

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

Presentation to:

**Civil GPS Service Interface Committee (CGSIC)
U.S. States and Local Government Subcommittee (USSLS)
June , 2009
Honolulu, Hawaii**

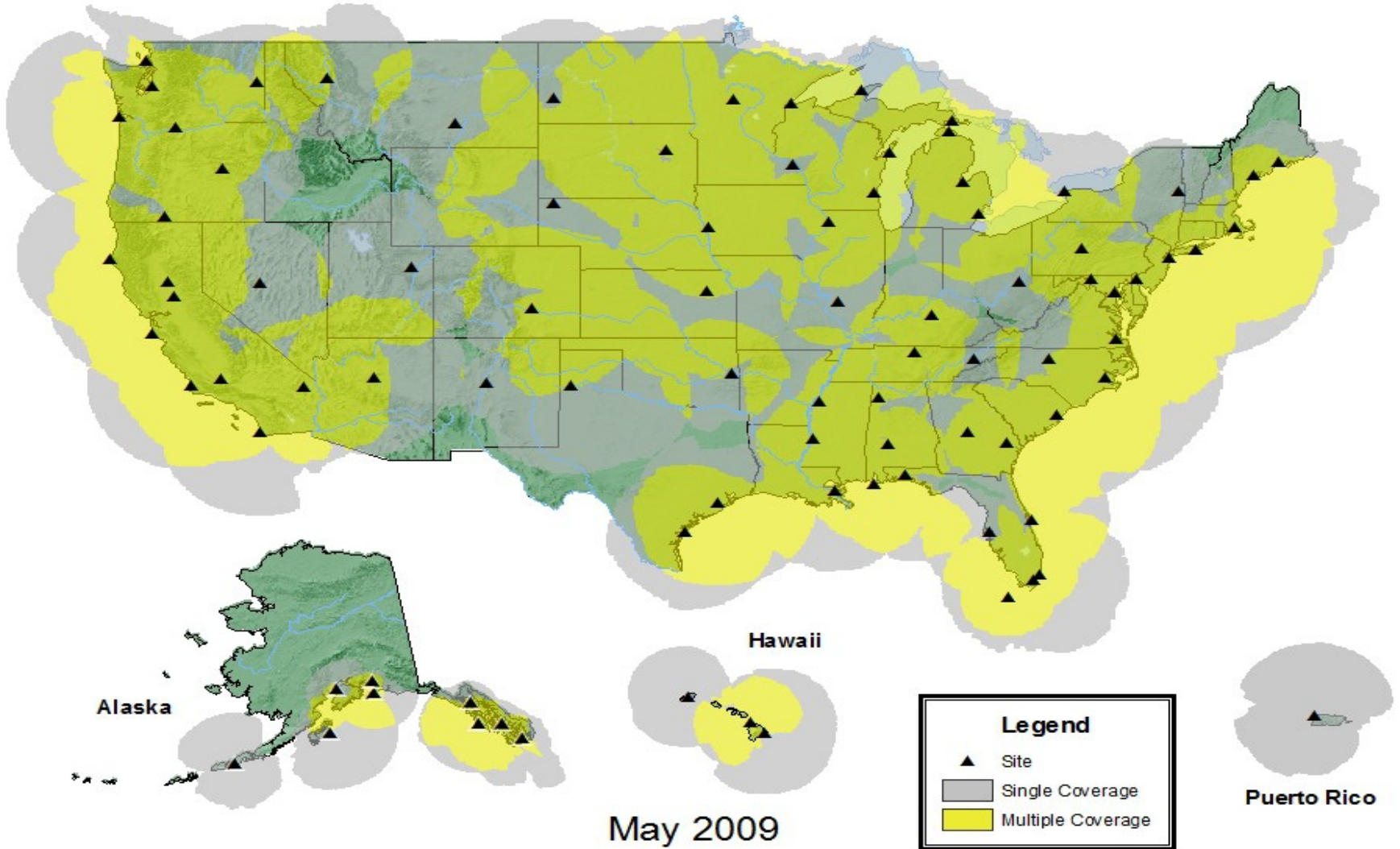
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NDGPS is a National PNT Utility

- 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

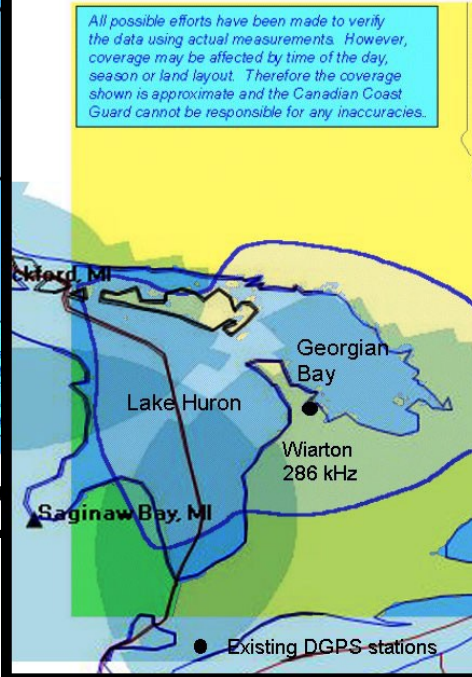
DGPS Coverage - Pacific Region



All possible efforts have been made to verify the data using actual measurements. However, coverage may be affected by time of the day, season or land layout. Therefore the coverage shown is approximate and the Coast Guard cannot be responsible for any inaccuracies.

● ● ● Existing

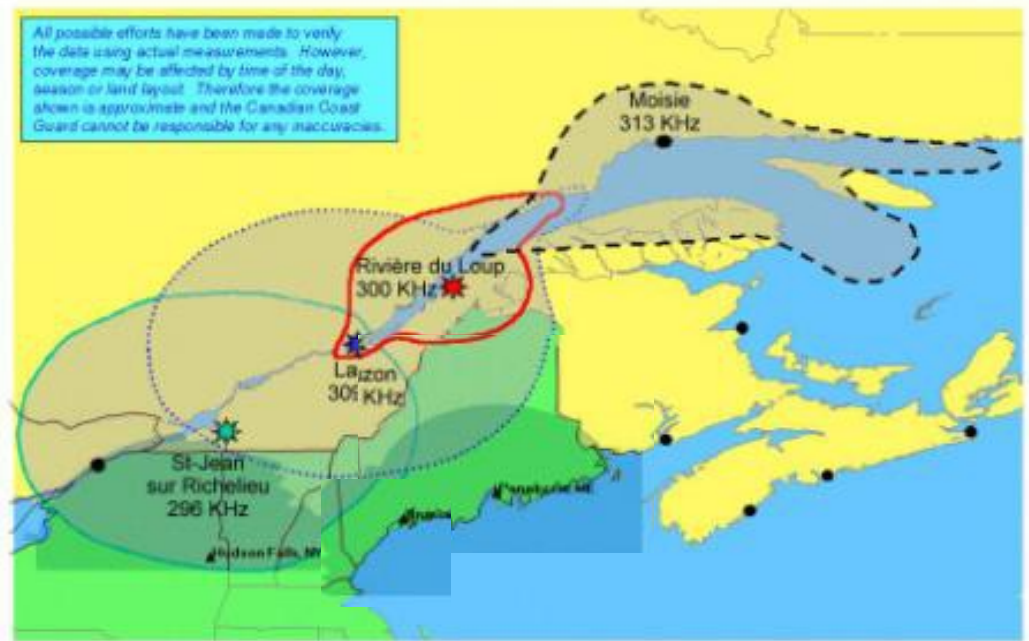
DGPS Coverage - Central Region



All possible efforts have been made to verify the data using actual measurements. However, coverage may be affected by time of the day, season or land layout. Therefore the coverage shown is approximate and the Canadian Coast Guard cannot be responsible for any inaccuracies.

● Existing DGPS stations

DGPS Coverage - St. Lawrence Seaway



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☼ Existing DGPS + OTF Stations ● Existing DGPS Stations

January 31, 2003

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

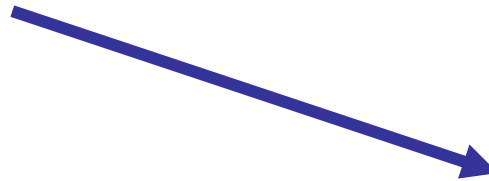


- NDGPS provides ~15% of CORS stations
- More importantly, provides a “robust backbone”



Before CORS:

Accurate differential GPS positioning
with multi-person field crew



After CORS:

Accurate differential GPS positioning
with one-person field crew.



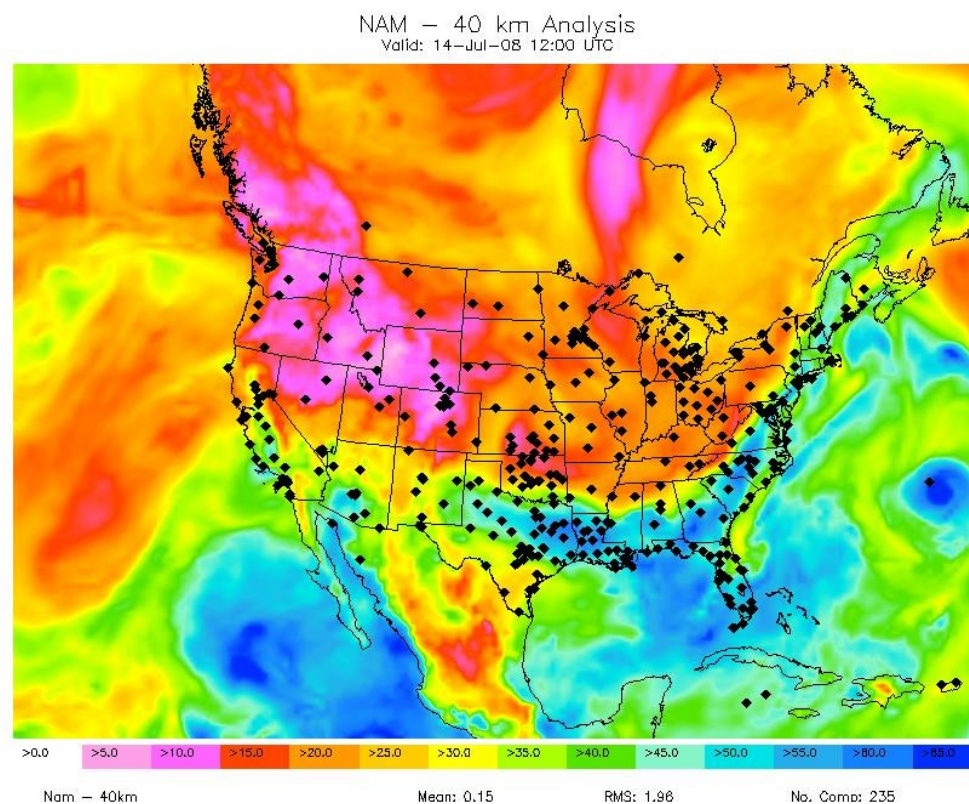
Precision Agriculture

- 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



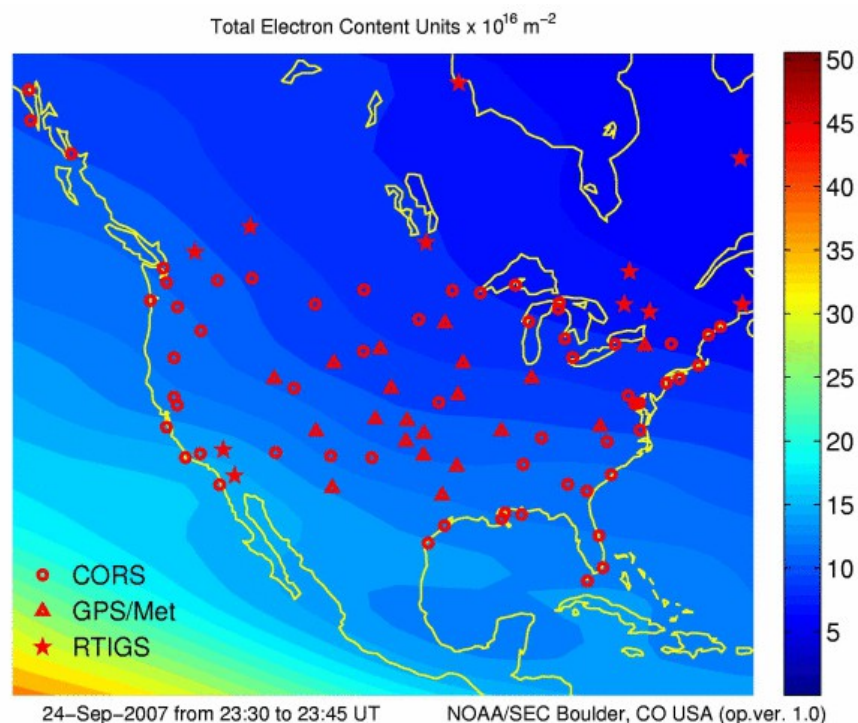
Severe Storm Forecasting

- 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

