

Report on GPS Jamming Trials and Criminal Use of Jammers



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Presentation Contents

- Background & Research Projects
- Jamming Trials
- Who or What is Jamming?
- Where to buy your jammers
- Detection Stories

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

Sennybridge 2014



- Testing during MoD Trials
 - Sponsored through CPNI
- Geolocation of stationary and moving jammers
 - Using remote sensors and a central server
- Identification and localisation of a jammer
 - Using handheld and fixed DF technology
- Detectability testing of J242-G half watt jammer
- Tests in Open Space and Urban Environment
 - Significant multipath environment



Participants & Activity



■ Participants

- Chronos Technology Ltd
- University of Bath
- EE
- General Lighthouse Authorities
- Hampshire Police
- Exelis
- Others

■ Activity

- Day 1 Open Space
- Day 2 Simulated Urban Environment

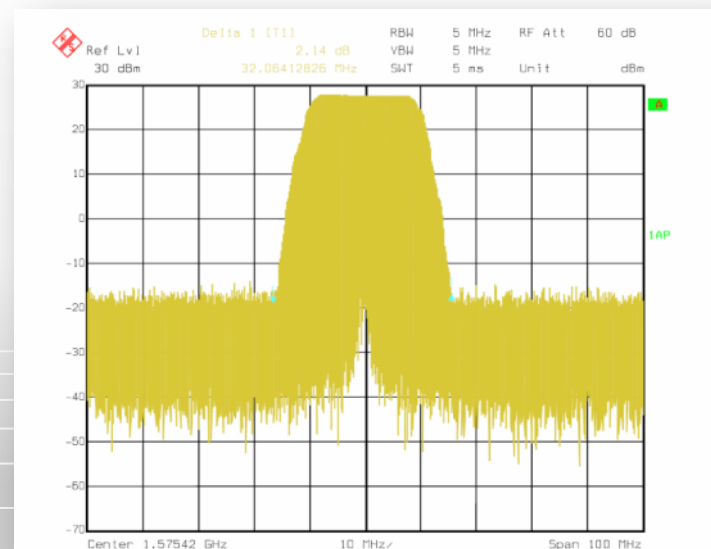
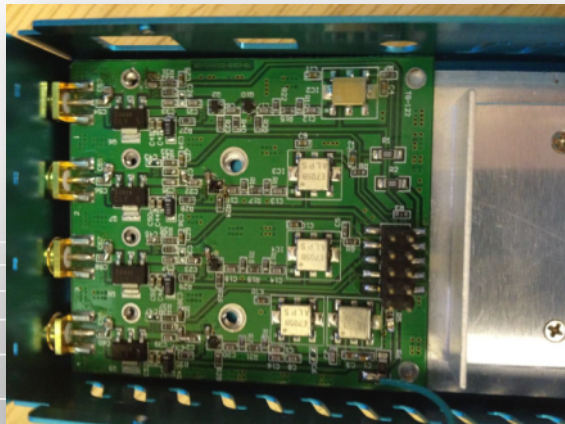


*Photos: With the permission of the
Commandant, Sennybridge Training Area*

“Blue” GNSS Jammer



- 500 mW, L1,L2,L3,L4,L5
- L1 Detectable at 1.6m
 - Ran out of line of sight!
- Tear-Down Report from UoB



High Speed Logging

- 5900GB IQ data captured
- Day 2 – all jamming events
- Available to team for further analysis



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

Geolocation Testing

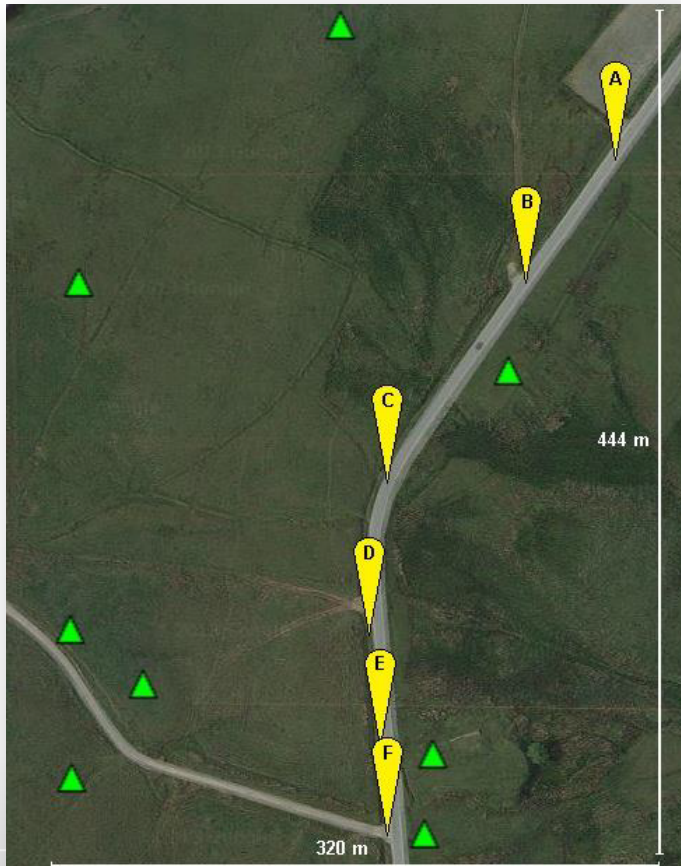


- Exelis Signal Sentry® 1000
 - Uses Chronos Sensors
- Mesh – Open Space & Urban
- Wireless Links
- Sensors in weatherproof enclosures

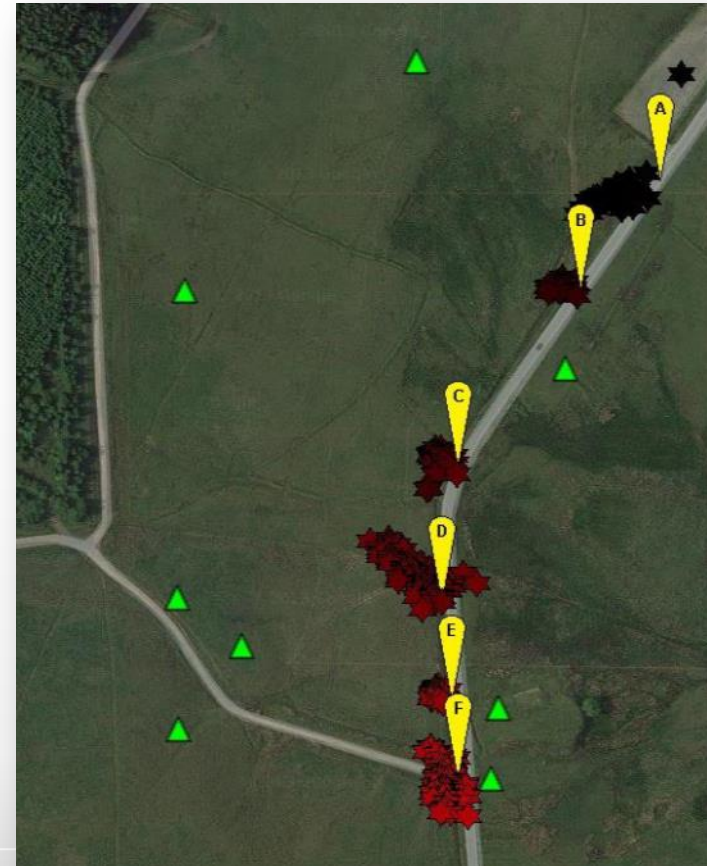


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Mesh Tests – Open Space - Static

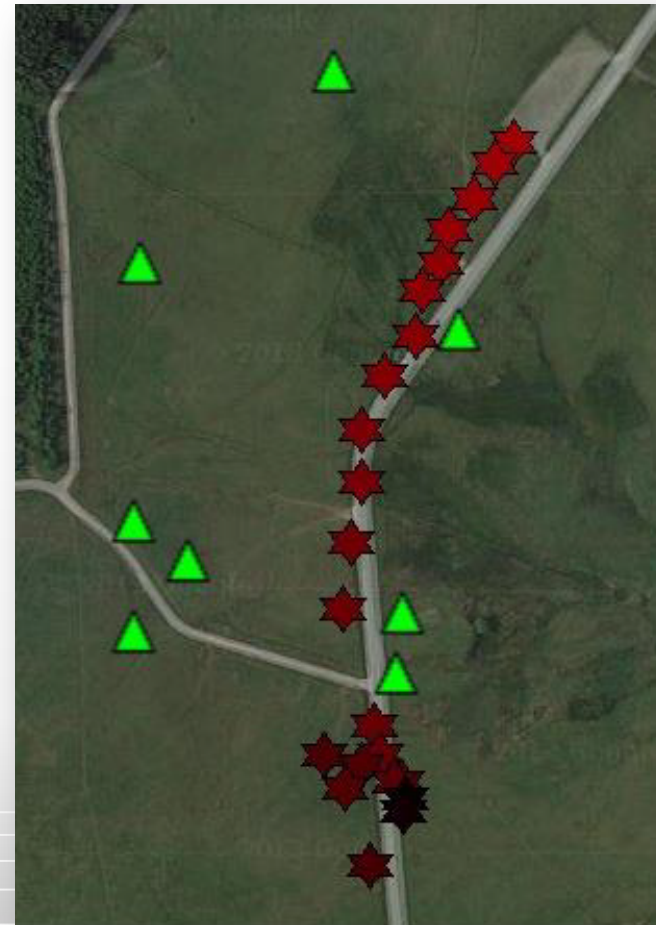
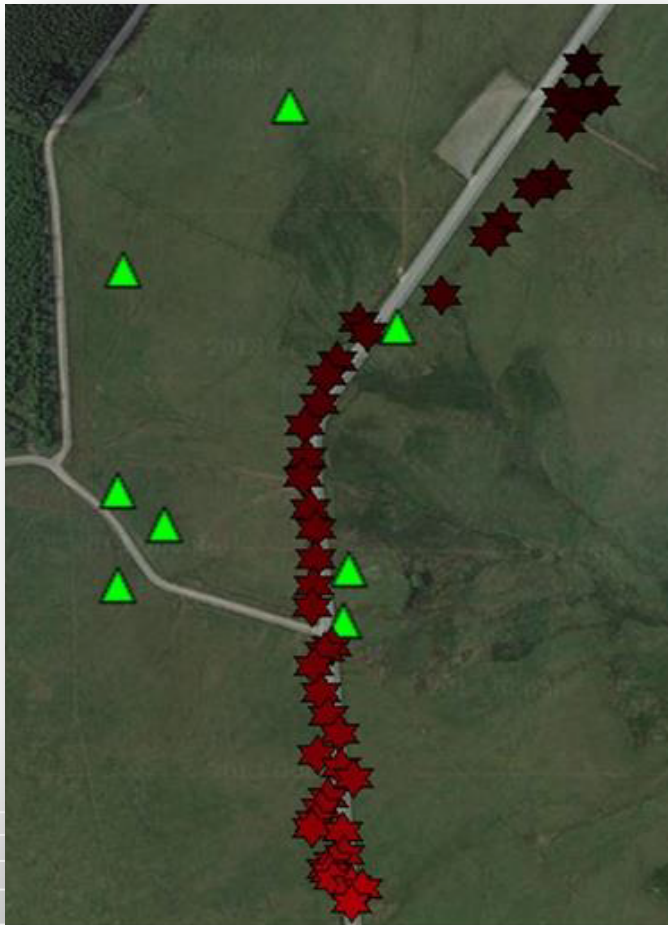


Way Points Set up South of Car Park



Static Testing at Waypoints

Mesh Tests – Open Space - Car



Mesh Tests – Urban - Bicycle



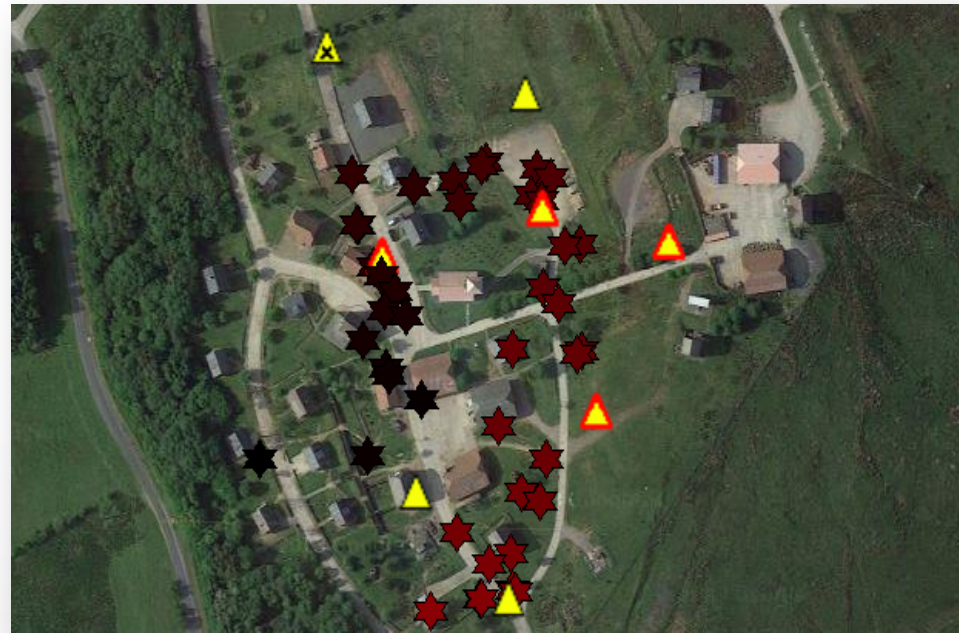
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Mesh Tests – Urban - Car



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

Drive Through



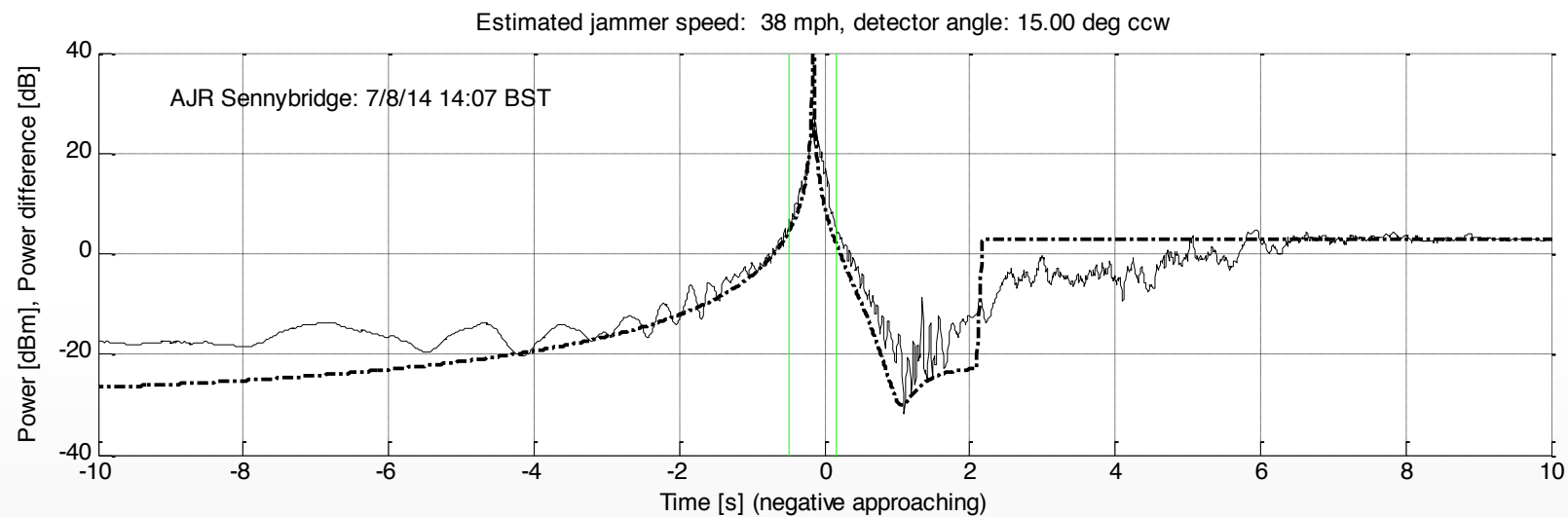
Photos: With the permission of the Commandant, Sennybridge Training Area

Sennybridge Videos



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

AJR – Automatic Jamming Recognition



T0-0.33s



T0



T0+0.33s



Research with Hampshire Police



GPS Jamming Assisted Crime



- Top end vehicles & plant
 - Doors open in 10 seconds
 - Jammer on back seat
 - Gone in 20 seconds!
 - Break up or export



Photos courtesy of AVCIS

Car Crime Videos



<http://www.bbc.co.uk/programmes/p014f7jk>

<https://www.youtube.com/watch?v=l8fe3nNUmBg>

Scene of Crime Photos

Cigarette Lighter
style Jammer hot
wired to car battery



Photo courtesy of Hampshire Police

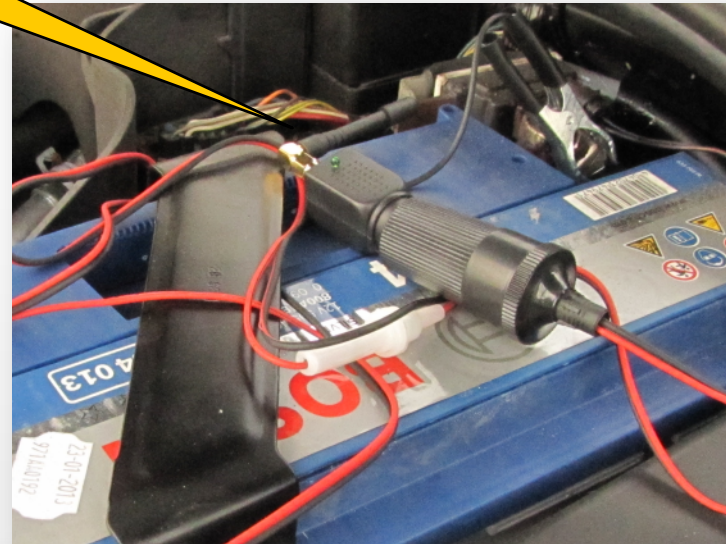


Photo courtesy of AVCIS

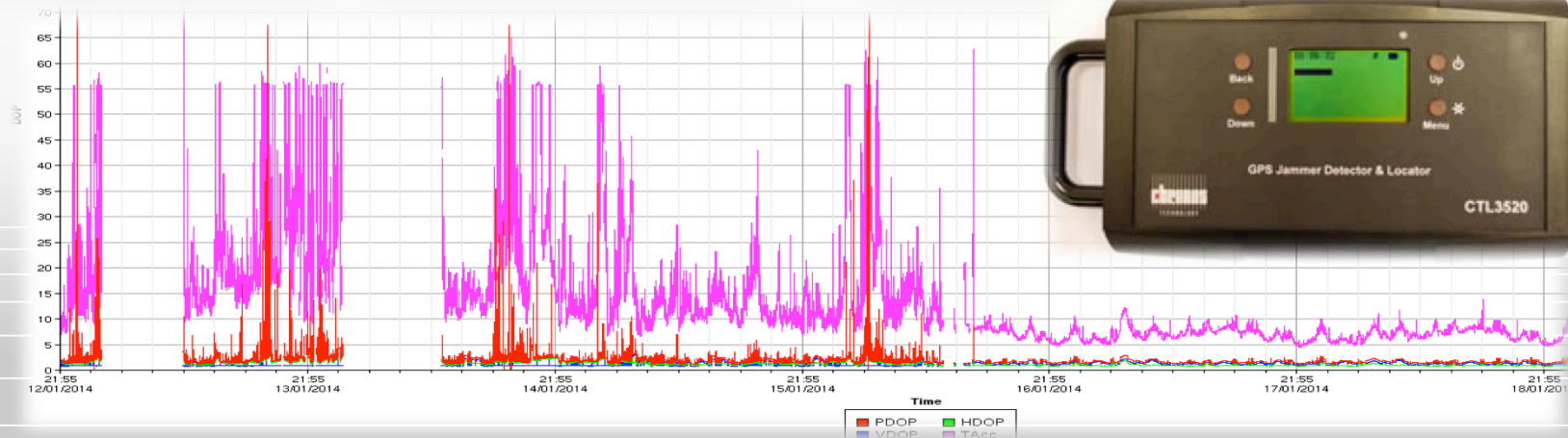
Unauthorised Truck Journeys



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



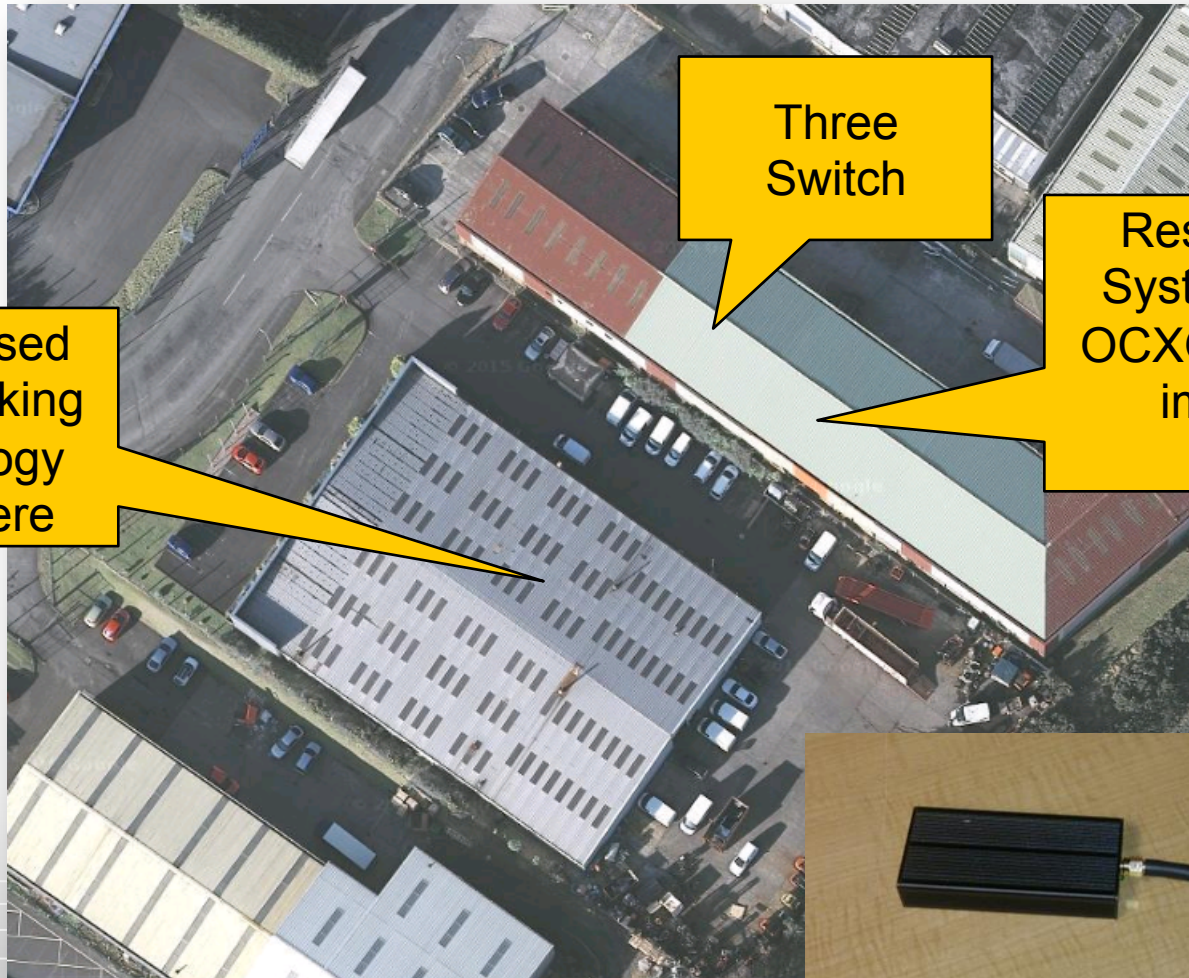
Jamming Fleet Tracking Technology



GPS based
fleet tracking
technology
used here

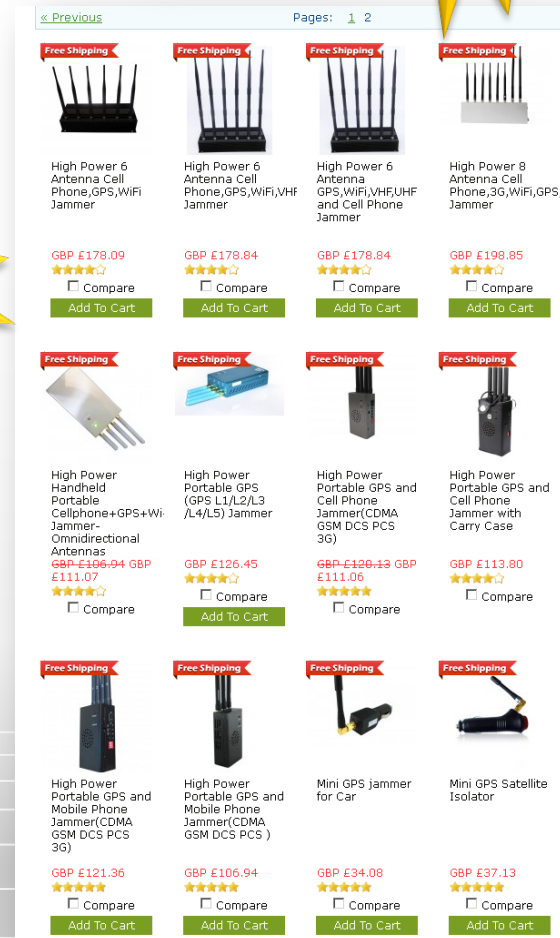
Three
Switch

Resilient Timing
System using Rb/
OCXO holdover not
impacted by
jamming



Where to buy Jammers

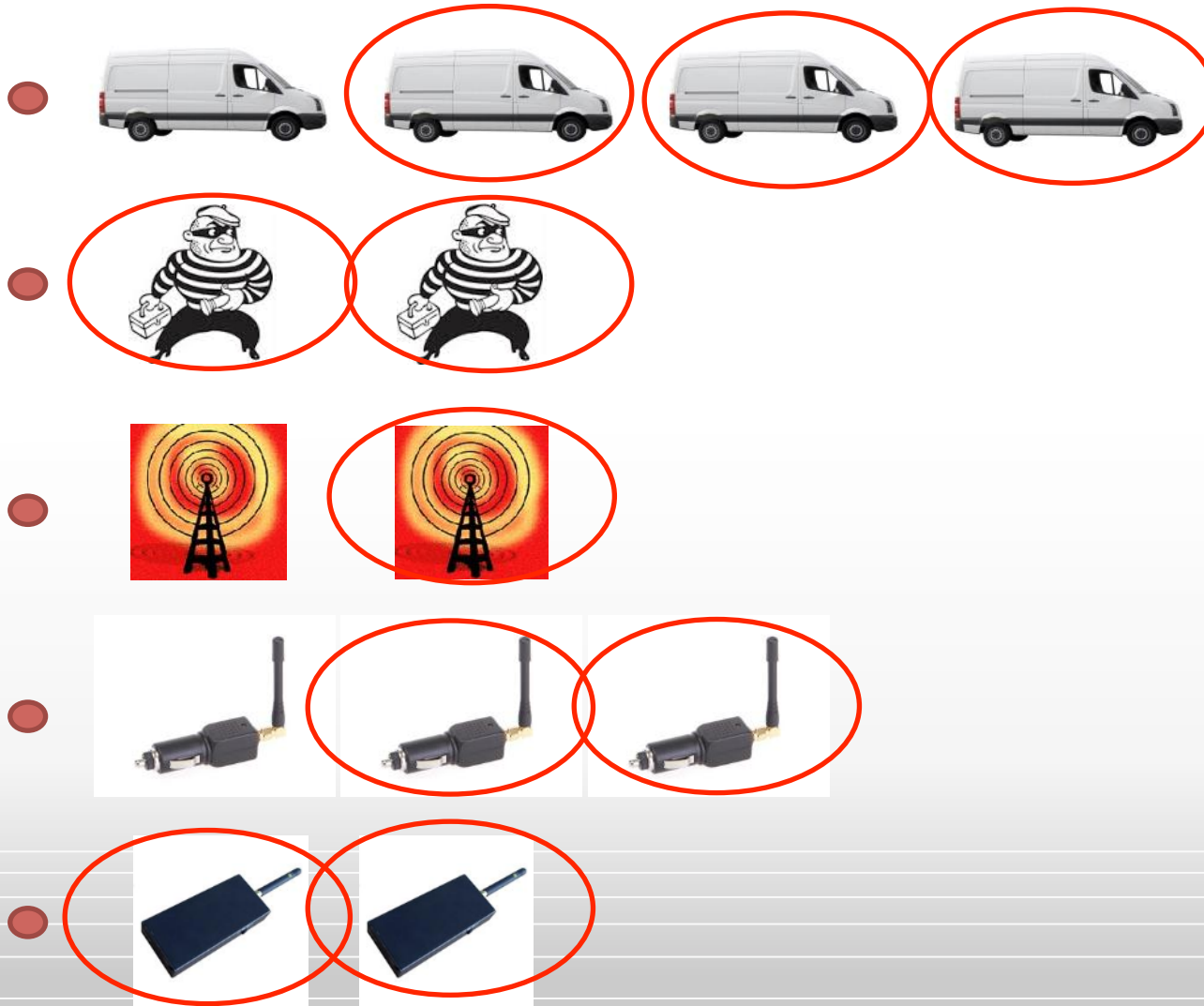
- Over 50 active Chinese Web Sites
- Power ~ 100mW to 50W!



More Powerful Jammers

- Many Web sites
- Easy to get

Kills @ Feb 2015!



Conclusion

- Research is on-going
 - Detection, Mitigation, Resilience
- Not always Criminal Use
 - Jammer Assisted Crime
 - RFI from harmonics
 - Reradiating GPS Antennas
 - Personal Privacy
- Download the SENTINEL Report
 - [Here](#)
- Linked in Discussion – GNSS Vulnerabilities





Thankyou

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