

A brief extract from a joint paper by those listed below:

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## 2. THE NEW REQUIREMENT FOR RESILIENT OR SECURE POSITIONING, NAVIGATION AND TIMING (PNT)

### 2.1 GNSS VULNERABILITY

The vulnerabilities of GNSS are well known and have been documented by the US Department of Transportation's Volpe Center [2] and the General Lighthouse Authorities of the United Kingdom and Ireland (GLAs) [3] among others.

In 2008, the European eLoran Forum set out the strategic importance of positioning, navigation and timing systems (PNT) [4] that underpin the European critical infrastructure (e.g. power systems, telecommunications, transport and finance) and stressed the need for three PNT systems for making European critical infrastructure robust and resilient: GPS, Galileo and eLoran.

Before 2008, GNSS vulnerability assessments generally considered unintentional interference as being the major culprit because there was little evidence of deliberate interference in the civil sector.

**This is no longer the case.**

### 2.2 THE MARKET FOR JAMMERS

The impact of GNSS denial whether by intentional or unintentional interference is well understood.

The GLAs' trials have shown how significantly GPS jamming adversely impacts on the safety of navigation on a modern vessel and this is a major concern for e-Navigation and maritime situational awareness based on the Automatic Identification System (AIS) [5].

The San Diego jamming incident (there are others) showed the effect of jamming on telephone switches, cellular phones and hospital paging systems [6].

One of the most significant developments in 2008/9 has been the exponential increase in the number of low-powered GNSS jammers deployed maliciously in the civil sector [7].

The GLAs now await their deployment in the maritime environment with the potential of chaos at maritime pinch-points around the World like the Dover Straits.

In February 2008, the US Department of Homeland Security (DHS) announced that it was starting to deploy eLoran based on the need for a GPS backup and eLoran's ability to mitigate any safety, security or economic effects of a GPS outage or disruption [8]. This decision remains valid and is as applicable in Europe as it is in the US.

## 2.3 THE NEW REQUIREMENT

An increased awareness of GNSS vulnerability, jamming and its impact means that new markets for resilient, robust or secure PNT are emerging: telecommunications; general aviation; professional and recreation use as well as search and rescue in the maritime sector; and defence, homeland security and law enforcement.

In many sectors, this new requirement for resilient, robust or secure PNT will secure a wide variety of GPS-enabled industrial and user benefits worldwide that have resulted from new applications and services.

A key cross-sector benefit has been manning efficiency savings arising from system integration and automation. In many cases, automation has resulted in a change of operational concept where reversion to the previous operational concept is almost impossible without increasing the number and skill of the people involved. Secure PNT will protect these manning efficiencies when GPS is unavailable. The immediate benefit is economic and for some applications (e.g. maritime domain awareness) there are also safety and security benefits.

[2] John A Volpe National Transportation Systems Center, Vulnerability Assessment of the Transportation Infrastructure relying on the Global Positioning System, Final Report, August 29 2001.  
([http://www.navcen.uscg.gov/GPS/geninfo/vulnerability\\_assess\\_2001.pdf](http://www.navcen.uscg.gov/GPS/geninfo/vulnerability_assess_2001.pdf))

[3] General Lighthouse Authorities of the United Kingdom and Ireland The Case for eLoran, May 2006.  
([www.nlb.org.uk/news/PR2006/eLoran\\_Press\\_Release.pdf](http://www.nlb.org.uk/news/PR2006/eLoran_Press_Release.pdf))

[4] European eLoran Forum, eLoran: Securing Positioning, Navigation and Timing for Europe's Future, April 2008.  
([http://www.nlb.org.uk/news/pdf/eloran\\_pnt.pdf](http://www.nlb.org.uk/news/pdf/eloran_pnt.pdf))

[5] Grant A, Williams P, Ward N and Basker S (2009). GPS Jamming and the Impact on Maritime Navigation. Journal of Navigation, 62 , pp 173-187

[6] Jewell D, Ubiquity and the Joint Navigation Conference, GPS Insights, GPS World, April 2007  
(<http://mg.gpsworld.com/gpsmg/article/articleDetail.jsp?id=418420>)

[7] Last J.D., 'Silent Witness', Navigation News (Royal Institute of Navigation), pp10-13, January/February 2009  
([www.professordavidlast.co.uk/cms\\_items/f20090402085322.pdf](http://www.professordavidlast.co.uk/cms_items/f20090402085322.pdf))

[8] US Department of Homeland Security, Statement from DHS Press Secretary Laura Keehhner on the adoption of national backup system to GPS, February 7, 2008.  
([http://www.piersystem.com/posted/786/LO\\_RAN\\_FINAL\\_Release.191614.pdf](http://www.piersystem.com/posted/786/LO_RAN_FINAL_Release.191614.pdf))