

# GAARDIAN Project Results & Introduction to The SENTINEL Project

KTN Digital Systems

**Location & Timing Programme**

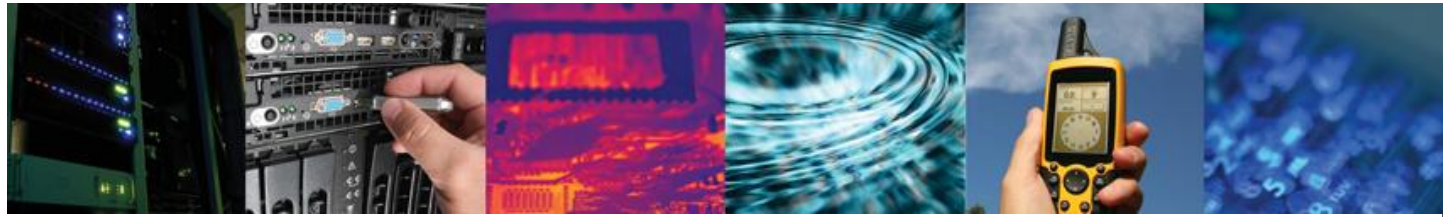
**GNSS Interference, Detection & Mitigation Conference**

**Thurs 11<sup>th</sup> March 2011**

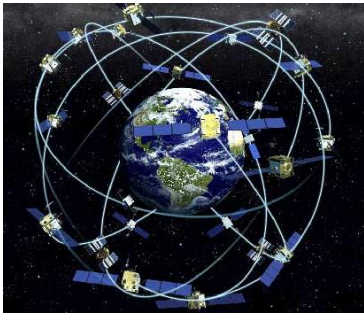
**NPL Teddington**



**Charles Curry, B.Eng, FIET  
MD – Chronos Technology Ltd**

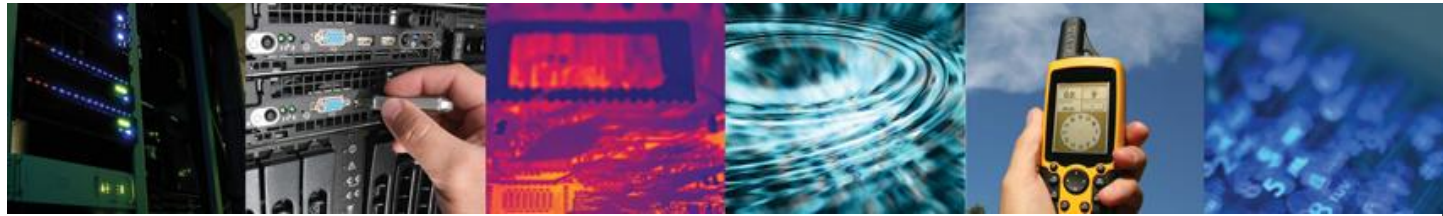


## The **GAARDIAN** Project - *GPS Interference Detection & Mitigation*

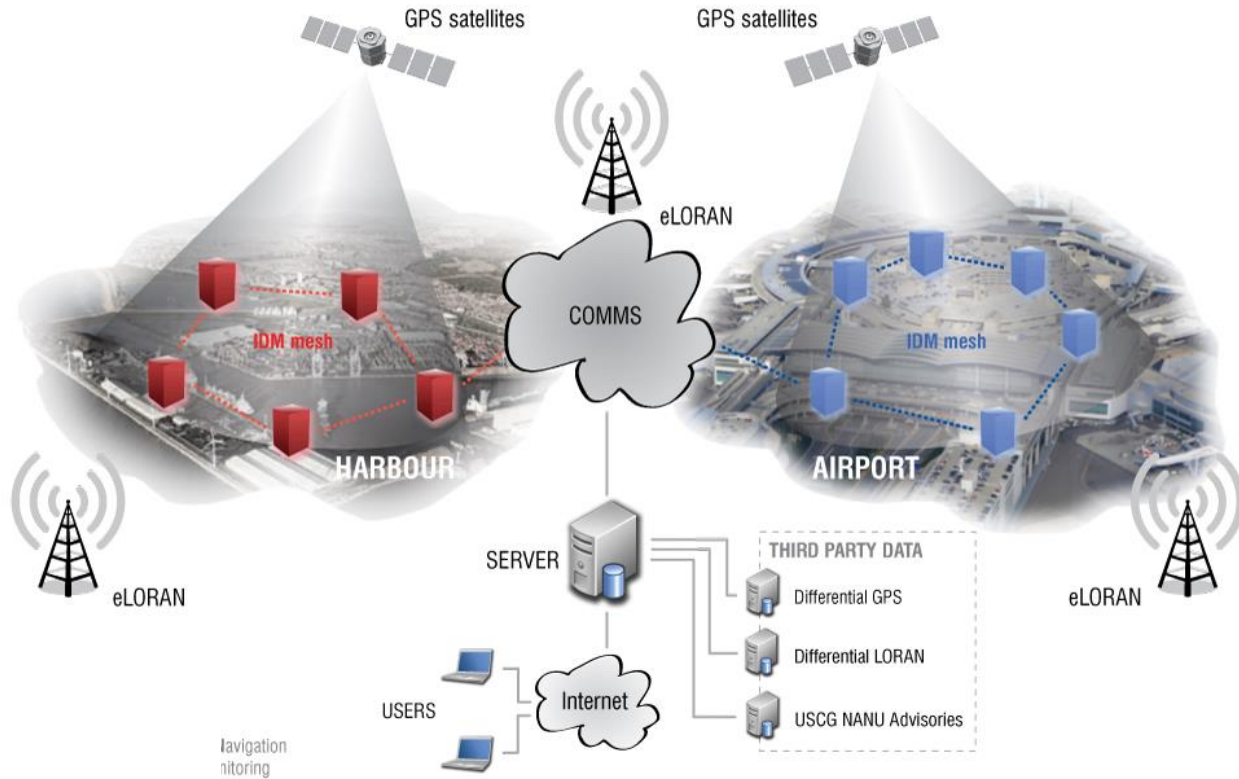


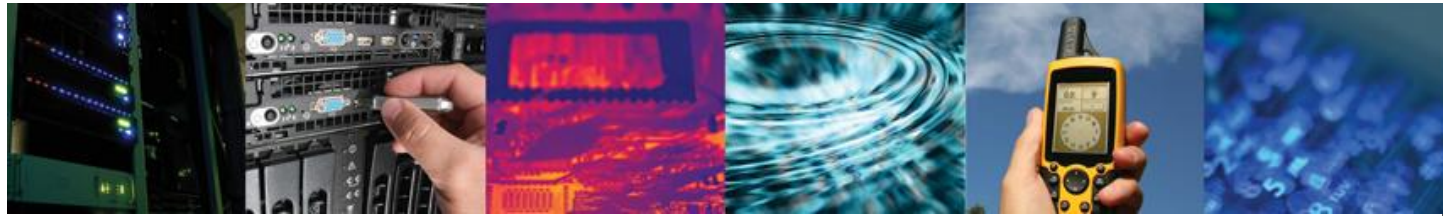
- **GNSS Availability, Accuracy, Reliability and Integrity Assessment** for Timing and Navigation
- UK Government Funded R&D Project (>£2m)
  - through **Technology Strategy Board**
  - ***“Gathering Data in Complex Environments”***
- Research Data Gathering necessary to create a GPS Interference Detection & Mitigation (IDM) network
  - At point of use, 24x7x365
    - for mission & safety critical applications
  - Which use GPS (or GNSS) signals
  - **Leveraging eLoran signals to assist QoS determination**





# GARDIAN



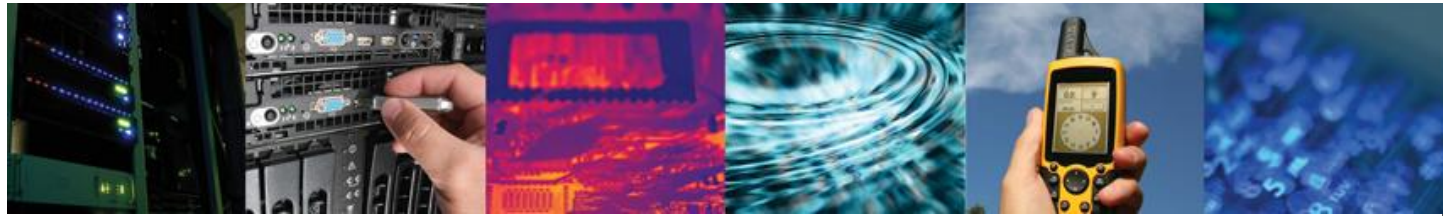


## The **GAARDIAN** - Partners



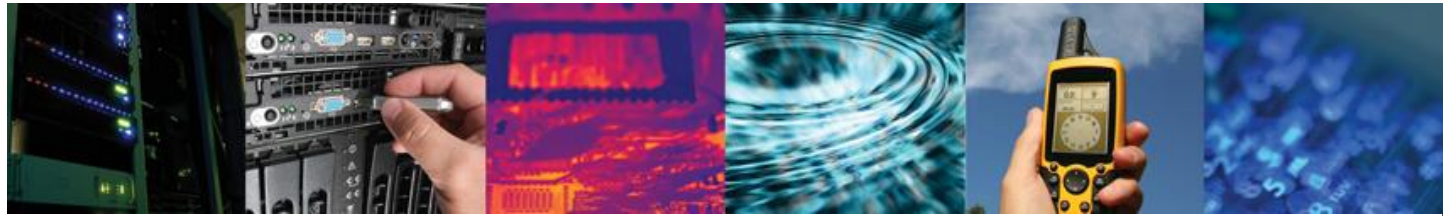
- GLA – General Lighthouse Authorities
  - User Community - Maritime
  - eLoran
- Imperial College London - Dept of Civil Eng
  - User Community - Transport
  - Integrity Monitoring Algorithms
- University of Bath - Dept of Electrical & Electronics
  - GPS & Space Weather
- BT – Adastral Research Laboratories
  - User Community – Telecoms
- Ordnance Survey
  - User Community – Land Geolocation
- NPL – National Physical Laboratory
  - Time, UTC Traceability
- Chronos Technology Ltd
  - Real time Timing measurement to ns granularity
  - GPS products, components & system integration
  - GAARDIAN Project Leader





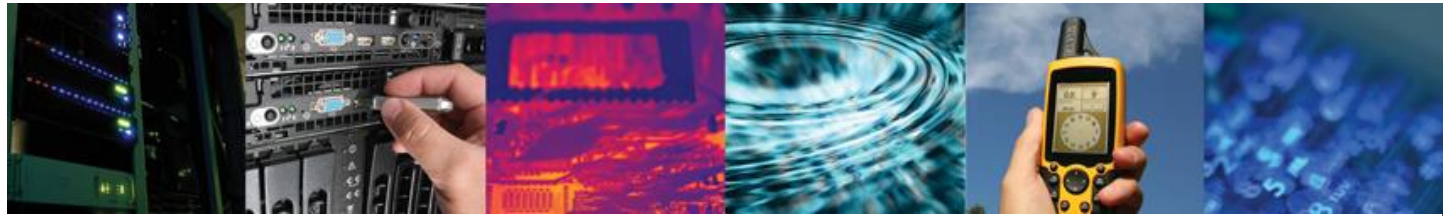
## Real Time GNSS & eLoran Integrity Monitoring at Point of Use

- **GAARDIAN** – The Challenges!
  - Manage vast amounts of data from within PNT receivers
    - GPS and eLoran
  - In real time
    - 24x7x365
  - Report unambiguous integrity, accuracy, continuity, reliability
    - Observing many different parameters
  - Adapt a “Telecom” industry optimised hardware probe
    - To be PNT data gathering platform
  - Create a central web based data display and analysis tool
  - Adapt academic algorithms written in Matlab into C++ on Linux
    - UoB, ICL, GLA
  - Source an eLoran Receiver that works!



## **GAARDIAN** – How will PNT Systems be affected?

- Different systems will exhibit different vulnerabilities
  - Some systems may be unaffected
- Different user groups will be susceptible to different vulnerabilities
  - Some industries do build in mitigation
- Vulnerabilities will be evident at different times
  - Environmental impact – weather, space weather
  - Satellite visibility
  - Local infrastructure
  - User movement
- Problems will not be systematic or deterministic



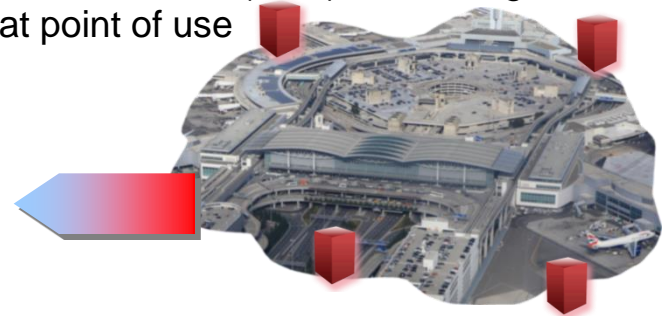
## GAARDIAN – Deliverables

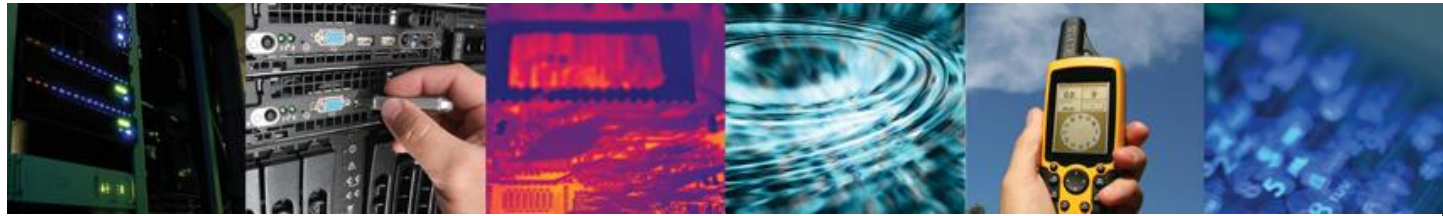
**Users**



- Develop 24x7 web enabled IDM sensors
  - IDM – Interference, Detection & Mitigation
  - Which can be deployed as networks
  
- Locally deployed networks of IDM sensors in the vicinity of the user
  - GAARDIAN will deploy trial sensors to analyse data
  - Reduce data at source without losing “content”
  - Heartbeats and “Event” communication back to Server
  - User alert via independent messaging
  - Store for user viewing over internet
  
- Enable Real-Time GPS, Galileo, Glonass or eLoran (PNT) monitoring
  - For Mission/Safety critical users at point of use

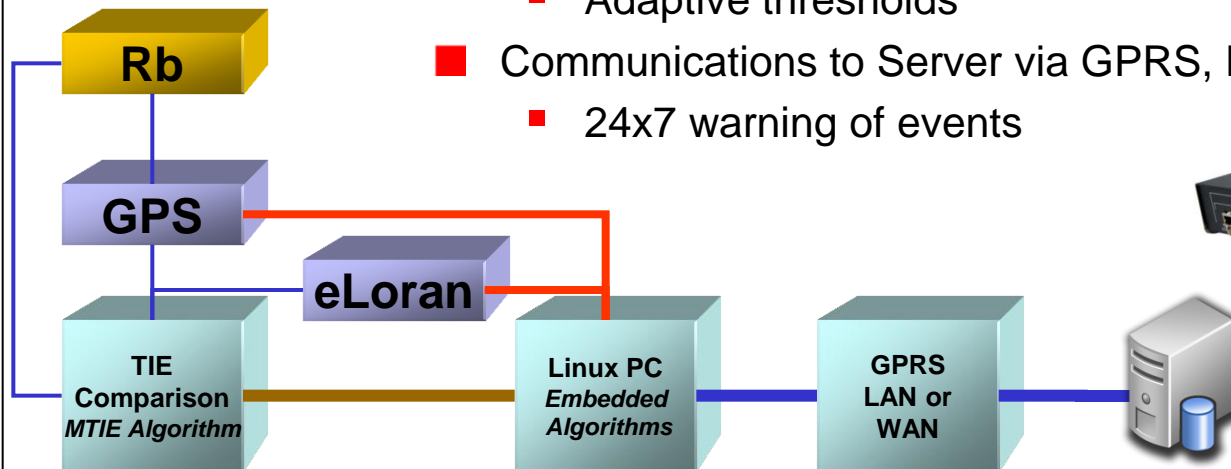
**GAARDIAN  
Server**



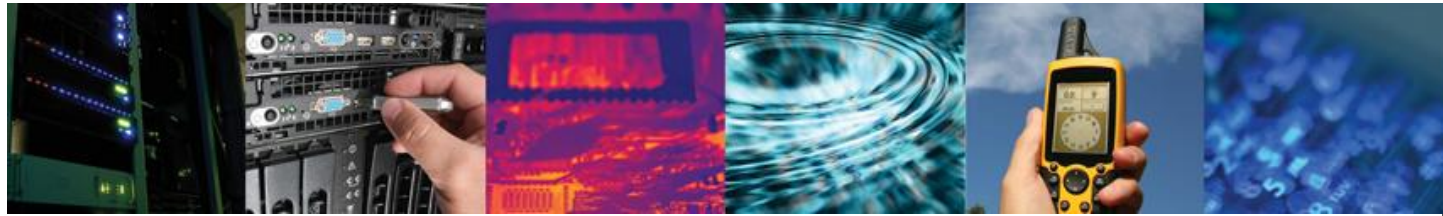


## GAARDIAN – IDM Sensor

- IDM Sensors based on Chronos SyncWatch probes
  - Watching GPS & eLoran Signals
- Time Interval Error (TIE) Monitoring between PNT signals from BT
- Embedded Linux to process TIE and PNT data
  - Algorithms from CTL, GLA, ICL and UoB
  - Event severity and manageability discrimination
  - Adaptive thresholds
- Communications to Server via GPRS, LAN or WAN
  - 24x7 warning of events







For Further Information contact:-

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or any of the partners

or visit

[www.gps-world.biz/gaardian/index.php](http://www.gps-world.biz/gaardian/index.php)