



# ***Domestic Space-Based PNT Interference Detection and Mitigation***

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# *Presentation Overview*



- **Current GPS Interference Detection and Mitigation Process**
- **Interference Case Study**
- **Interference Detection and Mitigation (IDM) Plan and Implementation**



# *Current GPS Interference Detection and Mitigation Process*



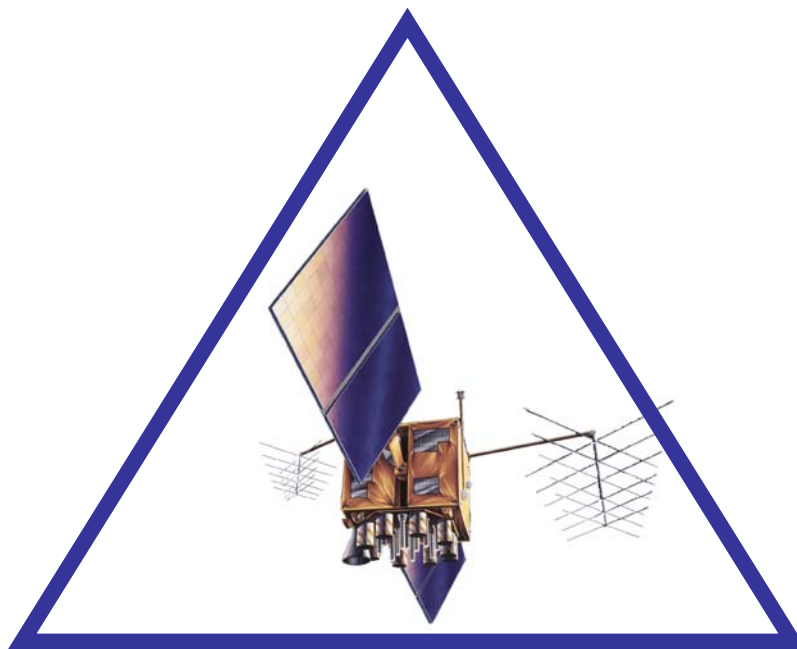
- **GPS SPS Outage Causes**
  - **GPS Constellation anomalies**
  - **User equipment anomalies**
  - **GPS frequency interference**
    - Intentional
    - Unintentional



# *Current GPS Interference Detection and Mitigation Process*



USAF GPSOC  
(military)



USCG NAVCEN  
(surface)

FAA NOCC  
(aviation)

***Domestic GPS Outage Reporting***



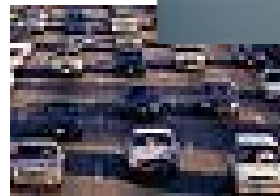
# *Current GPS Interference Detection and Mitigation Process*



- **GPS Outage Detection**
  - **Government managed systems that monitor and/or augment GPS**
    - GPS Ground Segment Monitors (USAF)
    - WAAS (FAA)
    - NDGPS (USCG)
    - CORS (NOAA)
    - JPL DGPS Network (NASA)
  - **User Reports (domestic and international)**
    - Web-based
    - Phone calls
    - Emails



# Interference Case Study



Electric Power

Postal and Shipping

Emergency Services

Chemical and Hazardous Materials

Information and Telecommunications

Transportation

Food and Agriculture

Defense Industrial Base

Public Health

Banking and Finance

Water





# *Interference Case Study*

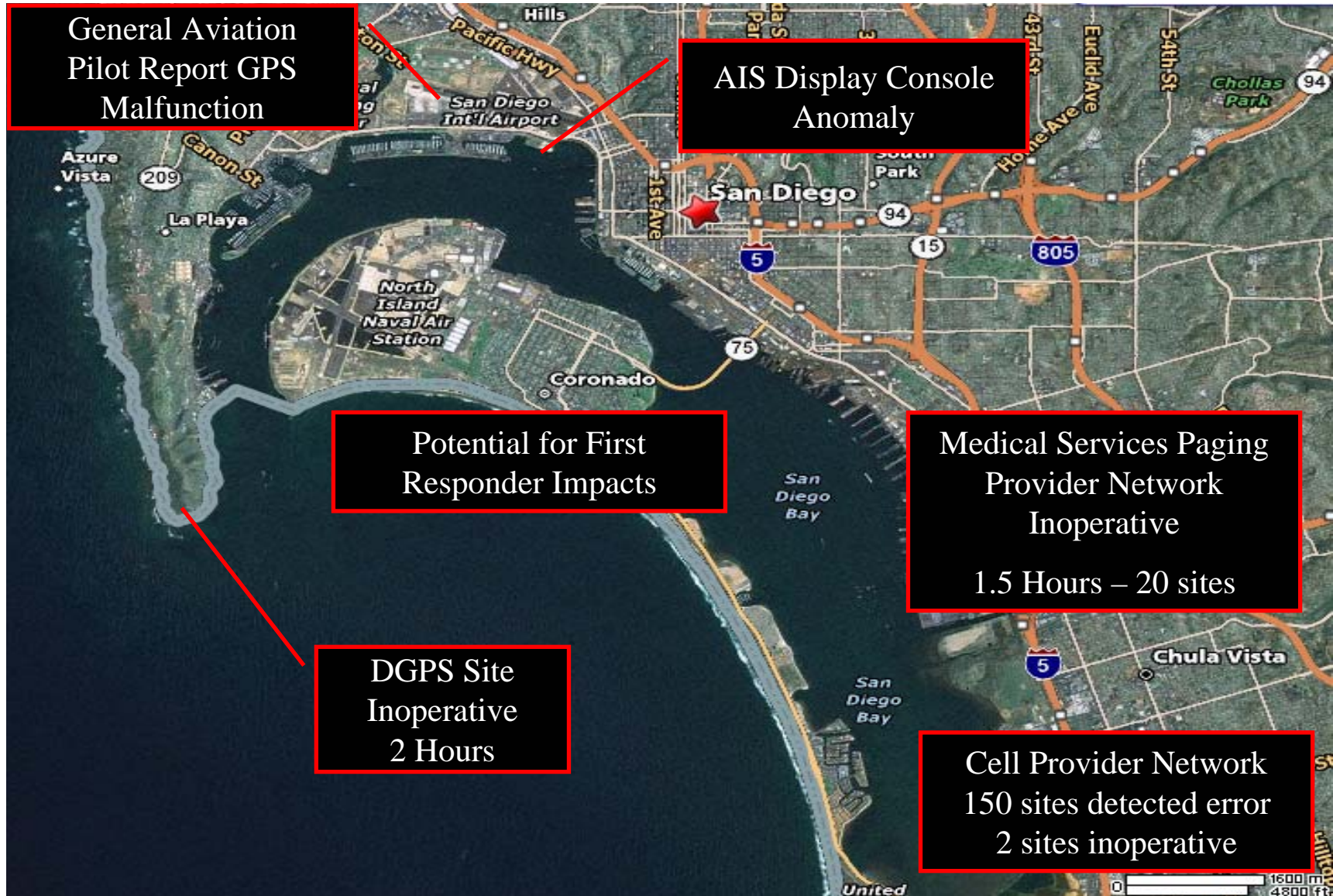


- **Date: 22 January 2007**
- **Location: San Diego harbor south to Mexican border and up to 10 miles inland.**
- **Duration: 1200-1600 PST**
- **Cause: Unintentional Interference**





# Interference Case Study







## *IDM Plan Goals*



- **Coordinate domestic capabilities** to identify, analyze, locate, attribute, and mitigate sources of interference to the GPS and its augmentations
- **Collect, analyze, store, and disseminate interference reports** from all sources to enable appropriate investigation, notification and enforcement action
- **Develop and maintain capabilities, procedures and techniques, and routinely exercise civil contingency responses** to ensure continuity of operations in the event that access to the GPS is disrupted or denied.



# *IDM Implementation Actions*



- August 2007 – The President approved the National PNT IDM Plan
- January 2008 – DHS signed IDM Plan Implementation Strategy into force
- DHS expected to issue publicly releasable fact sheet and summary of IDM Plan



## *Implementation Actions*



- February 7, 2008 – DHS announced adoption of eLoran as a national backup to the GPS to mitigate any safety, security, or economic effects of a GPS outage or disruption
- President's Fiscal Year 2009 Budget Request:
  - Migrate administration of LORAN-C from USCG to DHS National Protection and Programs Directorate (NPPD), includes transfer of budget authority for funding and personnel
    - Prepare for conversion of Loran-C operations to eLoran
  - NPPD to oversee development of eLoran to provide national backup capabilities for positioning, navigation, and timing.
  - Coast Guard will continue operation of the system in 2009 on a reimbursable basis



# *eLoran* Status

CAPT Ed Thiedeman

Commanding Officer

USCG Navigation Center





# ***Adoption of National Backup System to GPS***



- The U.S. Department of Homeland Security will begin implementing an independent national positioning, navigation and timing system that complements the Global Positioning System (GPS) in the event of an outage or disruption in service.
- The enhanced Loran, or eLoran, system will be a land-based, independent system and will mitigate any safety, security, or economic effects of a GPS outage or disruption. GPS is a satellite-based system widely used for positioning, navigation, and timing. The eLoran system will be an enhanced and modernized version of Loran-C, long used by mariners and aviators and originally developed for civil marine use in coastal areas.
- In addition to providing backup coverage, the signal strength and penetration capability of eLoran will provide support to first responders and other operators in environments that GPS cannot support, such as under heavy foliage, in some underground areas, and in dense high-rise structures. The system will use modernized transmitting stations and an upgraded network.





# DHS Loran Statement



The February DHS Press Secretary's Statement can be downloaded from the NAVCEN website homepage.

**NAVIGATION CENTER**  
The Navigation Center of Excellence

U.S. Department of Homeland Security  
UNITED STATES COAST GUARD

Consolidated Nav Info | DGPS Advisories | GPS Advisories / NANUs | GPS Testing Notices | LNM's | Almanacs | Nav Rules | AIS | Contact Us | Search | Home

April 17, 2008

**NAVIGATION CENTER POINTS OF INTEREST**

**Primary Mission Areas:**

- Global Positioning System
- Differential GPS
- Nationwide DGPS
- LORAN C
- Inland River Vessel Movement Center
- Civil GPS Service Interface Committee
- Automatic Identification System
- Electronic Navigation & Charting
- Maritime Telecommunications

**Services & Reporting:**

- Receive Free LNM Updates
- Receive Free GPS Status Messages
- Receive NANU Updates
- Join CGSIC (free)
- Report an ATON Discrepancy or Outage
- Report a GPS Problem
- Report a DGPS Problem
- Report an AIS Problem
- Report a LORAN Problem
- Contact Us

**Current Operational / Safety Information**

- Consolidated Nav Info
- DGPS Site Status
- GPS Ops Advisories & NANUs
- GPS Almanacs
- GPS Interference Notices
- Local Notice to Mariners
- Light List and Corrections
- Navigation Rules
- Navigation Regulations
- Navigation Safety Alerts

**Maritime Information**

- USCG "Homeport" Website
- Vessel Traffic Services
- Global Maritime Distress and Safety System
- CG Nat'l Distress System
- Digital Selective Calling
- Vessel Traffic Services
- VHF Channels & Freqs
- MF & HF Channels
- Nav Pubs and Documents
- Radio Watch Requirements
- Marine Safety Information Broadcasts
- Ports and Waterways Safety System

**More About NAVCEN**

- Mission Statement
- Contact Us
- Directions to NAVCEN
- Search Our Site
- Site Map
- Website Privacy Policy

**News and Notices:**

- Reported GPS/AIS User Equipment Problems Involving PRN32: Read our notice...
- PRN 32 Announcement: Per NANU 2008023, PRN 32 will be set healthy at 1800Z 26 Feb 2008.
- DoD Announcement: Success In Intercepting Non-Functioning Satellite in Final Orbits. Read more...
- Adoption of a National Backup System to GPS - On Feb 7th, 2008, DHS issued a statement regarding the adoption of eLoran (enhanced LORAN) as the back to GPS...read the statement in its entirety (18K, PDF).**
- Decision made to continue providing high frequency (HF) radio broadcasts of weather forecasts and warnings...Final Report now available: A Business Case for the Continuance of the USCG High-freq Broadcasts of National Weather Service Marine Weather Forecasts.
- The 2007 Light Lists have been published and are available for download in PDF.
- Please read Coast Guard Marine Safety Alert 2-07 (PDF, 85K) regarding marine radios and AIS equipment.
- You may view previous news items here.





# *Planned Operational Capability*



- eLoran can be used as backup/complement to GPS.
- Terrestrial, high power, low freq; inverse of GPS; Inherently less susceptible to deliberate interference.
- GPS-like, digital user equipment . Position data presented in LAT/LON coordinates.
- Meets Maritime Harbor Entrance & Approach accuracy requirement of 10-20M.
- Meets Aviation Required Navigation Performance of 0.3 nautical miles for Non-Precision Approach & integrity.
- Meets precise frequency & timing requirements.
- Coverage in many obstructed areas not served by GPS.



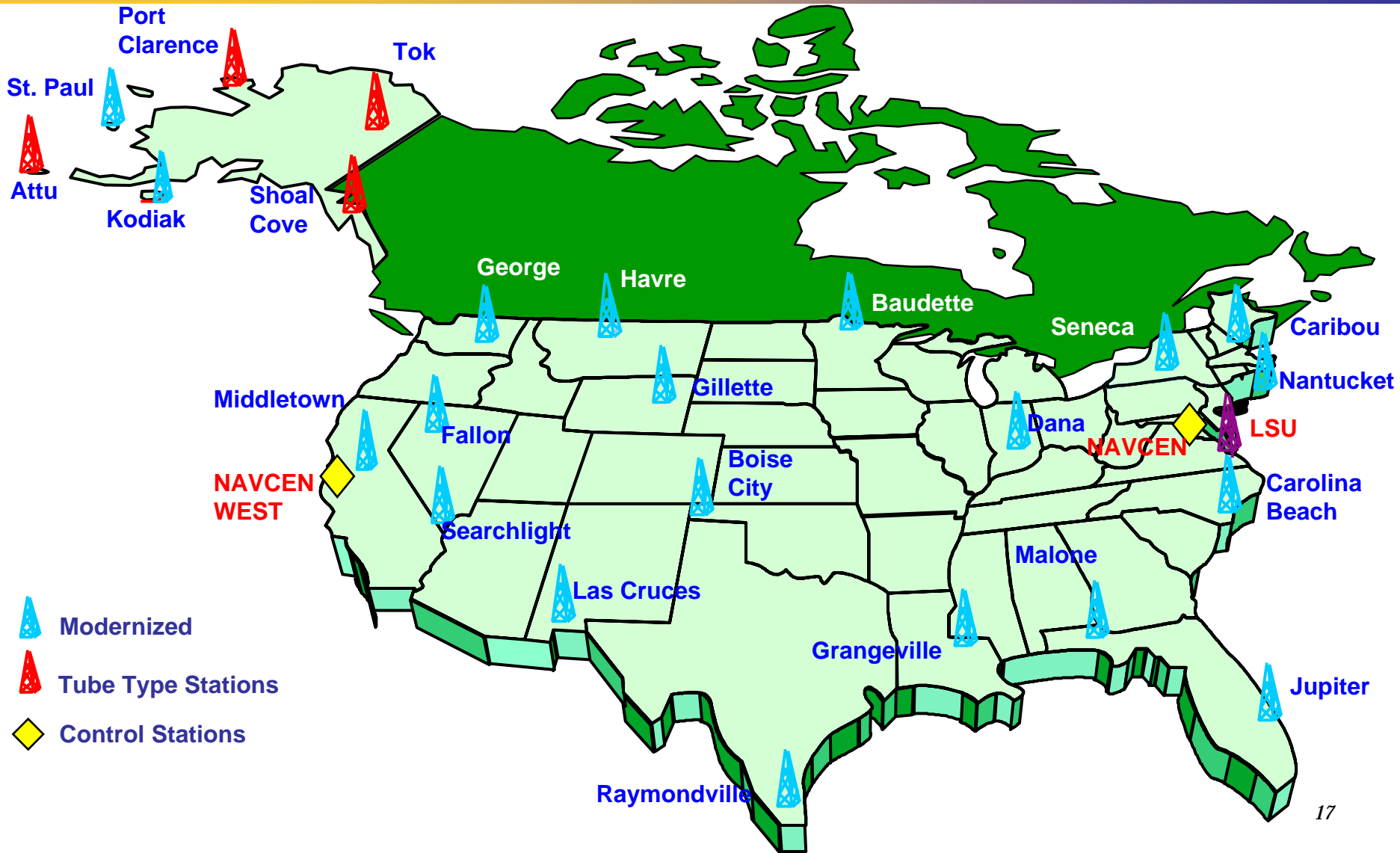
# Capabilities Progression



User Required Capabilities	Loran-C	Modernized Loran - 2007	eLoran
<b>Aviation</b>			
En Route (RNP 2.0 ->1.0)	Yes	Yes	Yes
Terminal (RNP 0.3)	No	No	Yes
Non-Precision Approach (NPA) - RNP 0.3	No	No	Yes
<b>Maritime</b>			
Oceanic	Yes	Yes	Yes
Coastal Confluence Zone (CCZ)	Yes	Yes	Yes
Harbor Entrance and Approach (HEA)	No	No	Yes
<b>Telecom &amp; Other (Time/Frequency)</b>			
Stratum 1 Frequency	Yes	Yes	Yes
Time of Day/Leap Second/UTC Reference	No	Yes	Yes
Precise Time [<50 ns UTC(USNO)]	No	No	Yes



# Current U.S. Loran System





# *Projected Transition Phases*



- **January 2008 - October 2008**
  - New Executive Agency develop transition plan with CG
  - Brief strategy to Congressional stakeholders
- **October 2008**
  - Begin transition of operating and maintenance to new Executive Agency
- **October 2010**
  - New Executive Agent assumes full responsibility for loran operations



# *Backup Slides*



# *U.S. 2009 Budget Information*



- Department of Homeland Security 2009 Budget

<http://www.whitehouse.gov/omb/budget/fy2009/budget.html>

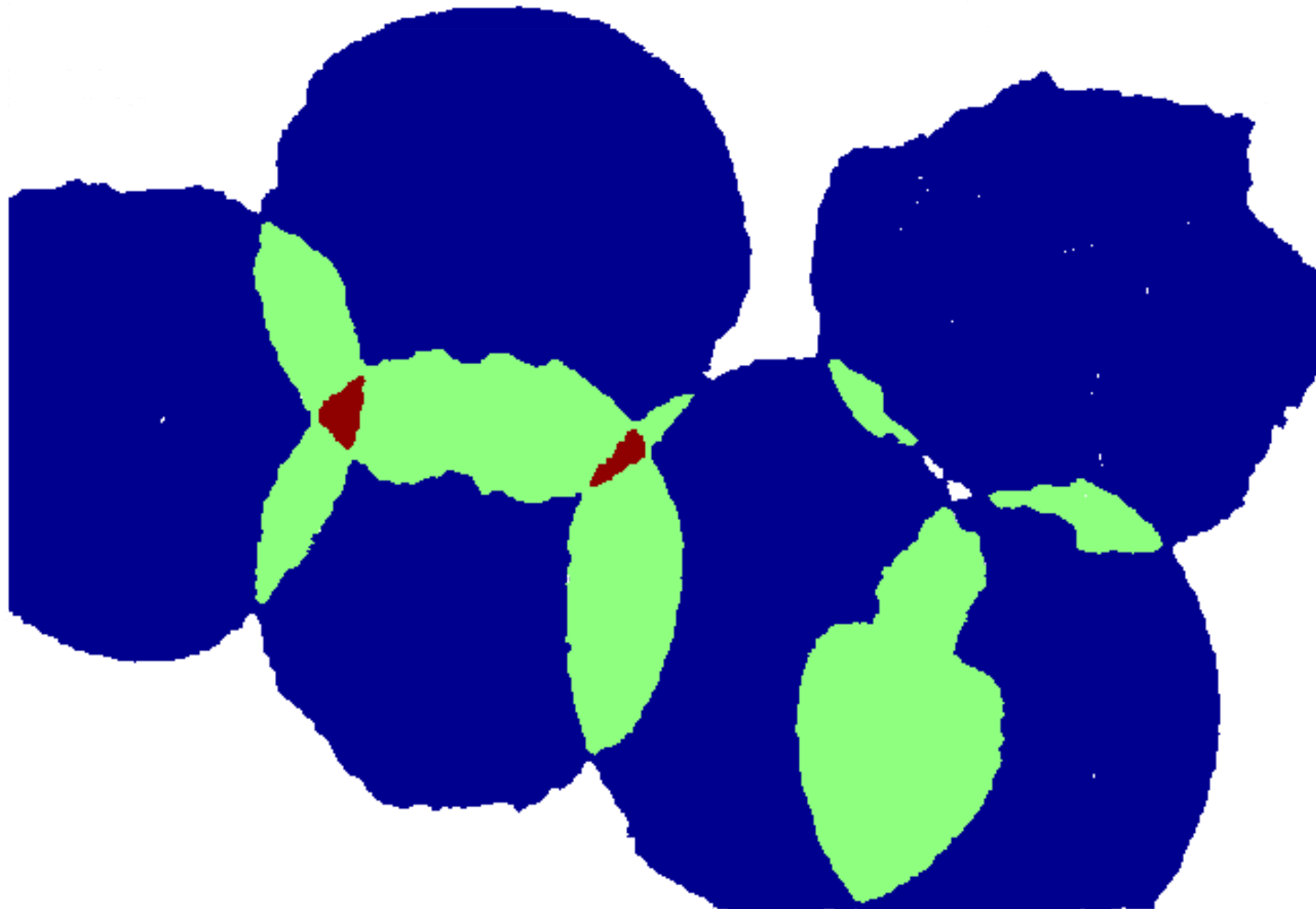
- U. S. Coast Guard Posture Statement with 2009 Budget in brief, Loran discussed on page 41

<http://www.uscg.mil/comdt/DOCS/LOW.RES.CG%20FY09%20Posture%20Statement.FINAL.Jan29.pdf> - 2008-02-08





# *Current Loran Data Channel Coverage*



## **Legend**

Blue – Single

Green – Dual

Red - Triple