



QUADRANT

Dependent Surveillance With Integrity

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QinetiQ

Quadrant

QinetiQ Perspective

- Involved in development of Mode S radar technology and international standards from early 1970s
- Recognised new surveillance techniques evolving from secondary radar
 - Multilateration
 - ADS-B
- Instigated the QUADRANT programme in 2002 to develop relevant technologies and techniques

Quadrant

Concept

- Low cost, highly deployable sensor array feeding central processor
- ADS-B performance capable of giving 200NM range in a high fruit environment
- Multilateration capability to high accuracy
 - 7.5 m for local area operation
 - 100m for wide area operation
- Ability to combine multilateration and ADS-B techniques to provide integrity approaching or equal to radar

Quadrant Central controller

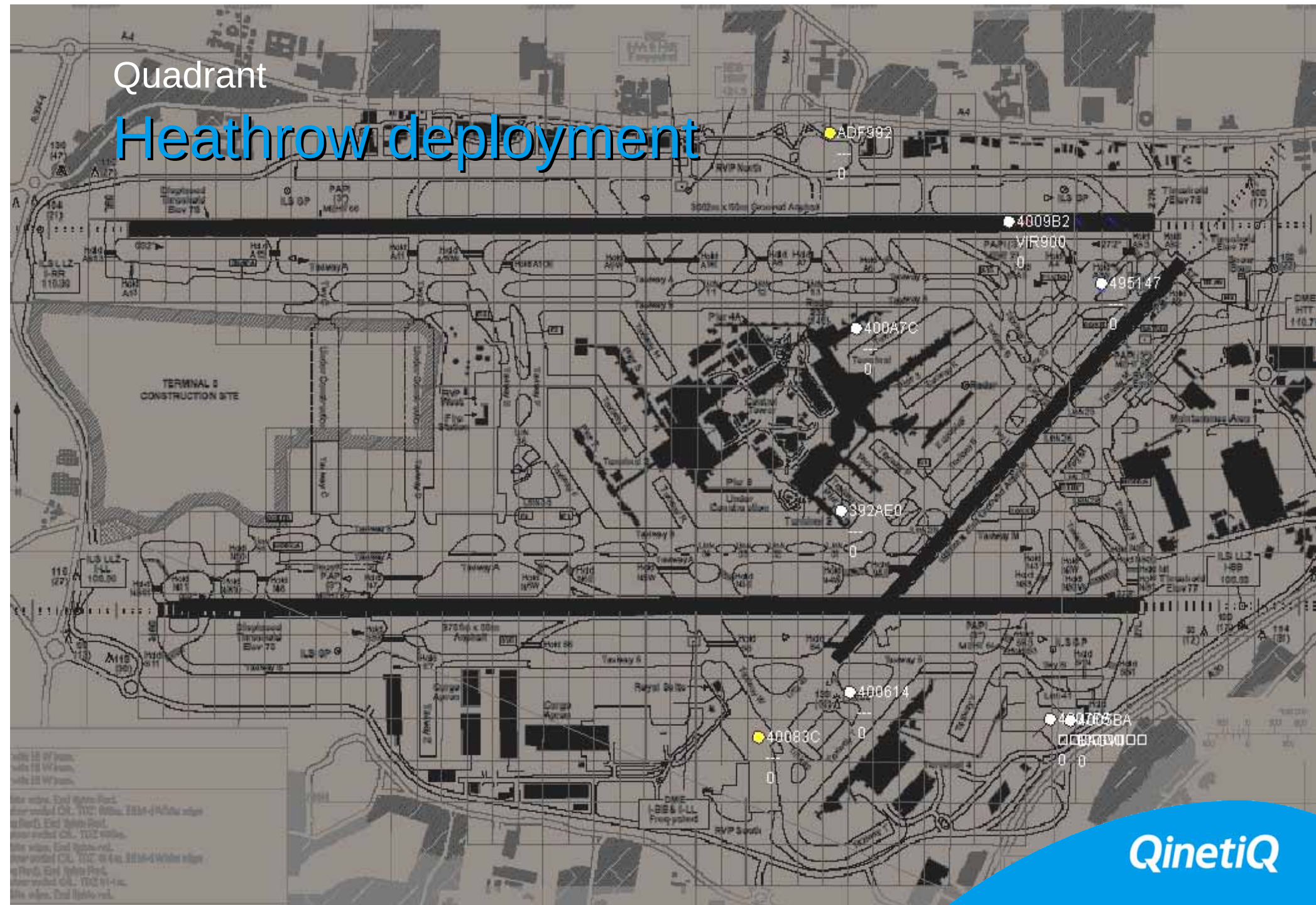
- PC based
- Self configuring on available sensors
- Performs continuous diagnostics and calibration
- Generates ASTERIX or user defined output

The screenshot displays the Quadrant Central controller software interface. At the top, there are control buttons: Start, Stop, Pause, MLAT: AUTO, and a checkbox for All. Below these are Load Configuration and Load Run buttons. A status section shows Messages Received (8578), Average Rate (0.9), and Current Rate (196.000). On the right, a table shows the status of Sensor 3 and Sensor 4 across categories: Connected, Active, Correlated, Cor. Status, Calibrated, and Cal. Status. The main area displays a list of addresses and callsigns on the left, and a detailed view of the selected address (400403, BAW008) on the right, including Last Position, Last Velocity, and Debug String. At the bottom, there are sections for Sensor Data, Curve Fit Type, Coefficients, RMS Residuals, and a table for Correlation Window, Correlation Offset, Correlation Ratio, Calibration Bin Resolution, Calibration History, Calibration Tolerance, Contemporary Window, Collating Delay, and RMS Tolerance. The bottom right corner features a QinetiQ logo.

Quadrant ADS-B

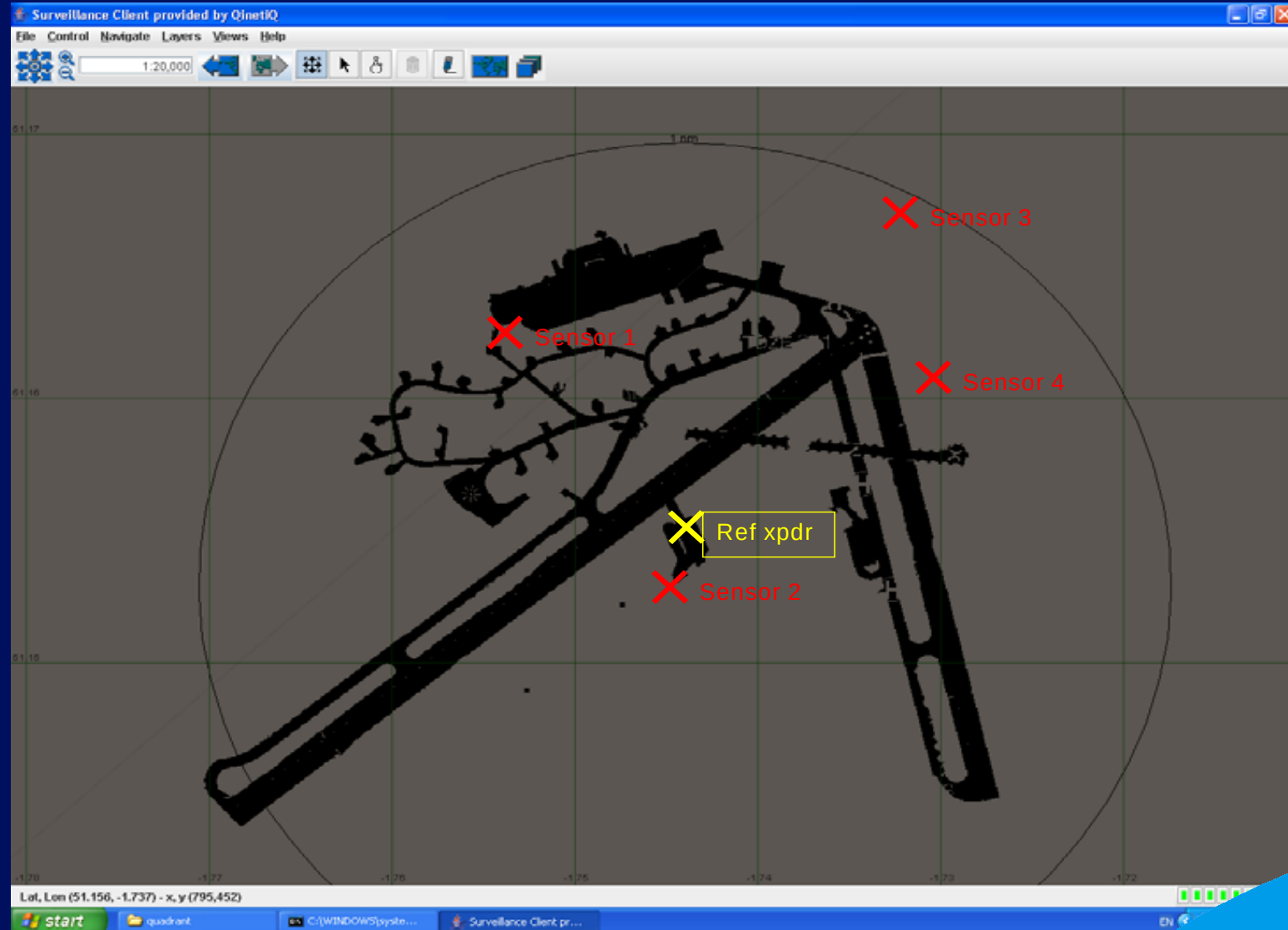
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Heathrow deployment



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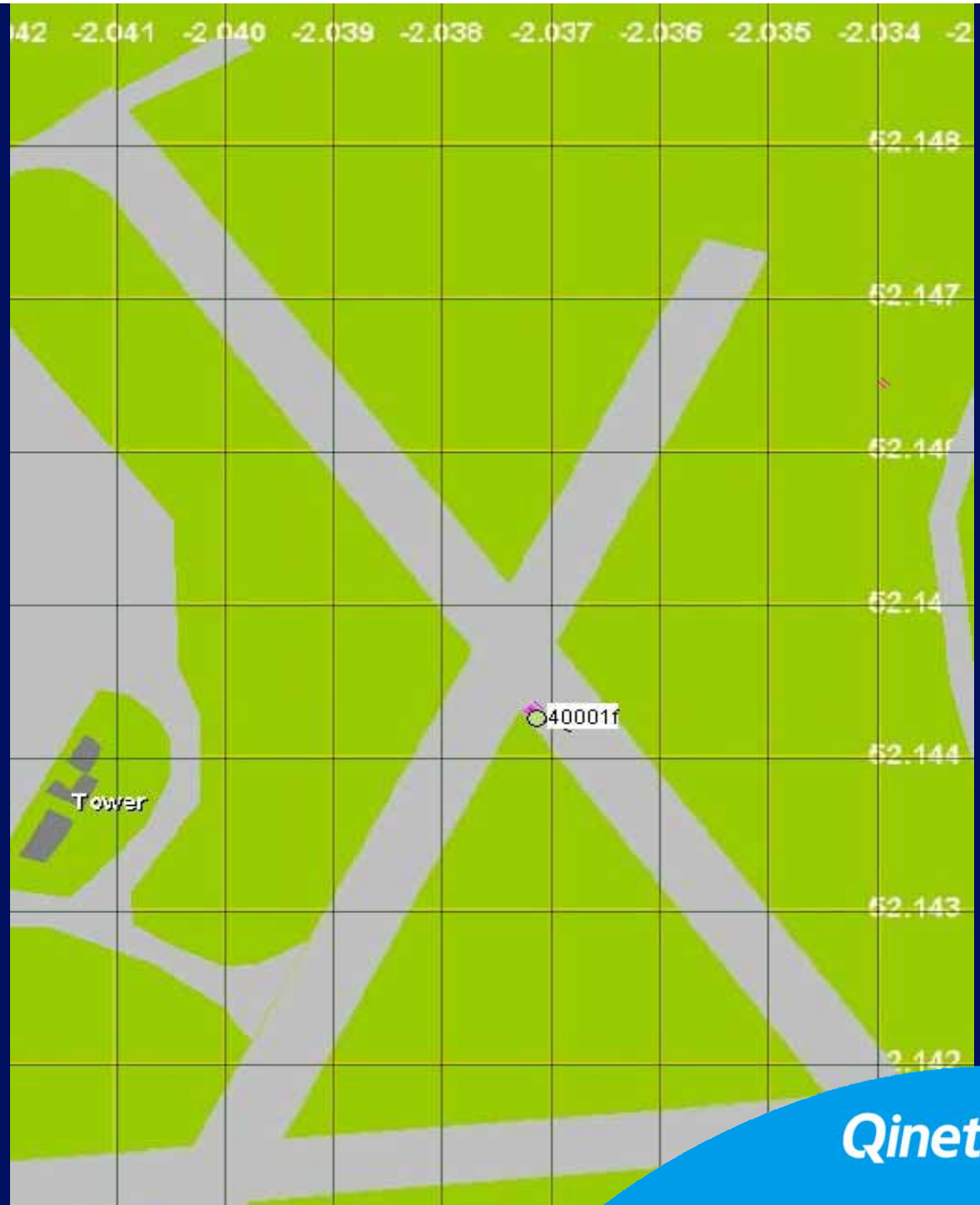
Local area trials (Boscombe airfield trials)



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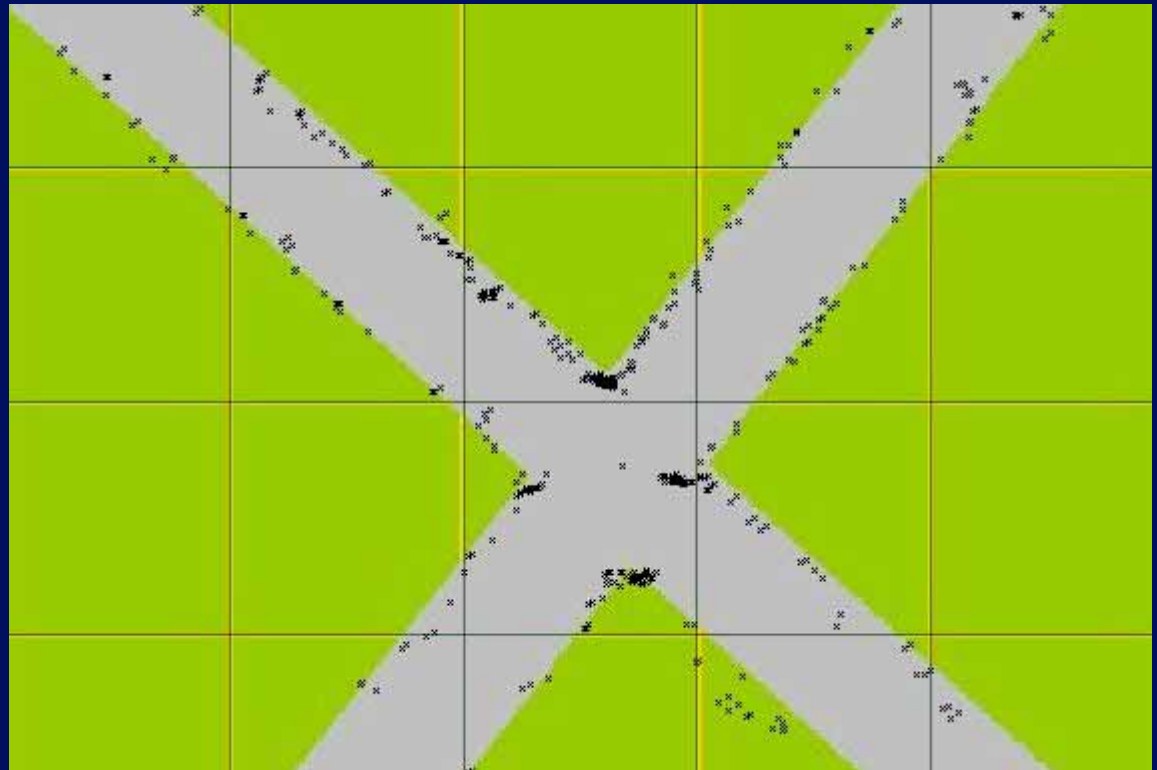
Quadrant Multilateration

Pershore Airfield trial



Quadrant Multilateration

Pershore
Airfield trial

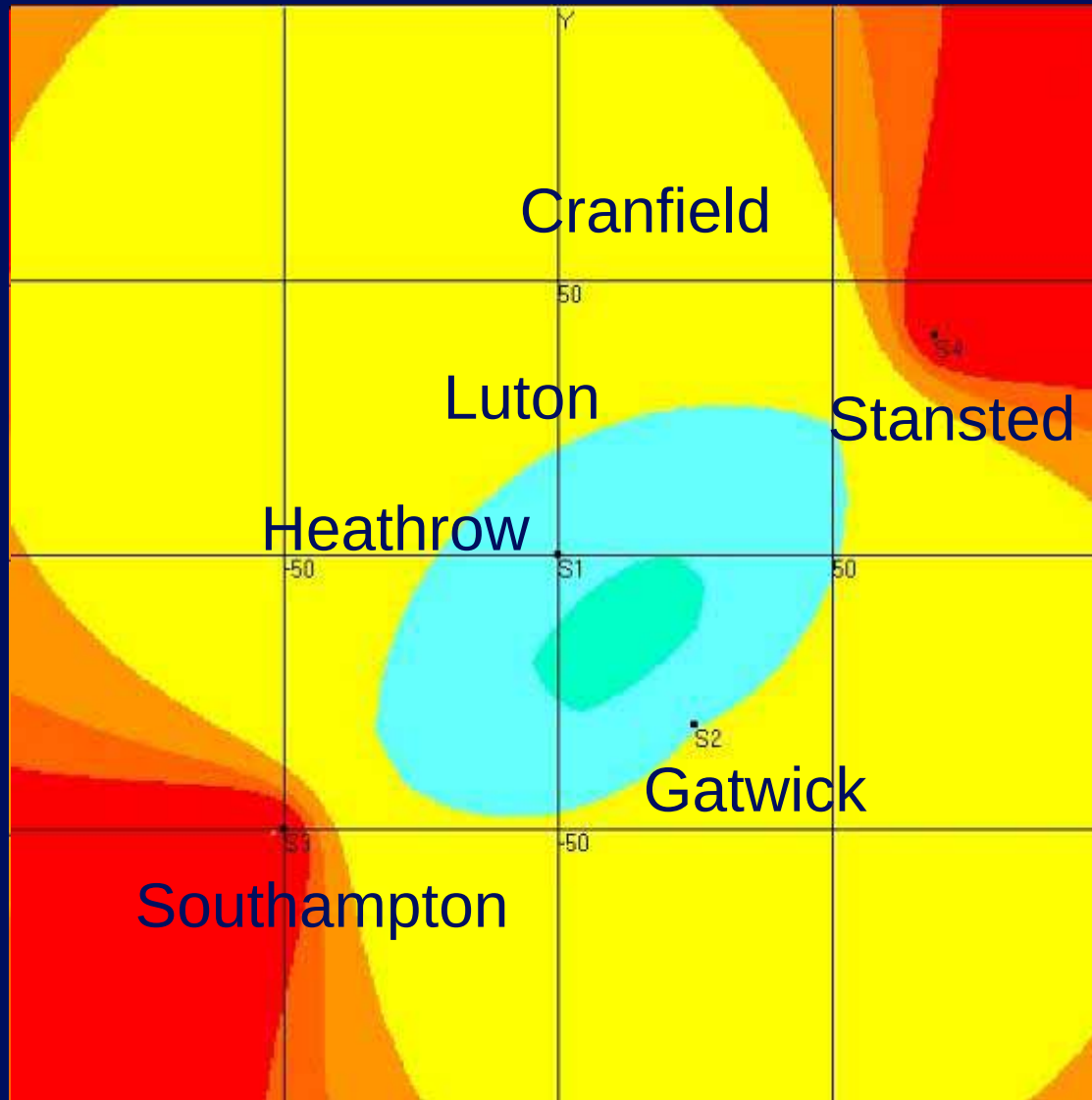


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Wide area trials



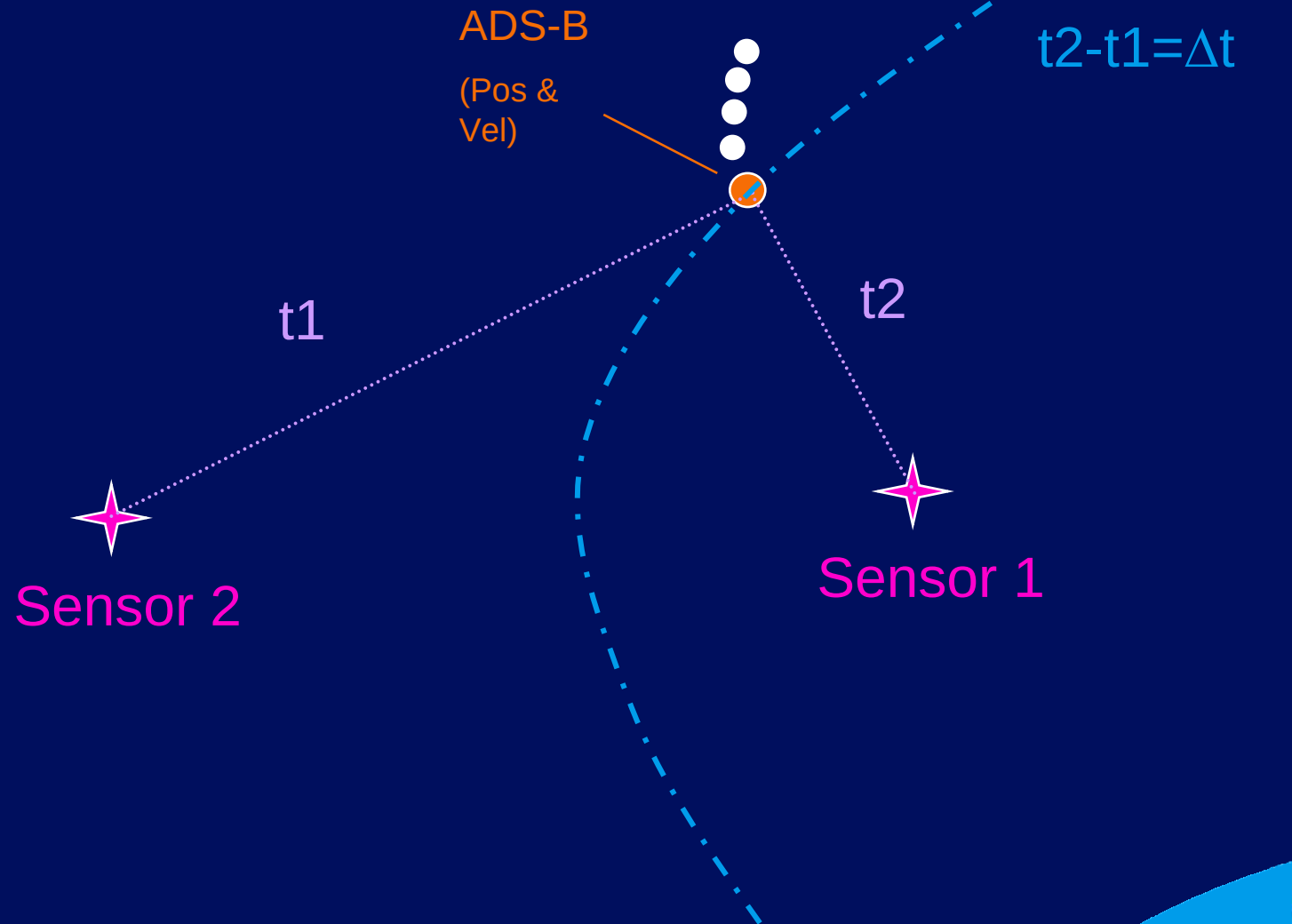
Wide-Area Multilateration Performance



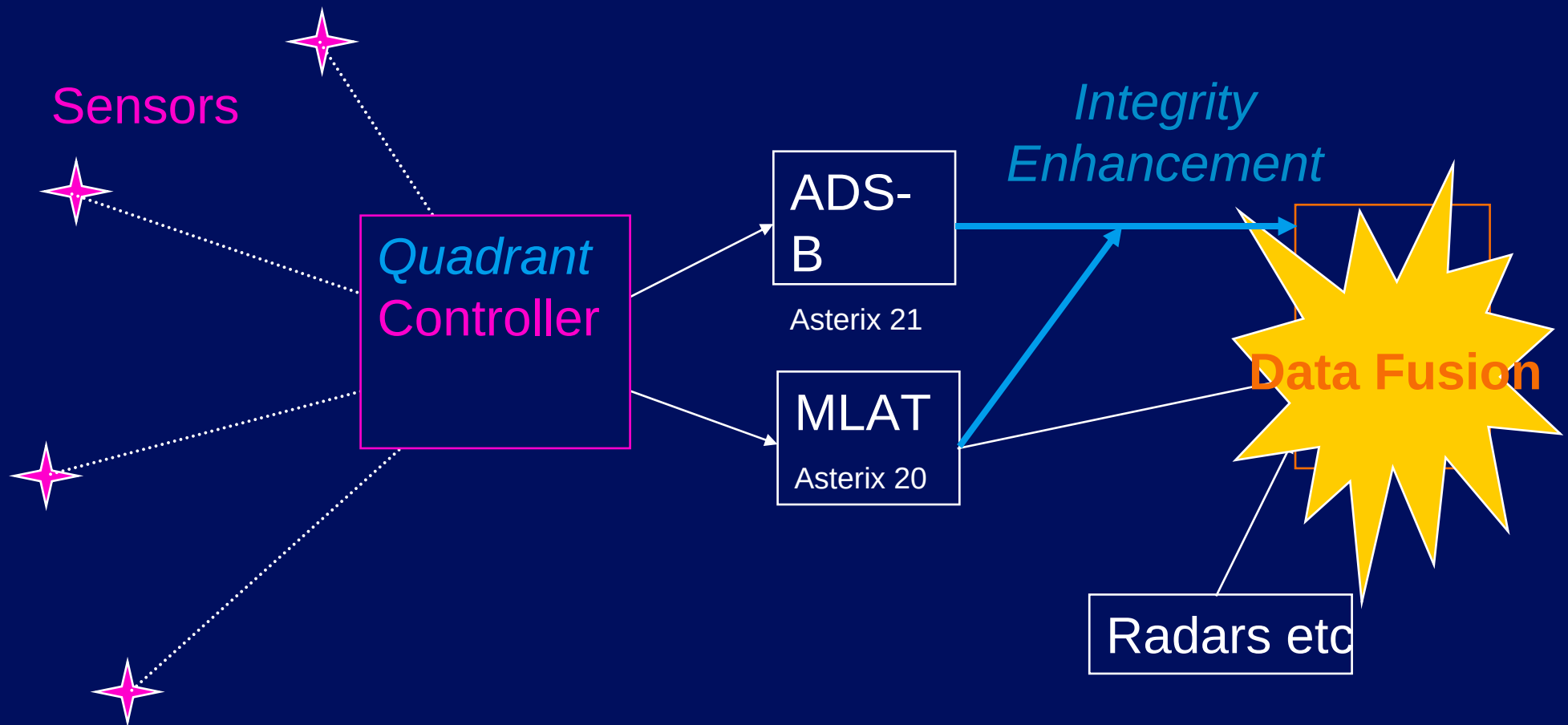
Quadrant Integrity

- ADS-B is dependent on accurate reports from the aircraft
- Position integrity is asserted within the messages
 - Not independently verified
- MLAT can be used to provide an independent integrity check, even from a partial MLAT solution
 - Therefore even a basic ADS-B network can perform such checks
 - Sensors will need an MLAT capability

Quadrant Integrity



Quadrant Integrity



Quadrant

Moving forward

- Ongoing research programme for high integrity ADS-B (Supported and part funding by UK DTI)
- CRYSTAL UK
 - SE UK ADS-B/MLAT evaluation system
 - EUROCONTROL programme, with UK NATS, SITA and Raytheon
- All MLAT products are also ADS-B systems
 - ADS-B product available within 6 months
 - Local Area Multilateration – 12 months
 - Wide Area Multilateration – 12 months



Demonstration

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