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
• 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
- Chemical and Hazardous Materials
- Emergency Services
- Transportation
- Information and Telecommunications
- Food and Agriculture
- Defense Industrial Base
- Public Health
- Banking and Finance
- Water
- Transportation
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

General Aviation Pilot Report GPS Malfunction

AIS Display Console Anomaly

Potential for First Responder Impacts

DGPS Site Inoperative 2 Hours

Medical Services Paging Provider Network Inoperative 1.5 Hours – 20 sites

Cell Provider Network 150 sites detected error 2 sites inoperative
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.
The February DHS Press Secretary’s Statement can be downloaded from the NAVCEN website homepage.
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

<table>
<thead>
<tr>
<th>User Required Capabilities</th>
<th>Loran-C</th>
<th>Modernized Loran - 2007</th>
<th>eLoran</th>
</tr>
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<tbody>
<tr>
<td><strong>Aviation</strong></td>
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<tr>
<td>En Route (RNP 2.0 -&gt;1.0)</td>
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<td>Terminal (RNP 0.3)</td>
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<td>Non-Precision Approach (NPA) - RNP 0.3</td>
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<td><strong>Maritime</strong></td>
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<td>Oceanic</td>
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<td>Coastal Confluence Zone (CCZ)</td>
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<td>Precise Time [&lt;50 ns UTC(USNO)]</td>
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</table>
Current U.S. Loran System

Tube Type Stations
Control Stations
Modernized
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
• Department of Homeland Security 2009 Budget
  

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

Current Loran Data Channel Coverage

Legend
Blue – Single
Green – Dual
Red - Triple