



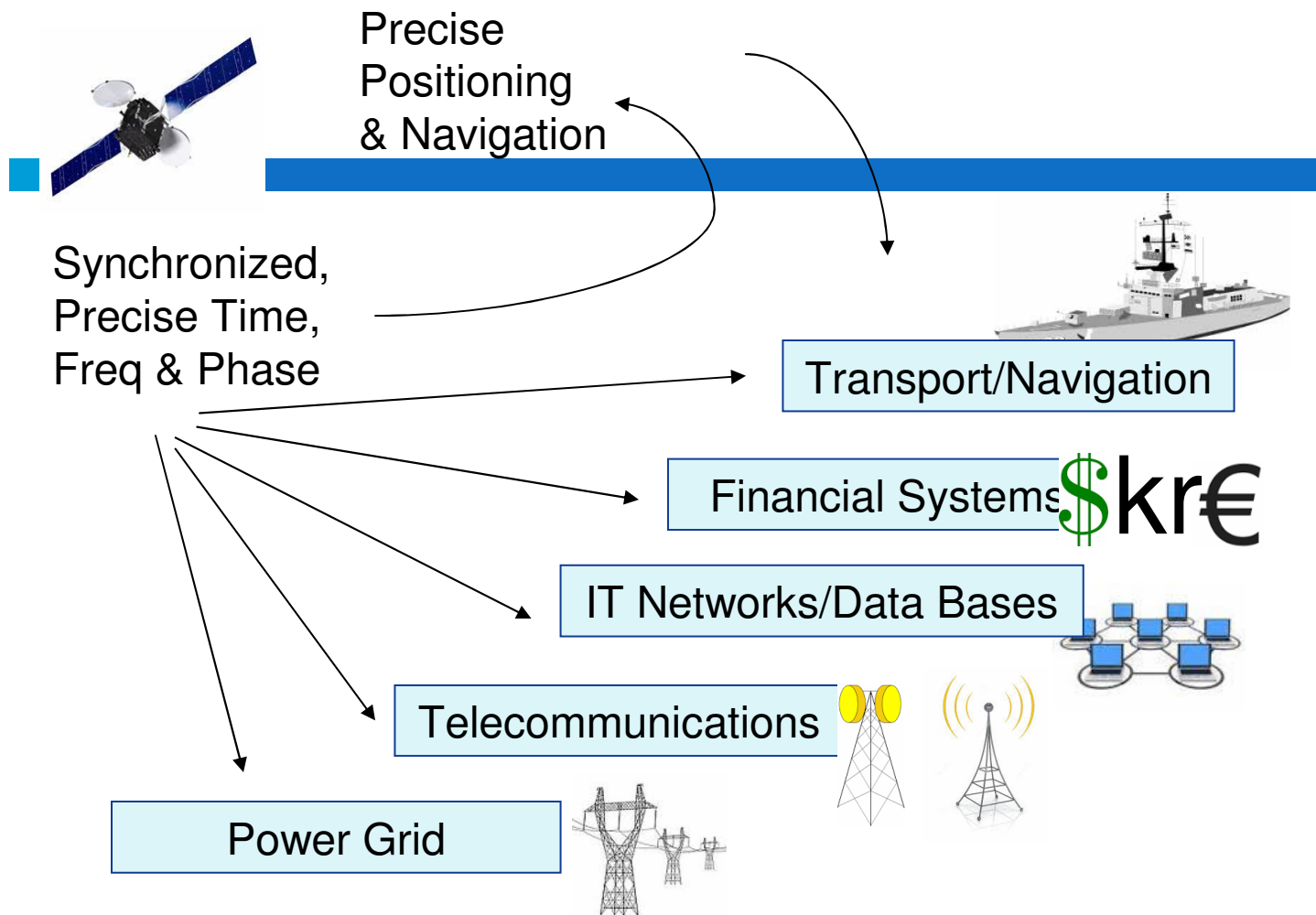
Almost Everything Depends...

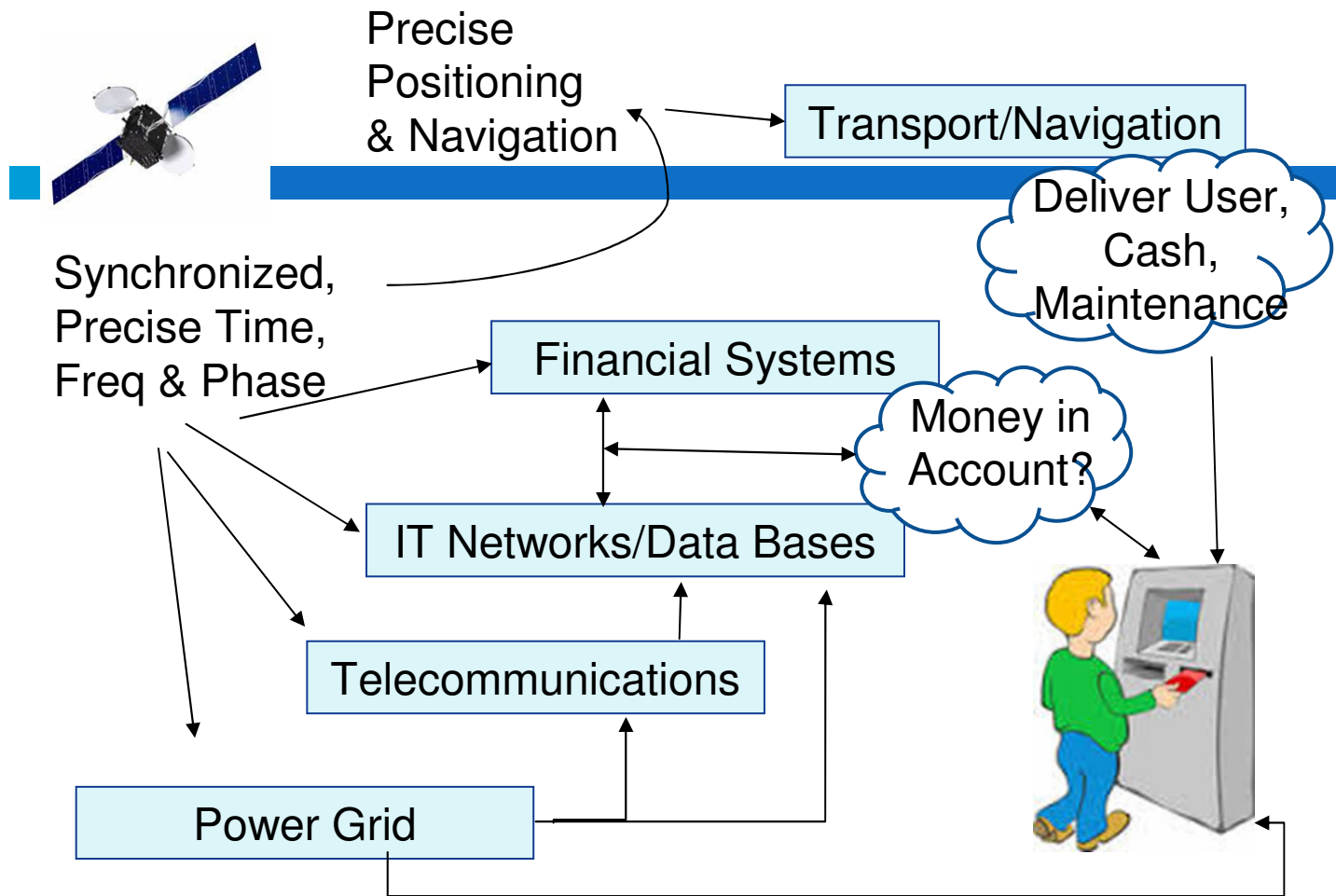
NOV 2015

ICG 10 Boulder, Colorado, USA



Almost Everything
Depends Upon
GNSS!



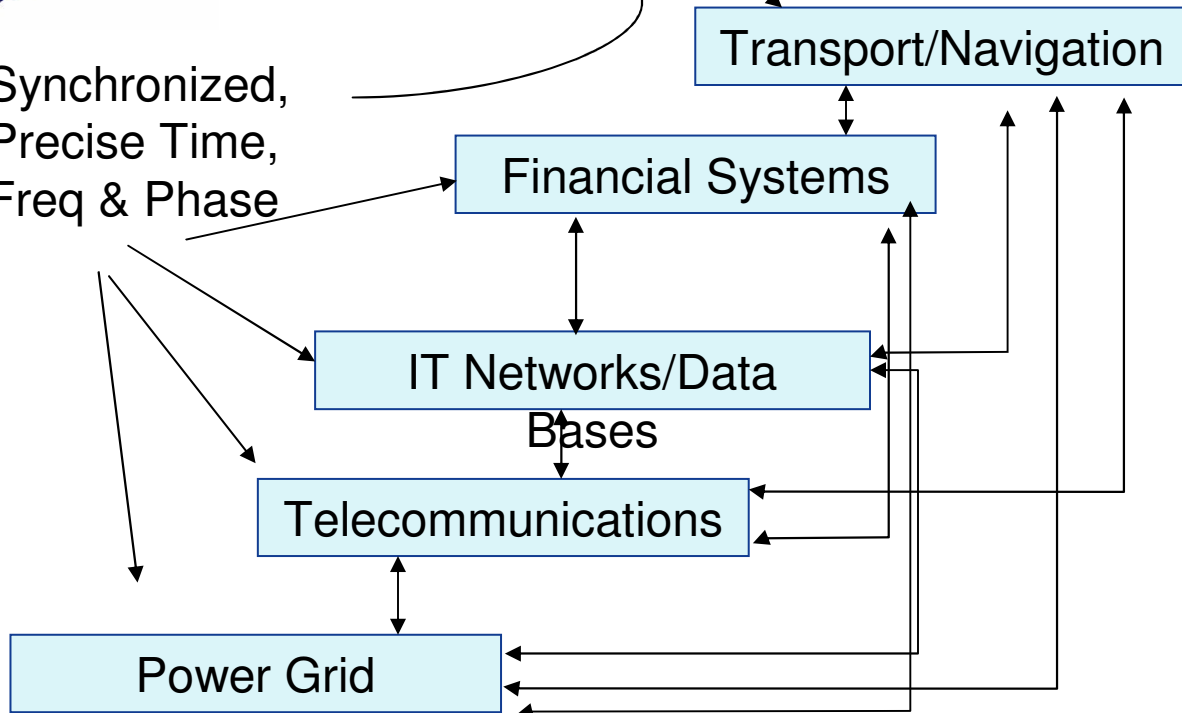


Almost Everything Depends Upon GNSS!



Precise Positioning & Navigation

Synchronized, Precise Time, Freq & Phase



Almost Everything Starts to Fail Without GNSS!



Financial Systems

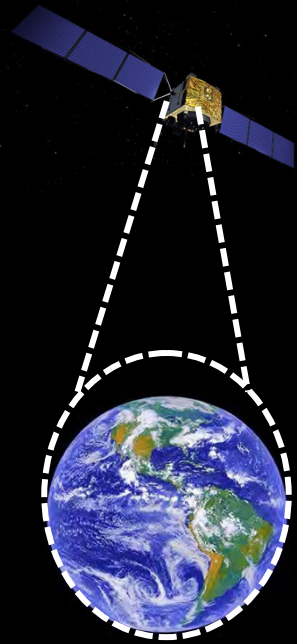
Transport/Navigation

IT Networks/Data
Bases

Telecommunications

Power Grid

7

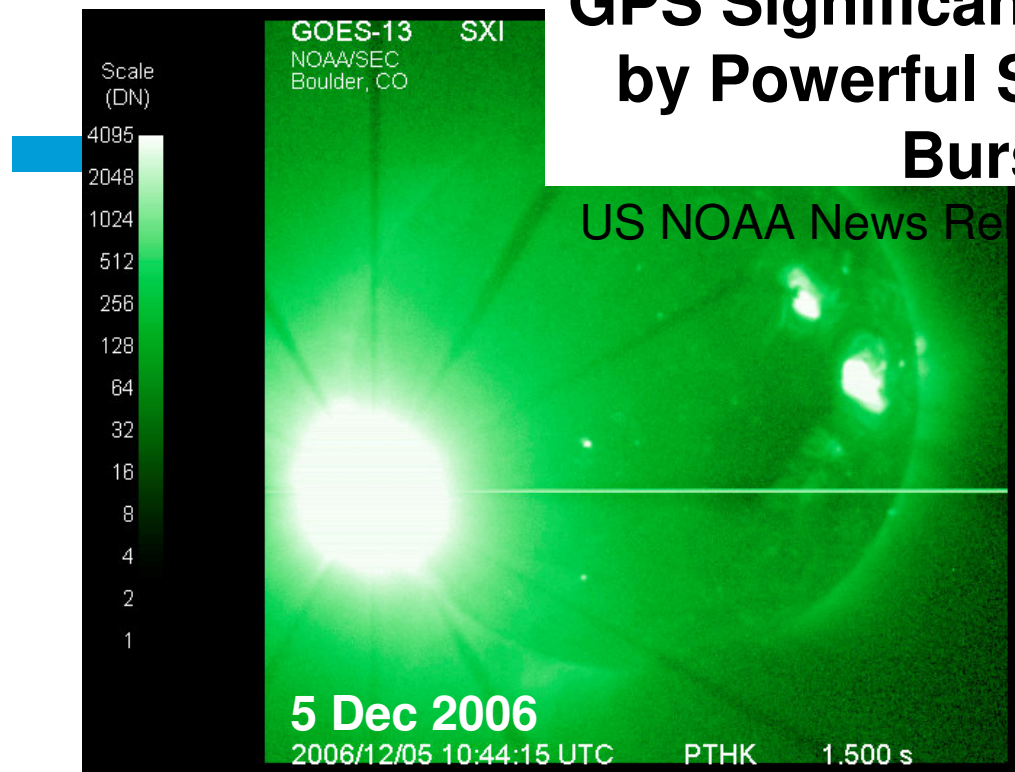


“...a single point of failure...”

Dr. Brad
Parkinson, “Father
of GPS”

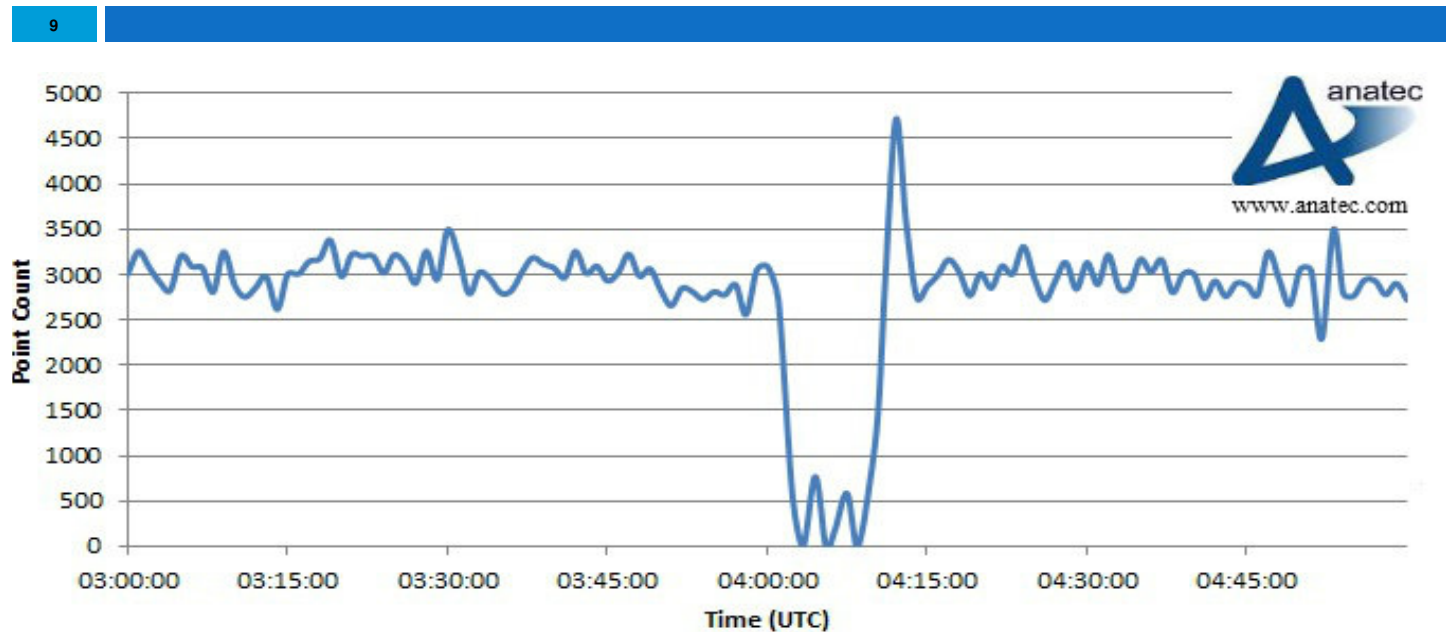
GPS Significantly Impacted by Powerful Solar Radio Burst

US NOAA News Release 4 April 2007

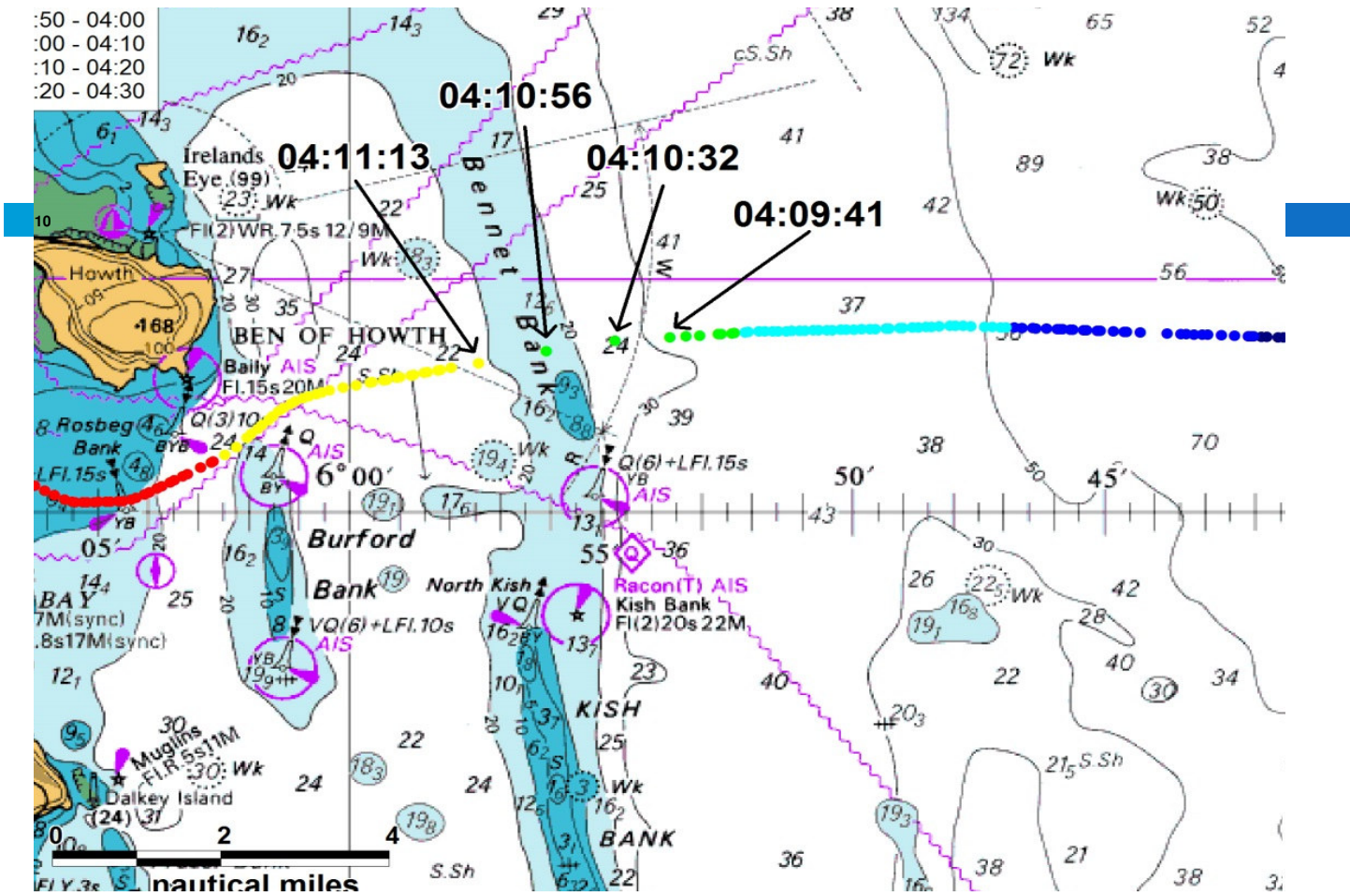


“The burst ... swamped GPS receivers over the entire sunlit side of the Earth.”

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



1 January 2004 - About 5 Hours



≈ 16 km errors reported

***"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...

GPS World

**GLONASS Gone
...Then Back**

InsideGNSS

Engineering Solutions from the Global Navigation Satellite System Community

**GLONASS Suffers
Temporary
System-wide
Outage**





Local Disruptions per Day – Tens of thousands





JAMMER ALL

Free shipping by  or 

* Only for Legal Use

Product Description

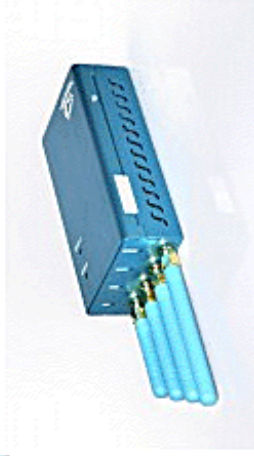
Are you sick of being tracked like a criminal? This certain device is a gorgeous GPS jammer which can totally solve your troubles. The can prohibit signals from tracking your current location; pay a private space for you. All of this owes to the **high power portable GPS (GPS L1/L2/L3/L4/L5) jammer**.

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

Free Shipping

RRP: ~~GBP £110.26~~

Your Price: **GBP £101.43**
 (You save **GBP £8.83**)



SKU: JM110838

Rating:  ([6 product reviews](#))

Shipping: Calculated at checkout

Quantity:



* Only for Legal Use

Product Description

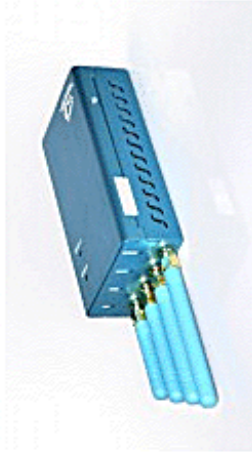
Are you sick of being tracked like a criminal? This certain device is a gorgeous GPS jammer which can totally solve your troubles. The can prohibit signals from tracking your current location; pay a private space for you. All of this owes to the **high power portable GPS (GPS L1/L2/L3/L4/L5) jammer.**

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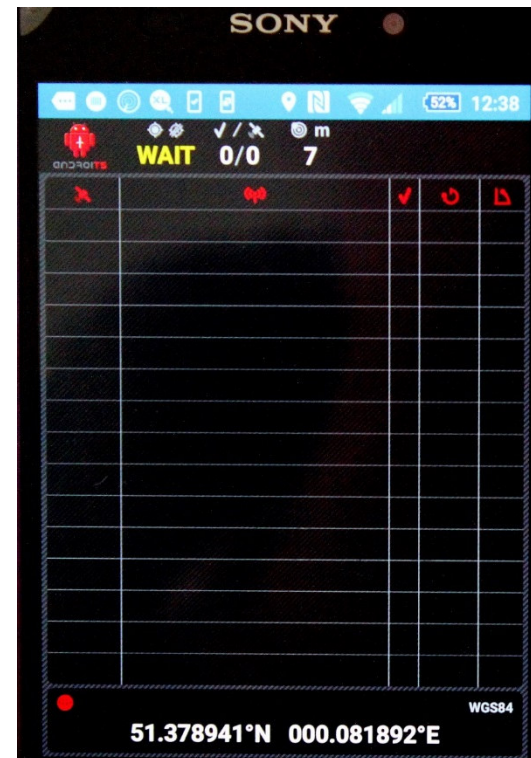
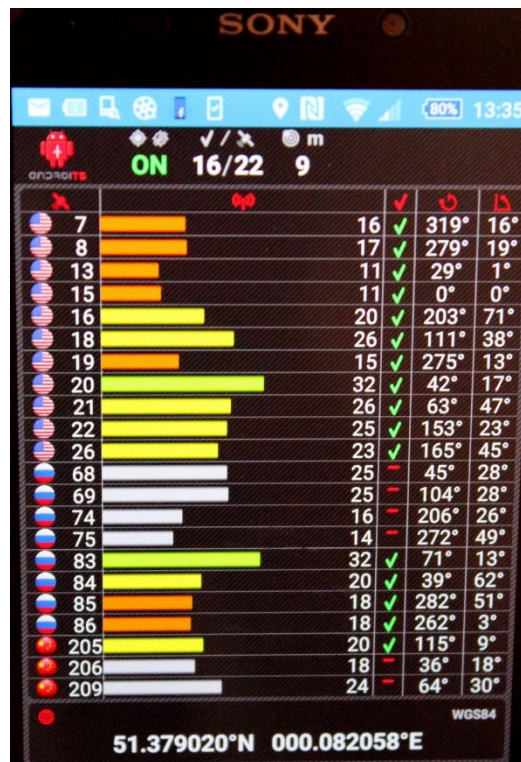
SKU: JM110838

Rating: **★★★★☆** ([6 product reviews](#))

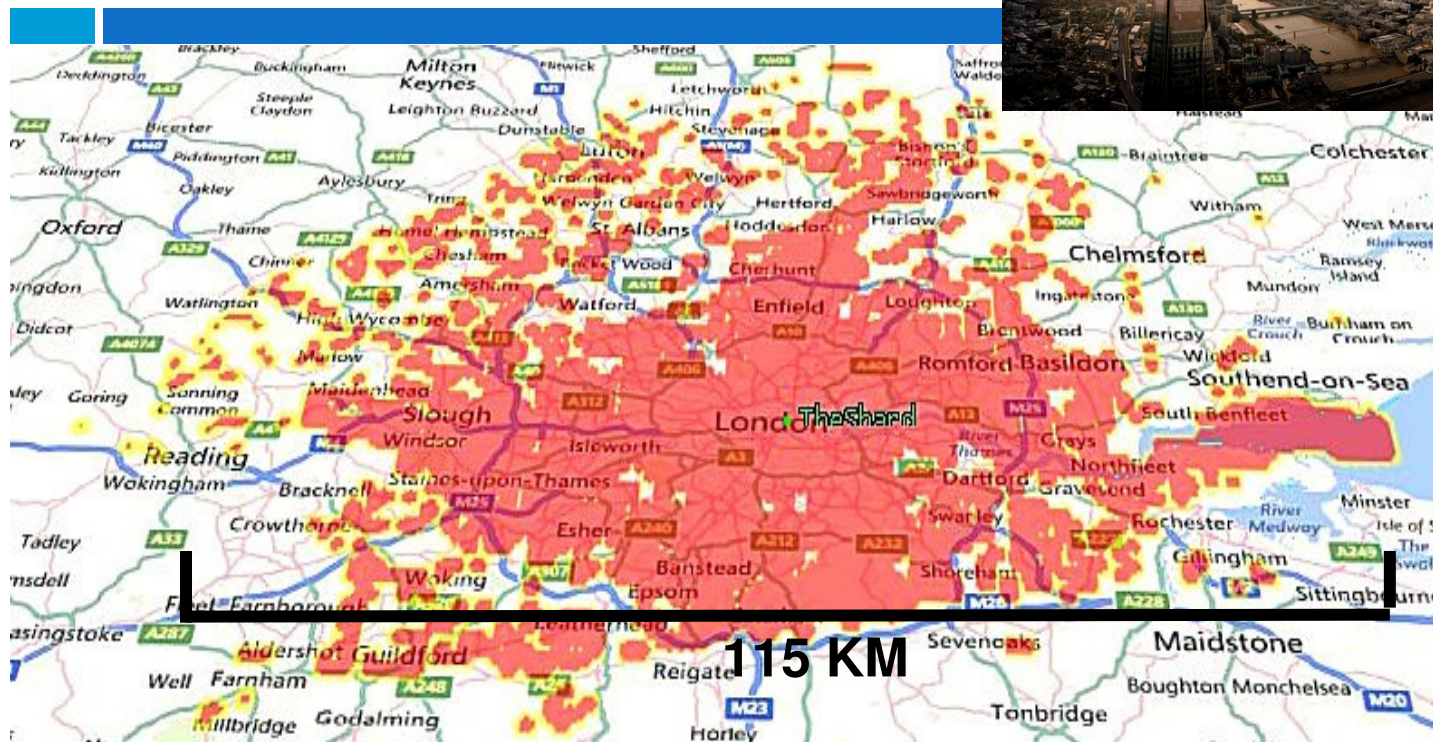
Shipping: Calculated at checkout

Quantity:

Equal Treatment for All



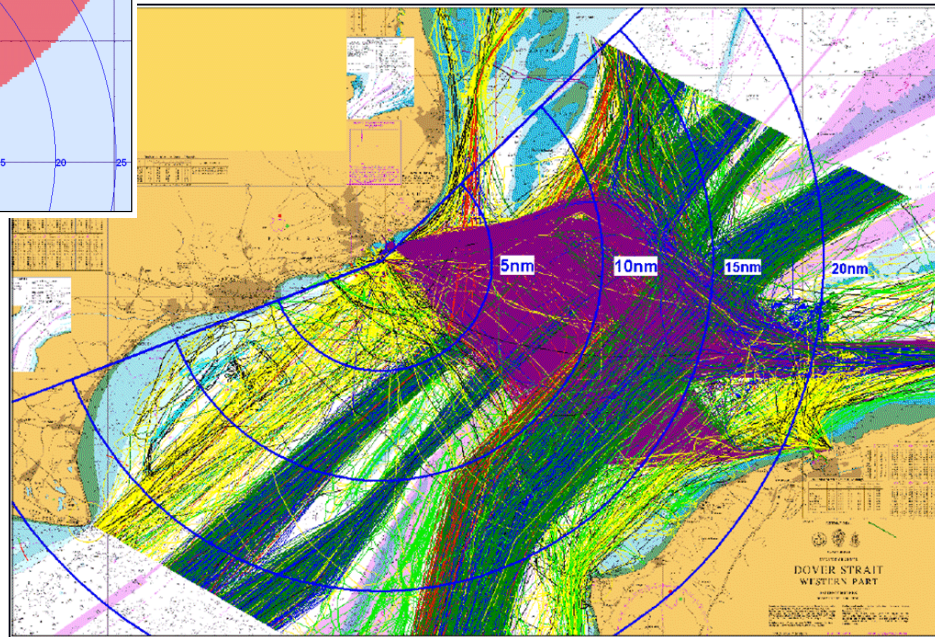
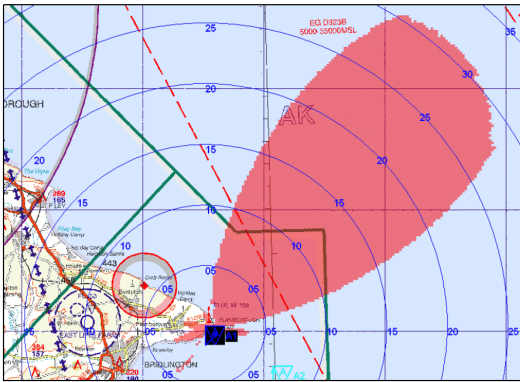
Local Disruption - Simulation



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

Picture: Michael Jones, Chemring TS

Local Disruption – Maritime Trials



Courtesy Prof David Last
& Trinity House
2 Watt Jammer on cliff



European
Commission

Example project - DETECTOR



Detector

Fingerprinting GNSS Threats

Fingerprinting GNSS Interferences “in-the-wild”

Nottingham Scientific Ltd (NSL)

(further details: mark.dumville@nsl.eu.com)

Deploy systems

Detect interference

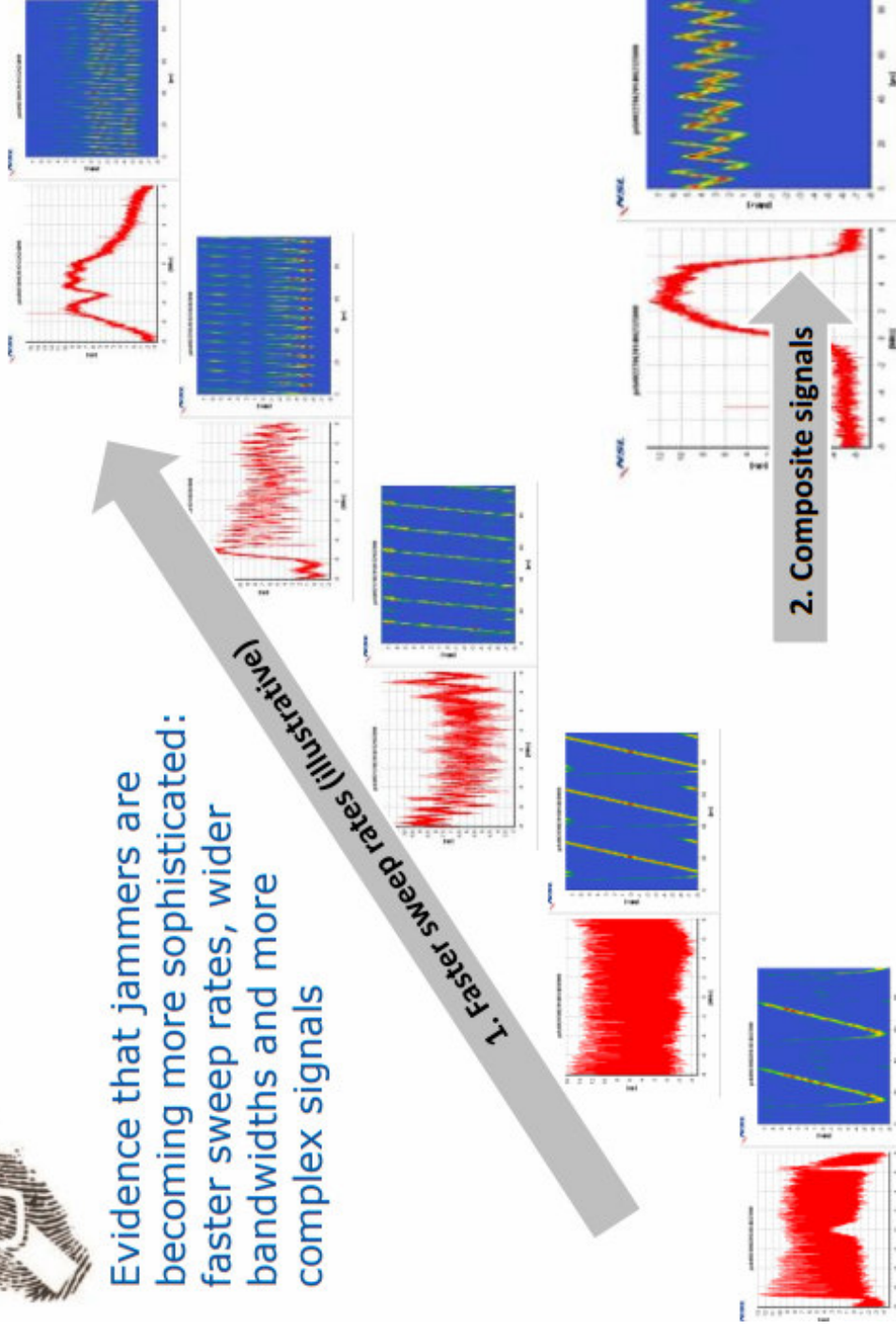
Characterise the threat

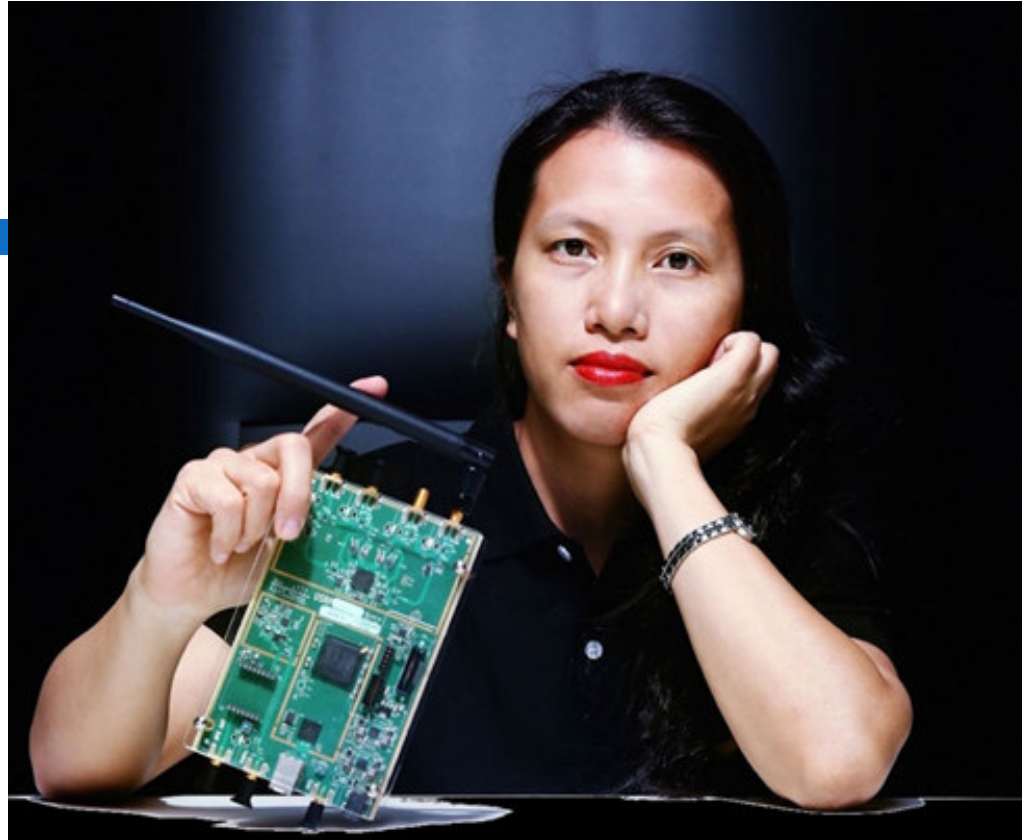


Indications of an evolution...

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

1. Faster sweep rates (illustrative)





Defcon Convention Aug 2015
\$300 Spoofer

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 & Use



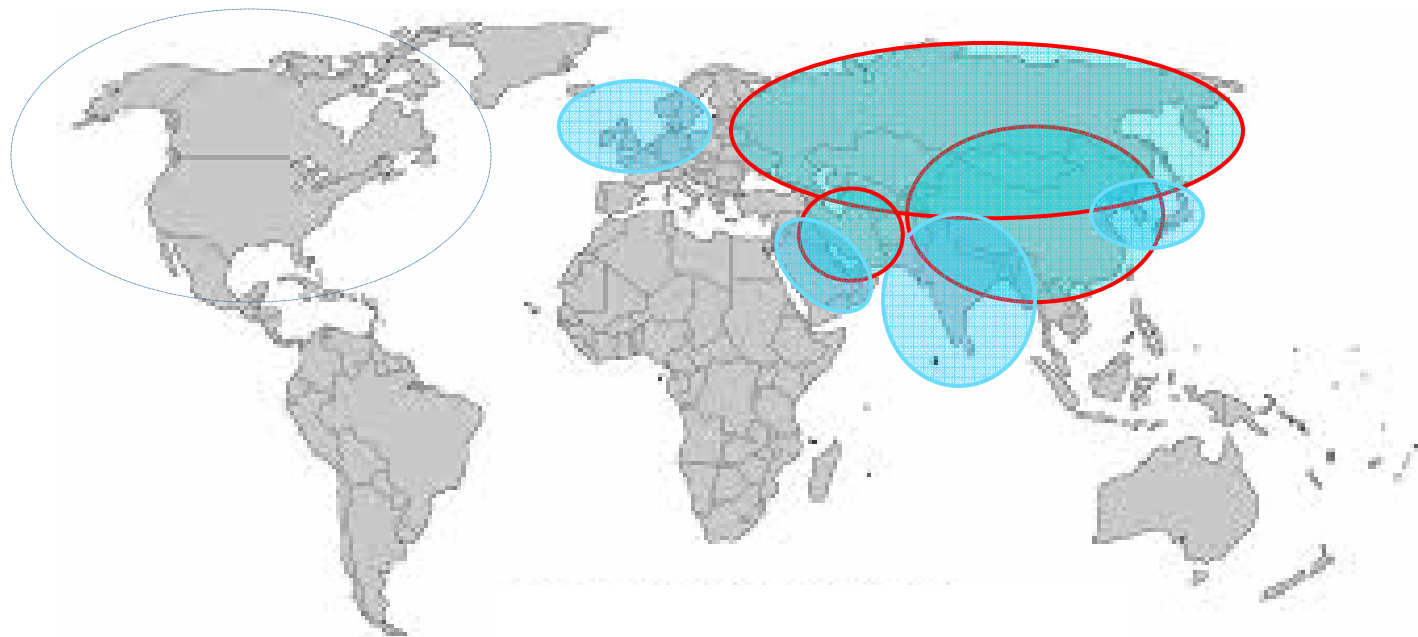
- Develop standards for jam-resistant receivers to include ARAIM and RAIM
- Establish as an industry best practice having more than one source of precise Position, Navigation and Timing (PNT) for critical infrastructure
- For critical infrastructure that uses space-based PNT, establish as an industry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

Augment GPS/GNSS Ser

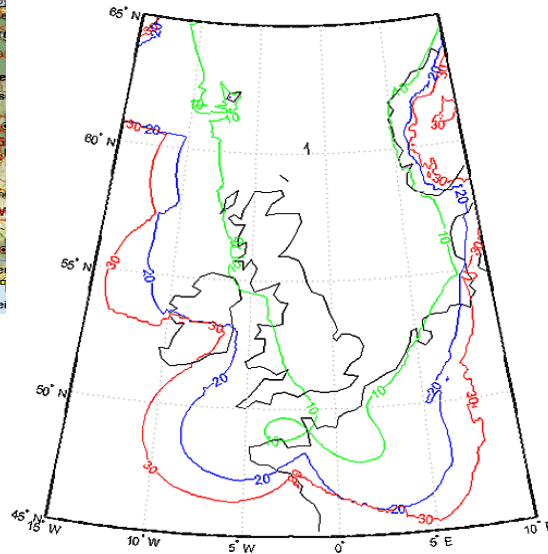


- Provide a wide-area, difficult to disrupt, diverse non-space PNT service (GPS-Earth/eLoran)
- Develop standards for seamless use of this service with space-based PNT
- Encourage development of numerous, complementary terrestrial PNT services to increase resilience (integrated radar, local positioning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

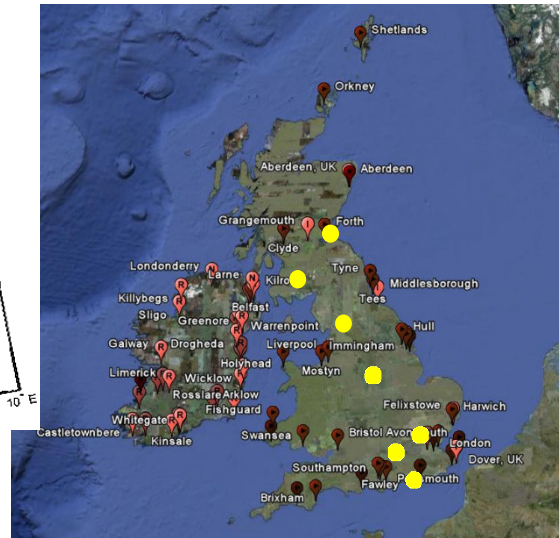
Loran Systems Today



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 – Eide (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

32

“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

33



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

Public Law 113-66
National Defense Authorization Act for 2014

50,000 eLoran Receivers?"

34

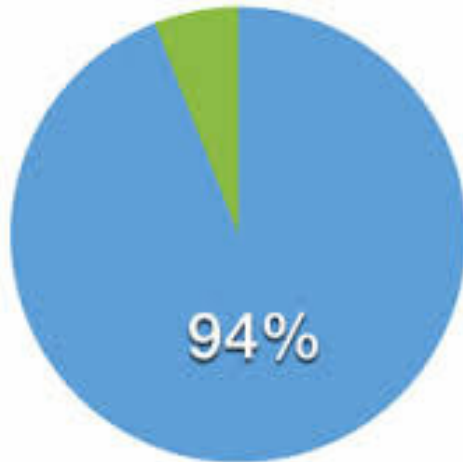
FedBizOpps.G
OV
14 Jan 2015

The screenshot shows a web page from FedBizOpps.gov. At the top is a navigation bar with tabs for Home, Getting Started, General Info, Opportunities (highlighted), Agencies, and Privacy. Below the navigation bar are links for Buyers (Login | Register) and Vendors (Login | Register), along with an Accessibility link. The main content area features the U.S. Army logo and the title '59--Enhanced LORAN (eLORAN) RECEIVERS FOR ARMY PLATFORMS'. Below the title is the Solicitation Number (W56KGY-15-R-ELOR), Agency (Department of the Army), Office (Army Contracting Command), and Location (ACC-APG - Aberdeen Division C). There are three tabs: Notice Details (selected), Packages, and Interested Vendors List. On the right side of the tabs are links for Print and Link. The page is divided into three columns. The left column contains 'Original Synopsis' with the date 'Jan 14, 2015' and time '2:34 pm'. The middle column has two buttons: 'Return To Opportunities List' and 'Watch This Opportunity', and another button: 'Add Me To Interested Vendors'. Below these buttons are fields for 'Solicitation Number: W56KGY-15-R-ELOR' and 'Notice Type: Sources Sought'. The 'Synopsis' section is titled 'REQUEST FOR INFORMATION (RFI) FOR: Enhanced LORAN (eLORAN) RECEIVERS FOR ARMY PLATFORMS' and contains a detailed paragraph: 'THIS IS A REQUEST FOR INFORMATION (RFI) ONLY. THIS REQUEST IS FOR PLANNING PURPOSES, AND SHALL NOT BE CONSTRUED AS A SOLICITATION ANNOUNCEMENT, INVITATION FOR BIDS, REQUEST FOR PROPOSALS, QUOTES OR AN INDICATION THAT THE GOVERNMENT WILL CONTRACT FOR THE ITEMS CONTAINED IN THIS NOTICE. AFTER REVIEWING THE DESCRIPTIONS CURRENTLY POSTED TO FEDBIZOPS, INTERESTED CAPABLE VENDORS ARE INVITED TO PROVIDE RESPONSES. THE GOVERNMENT WILL NOT REIMBURSE RESPONDENTS FOR ANY COST ASSOCIATED WITH THE SUBMISSION'. The right column is titled 'GENERAL INFORMATION' and lists: 'Notice Type: Sources Sought', 'Posted Date: January 14, 2015', 'Response Date: February 13, 2015', 'Archiving Policy: Automatic, on specified date', 'Archive Date: March 15, 2015', 'Original Set Aside: N/A', 'Set Aside: N/A', 'Classification Code: 59 -- Electrical and electronic equipment components', and 'NAICS Code: 334 -- Computer and Electronic'.

RNT Fnd | Jan 2015

US Dept. of Transportation – Request for Comment

Response - 'We need eLoran'

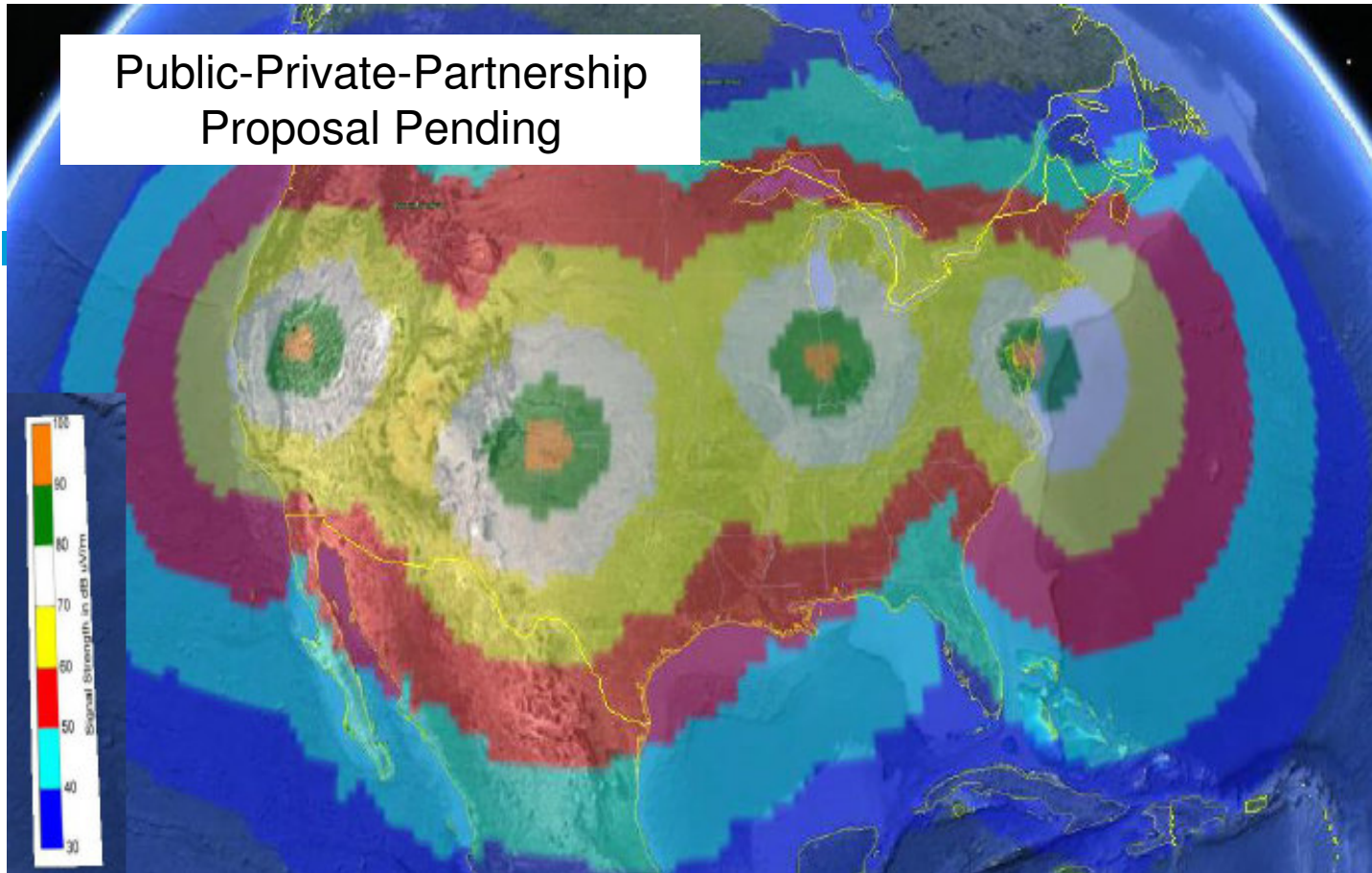


May 2015 – 94%
March 2007 - 93%

Including:

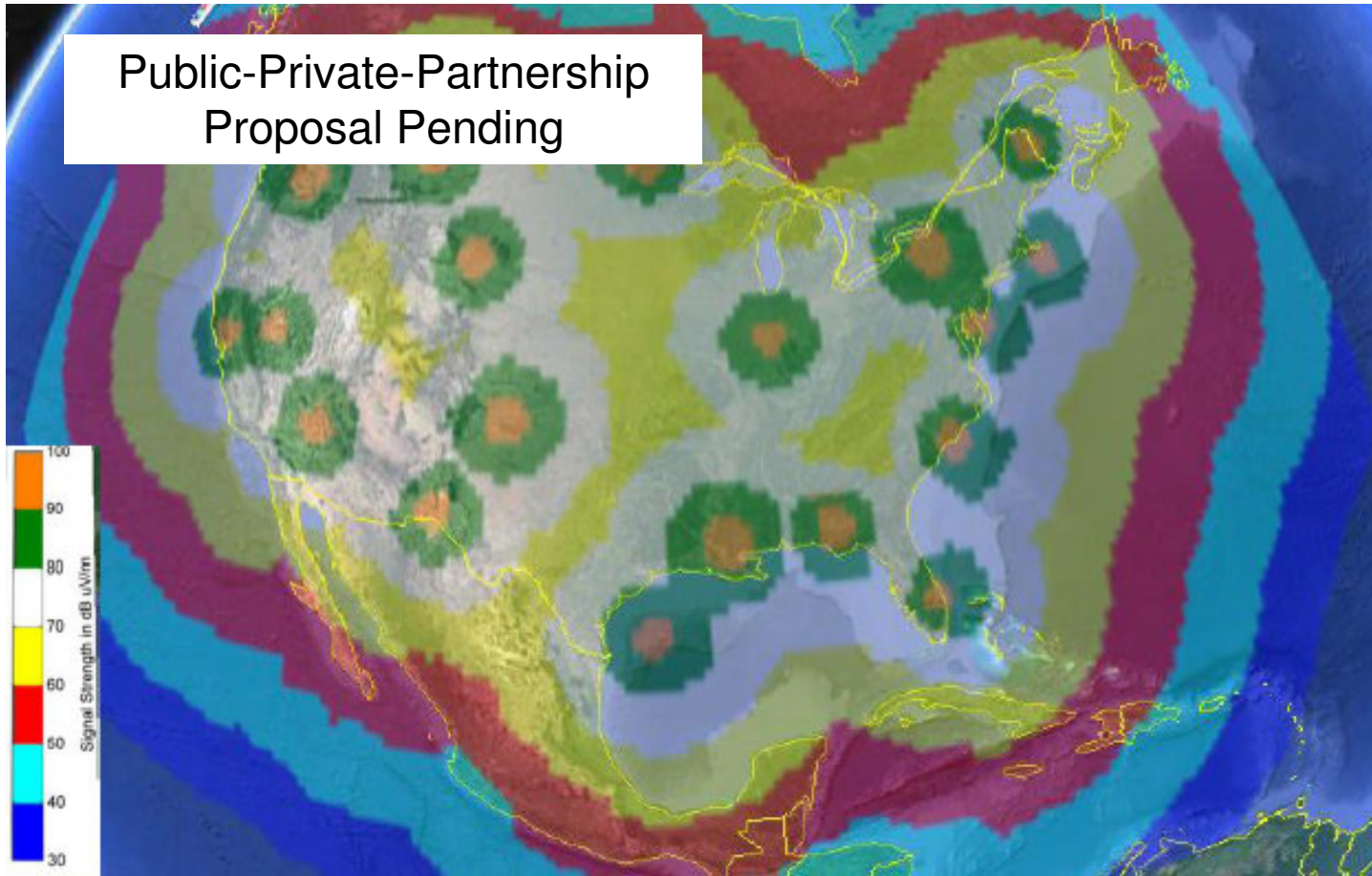
- The GPS Innovation Alliance
- Radio Technical Commission Maritime
- GMDSS Task Force
- Aircraft Owners and Pilots Assn.
- Atlantic Lobstermen's Association
- General Light House Authority
- Australian Maritime Safety Authority

Public-Private-Partnership
Proposal Pending



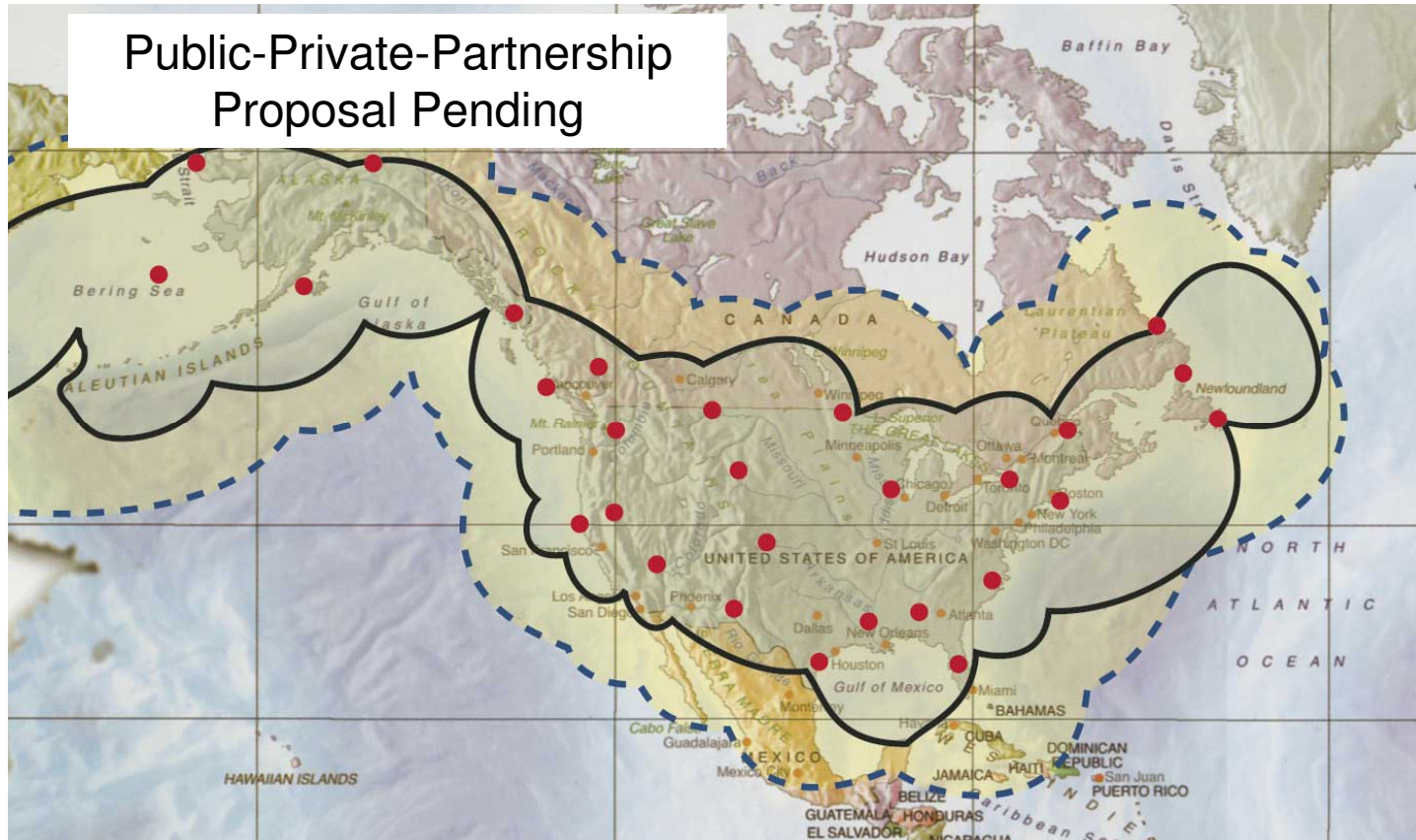
Phase I – Timing Continental US, 4
Sites

Public-Private-Partnership
Proposal Pending



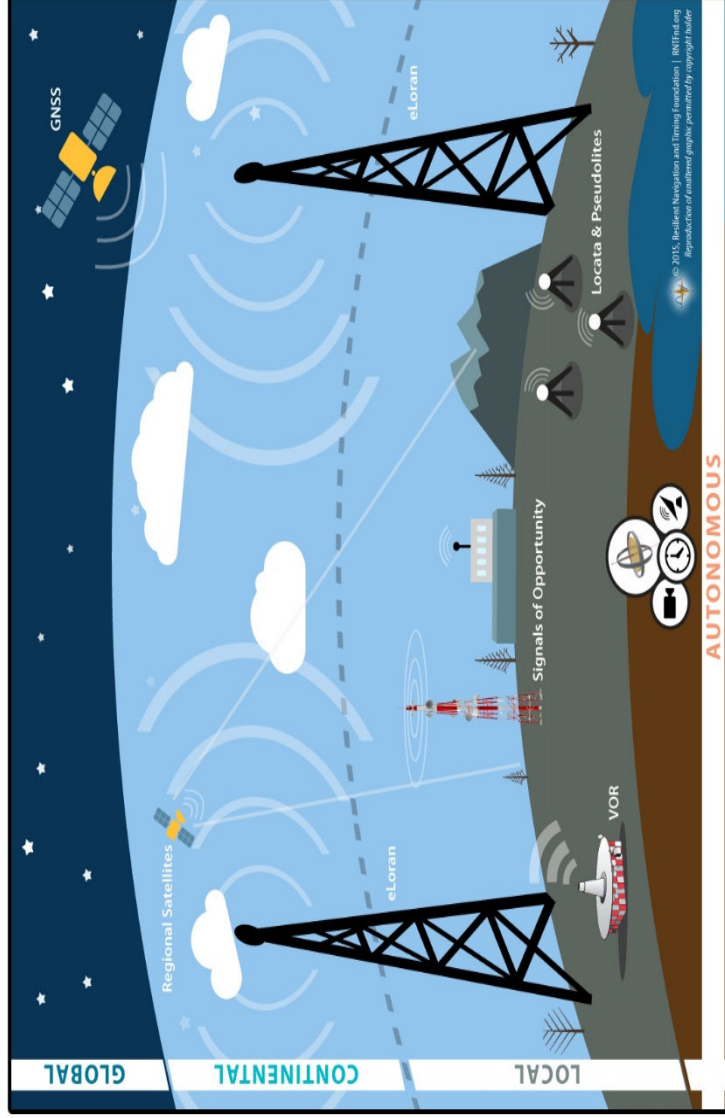
Phase 2 - Positioning, Navigation,
Timing Continental US, 19 Sites

Public-Private-Partnership
Proposal Pending



Phase 3 – PNT, Freq, Phase &
Data

Positioning, Navigation, & Timing (PNT) Multi-Level Resiliency Model



IDENTIFICATION



International Membership

Poland

Netherlands

Norway

Egypt

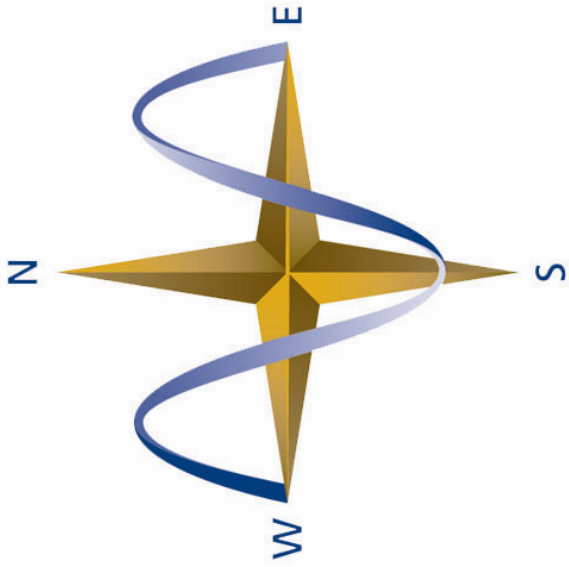
United Kingdom

Australia

Canada

United States

- Charity Registered in Virginia



RESILIENT
NAVIGATION
and TIMING
FOUNDATION



Helping protect critical infrastructure by promoting **resilient** navigation & timing worldwide.

Learn more about **WHAT WE DO**

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 upon satellite systems for precise navigation and timing services. These are exceptionally precise and dependable, yet jamming, spoofing, and other forms of interference appear to be growing in frequency and severity. Neither are space systems immune to severe space weather or cyber-attacks. This has the potential for devastating effects on our lives and economic activity.



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



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In the News

[From Our Blog](#) ★ ★ ★