Nationwide Differential Global Positioning System (NDGPS) – Capabilities and Potential

Presentation to:

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U.S. States and Local Government Subcommittee (USSLS)
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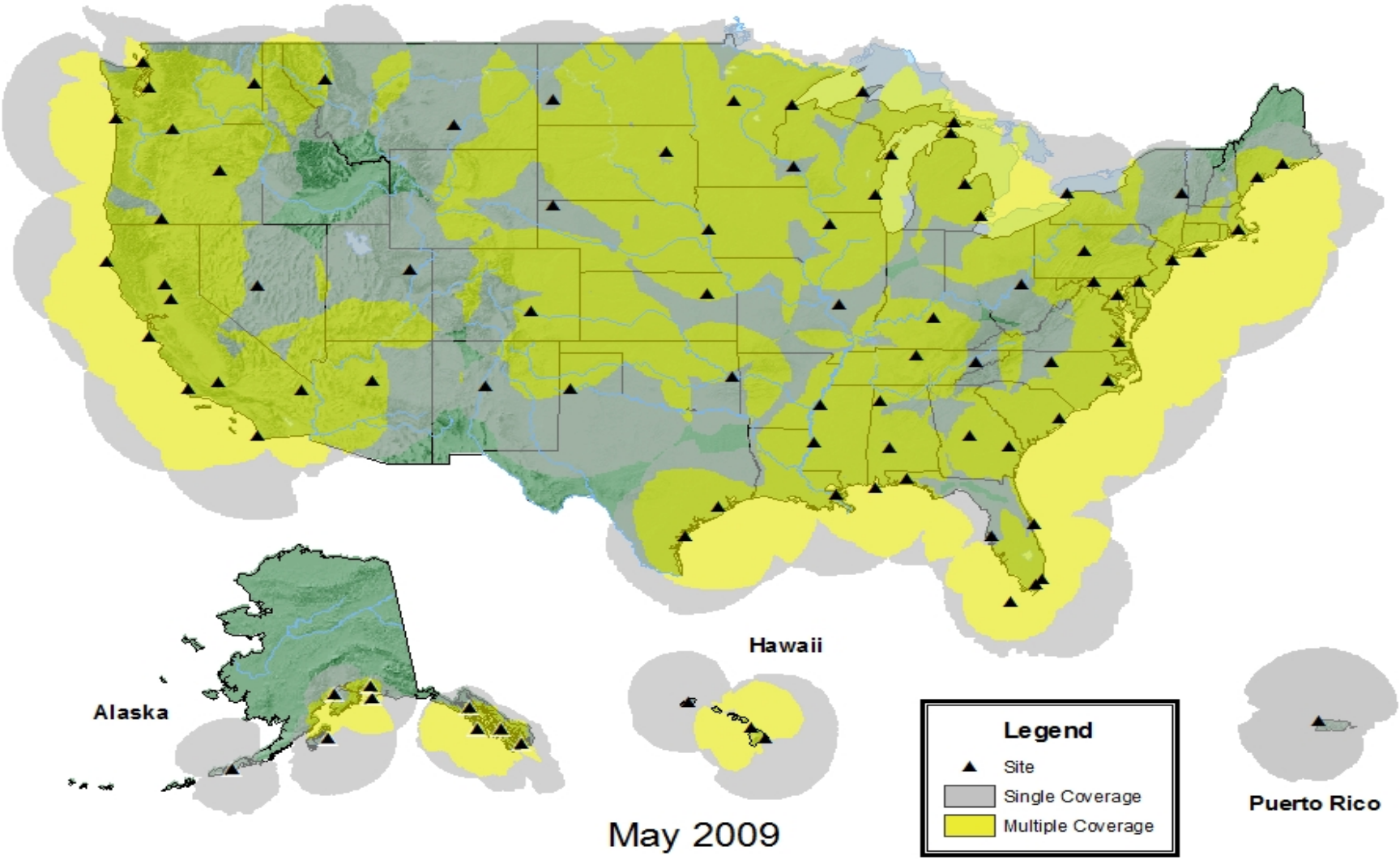
NDGPS is a National PNT Utility

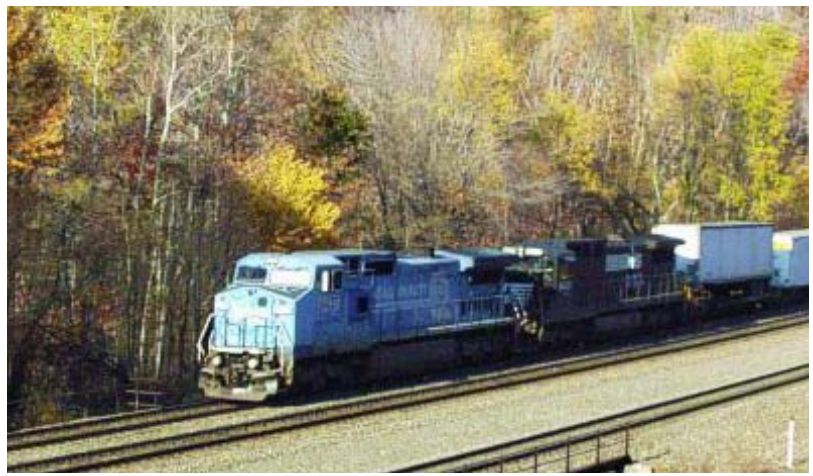
- Operated/managed by Coast Guard as a Combined NDGPS (Maritime + DOT + ACOE sites)
- System Specifications
  - Corrections broadcast at 285 and 325 kHz using Minimum shift Keying (MSK) modulation
  - Real-time differential GPS corrections provided in Radio Technical Commission for Maritime Services (RTCM) SC-104 format
  - No data encryption
  - Real-time differential corrections for mobile and static applications
- Single coverage terrestrial over 92% of CONUS; double coverage over 65% of CONUS
  - Hawai'i coverage by maritime sites

Nationwide DGPS Coverage



Terrestrial NDGPS Capabilities and Uses

- Transportation operational requirements:
  - Federal Highway Administration (FHWA)
    - *on behalf of state and local DOT stakeholders*
    - *routine use in Federal-Aid Program*
    - *survey, construction, quality, asset management*
  - Federal Railroad Administration (FRA)
    - *safety system requirements (positive train control, track defect location)*
  - Association of American Railroads
    - *baseline reference for positive train control (PTC)*
  - National Governor's Association
    - *use by state DOTs, resource management agencies*



Terrestrial NDGPS Capabilities and Uses (2)

- Other federal, state/local and private operational requirements:
  - Department of Agriculture/Department of Interior (NPS, USFS, BLM, etc.)
    - *One meter real-time positioning and navigation*
    - *Fire management and safety*
  - Department of Commerce (NOAA)
    - *Continuously Operating Reference Stations*
    - *Severe weather forecasting*
  - State, County and Local Governments
    - *Departments of Transportation, Natural Resources, Environmental Protection, Agriculture, Parks*
  - Private/Non-Profit Sector
    - *U.S. GPS Industry Council*
    - *National Precision Farming Association*
    - *Professional Land Surveyors*

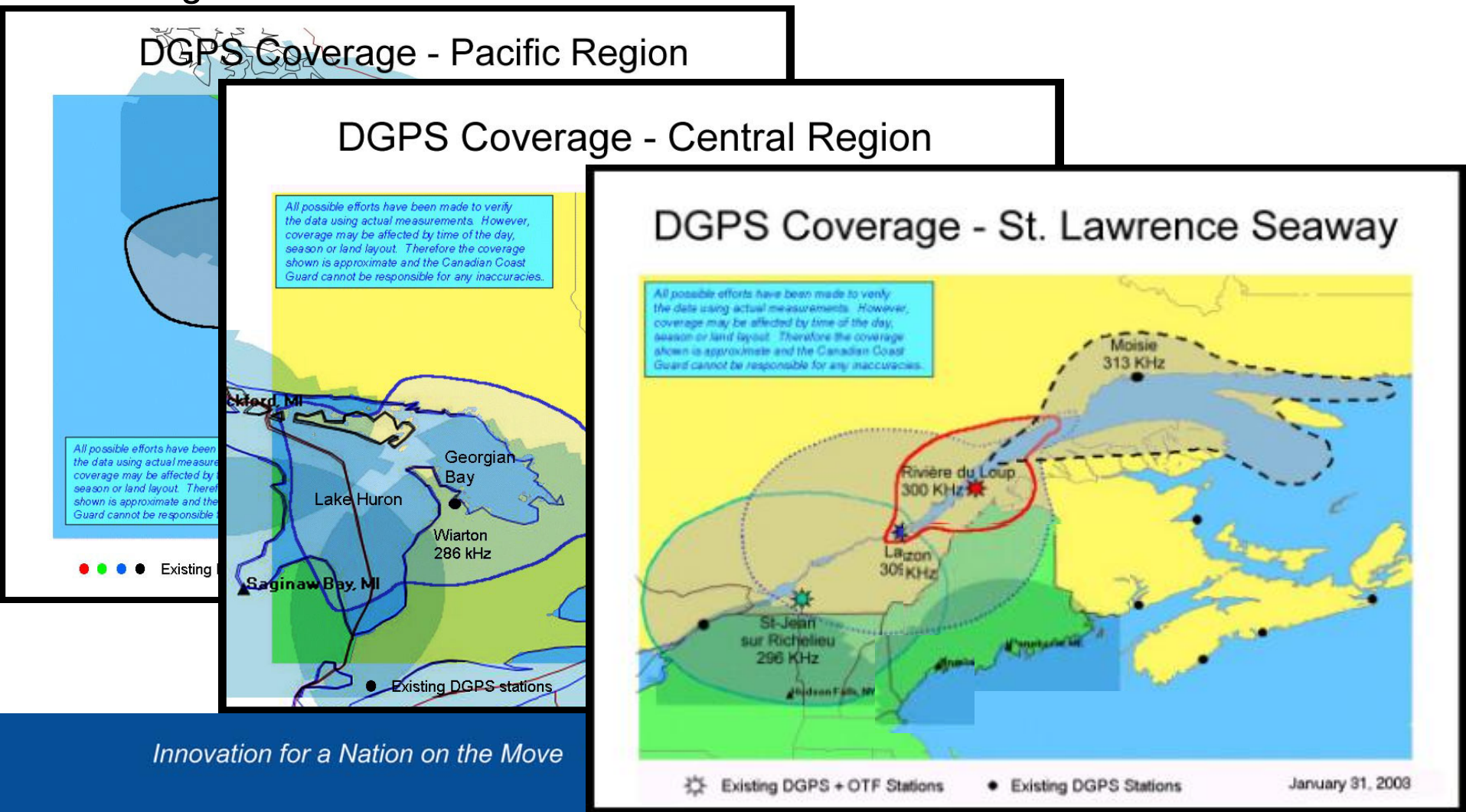
Current Highway Applications

- Surveys: Land, roads, hydrological and environmental location, and management and maintenance
- Inventory and asset management: Infrastructure asset location, assessment, management, maintenance and protection
- Utilities: Location, management, and maintenance
- Roadside management: Precision application of pesticides, runoff minimization, avoidance of protected species, roadside features (condition and location)
- Law Enforcement: Incident location and reporting, emergency response
- Similar applications in use for Federal/state/local/private/ university resource and environmental management missions and research

Cooperation with Canada

U.S. Department of Homeland Security
United States Coast Guard

- 16 U.S. and 11 Canadian DGPS sites cooperate for increased coverage along the border



NDGPS in Dredging

US Army Corps of Engineers®

- Army Corps of Engineers uses include:
  - Aids to Navigation
  - Underwater Surveying
  - Dredging (2 meter accuracy requirement)

CORS Supports Precise Positioning

- NDGPS provides ~15% of CORS stations
- More importantly, provides a “robust backbone”

Before CORS:
Accurate differential GPS positioning
with multi-person field crew

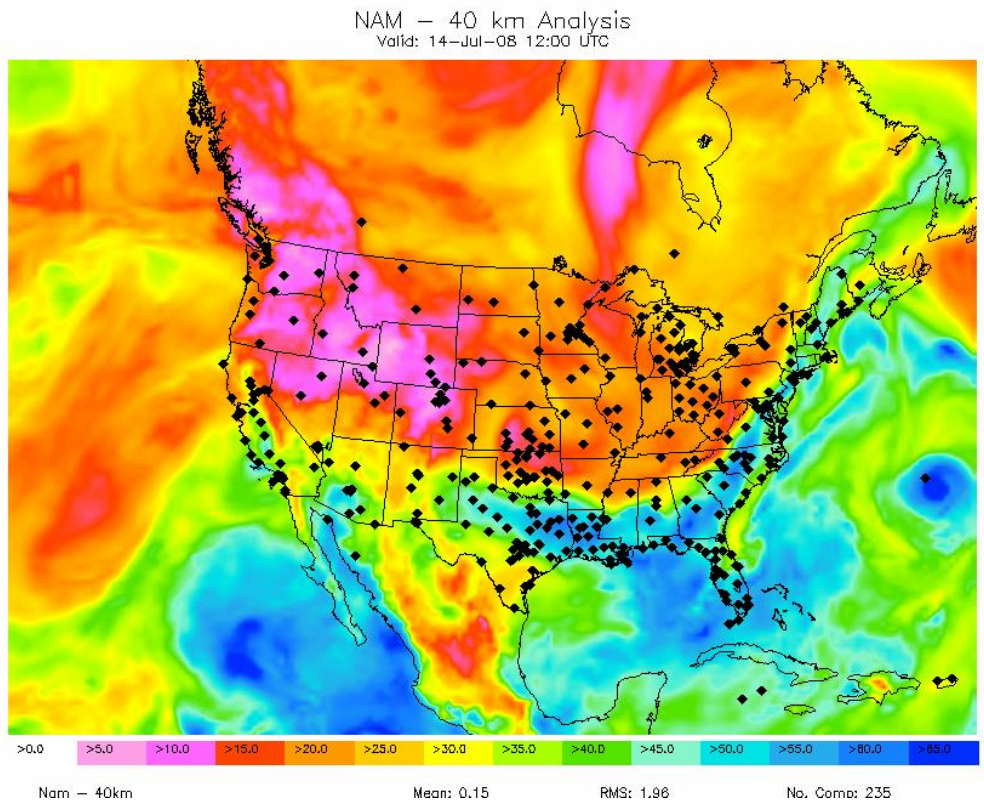
After CORS:
Accurate differential GPS positioning
with one-person field crew.

Precision Agriculture

- Maximize use of resources
  - Optimized plowing of crop rows
  - Tailored applications of seeds, fertilizer, water, pesticides
  - Improved management of land, machinery, personnel, time
  - Greater crop yields
- Minimize environmental impacts
  - Localized identification and treatment of distressed crops reduces chemical use
  - Precise leveling of fields prevents fluid runoff

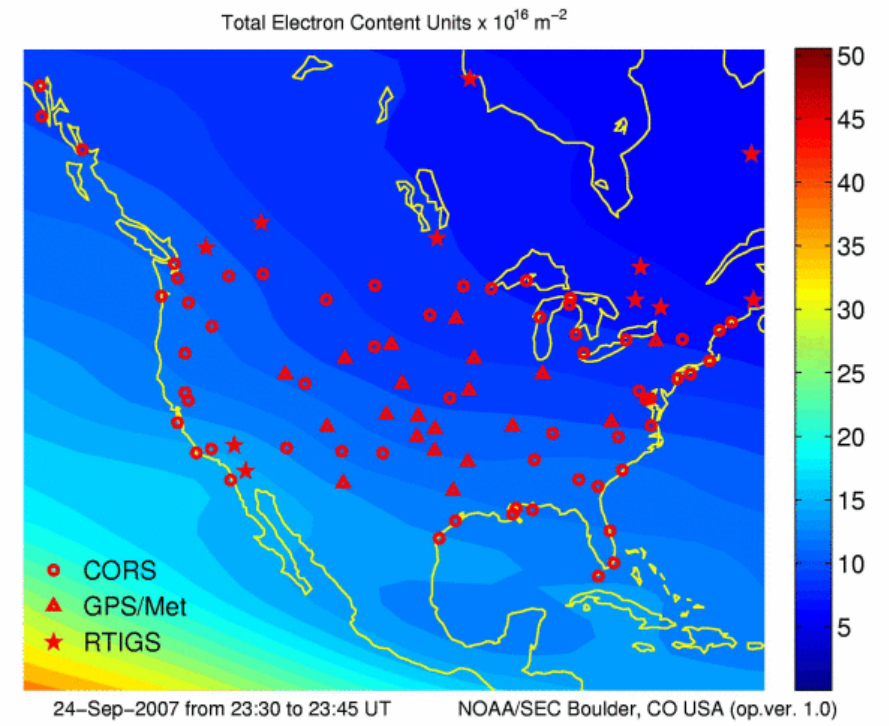
Severe Storm Forecasting

- NOAA's Earth Systems Research Laboratory uses M/NDGPS data to estimate the amount of water vapor over the U.S. every 30 minutes
  - Used by weather forecasters to monitor rapidly changing conditions
  - This knowledge is critical for forecasting severe weather events such as tornados, hurricanes, thunderstorms, and snow storms
  - Used in several operational NOAA weather models



Monitoring Space Weather

- NOAA's Space Weather Prediction Center uses NDGPS data to map the spatial distribution of free electrons in the ionosphere, once every 15 minutes
  - The distribution of free electrons in the ionosphere affects HF radio communication and delays the arrival of GPS signals
  - Delay is interpreted as position errors, which can be as large as 100 meters in extreme cases
  - Solar storms proven to affect on-orbit satellite performance and transmissions, including GPS



NDGPS Potential Opportunities

- NOAA/National Geodetic Survey test-streaming NDGPS corrections to users over Internet
  - Improved civil sector customer service
  - Enabling technology for commercial services
- DOT and Coast Guard continuing to pursue potential high accuracy (HA-NDGPS) upgrade
  - Joint documentation meetings (DOT/FHWA, Coast Guard)
  - Depends upon requirements definition
- DOT prepares Report to Congress on DOT segment (“inland”)
  - Documents program progress and strong Coast Guard management
  - Documents need for sustained program funding to continue operations (equipment recapitalization, baseline O&M) and construction