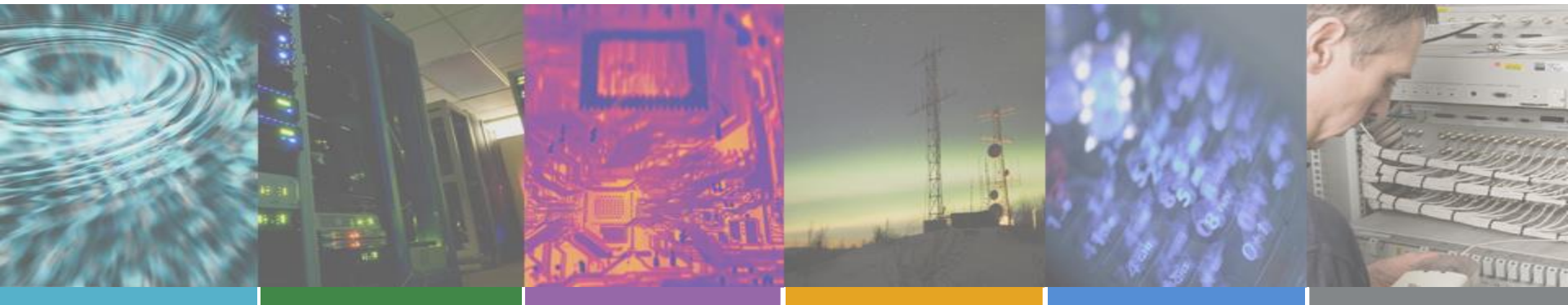


# Detecting GPS Jammers “Gone in 20 Seconds”

## *Update on UK Research into the GPS Jamming Threat*



CGSIC Annual Conference  
8<sup>th</sup> September 2014

Prof. Charles Curry BEng, CEng, FIET  
Chronos Technology Ltd

# Presentation Contents

- Background Research
- Black Swan Threats
- Who is What Jamming?
- Where to buy your jammers
- GPS Jammer Detection Solutions
- Testing
- What Next?

# The SENTINEL Project – 2011 - 2013



- GNSS **SE**rvices **N**eeding **T**rust **I**n **N**avigation, **E**lectronics, **L**ocation & timing
- 2011: UK Government Funded R&D Project, 2 years, ~£1.5m
  - through **Technology Strategy Board**
  - ***“Trusted Services”*** Call
  - Competition – Autumn 2010
- Research to establish the extent to which GPS signal are being jammed by commercially available jammers.





# The SENTINEL Partners



- ACPO-ITS – Association of Chief Police Officers
  - User Community – Law Enforcement
  - Brings other Government agencies into the collaboration
- GLA – General Lighthouse Authorities
  - User Community - Maritime
  - eLoran
- University of Bath - Dept. of Electrical & Electronics
  - GPS & Space Weather
- Ordnance Survey
  - User Community – Land Geolocation
- NPL – National Physical Laboratory
  - Time, UTC Traceability
- Thatcham Vehicle Security
  - Certification of safety critical services
- Chronos Technology Ltd
  - GAARDIAN Research
  - SENTINEL Project Leader



# Project AJR – Just Starting



**Automatic Jamming Recognition**  
Colocation of GPS Jamming  
Detection with ANPR



*Photos: With the permission of the Commandant, Sennybridge Training Area*

# Headlines!



**TechWeek Europe**  
Enhancing business with technology – in association with eWeek.com

HOME GALLERIES EURO STORY SECURITY CLOUD SMB SERVERS MOBILE GREEN  
NEWS OPINION IT LIFE WHITE PAPERS WEBCASTS VIDEO QUIZ POLLS IT JOBS

**TECH SUCCESS AWARDS**  
The Winners have been announced.  
Click here to see the names of the winners.

**sentinel** Illegal GPS Jammers Are Widespread, Study Finds  
Research by the Government-backed Sentinel consortium shows dangerous GPS jammer use in the UK is on the rise

On February 23, 2012 by Max Smolaks 26

Illegal systems which jam GPS are widely used in the UK, according to a new study conducted in six months.

The Sentinel study, a £1.5m government project run by a consortium that includes the police and the National Physical Laboratory, found 60 violations in six months by monitoring just 20 roadside locations, according to a paper presented at the *GNSS Vulnerability 2012: Present Danger, Future Threats* conference held at the National Physical Laboratory yesterday.

**BBC** Sign in News Sport Weather iPlayer TV Ra

**NEWS TECHNOLOGY**

Home World UK England N.Ireland Scotland Wales Business Politics Health Education Sci/Env

22 February 2012 Last updated at 00:01

Share

**Sentinel project research reveals UK GPS jammer use**

By Chris Vallance  
BBC News

**The illegal use of Global Positioning System (GPS) jammers in the UK has been revealed in a groundbreaking study.**

GPS jammers are believed to be mostly used by people driving vehicles fitted with tracking devices in order to mask their whereabouts.

In one location the Sentinel study recorded more than 60 GPS jamming incidents in six months.

The research follows concern that jammers could interfere with critical systems which rely on GPS.

The project was the work of a consortium which included Acpo and the National Physical Laboratories

Related Stories

# Black Swan Events



Nassim Nicholas Taleb

- **Surprise to the observer**
- **Significant impact**
- **With hindsight – could have been predicted**

**Not necessarily a surprise to everyone**

# Recent Black Swan Events

- GPS SVN/PRN23
  - 1<sup>st</sup> Jan 2004 Rb failure, massive loss of GPS timing
- GPS - The “San Diego Incident”
  - 2004 - US Navy Own Goal – CDMA Network down 3 hours
- GPS - North Korea
  - 2010 & on-going! South Korea suffers wide area GPS Jamming
- GPS - The “Newark Incident”
  - 2012 - White Van man on I95, Honeywell “SmartPath” GBAS
- Glonass
  - 1<sup>st</sup> April 2014 Failure of all sats for 11 Hours, Bad ephemerides upload
  - 14<sup>th</sup> April 2014 8 sats set unhealthy for 30 minutes
- Galileo
  - Failure of GSAT104 on 27<sup>th</sup> May 2014
  - GSAT 105 and 106 in wrong orbit – Aug 2014



# GPS Jamming Assisted Crime

- Top end vehicles
  - Doors open in 10 seconds
  - Jammer on back seat
  - **Gone in 20 seconds!**
- Plant
  - Jammer in cab
  - Drive away
  - Park in container for export



# Most Popular UK Van Target!

## Mercedes Sprinter Vans



Photo courtesy of Hampshire Police

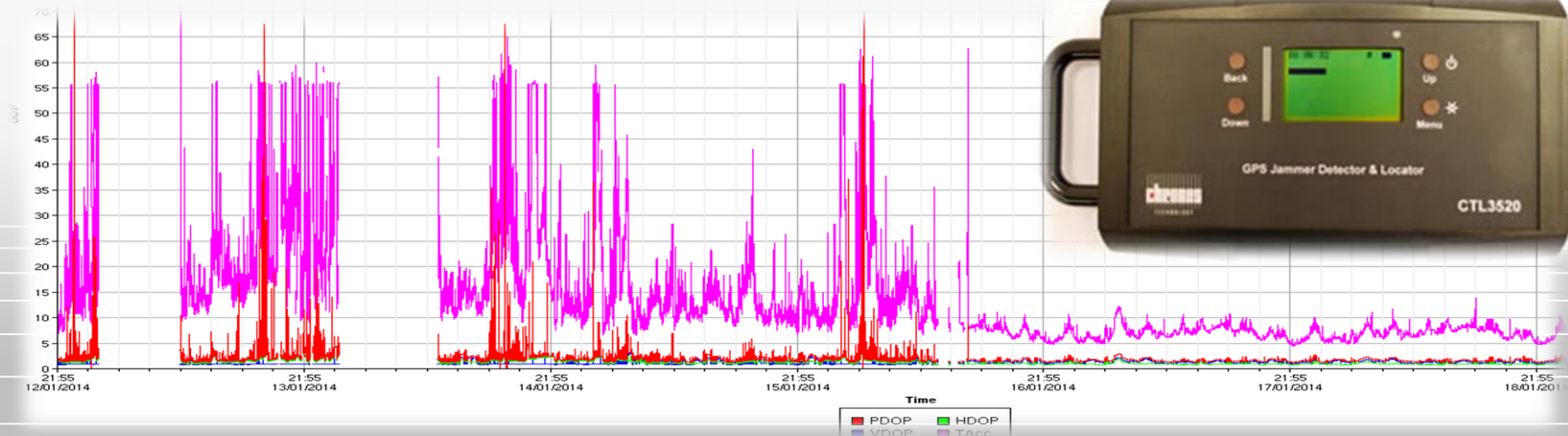
# Unauthorised Truck Journeys



Truck driver uses Jammer so  
he can sleep at home not at  
the Highway Truck-Stop  
Cell Site off-air for 8 hours!!



# Rogue Antennas















# Where to buy Jammers

- Over 50 active Chinese Web Sites
- Power ~ 100mW to 50W!



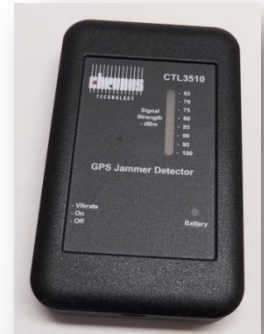
« Previous Pages: 1 2

|   |   |   |   |
|---|---|---|---|
| <p>Free Shipping</p>  <p>High Power 6 Antenna Cell Phone, GPS, WiFi Jammer</p> <p>GBP £178.09</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p> <p>Add To Cart</p>                      | <p>Free Shipping</p>  <p>High Power 6 Antenna Cell Phone, GPS, WiFi, VHF Jammer</p> <p>GBP £178.84</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p> <p>Add To Cart</p>                 | <p>Free Shipping</p>  <p>High Power 6 Antenna GPS, WiFi, VHF, UHF and Cell Phone Jammer</p> <p>GBP £178.84</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p> <p>Add To Cart</p> | <p>Free Shipping</p>  <p>High Power 8 Antenna Cell Phone, 3G, WiFi, GPS, Jammer</p> <p>GBP £198.85</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p> <p>Add To Cart</p> |
| <p>Free Shipping</p>  <p>High Power Handheld Portable Cellphone+GPS+Wi-Jammer-Omnidirectional Antennas</p> <p>GBP £106.04</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p>             | <p>Free Shipping</p>  <p>High Power Portable GPS (GPS L1,L2,L3 /L4/L5) Jammer</p> <p>GBP £126.45</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p> <p>Add To Cart</p>                   | <p>Free Shipping</p>  <p>High Power Portable GPS and Cell Phone Jammer(CDMA GSM DCS PCS 3G)</p> <p>GBP £120.49</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p>                | <p>Free Shipping</p>  <p>High Power Portable GPS and Cell Phone Jammer with Carry Case</p> <p>GBP £113.80</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p>             |
| <p>Free Shipping</p>  <p>High Power Portable GPS and Mobile Phone Jammer(CDMA GSM DCS PCS 3G)</p> <p>GBP £121.36</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p> <p>Add To Cart</p> | <p>Free Shipping</p>  <p>High Power Portable GPS and Mobile Phone Jammer(CDMA GSM DCS PCS 3G)</p> <p>GBP £106.94</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p> <p>Add To Cart</p> | <p>Free Shipping</p>  <p>Mini GPS jammer for Car</p> <p>GBP £34.08</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p> <p>Add To Cart</p>                                       | <p>Free Shipping</p>  <p>Mini GPS Satellite Isolator</p> <p>GBP £37.13</p> <p>★★★★☆</p> <p><input type="checkbox"/> Compare</p> <p>Add To Cart</p>                           |

# GPS Jamming Detection Solutions



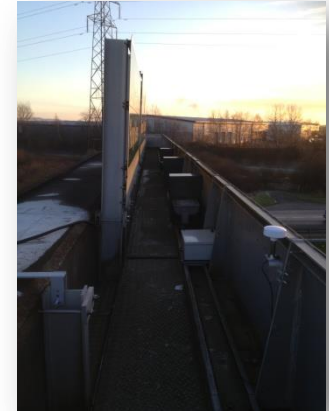
- Handhelds
  - CTL3510, CTL3520
- Rapid Deployment Threat Demonstrators
  - Just needs power & permission
- Meshed Threat Geolocation Networks
  - Scales to National / International
  - Localised CNI Protection
- All field trial proven solutions



# Rapid Deployment Threat Demos

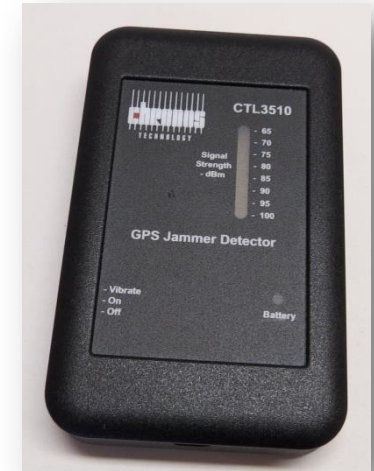


- Systems in UK, USA and around the World
- Backhaul: Wireless mesh, ADSL, 3G/4G
- Weather-proof, mains power with UPS backup
- Real time, web based data collection and display
- Data Analytics, Download event logs, Reports
- Deployment < 2weeks (subject to site survey)



# CTL3510 – Key Features

- Hand Held, Simple to use
- **Identifies Jammer Activity**
- Detecting GPS jamming
- High sensitivity
- Visual LED display of jammer strength
- Covert Vibration jammer indication
- Rechargeable battery via micro USB
- Event Log





# CTL3520 – Key Features

- Hand Held, Simple to use
- **Identifies which car!**
- Direction Finding Capability
- Detects GPS L1 jamming
- High sensitivity, LED Display
- Attenuator for detection of High Power Jamming
- Rechargeable battery via micro USB



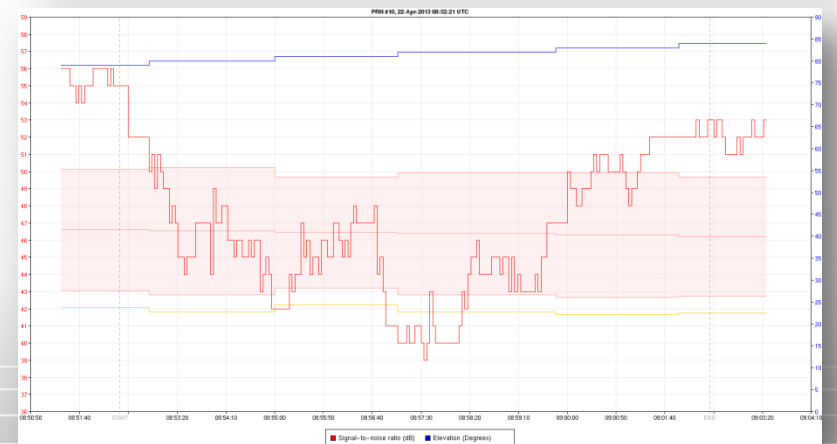
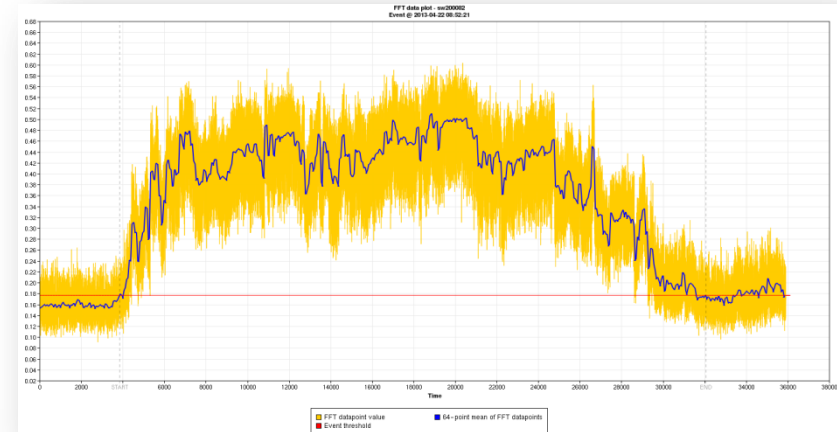
# 24x7 Jammer Monitoring

- Uses 24x7 field deployed sensors
- **Actionable Intelligence**
- Central management system
- Logs jamming event data
- Email alerts
- Roadmap features include....
  - GSM jamming detection
  - Small footprint co-located with ANPR



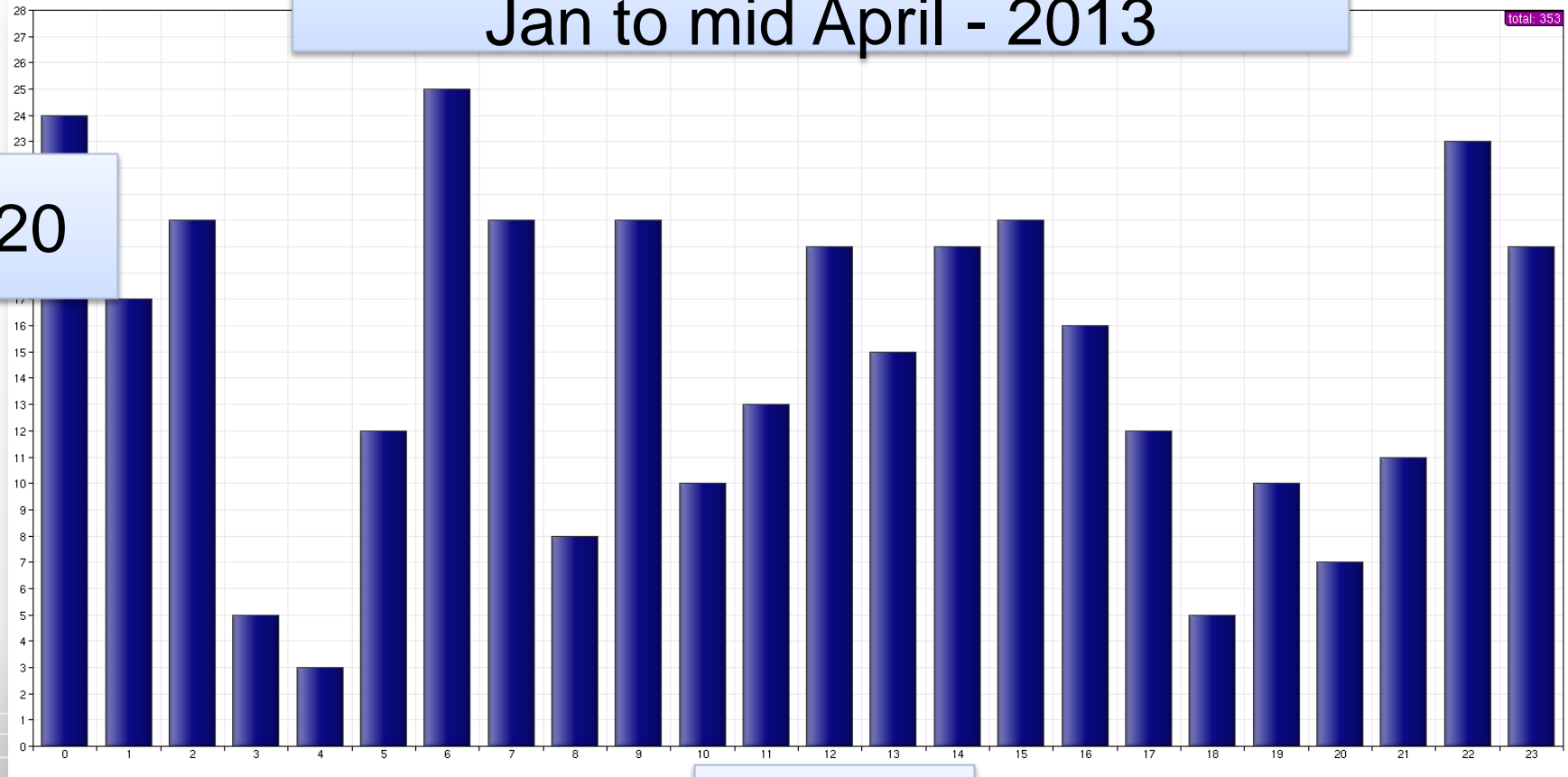
# Dissimilar Detection Techniques

- A recent 10 minute “event” outside the Stock Exchange!
- 1: Power in L1 Spectrum using FFT
- 2: Susceptibility of GPS by measuring C/No



# City – Data Analysis

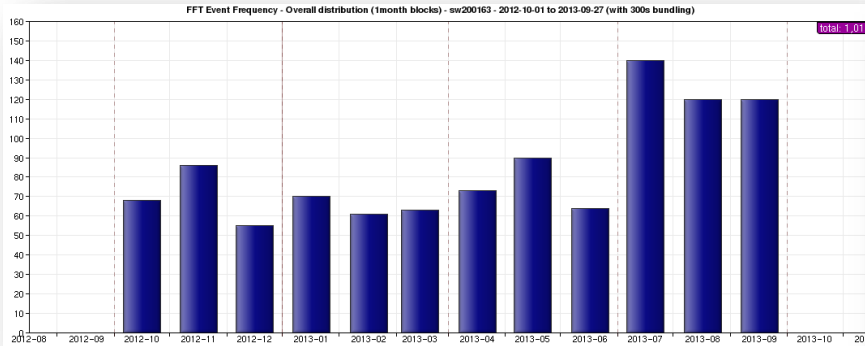
Total of all events by Hour of Day  
Jan to mid April - 2013



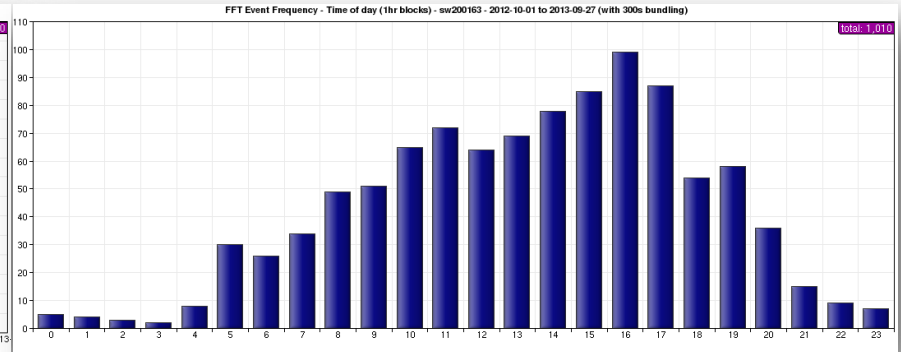
20

Midday

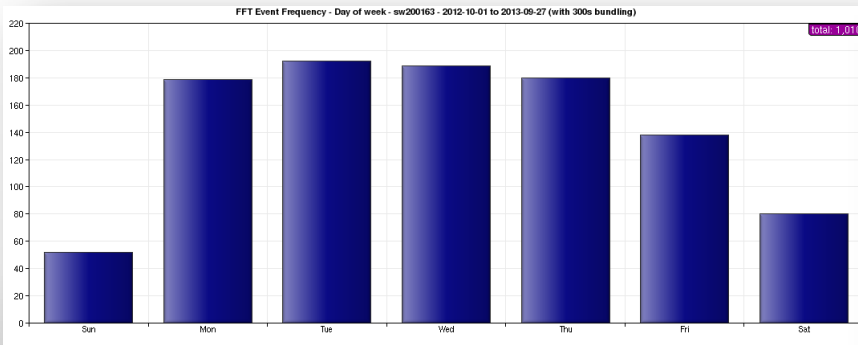
# Events detected on rural motorway 200ft from ILS cabin at provincial airport



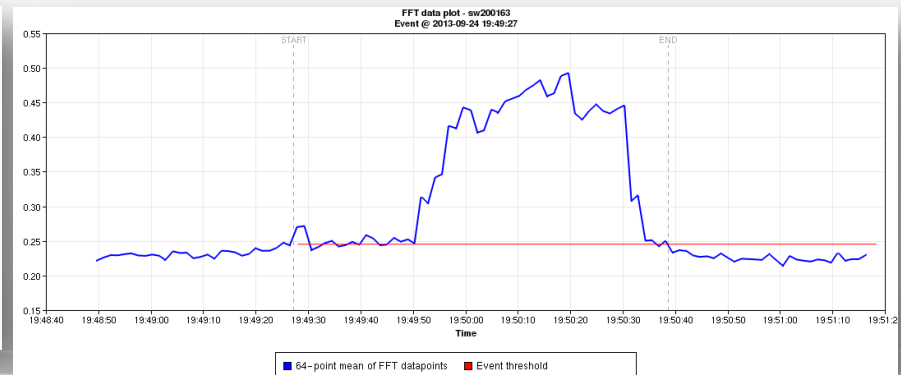
Events by  
Month



Events by Hour through Day

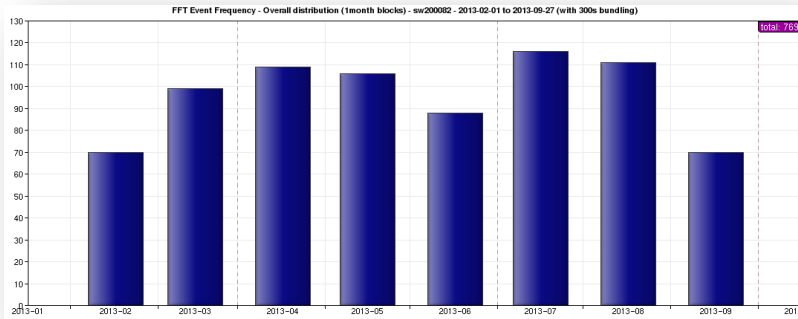


Events by Day of Week

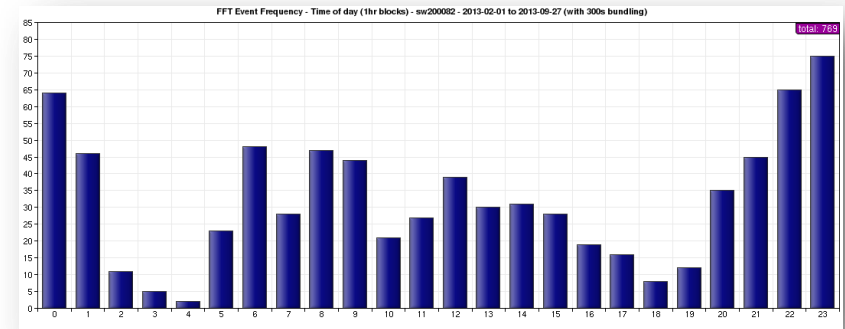


Typical Event

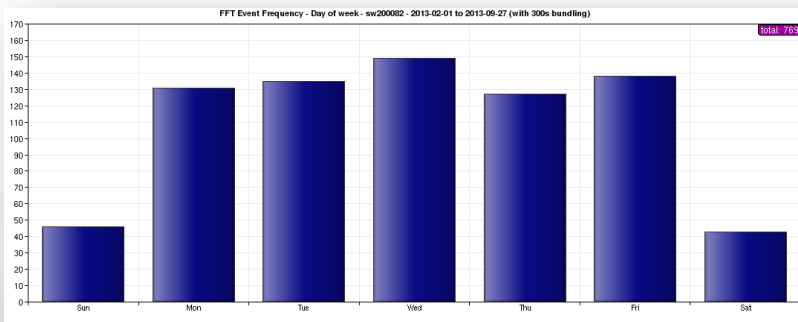
# Events detected - London Stock Exchange



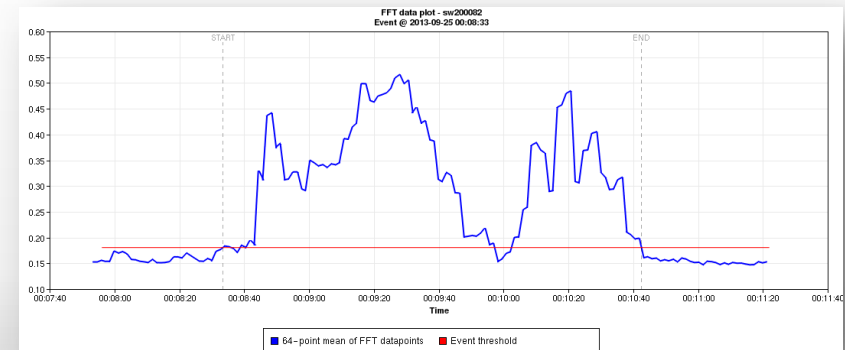
Events by Month



Events by Hour through Day



Events by Day of Week



Typical Event

**July 2013 – 100 events : July 2014 – 150 events**

# Signal Sentry® 1000

- Chronos Sensor solutions inside the Exelis System
- Jamming Sensor Network Mesh
- **Real time geolocation of threat**
- Individual jammer detection and geolocation
- Identifies approximate location
  - Agents on ground use CTL3520 to identify exact location
- Scalable from CNI to national / international
- Trialled at Super Bowl – Met Life Stadium
- Tested at Sennybridge UK



# Sennybridge Testing



*Photos: With the permission of the Commandant, Sennybridge Training Area*



# What Next?



Download the SENTINEL Report [Here](#)

Do a risk assessment for a “Black Swan Event”



**Thankyou**

[www.chronos.co.uk](http://www.chronos.co.uk)

[www.gpsworld.biz](http://www.gpsworld.biz)

[charles.curry@chronos.co.uk](mailto:charles.curry@chronos.co.uk)