

Protecting GNSS services in the EU and beyond



Mark Dumville / William Roberts
Nottingham Scientific Limited [NSL]



NSL Company Overview

- NSL is a UK based high-tech small-to-medium sized enterprise.
- NSL specialize in the use of satellite navigation through shaping the use of Global Navigation Satellite Systems (GNSS) within **critical applications** such as those that:
 - directly affect the **safety** of citizens
 - are key in terms of national **security**
 - affect the way **business** is conducted.
- NSL develop and deliver GNSS-based services, systems, solutions, and intellectual property ensuring positioning and navigation is accurate and reliable, safe and secure, resilient and robust.



vulnerabilities

errors

events

losses

drifts

ATTACKS

risks

threats



Denial of service

incidents

outliers

BIASES


faults

anomalies

failures

EU governments use GNSS to deliver policy...

Slovakia has experienced the largest extension of road tolling networks worldwide so far.



Slovakian RUC Network

- RUC network until 31/12/2013
- RUC network added from 01/01/2014

Source: SkyToll

In addition to Slovakia, Germany, Switzerland and Hungary have successfully implemented GNSS-based tolling. Other countries are also leveraging the benefits:

- Belgium and Russia have launched similar projects implementing GNSS-based schemes.
- France, Finland, Bulgaria, Denmark, The Netherlands and Lithuania have all declared their interest in GNSS-based schemes.



GNSS based Truck tolling



Remotely Piloted Aircraft Systems



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Offenders to be tracked by satellite under new pilot scheme

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Up to 1,500 offenders will be tracked by a satellite tagging system under a Ministry of Justice pilot scheme.

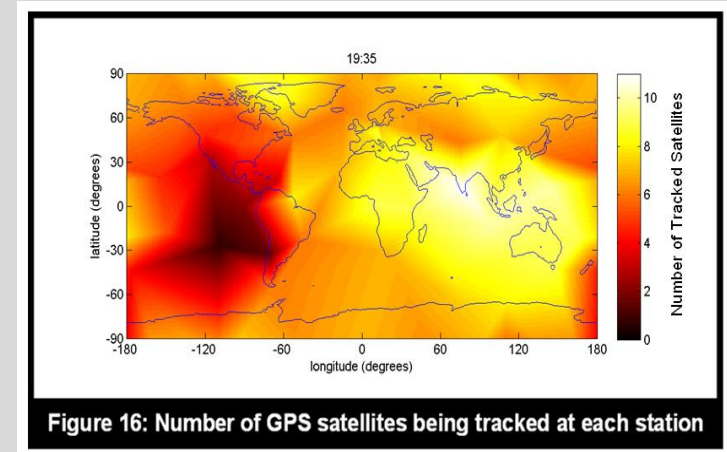
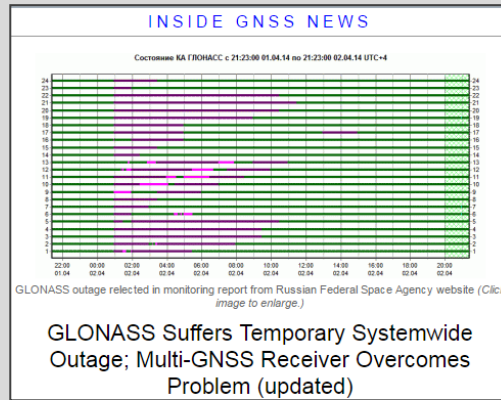
Offender monitoring

GNSS based road user charging



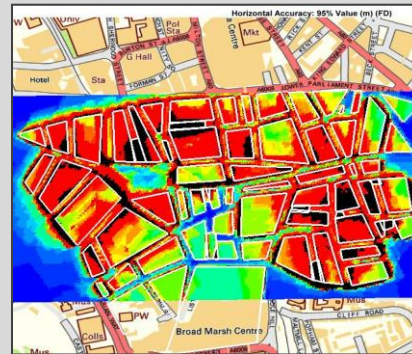
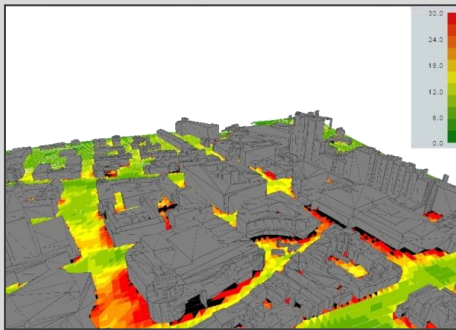
Fisheries Policy

Governments trust GNSS to deliver, however...



1. GNSS system issues

2. Solar Flare



3. Masking, obscurations and blockages

4. High ionospheric activity

Governments must defend against threats...



Fines up to 50,000 euros for truckers with GPS jammer to avoid toll

Aanbesteden Delen Tweet G+ 13 COMMENTS

By Editor
24/01/17 - 15u31 Source: Belga
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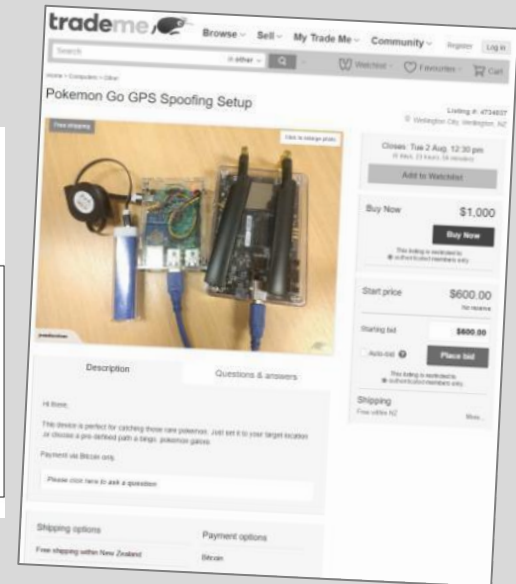


TOLL Truckers who use a GPS jammer to avoid the toll, risking fines up to 50,000 euros. That is informed today at Viapass, the government agency that coordinates the kilometer charge. Moreover, there are three ways in which the fraud is detected: via fixed porches above the road, and flexible control over the mobile control units. In addition, irregularities can be noted in the billing says Edward Claessens of Viapass.



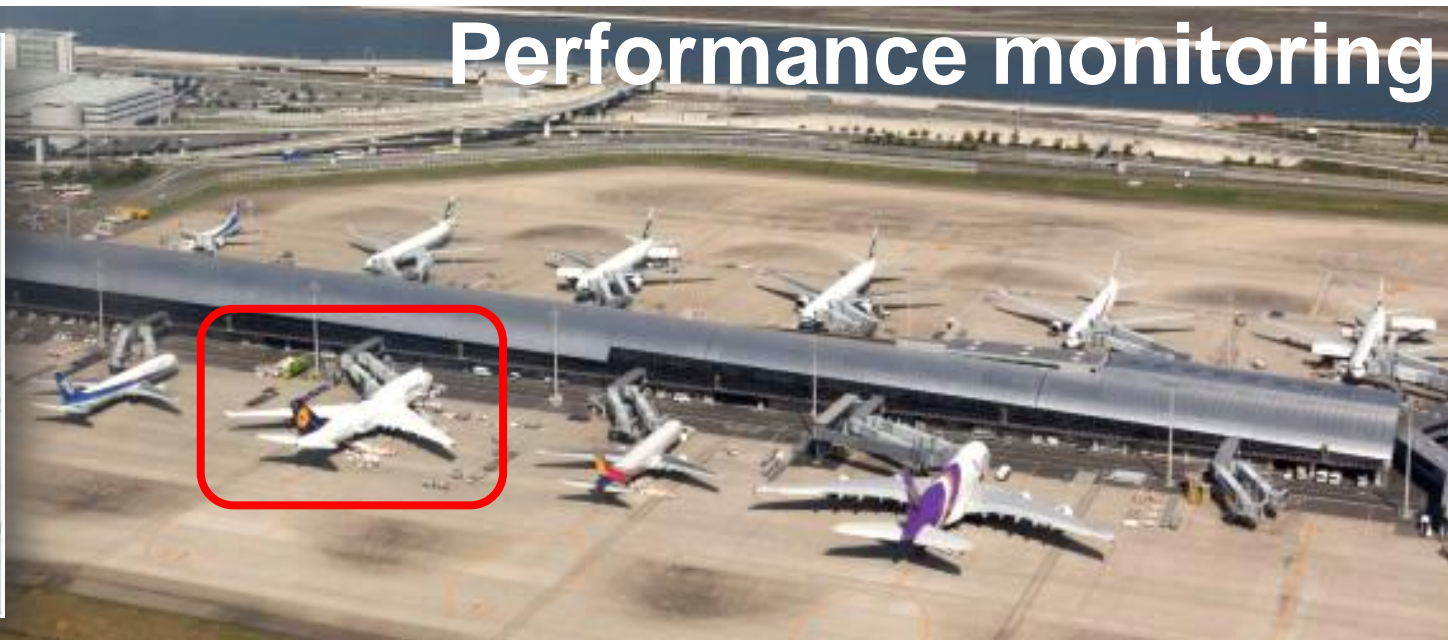
HPE Security Research

Map is not a territory: How to spoof GPS on a shoeing
DeepPebbles Sensor Security Researcher



(1) NSL ensures GNSS is safe...

Performance monitoring



- Use of **CORS GNSS** data
- Assessing performance of GNSS for airspace
- Meeting International Standards (eg, ICAO)
- Accuracy, Integrity, Availability and continuity



(2) NSL ensures GNSS is available...



Interference monitoring



- **Detect, characterise, locate GNSS jammers**
- Identify the impact of interferences on GNSS
- Critical National Infrastructure and sites



(3) NSL protects GNSS spectrum...



Not permitted in some countries



spectrum enforcement



- spectrum compliance monitoring
- geolocalisation of RF interferences and jammers
- major transport networks and infrastructures



(4) NSL ensures GNSS can charge users...



- Integration of GNSS, mapping and charging zones
- Improving GNSS performance
- Identifying problems in map databases
- pay as you drive insurances, telematics



(6) NSL ensures GNSS receivers are fit for use...



Compliance Testing



- Qualification testing of GNSS receivers for governments
 - Fisheries, justice, avionics, road transport
- Support development of test specifications and standards

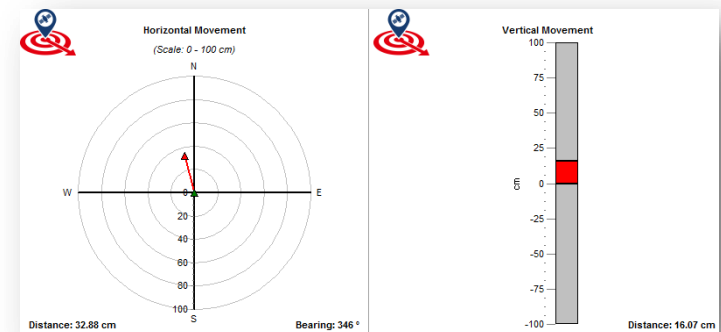


(5) NSL monitors critical infrastructure...

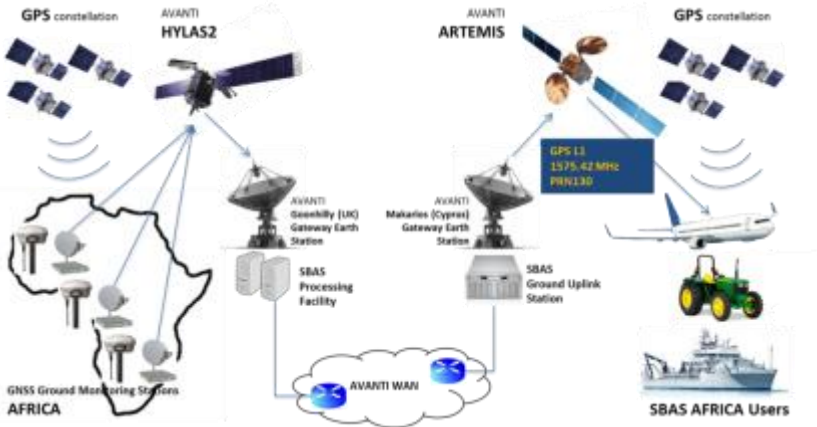
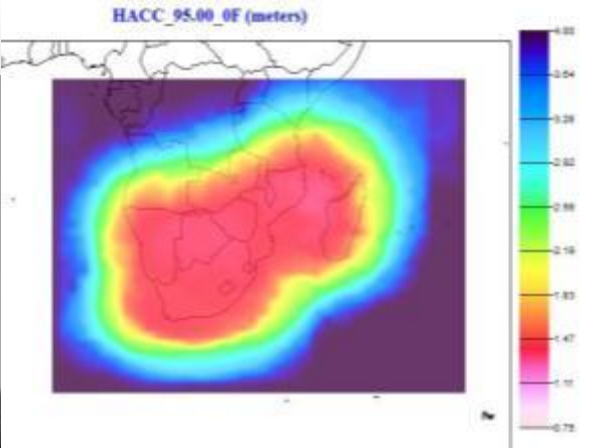


Condition monitoring

- **Cost effective RTK for mass deployment**
- Stability monitoring and movement detection
- 3D movements, combined GNSS and IMU
- Geotechnical earthworks and structures



(6) NSL provide fit-for-purpose affordable GNSS...



- **multi-GNSS, multi-Frequency stations**
- rapid deployment of GNSS infrastructure
- tests and pilots (eg EGNOS in Africa)

Thank you for your attention



mark.dumville@nsl.eu.com

william.roberts@nsl.eu.com

Nottingham Scientific Limited [NSL]



NSL
www.nsl.eu.com

EU-Japan GNSS Mission, Tokyo, 7-10 March 2017