UK Civil Aviation Authority

ICAO EUR/MID GNSS RFI Workshop

Stuart Rankin

Policy Principal CNS & Spectrum

Doha, Qatar, 18-20 November 2025

GNSS RFI Workshop – UK Perspective

UK Civil Aviation Authority

UK Context and Approach

- Safety Risk Management
- Data Gathering
- Legitimate Activity

Minimum Operational Network

- Aim
- Dependencies
- Status

Oceanic Impact

- Overview
- Issues
- Mitigations

UK Civil Aviation Authority

- Communication, Navigation, Surveillance and Spectrum Policy Team
  - Policy development and maintenance
  - ICAO Engagement on CNSS matters including panel membership
  - ECTRL CNS&S engagement
  - Frequency and Spectrum Management
    - National frequency manager for CNS
    - Spectrum management including radio regulator and military liaison
  - Future CNS technology
    - UAV C2 Link
    - Surveillance requirements
    - Electronic Conspicuity

UK Context

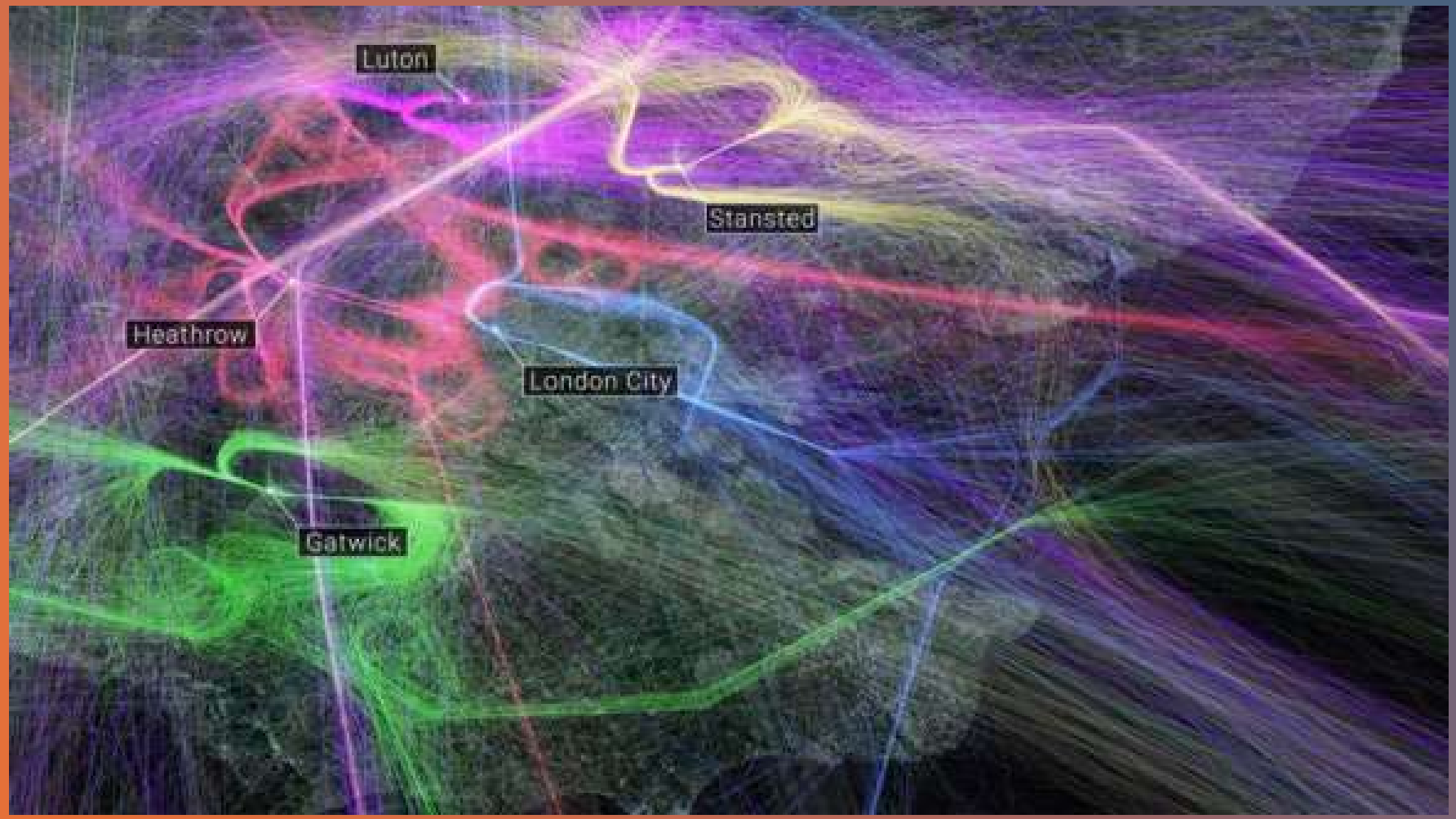
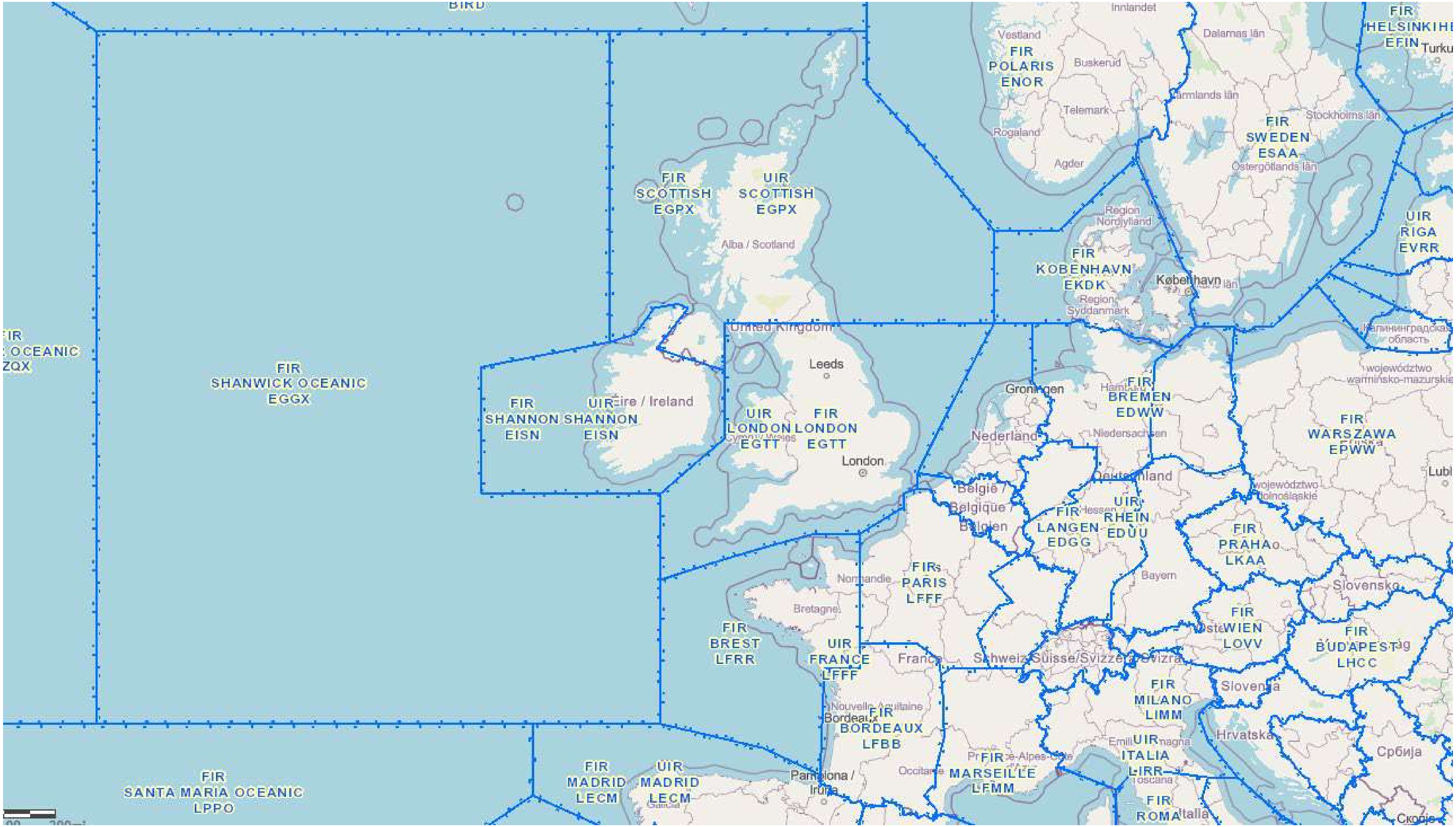
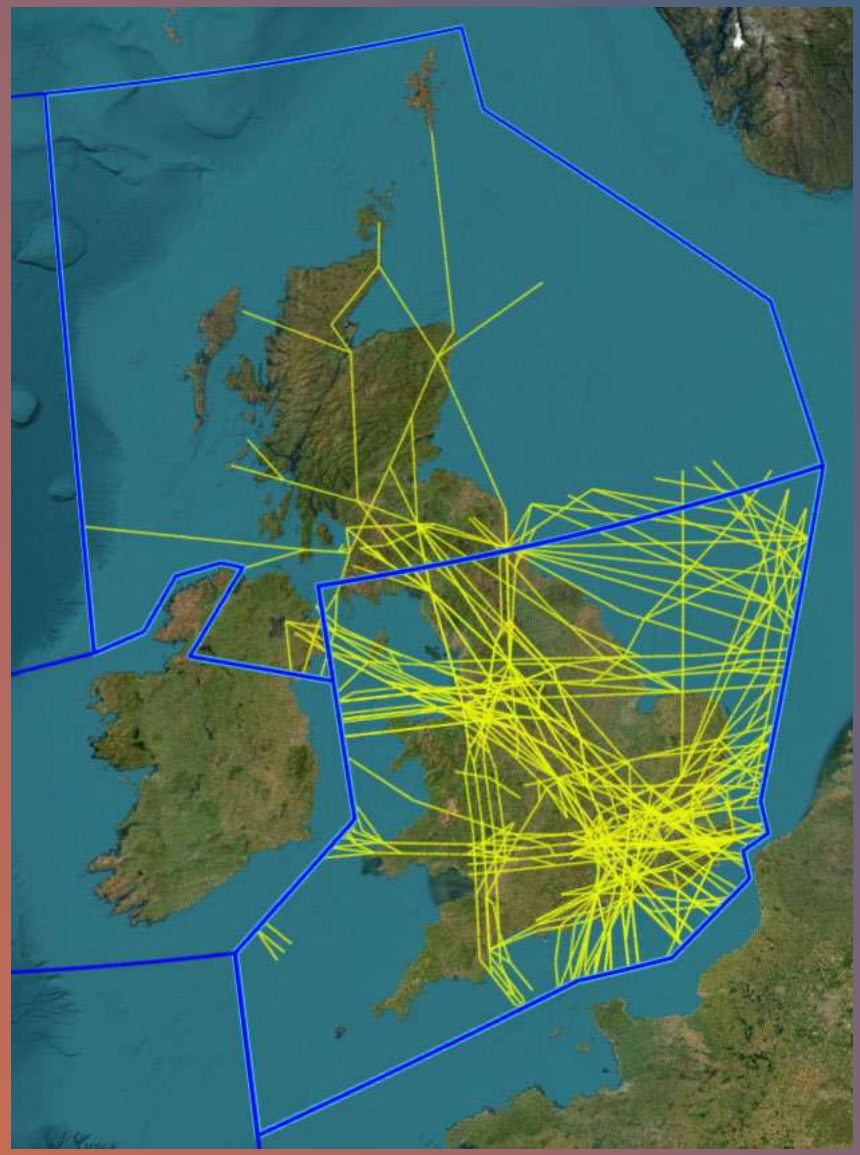
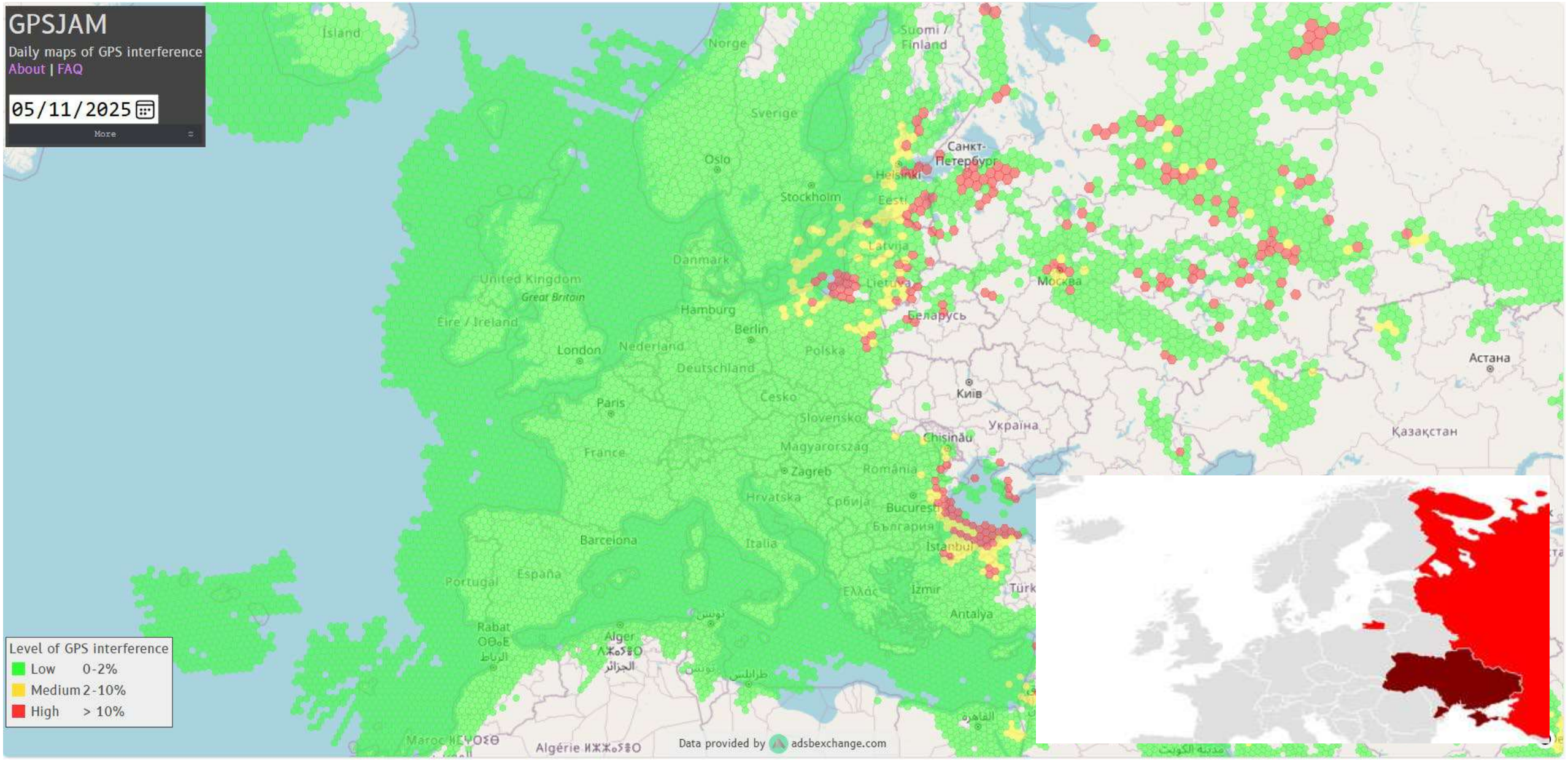


Image Credit – NATS


FIR
SHANWICK OCEANIC
EGGX
FIR
SCOTTISH
EGPX
UIR
SCOTTISH
EGPX
FIR
SHANNON
EISN
UIR
SHANNON
EISN
UIR
LONDON
EGTT
FIR
LONDON
EGTT
FIR
BREST
LFRR
UIR
FRANCE
LFFF
FIR
PARIS
LFFF
FIR
BORDEAUX
LFBB
FIR
MARSEILLE
LFMM
FIR
MADRID
LECM
UIR
MADRID
LECM
FIR
SANTA MARIA OCEANIC
LPPO
FIR
POLARIS
ENOR
FIR
SWEDEN
ESAA
FIR
KOBENHAVN
EKDK
UIR
RIGA
EVRR
FIR
BREMEN
EDWW
FIR
LANGEN
EDGG
UIR
RHEIN
EDUU
FIR
WARSZAWA
EPWW
FIR
PRAHA
LKAA
FIR
WIEN
LOVV
FIR
BUDAPEST
LHCC
FIR
MILANO
LIMM
UIR
ITALIA
LIRR
FIR
ROMA
United Kingdom
Leeds
London
Alba / Scotland
Éire / Ireland
Nederland
Deutschland
Belgique
Bretagne
Normandie
Nouvelle-Aquitaine
Bordeaux
Schweiz/Suisse/Svizzera/Svizra
Slovensko
Slovenija
Hrvatska
Србија
København
Groningen
Rogaland
Telemark
Buskerud
Vestland
Agder
Innlandet
Dalarnas län
Stockholms län
Östergötlands län
Region Nordjylland
Region Syddanmark
Bayern
Turku




GPSJAM
Daily maps of GPS interference
About | FAQ
05/11/2025
More
Level of GPS interference
Low 0-2%
Medium 2-10%
High > 10%
Data provided by adsbexchange.com
Ísland
Norge
Suomi / Finland
Sverige
Oslo
Санкт-Петербург
Helsinki
Stockholm
Eesti
Latvija
Lietuva
Москва
Беларусь
Danmark
United Kingdom
Great Britain
Eire / Ireland
Hamburg
Berlin
London
Nederland
Deutschland
Polska
Astana
Київ
Україна
Česko
Slovensko
Paris
Chișinău
Қазақстан
Magyarország
France
Zagreb
România
Hrvatska
Србија
București
България
İstanbul
Barcelona
Italia
España
Portugal
Ελλάς
İzmir
Türk
Antalya
Rabat
Alger
الجزائر
Maroc
Algérie
القاهرة

UK Risk Picture

- UK Safety Risk Working Group establishing risk to different users
- International risk informed by ICAO, EASA, IATA information
  - Safety Notice
  - Multiple engagement forums including operators, recreational users etc.
- UK specific risk, to be informed by:
  - ADS-B derived information (tools like ECTRL Sherlock)
  - Localised ground based GNSS capability (OS NET)
  - Quarterly assessment of GNSS performance
  - Potential partnerships with law enforcement and other government departments
  - General reporting through MOR and specific reports from operators
    - Follow up work with radio regulator to investigate patterns of RFI

Safety Risk Management – Three Parts

Commercial Air Traffic

- Worldwide
- Coms, Nav, Surv

General Aviation

- UK
- EC, Moving Maps

Unmanned

- UK
- Nav, Return Home

Stakeholder Focus

GA

- Education
- Equipage
- Alternatives
- Infrastructure

UAV

- Risk Picture
- Integrity requirements
- Failure cases(JARUS)
- Alternative PNT
  - Optical
  - UWB
  - E-Loran
  - TODA

CAT

- Operator engagement
- ICAO Influence and participation (Global Solution)
- Infrastructure (MON)
  - DME
- Education
- Avionics Performance

Navigation MON

Image Credit – Drone Adventure

Navigation Minimum Operational Network

- UK NAV MON built on multiple stages:
  - 1 – PBN resilience (DME coverage requirements to support PBN)
  - 2 – Further resilience (ILS Capability, non-PBN operations, new airspace users)
- Acknowledging ICAO SL
- Analysis under way to determine suitability of current DME network
- Considerations for optimisation of network to support NAV-MON
- Future considerations for UK infrastructure
- Currently in the absence of UK-SBAS capability (Phase 2)

Navigation Minimum Operational Network

State Requirement (What resilience)

Coverage

Availability

Airport/Airspace Needs (Specific Requirements)

Pax Figures

IFR Requirement

Other Factors

UK MON

Frequency Capacity (How much space)

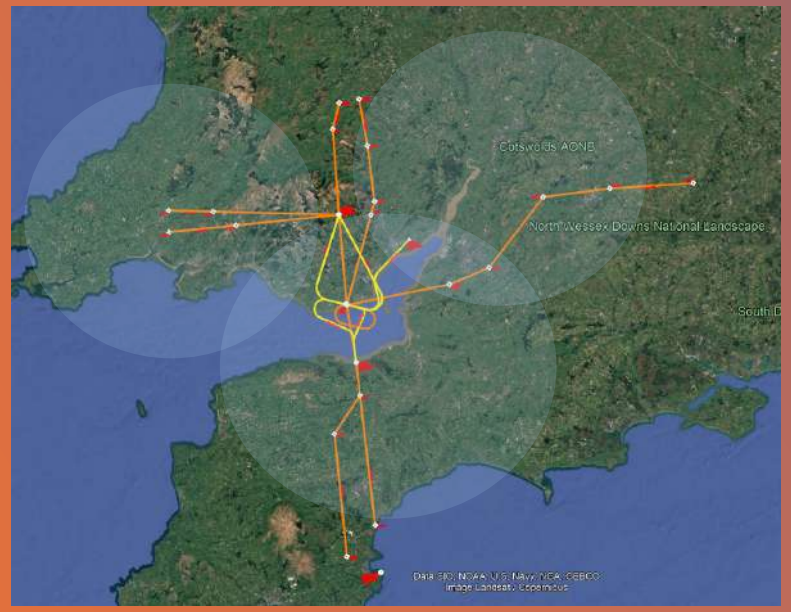
Surveillance Services

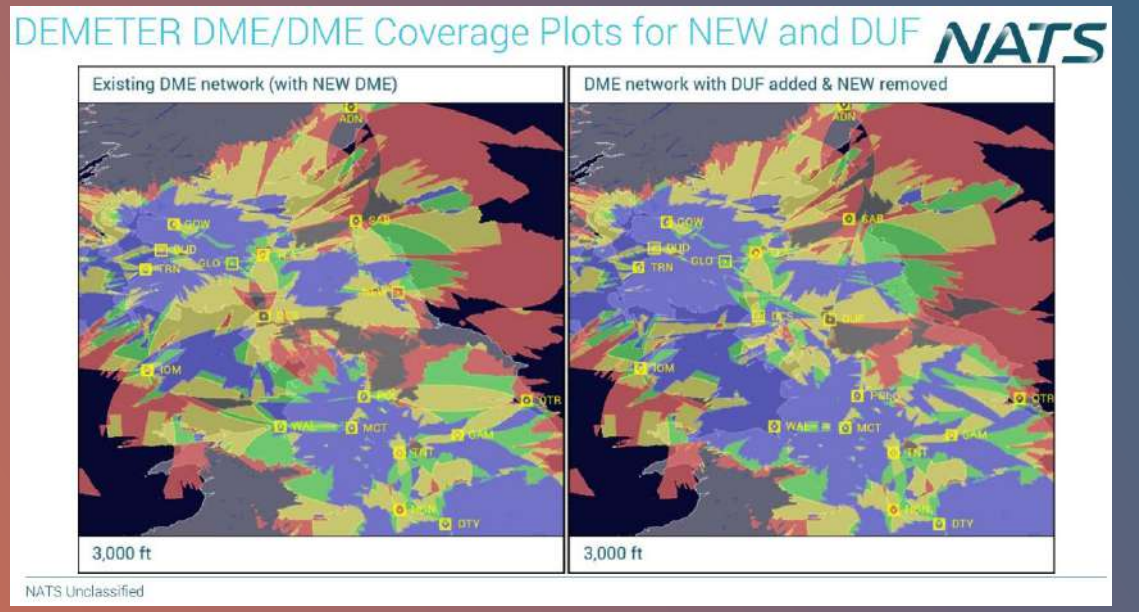
ANSP Licence

Mil Assets

Determining MON requirements

- Coverage Requirements
  - Coverage at a range of altitudes
  - Airport coverage
  - Risk of GNSS jamming
- Availability Requirements
  - Resilient to failure
  - London TMA
  - Criticality of location (No. Pax)





Other considerations for MON

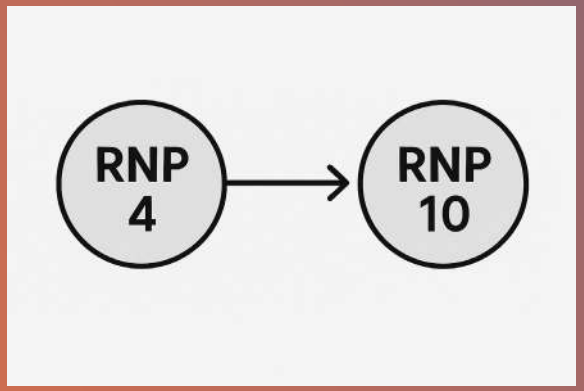
- Infrastructure sharing and coordination
  - Military
  - Neighbouring States
- UAV Vs. Crewed
- Communication and Surveillance Networks
- Frequency Management

Oceanic Airspace

Image Credit – NATS

Latent Effects (Contaminated Receiver)

- Limited local jamming known over the UK and Oceanic Airspace
- Flights to/from effected areas can retain impact of spoofing hours prior
- Corrupted ephemeris (satellite orbital) data creates a latent vulnerability
- Shanwick Oceanic Control Area (OCA) is managed by the UK, an area of approximately 700,000 square miles, this is managed through NATS (National Air Traffic Services) at its Prestwick control centre.



A non-exhaustive list of possible effects and impacts of GNSS jamming and/or spoofing are documented in various sources such as ***EASA Safety Bulletin SIB No: 2022-02R3*** (https://ad.easa.europa.eu/ad/2022-02R3). The following is a list of issues that are directly impacting NAT operations:

- Failure or degradation of aircraft systems which use GNSS as a time reference or source of position information, leading to;
  - loss of, or unreliable ADS-B data,
  - loss of, or unreliable ADS-C data, (for example time errors)
  - loss of Controller Pilot Data Link Communication (CPDLC).
- Inability to conduct or maintain GNSS based Area Navigation (RNAV) or Required Navigation Performance (RNP) operations.

Note 1: Navigation specifications RNAV 10 (RNP 10) and RNP 4 are required for the application of performance-based separations.
Note 2: RNP 4 requires at least one functioning GNSS.
Note 3: RNAV 10 (RNP 10) is required to operate within the NAT HLA (between FL290 – FL410).

GNSS Interference in Oceanic Airspace

UK Civil Aviation Authority

IMPACTS

- Loss of RNP4 compliance
  - *Required for application of reduced separations (e.g. ASEPS/PBCS)*
- Loss of RNAV10 (RNP10) compliance
  - *Required to operate in the NAT HLA (between FL290 – FL410)*
- Loss or incorrect ADS-B (in & out)
  - *Ghosting or loss of ATS Surveillance targets*
- Loss or incorrect ADS-C reports
  - *FOM alerts or incorrect estimates in reports*
- Loss of CPDLC connection
  - Required for application of *reduced separations (e.g. ASEPS)*

- 5-50 aircraft impacted daily
- Several hundred reported events through 4114
- Predominantly single GPS degradation resulting in aircraft not meeting RNP4 requirements
- Various systems impacted, ADS-B, ADS-C, CPDLC, Onboard clock timing, GPS, FMC, etc.
- Service Impact – Condition 11 KPIs under threat

MITIGATIONS

- Internal HAZID
- External stakeholder engagement – ANSPs/CAA/Airlines/Aircraft Manufacturers/ICAO
- NAT Ops Bulletin
- NOTAM and OTS Track Note
- Oceanic ART and briefings
- MATS 2 updates
- Defensive controlling techniques – Traffic Volume and increased separation standards
- Investigation into automated methods of identifying & recording impacted a/c

Working Group Established

Note – Aircraft have varying levels of impact and recovery. E.g., AAL:
B777-300ER - fails to recover after leaving area of RFI. Circuit Breaker required, but not permitted.
B787-9 – Just as susceptible to RFI, but auto recovers after exiting area.

Slide Credit – NATS

NATS (and CAA) Actions

- NATS has implemented defensive controlling measures and updated policies to manage GNSS spoofing
- Regular ATC briefings enhance controller readiness for worst-case scenarios
- Occurrence data analysis is essential but currently depends on aircrew reports
- Automation of interference detection could transform GNSS monitoring
- UK government, CAA, and NATS collaborating on awareness, escalation, and mitigation strategies
- Growing threat of domestic spoofing due to increased accessibility of interference devices
- Participation in EUROCONTROL and UK exercises to test large-scale interference response
- Scenario-based exercises continue to strengthen aviation resilience
- Coordinated short, medium, and long-term mitigations being developed
- UK engaging internationally with ICAO and EUROCONTROL for a global approach

Slide Credit – NATS

Oceanic Airspace - Future Mitigations

- Continued coordination through relevant forums
- Avionics improvements could offer longer term mitigations
- Crew guidance regarding in-flight GNSS receiver reset and confirmation of functions (OEM guidance)
- Continued education and awareness for pilots and controllers
- Use of live data to inform defensive controlling
  - ECTRL Sherlock Tool
- Considerations of GNSS vulnerability for airspace design

Military Exercises

Military Exercises

- The UK CAA supports UK military to test capability and ‘train as they fight’
- Critical to have robust coordination mechanisms (PCNOJ)
- Law Enforcement activity has also increased as the UAV threat increases


UK AIRPORTS FACE INEVITABLE DRONE ATTACKS, AVIATION CHIEF WARNS AFTER BELGIUM SHUTDOWNS

Haye Kesteloo / November 11, 2025 /


More Drones Spotted Over USAF Bases in UK

Nov. 27, 2024 | By Greg Hadley


Drone-blocking technology ‘urgently’ required at jails in England and Wales

Ability to maintain control in prisons ‘critically undermined’ by scale of illicit drug use and trade, MPs say


The long read

This article is more than 4 years old

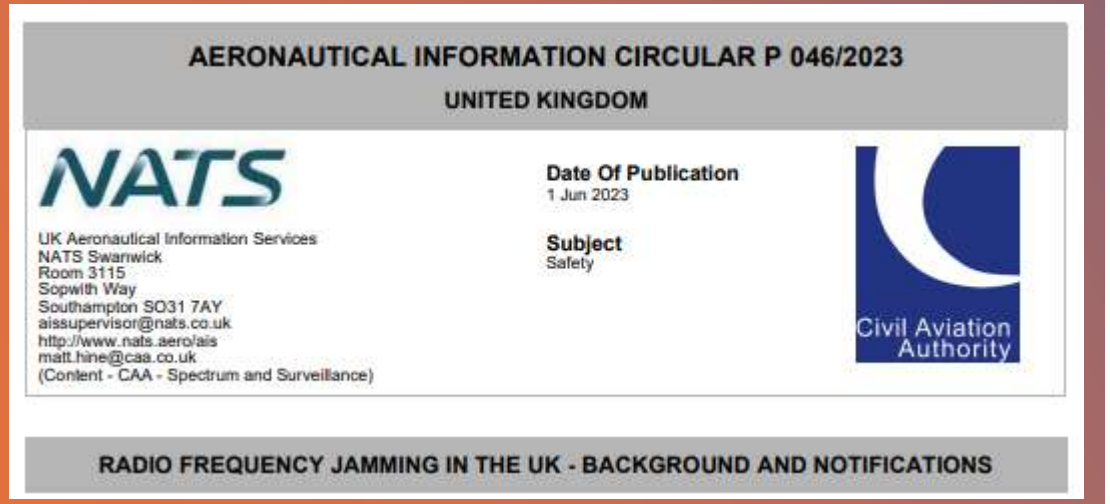
The mystery of the Gatwick drone

A drone sighting caused the airport to close for two days in 2018, but despite a lengthy police investigation, no culprit was ever found. So what exactly did people see in the Sussex sky?

By Samira Shackle

Military Exercises

- Notification and Education
- Process incorporating relevant stakeholders
- Agreed universal parameters
- Multiple examples in UK AIP
- Assessed against known state of terrestrial aids



AERONAUTICAL INFORMATION CIRCULAR P 046/2023

UNITED KINGDOM

NATS

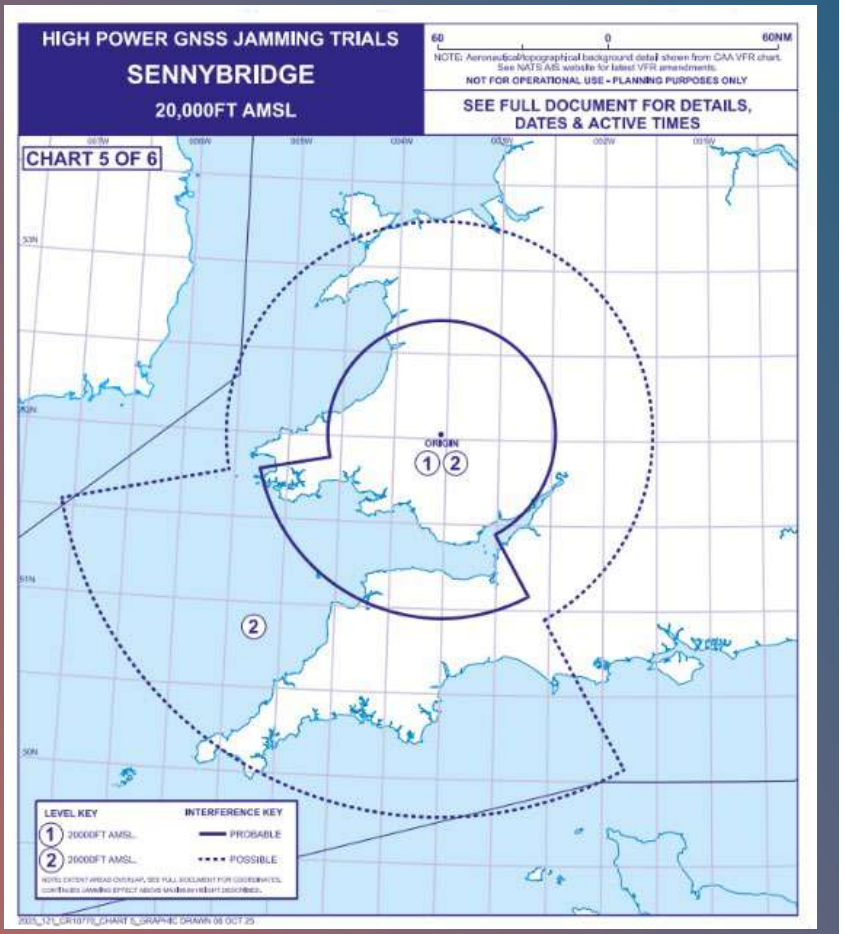
UK Aeronautical Information Services
NATS Swanwick
Room 3115
Sopwith Way
Southampton SO31 7AY
aissupervisor@nats.co.uk
http://www.nats.aero/ais
matt.hine@caa.co.uk
(Content - CAA - Spectrum and Surveillance)

Date Of Publication
1 Jun 2023

Subject
Safety

Civil Aviation Authority

RADIO FREQUENCY JAMMING IN THE UK - BACKGROUND AND NOTIFICATIONS



Additional Considerations

- Buying and using jammers/spoofers - The Law
- Airport monitoring functions
- Electronic conspicuity dependencies and resilience – Validation of ADS-B
- Reporting of events