Resilient PNT
- An Outsider’s View

Professor David Last

National Space-Based PNT Advisory Board
Boulder, CO, USA
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A Proper Navigator

Photo: Dreamstime.com
National Critical Infrastructure – Dependence on GPS

GPS Supporting Power Grid Systems
- Energy Plants
- Substations
- Power Grids

GPS Supporting Banking Operations
- ATM Networks
- Stock Exchanges
- Banks/Nodes
- Internet Banking

GPS Supporting Transportation Systems
- Rail Yards
- Switching Towers & Signals
- C² Centers
- Air Traffic Control
- Ship Routing

GPS Supporting Communications Systems
- Wireless Internet
- GPS Time & Position
- Access GIS/Map
- Relay Position To 911 Dispatch
- Comms Networks

GPS Critical Infrastructure Timing Study: Usage/Loss Impacts/Backups/Mitigation, James Caverly, NPPD (DHS) 2007
GPS plus …

GLONASS (Russia)       Compass-Beidou (China)

QZSS (Japan)       GALILEO (Europe)       IRNSS (India)

… and all the augmentations:
Loran’s Capability to Mitigate the Impact of a GPS Outage on GPS Position, Navigation, and Time Applications

Prepared for the
FEDERAL AVIATION ADMINISTRATION
VICE PRESIDENT FOR TECHNICAL OPERATIONS
NAVIGATION SERVICES DIRECTORATE

March 2004
STATEMENT FROM DHS PRESS SECRETARY LAURA KEEHNER ON THE ADOPTION OF NATIONAL BACKUP SYSTEM TO GPS

Today 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.
Prototype eLoran using the stations of the North-West European Loran System: UK Initial Operational Capability was declared on 31 October 2014
Enhanced Differential Loran Maritime Trials in The Netherlands Declared Successful
The Timing Bonus

The GLAs’ prototype eLoran system already delivers precise timing to telecoms operators and broadcasters across the UK and Ireland.

Commercial GPS-eLoran Timing Receiver

Picture: Chronos Technology Ltd
Prototype eLoran using the stations of the North-West European Loran System: UK Initial Operational Capability was declared on 31 October 2014
Systems - or simply GNSS?

*GPS plus ...*

- GLONASS (Russia)
- Compass-Beidou (China)
- QZSS (Japan)
- GALILEO (Europe)
- IRNSS (India)

... and all the augmentations:
• Does the US see a role for eLoran as a complement to GPS in delivering resilient PNT?

• Does the US recognise and encourage the move to GNSS receivers that take advantage of multiple constellations?