Almost Everything Depends…

ICG 10 Boulder, Colorado, USA

NOV 2015
Almost Everything Depends Upon GNSS!
Precise Positioning & Navigation

Synchronized, Precise Time, Freq & Phase

Transport/Navigation

Financial Systems

IT Networks/Data Bases

Telecommunications

Power Grid
Power Grid
Telecommunications
Financial Systems
IT Networks/Data Bases
Telecommunications
Synchronized, Precise Time, Freq & Phase
Precise Positioning & Navigation
Transport/Navigation
Deliver User, Cash, Maintenance
Money in Account?

Deliver User, Cash, Maintenance
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Deliver User, Cash, Maintenance
Money in Account?
Almost Everything Depends Upon GNSS!

Synchronized, Precise Time, Freq & Phase

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Power Grid
Almost Everything Starts to Fail Without GNSS!
"...a single point of failure..."

Dr. Brad Parkinson, “Father of GPS”
“The burst … swamped GPS receivers over the entire sunlit side of the Earth.”
Solar Flare 13 Sept 2014

Data Point Count in Relation to Time  (Courtesy of Trinity House AIS Network)
Dublin Approach by Time – *Ulysses* (Courtesy of Trinity House)
Unlikely
"A significant GPS anomaly occurred on 1 Jan 04... resulted in the transmission of Hazardously Misleading Information."

US Air Force
1 April 2014 - 11 Hours…

GLONASS Suffers Temporary System-wide Outage

GLONASS Gone ...Then Back
Local Disruptions per Day – Tens of thousands
Product Description

Are you sick of being tracked like a criminal? This certain device is a gorgeous GPS jammer which can totally solve your troubles. The can prohibit signals from tracking your current location; pay a private space for you. All of this owes to the high power portable GPS (GPS L1/L2/L3/L4/L5) jammer.

High Power Portable GPS (GPS L1/L2/L3/L4/L5) Jammer

Free Shipping

RRP: GBP £110.25
Your Price: GBP £101.43
(You save GBP £8.83)

SKU: JM110838
Rating: ★★★☆☆ (6 product reviews)
Shipping: Calculated at checkout
Quantity: 1
Add to cart
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Equal Treatment for All
Local Disruption - Simulation

Red: Receivers jammed. Yellow: Reception degraded.
Model: 100W jammer. Commercial-grade receivers.

Picture: Michael Jones, Chemring TS

115 KM
Local Disruption – Maritime Trials

Courtesy Prof David Last & Trinity House
2 Watt Jammer on cliff
Example project - DETECTOR

Fingerprinting GNSS Interferences “in-the-wild”
Nottingham Scientific Ltd (NSL)
(further details: mark.dumville@nsl.eu.com)
Indications of an evolution...

Evidence that jammers are becoming more sophisticated: faster sweep rates, wider bandwidths and more complex signals

1. Faster sweep rates (Illustrative)

2. Composite signals
Systems + Policy

Protect

Toughen

Augment
Protect GNSS

- Recognize PNT as critical infrastructure
- Designate and empower a lead federal official
- Protect the adjacent bands to GNSS as “quiet” neighborhoods
- Make ownership of jammers a misdemeanor
- Make use of jammers a felony
- Make anti-jamming and anti-spoofing laws enforceable at all levels of government
- Establish a national system to detect & rapidly locate jamming
- Ensure sufficient enforcement personnel to detect, prevent, respond to and prosecute jamming
Toughen Receivers & Users

- Develop standards for jam-resistant receivers to include ARAIM and RAIM
- Establish as an industry best practice having more than one source of precise Position, Navigation and Timing (PNT) for critical infrastructure
- For critical infrastructure that uses space-based PNT, establish as an industry best practice being able to continue normal operations in the event of an extended GNSS service disruption.
Augment GPS/GNSS Services

- Provide a wide-area, difficult to disrupt, diverse non-space PNT service (GPS-Earth/eLoran)
- Develop standards for seamless use of this service with space-based PNT
- Encourage development of numerous, complementary terrestrial PNT services to increase resilience (integrated radar, local positioning systems, inertial, etc.)
Loran Systems Today
eLoran in United Kingdom

- 7 major east coast ports
- IOC on 31 October 2014
European Loran-C - Today

- Norway - Vaerlandet, Boe, Jan Mayen, Berlevåg
- France - Lessay, Soustons
- UK - Anthorn
- Denmark – Ejde (Faeroes)
- Germany - Sylt
Euro-Loran → Galileo-Earth?

- Towers Synchronized w/ Satellites
- Galileo stronger
- Galileo services indoors
- Deters jamming & spoofing
- High power/Low freq
US Government Concerned

“We have known about the problem since 2001.”
Dept. of Transportation Deputy Secretary 2013

“Interested in eLoran as part of APNT.”
Dept. of Defense CIO 2013

“GPS is a single point of failure for critical infrastructure.”
Dept. of Homeland Security Asst Sec. 2015
US Government Concerned

‘When space assets are not available – what’s the plan?’

Public Law 113-66
50,000 eLoran Receivers?"
US Dept. of Transportation – Request for Comment

Response - ‘We need eLoran’

 Including:
- The GPS Innovation Alliance
- Radio Technical Commission Maritime
- GMDSS Task Force
- Aircraft Owners and Pilots Assn.
- Atlantic Lobstermen’s Association
- General Light House Authority
- Australian Maritime Safety Authority

May 2015 – 94%
March 2007 - 93%
Phase I – Timing Continental US, 4 Sites
Phase 2 - Positioning, Navigation, Timing Continental US, 19 Sites

Public-Private-Partnership Proposal Pending
Phase 3 – PNT, Freq, Phase & Data

Public-Private-Partnership Proposal Pending
The Resilient Navigation and Timing Foundation is a non-profit, public benefit 501(c)(3) educational and scientific charity.

**Promote**
We promote multiple and resilient systems for balanced and healthy navigation and timing eco-systems.

**Combat**
We promote appropriate laws and enforcement to prevent GNSS jamming and spoofing.

**Educate**
We educate leaders and the public about the importance of navigation and timing, existing vulnerabilities and the need for resilience.

**Our Challenge**
Much of the world depends on satellite systems for precise navigation and timing services. These are exceptional, precise, and dependable, yet jamming, spoofing, and other forms of interference appear to be increasing in frequency and severity. Heinlein warned us years ago to prepare for this potential for devastating effects on our lives and economic exchange.

- [Join our ranks](#) and campaign for more solutions that bring balance of mind.
- [Get all the facts](#) [Download our Factsheet](#) to learn about the RNT Foundation.

**From Our Blog**

**In the News**