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

Future of U.S. NDGPS

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CGSIC - September 15th, 2015

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Future of U.S. NDGPS

- Current system utilizes 84 broadcast sites to provide positioning accuracy of 1-3 meters across 92% of CONUS
- Few users of the NDGPS broadcast
- USCG, DOT, and US Army Corps of Engineers Plans:
  - Retain NDGPS at 21 sites for single station near-shore coverage
  - Decommission 62 sites
  - One US Army Corps of Engineers (USACE) site to remain
- Termination of NDGPS broadcast at 62 proposed sites planned for Jan. 15, 2016*

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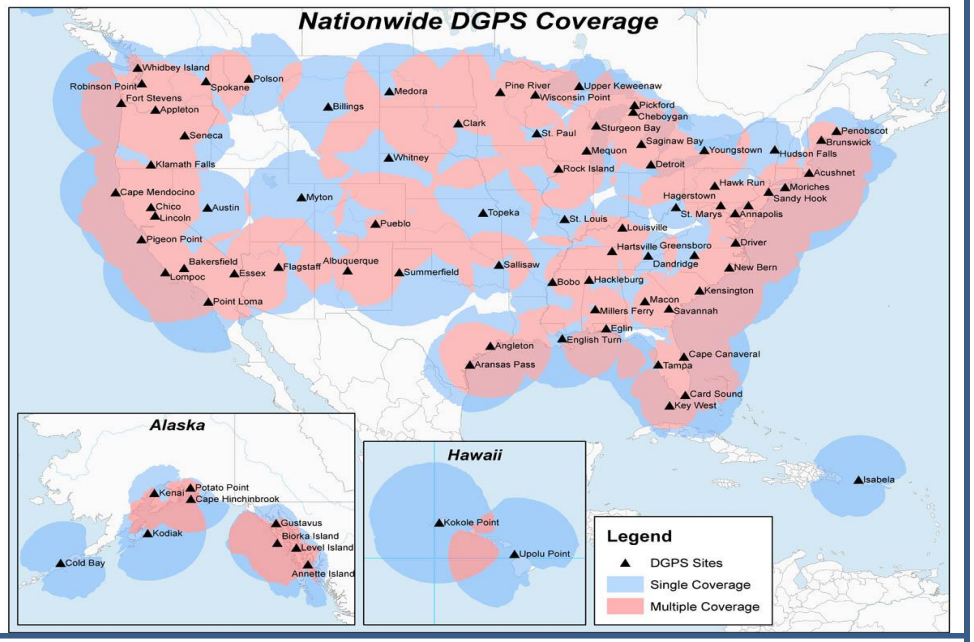
Nationwide Differential GPS (NDGPS)

System Description

- 84 Nationwide Remote Broadcast Sites throughout the United States and territories
  - 92% nationwide signal coverage
  - Better than 10 meter accuracy
  - 10 second integrity alarm to the user
  - Satisfies Harbor/Harbor Approach requirements
  - 99.7% availability requirement



Operations

- Redundant equipment at sites
- Redundant controls stations at NAVCEN

Stakeholders

- U.S. Army Corps of Engineers (USACE)
- Department of Transportation (DOT)
- U. S. Coast Guard (USCG)

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Contributing Factors

- Discontinuation of Selective Availability
  - Intentional signal degradation, known as SA, was disabled in 2000 allowing full signal accuracy to civil users
- Lack of USCG requirements
- Widespread use of the Federal Aviation Administration (FAA) Wide Area Augmentation System (WAAS)
- Continued GPS modernization
  - Additional civil frequencies allow for correction of ionospheric error
- Reduced availability of consumer grade DGPS receivers
- Federal Railroad Administration has no NDGPS requirement for Positive Train Control
- Agriculture sector uses commercial DGPS services

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2013 Federal Register Notice

- Joint DHS/USCG and DOT/RITA Federal Register Notice (FRN) Request for Public Comments [78 FR 22554; April 16, 2013]
- Targeted Outreach to User Community
- USG Requirements Assessed
- Direct Questions:
  - (1) Do you use NDGPS in its current form for positioning, navigation, and timing?
  - (2) What would be the impact if the NDGPS were to be discontinued?
  - (3) Are there alternatives that could be used to meet your PNT requirements?
  - (4) Are there alternative uses for the existing NDGPS infrastructure?
- Responses were few…..

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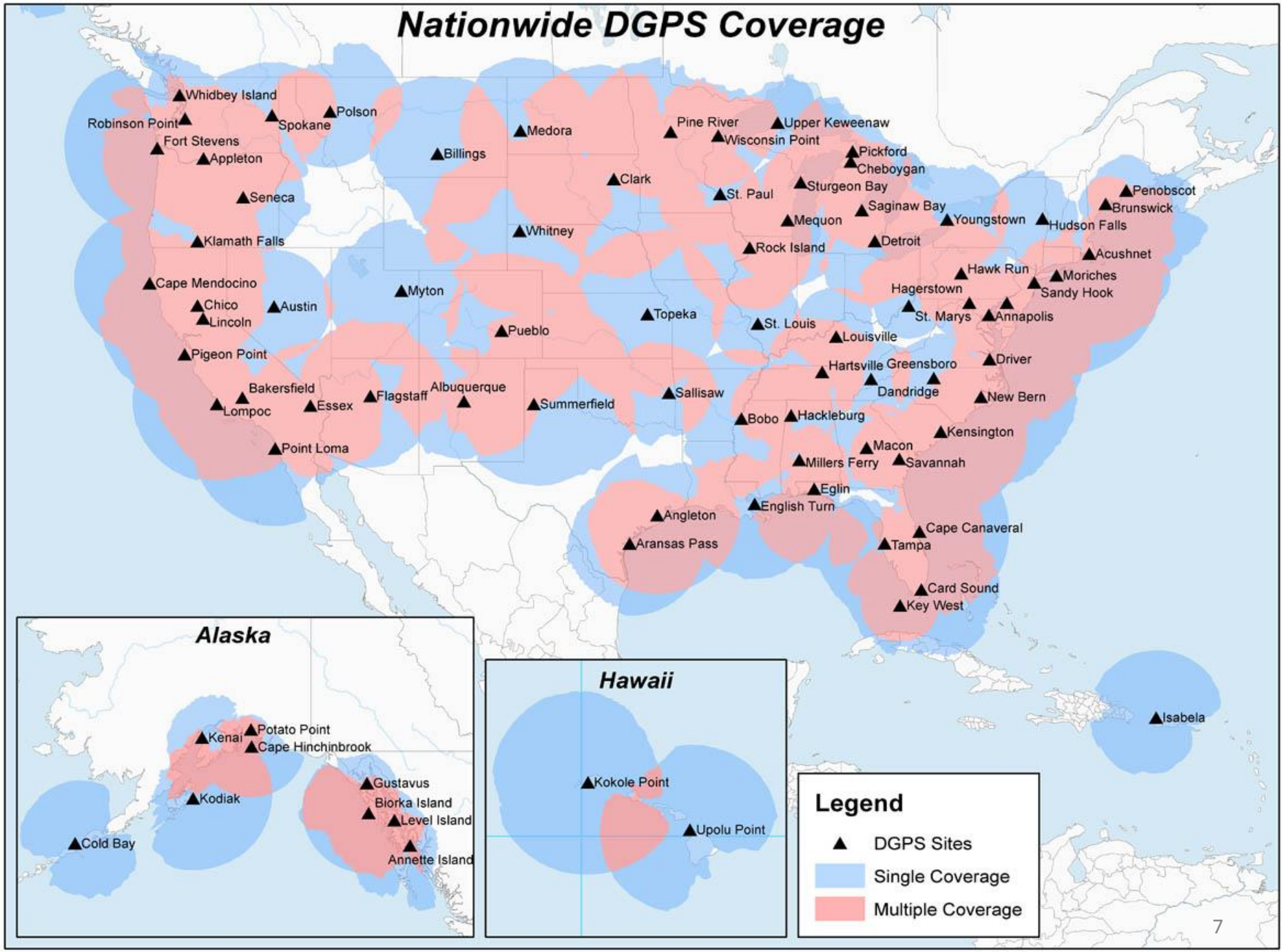
Assessment on Comments in Docket

- Few users of the NDGPS broadcast
  - Majority of use is for maritime sector
  - Primarily Pilots for precision shiphandling
- Bottom Line:
  - Insufficient users to justify a nationwide live broadcast


Nationwide DGPS Coverage
Whidbey Island
Robinson Point
Spokane
Polson
Fort Stevens
Appleton
Seneca
Klamath Falls
Cape Mendocino
Chico
Lincoln
Austin
Pigeon Point
Bakersfield
Lompoc
Essex
Flagstaff
Albuquerque
Point Loma
Billings
Medora
Whitney
Myton
Pueblo
Summerfield
Clark
Pine River
Wisconsin Point
Upper Keweenaw
Pickford
Cheboygan
Sturgeon Bay
St. Paul
Saginaw Bay
Mequon
Youngstown
Hudson Falls
Penobscot
Brunswick
Rock Island
Detroit
Acushnet
Hawk Run
Moriches
Hagerstown
Sandy Hook
St. Marys
Annapolis
Topeka
St. Louis
Louisville
Hartsville
Greensboro
Driver
Dandridge
New Bern
Sallisaw
Bobo
Hackleburg
Kensington
Macon
Millers Ferry
Savannah
Eglin
English Turn
Angleton
Aransas Pass
Cape Canaveral
Tampa
Card Sound
Key West
Isabela
Alaska
Kenai
Potato Point
Cape Hinchinbrook
Kodiak
Cold Bay
Gustavus
Biorka Island
Level Island
Annette Island
Hawaii
Kokole Point
Upolu Point
Legend
DGPS Sites
Single Coverage
Multiple Coverage


Whidbey Island
Robinson Point
Fort Stevens
Appleton
Spokane
Seneca
Klamath Falls
Cape Mendocino
Chico
Lincoln
Pigeon Point
Bakersfield
Lompoc
Point Loma
Polson
Medora
Billings
Whitney
Austin
Myton
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English Turn
Millers Ferry
Eglin
Macon
Hackleburg
Hartsville
Louisville
Upper Keweenaw
Wisconsin Point
Sturgeon Bay
St Paul
Mequon
Pickford
Cheboygan
Saginaw Bay
Youngstown
Detroit
Rock Island
Hawk Run
St Marys
Hagerstown
Reedy Point
Annapolis
Sandy Hook
Moriches
Acushnet
Hudson Falls
Brunswick
Penobscot
Greensboro
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Level Island
Annette Island
Cold Bay
Kokole Point
Upolu Point
Legend
Proposed Decom Sites
USCG Sites
USACE Site
USCG Coverage
USACE Coverage

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Next Steps

- November 16th, 2015: 90-day FRN commentary period closes
- November 20th, 2015: Impact analysis report assesses commentary
- December 15th, 2015: Local Notice to Mariner message released with notification of sites decommissioning
- January 15th, 2015:
  - Sites will be decommissioned
  - Decommissioning may be delayed for those sites with unmitigated impacts identified in the analysis of public comment
- Alternative uses for decommissioned DGPS sites will be examined

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Summary

- Few users of the NDGPS broadcast
- USCG, DOT, and USACE Plans:
  - Retain NDGPS at 21 sites for single station near-shore coverage
  - Decommission 62 sites
  - One USACE site to remain
- Termination of NDGPS broadcast at 62 proposed sites planned for Jan. 15, 2016*

BACKUP SLIDES

Overview of FRN Responses 1 of 3

Category	Respondents	Summary Comments
Maritime-Related (U.S.)	• 9 Pilots' Organizations + 2 individual members	• Universally opposes DGPS reduction/removal in pilotage areas; several technical/safety concerns • Universal negativity to WAAS as substitute augmentation system in pilotage and navigation • Most correspond to USCG Vessel Traffic Service (VTS) areas (e.g., Houston, New York, Seattle)
	• 2 private industry partners	• Quotes IALA R-121 that removal of SA does not remove requirement for augmentation • Uses data acquisition for underwater investigations
Non-Maritime (U.S.)	• 3 State DOTs • 2 Local DOT/DPW	• Uses for highway design and monument integrity • Uses CORS data for RTN; not use broadcast • Uses DGPS-based CORS for project control, post-processing, automated survey and construction • Uses DGPS – critical for survey, mapping, GIS and data sets, coastal and maritime navigation and environmental applications • Suggests use in GPS+GLONASS streaming RTK applications

Overview of FRN Responses 2 of 3

Category	Respondents	Summary Comments
Associations (U.S.)	• 1 Shipping Association	• Seeks measurement on relative position fixing capability of DGPS signal v. uncorrected GPS
	• 1 PNT Association	• Cites 30,000 daily navigation users in CONUS + tens of thousands at sea • Suggests NDGPS as most reliable augmentation for surface applications, and as backup for power, IT and other critical infrastructure outages; and natural disaster recovery
	• 1 Conservation Assn.	• Uses for GIS, emergency response
Private Sector	• 2 private industry partners	• Concerns for loss of critical accurate/reliable CORS stations for research, survey and mapping • Limits integration with SBAS and diversity of high integrity PNT services; suggests integration into national PNT network • Suggests integration with wide area nationwide Network RTK, and ubiquitous nationwide high accuracy location and timing

Overview of FRN Responses 3 of 3

Category	Respondents	Summary Comments
Individuals	• 4 individuals	• Uses for remote sensing elevation data/coastal management decisionmaking • Concerns for loss of realtime NAD83 data, WAAS accuracy insufficient • Most accurate system for obstructed areas • Specific concerns for NDGPS broadcast and CORS loss in Alaska, Hawaii, Puerto Rico
International	• 3 international organizations	• Increasing use of Portable Pilot Navigation Systems/ Personal Pilot Units requiring reliable signal input • Concerns for loss of DGPS attributes and impact on broader aims of e-Navigation • Limits integration with SBAS, diversity of high integrity PNT services • No use in Canadian cadastral surveying
Federal Agencies	• 5 Federal agencies	• CORS at DGPS sites critical; not use broadcast (2) • Concerns for accuracy impacts on OPUS • Can replace with WAAS, but not RAIM (accuracy) • No impact (2)

Proposed Maritime Sites for Decommissioning - USCG (27)

- Appleton, WA
- Biorka, AK
- Bobo, MS
- Brunswick, ME
- Cape Hinchinbrook, AK
- Cheboygan, MI
- Cold Bay, AK
- Driver, VA
- Eglin, FL
- Gustavus, AK
- Isabela, PR
- Key West, FL
- Kodiak, AK
- Kokole Point, HI
- Level Island, AK
- Lompoc, CA
- Mequon, MI
- New Bern, NC
- Penobscot, ME
- Pigeon Point, CA
- Robinson Pt, WA
- Saginaw, MI
- Sandy Hook, NJ
- Sturgeon Bay, WI
- Upper Keweenaw, MI
- Wisconsin Point, WI
- Youngstown, NY

Proposed Inland Sites for Decommissioning – DOT (29)

- Albuquerque, NM
- Austin, NV
- Bakersfield, CA
- Billings, MT
- Chico, CA
- Clark, SD
- Dandridge, TN
- Essex, CA
- Flagstaff, AZ
- Greensboro, NC
- Hackleburg, AL
- Hagerstown, MD
- Hartsville, TN
- Hawk Run, PA
- Hudson Falls, NY
- Klamath Falls, OR
- Macon, GA
- Medora, ND
- Myton, UT
- Pine River, MN
- Polson, MT
- Pueblo, CO
- Savannah, GA
- Seneca, OR
- Spokane, WA
- St. Marys, WV
- Summerfield, TX
- Topeka, KS
- Whitney, NE

Proposed Inland Sites for Decommissioning - USACE (6)

- Louisville, KY
- Millers Ferry, AL
- Rock Island, IA
- Sallisaw, OK
- St. Louis, MO
- St. Paul (Alma), MN