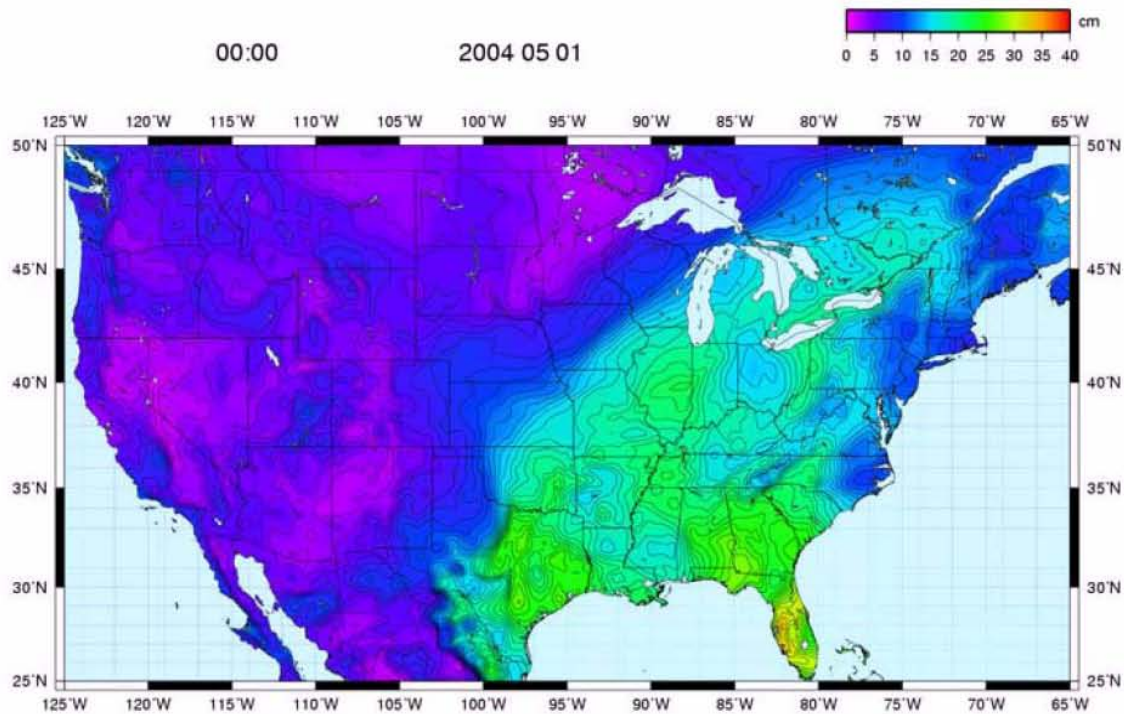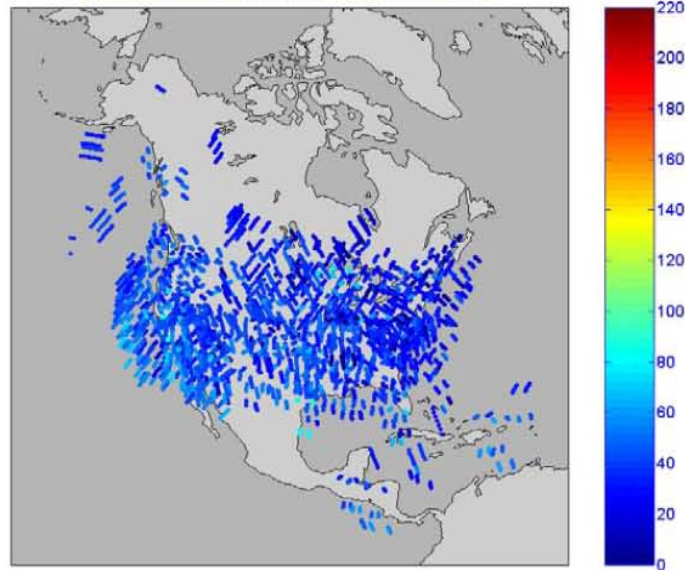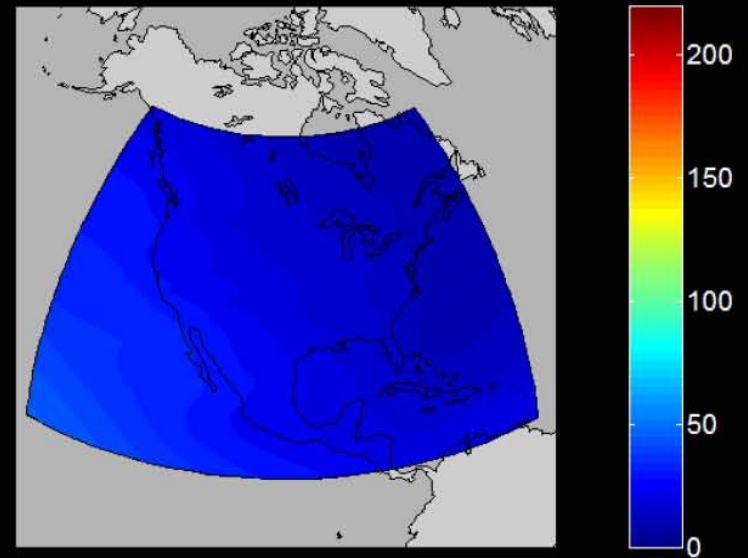
Weather Prediction - II

Estimated TEC at 375km shell, 29-Oct-2003 00:00:00UT

Inversion TEC(TECU) 28-Oct-2003 00:00:00UT

Where is being done today?

- ## Continuing Research
  - ## Additional Test Facilities
    - Completed Engineering Change Request Documentation for USCG
      - Up to three additional sites – Pueblo, CO, St. Marys,WV, and Lincoln, CA
    - Alternate Pueblo site on line in June
  - ## SBIR
    - Multilateration Receivers
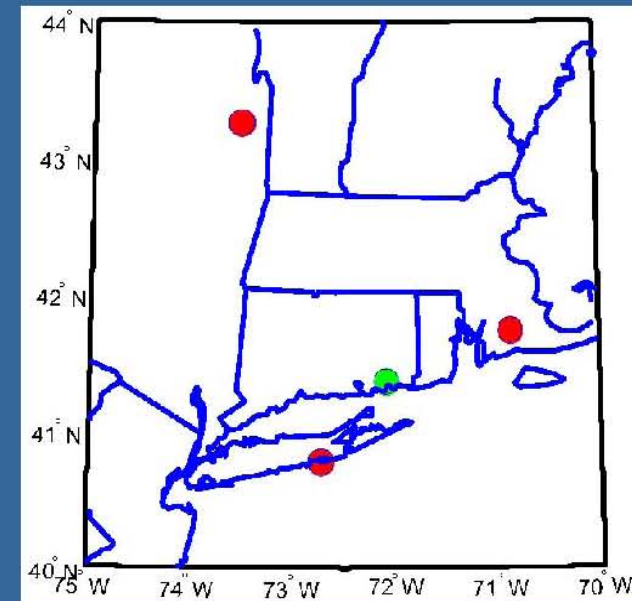   - Compression Algorithms
  - ## Outreach

Additional Test Facilities

- ## Alternate Pueblo Facility
  - ### Primarily Focus
    - Federal Railroad administration
    - Pueblo Rail Test Facility
  - ### Other Users
    - Department of Interior
    - University Research
    - Others as equipment is available
- ## Additional Sites – Discussions with USCG continuing

SBIR – Multilateration Receiver

- Small Business Innovative Research contract
  - DGPS Based Multilateration Positioning Receiver
    - Phase I completed
      - Paper demonstration of capability
    - Phase II pending

SBIR – Compression Algorithms

- ## GNSS Observable Compression Algorithm
  - Compress Observables
  - Compress Ionosphere model
  - Compress Troposphere model
  - Other Data as Appropriate

- ## Phase I awarded 9/15/2010
  - Expect non-proprietary algorithm within 6 months
  - Is not be exclusive to LF/MF broadcast
  - If successful, will follow on with Phase II and develop into standard.

Federal Highway Administration

Summary

- Original implementation proved subcentimeter long range solution

- Ongoing research:

  – Additional test facilities

  – Alternative ranging solutions

  – New compression algorithms

    - Standards!