


# Airspace Infringements: Causal Factors 2023

CAP 3069



This report, unlike previous reports that were written by the Causal Factors Working Group of the Civil Aviation Authority's Airspace Infringement Working Group (AIWG), has been written by the CAA's Airspace infringement Team.

The Team comprises four members and is part of the Airspace Modernisation Delivery Team within the Safety and Airspace Regulation Group.

The [Airspace & Safety Initiative](#) is a joint CAA, NATS and MoD initiative to tackle major safety risks in UK airspace.

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## Introduction

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An airspace infringement is the unauthorised entry of an aircraft into notified airspace. This includes controlled airspace, Special Use Airspace (SUAS), Aerodrome Traffic Zones (ATZ), Radio Mandatory Zones (RMZ) and Transponder Mandatory Zones (TMZ).

Of the 1,231 reported airspace infringements in 2023, the Team had access to Mandatory Occurrence Reports (MOR)/Alleged Breach of Air Navigation Legislation Reports for all reported occurrences and over 1,000 pilot reports, whether in the form of pilot-submitted MOR, the questionnaire at [airspace-safety.com/infringement/infringement-form/](https://airspace-safety.com/infringement/infringement-form/) or via email/word documents submitted to the CAA.

The factors considered are:

- Use of an air traffic service;
- Altimetry;
- Use of a VFR Moving Map;
- Planning and Threat and Error Management, including meteorology and use of regulated Aeronautical Information.

Unlike in previous years, where the analysis was carried out by the Causal Factors Working Group, this report will not contain percentages of causal factors by report numbers.

As well as detailing root causes and contributory factors of airspace infringements, this report will also serve to provide information to increase knowledge and understanding through the provision of web-links.

Based on the statistics that some 94% of airspace infringements involved powered aircraft, the findings are naturally biased in that direction. However, many of the root causes and contributory factors are applicable to flights of all aircraft categories.

### Reported airspace infringement occurrences by aircraft category

Category	Percentage
Aeroplane	70%
Helicopter	11%
Ultralight/Microlight	6%
Sailplane/Hang-glider/Paraglider	1%
Hot air Balloon	<1%
Military aeroplane/helicopter	7%
Unknown aircraft	4%

## Pilot Qualification

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From data taken directly from licensing checks conducted as part of the CAP1404 casefile review process, it was established that the type of licence held by the Pilot-in-Command (PIC) was as follows:

Licence Type/State of Licence Issue	Number of Occurrences	Percentage of Occurrences
Students	33	2.7%
UK issued licence (PPL/LAPL/NPPL/CPL/ATPL)	941	76.4%
Non-UK issued licence	110	9%
Military	87	7%
Unknown	60	4.9%

Of the 941 infringements involving UK licenced civilian pilots, 98 (10.4%) occurred during an instructional flight with a Flight Instructor or a flight test with a Flight Examiner.

## Use of Air Traffic Services (ATS)

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The Team categorises the use of Air Traffic Services (ATS) in four main categories:

1. Use of UK Flight Information Services (UK FIS) excluding London and Scottish Information;
2. Use of a Frequency Monitoring Code (FMC);
3. Basic Service from London and Scottish Information; and
4. Operating autonomously.

Whilst the use of an ATS is not mandatory in much of the UK's Class G airspace, there is still a reluctance to obtain a service. In analysis this reluctance has been found to be underpinned by the following main factors:

- Lack of confidence or perceived ability when communicating with Air Traffic Control;
- Limited capacity of some ATS units to be able to provide the requested type of service;
- Perception that a service that is subject to 'limitations' is pointless; and
- Lack of understanding of UK FIS.

In the case of understanding, the Team note that there is a lack of understanding of the suite of ATS that together form the UK FIS; in particular, a pilot's responsibilities associated with airspace avoidance and the provision of a Basic Service. In addition, a large number of pilots elect to obtain a Basic Service from the non-surveillance equipped London Information where either a Lower Airspace Radar Service (LARS) or the use of an FMC could have either provided a mitigation to airspace infringements or, as a minimum, the ability to resolve the occurrence in a more timely manner by the relevant radar controller. (see narrative number 23 at <https://airspacesafety.com/hot-spot-narratives/>)

### Links

- UK Flight Information Services CAP 774 – [www.caa.co.uk/CAP774](http://www.caa.co.uk/CAP774)
- Lower Airspace Radar Service - [airspacesafety.com/resources/](https://airspacesafety.com/resources/)

It was found that the use of an FMC is increasing in the UK. With some 26 codes now available in operation, with the correct use of the code, airspace infringements can either be prevented (where controller capacity permits) or resolved in a timely manner and, in many cases, prior to the occurrence leading to the use of safety intervention measures. Air Traffic Controllers are actively encouraged, when capacity permits, to apply 'defensive controlling' measures to offer information to a pilot whose track/trajectory indicates that an airspace infringement will possibly occur. However, this should not be expected, and it remains the pilot's responsibility to remain outside of notified airspace until a clearance or permission has been obtained.

Where the use of a displayed FMC has been unsuccessful in resolving an airspace infringement, the cause has been either:

- Incorrect frequency selected; or
- Radio volume has been lowered to either enable internal communications with a student or passenger.

### Links

- UK FMC card - [airspacesafety.com/resources/](https://airspacesafety.com/resources/)
- FMC aide memoirs - [airspacesafety.com/listening-squawks/](https://airspacesafety.com/listening-squawks/)
- Aeronautical Information Circular Y111/2023 - [nats-uk.ead-it.com/cms-nats/opencms/en/Publications/Aeronautical-Information-Circulars-AICs/](https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/Aeronautical-Information-Circulars-AICs/)

## Altimetry

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The Team has noted a marked reduction in the number of airspace events resulting from the incorrect use of the Regional Pressure Setting (RPS) when flying in proximity to controlled airspace. Pilots should always remember that if an Air Traffic Control Officer (ATCO) or Flight Information Service Officer (FISO) issues the RPS for use where there is more appropriate altimeter setting based on the airspace infrastructure, a pilot is not obliged to operate on the RPS and is strongly recommended to set the relevant aerodrome QNH. However, it is important that the pilot notifies the ATCO or FISO of the pressure setting being used and their altitude.

Two main causal factors related to altimetry noted in this reporting period were:

1. Pilots operating on the QNH below controlled airspace then set the aerodrome QFE to join the aerodrome traffic pattern and climbing to 're-adjust' to their previous indicated level meaning that they were then flying higher than intended. This is particularly significant when flying into aerodromes such as Elstree (elevation 332 feet AMSL and below the London Terminal Control Area which has, in that area, a base of 2,500 feet AMSL) and Nottingham (elevation 138 feet AMSL and north of the East Midlands Control Area-2 with a base of 1,500 feet AMSL).
2. During periods of extremely low pressure, pilots flying close to the base of controlled airspace that is defined as a Flight Level but operating on the local QNH. Pressure to height conversions in altimetry are based on International Standard Atmosphere (ISA). Independent of temperature, the conversion is 27 feet/hPa in the lower atmosphere (near ground) [<https://skybrary.aero/articles/altimeter-pressure-setting>]. As an example, if the QNH is 990 hPa below a CTA with base of FL55, any altitude above approximately 4,800 feet will result in an infringement.

Good practice when departing an aerodrome is to set the relevant QNH prior to commencing your taxi and check again as part of your pre-departure checks; part of that check will incorporate ensuring that the altimeter reads the aerodrome elevation if using QNH (or zero if using QFE when departing to enter the visual circuit). Prior to flight (ideally before starting your taxi from your parking spot), it is also a good idea to consider checking the accuracy of the pressure altitude that your transponder is reporting. To do this, set 1013 hPa on your altimeter sub-scale and check the altitude on the altimeter against the reading on the transponder. Remember to re-set the correct relevant altimeter setting before starting to taxi.

## Use of VFR Moving Maps

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There has been a marked increase in the use of VFR Moving Map technology in recent years which is a positive step in the prevention of airspace infringements and an aspect supported by the CAA. The Team is now noting that, as with the previous analysis of 2020, during infringements where VFR Moving Maps were being used, there was either gaps in the understanding of some functions available on applications or once in use, a lack of attention paid to the information that was being given, e.g. airspace warnings/alerts. The latter was particularly evident in vertical infringements where the initial airspace alert was acknowledged/dismissed, invariably as the pilot was aware of the CTA/TMA above and then a subsequent alert was not provided during a slow climb or for a further time-period (depending on the product in use). This may be the reason many pilots reported the lack of a warning/alert immediately prior to an infringement when using some applications.

Other associated causal factors that led to airspace infringement include:

- Depiction on charts of information relating to airspace re-classification and NOTAM;
- Failure of devices due to overheating or depleted power;
- Overreliance on altitude alerts when flying below higher-level CTA/TMA;
- Using VFR Moving Maps as the sole source of planning. Moving Map technology should not be the sole means of planning or navigation as highlighted in the European General Aviation Safety Team, Safety Promotion Leaflet, Using Advanced Navigation Technology Safely (EGAST GA7 page 3 refers).
- Incorrect configuration of alerts including pre-flight connection to enable aural alerts through a pilot's headset.
- Over focus on devices leading to a loss of cockpit monitoring and loss of situational awareness of altitude changes.
- 'Alert fatigue' leading to pilots' selection of visual alerts on the device screen prior to mentally noting the subject.

It is also important to remember that Moving Map applications are not regulated by the CAA, and users should note that the depiction of aeronautical information on VFR Moving Maps may be different to the UK Aeronautical Information products accessed via the NATS Aeronautical Information Service (AIS) website, such as VFR charts, the UK AIP and NOTAM information (NATS AIS is the authorised source of UK aeronautical information provided on behalf of, and regulated by, the CAA). In many occurrences where VFR Moving Maps have been used, pilots have cited misreading airspace base levels/altitude particularly when there is further controlled airspace above of a higher classification, for example a Class D Control Area (CTA) laying beneath a Class A TMA/CTA.

The Team has been advised, by SkyDemon, to remind users that "As always, it's worth reminding the end-user that NOTAMs were never originally intended for graphical



depiction at all, so although usually SkyDemon will do a great job of deciding what should be depicted and how, we are working in an imperfect system and the pilot should always read the NOTAM brief, where of course this NOTAM would have been clearly displayed.”

### Links

- Safety Sense Leaflet 29 – [VFR Moving Map Devices](#)
- Using Advanced Navigation Technology Safely - [GA7.pdf \(europa.eu\)](#)

## Planning and Threat and Error Management

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In some areas of the UK, due to the number of major airports (and the associated controlled airspace to enable complex integration of IFR traffic), minor aerodrome and site of unusual aerial activity, the airspace structures are complex. This in turn requires that pilots carry out detailed pre-flight planning and preparation to enable the flights to be safe, effective and enjoyable.

In most infringement events, the Team has noted that lapses in pre-flight planning and the application of Threat and Error Management are the major root causes. In many cases, the pilot has either used their VFR Moving Map device as the sole source of planning or, in the case of Flight Instructors, no flight planning has taken place to and from an exercise area. One of the main risks when using a VFR Moving Map as the sole source of planning, is that the creation of a waypoint-to-waypoint route line with ‘rubber banding’ may not give the pilot the opportunity to note and manage any threats from airspace structures along each sector of the route in the same way as drawing a line on a paper chart. Planning should incorporate the use of regulated aeronautical information products from the NATS AIS such as the most appropriate VFR charts and the UK AIP. When flying a route that requires changes in altitude due to, for example, CTAs it is good practice to annotate on a chart climb and descent points that take into account the requirements of the airspace as well as the effects of headwinds and tailwinds and should incorporate the ‘Take 2’ guidance where possible; these points should then be noted on a PLOG and added as separate waypoints onto VFR Moving Map device to act as triggers. In the planning stage you should also formulate a communications plan detailing from which Air Traffic Control Unit to obtain an Air Traffic Service and when that service can be obtained (considering areas of responsibility and Designated Operational Coverage (DOC)). In most cases of infringements of Restricted Area (Temporary), a final check, pre-departure, via the NATS AIS Information line on 0808 535 4802 could have prevented the events which resulted from a lack of situational awareness as to the existence of the structures.

In addition, it is important to include a detailed weather plan using regulated meteorological information from the UK Met Office aviation website using products such as GAMETS and MetForms F214 and F215 in order to be able to anticipate any en-route weather; in reviewing the MetForm F215 it is important to note the movement of any fronts

and troughs based on the direction and speed of travel when compared with intended flight time.

Other associated causal factors that led to airspace infringement include:

- Failing to use regulated sources of NOTAM information (NATS Internet Briefing Site) via [nats-uk.ead-it.com/cms-nats/opencms/en/home/](https://nats-uk.ead-it.com/cms-nats/opencms/en/home/).
- Failing to use the NATS AIS Information line on 0808535 4802 prior to each flight.
- A tendency just to reverse headings on the 'homeward flight'.
- A failure to discuss the planned route with passengers so that their wishes can be considered/incorporated/rejected in the planning stage (in-flight changes often lead to distraction and misreading of altitudes on VFR Moving Maps.)
- Not managing cockpit distractions during critical stages of flight; [Safety Sense Leaflet 31](#) provides valuable guidance.
- Pre- and in-flight decision making associated with meteorological conditions ('press-on-itis').
- Lack of planning on arrival/departure procedures at aerodromes that could be mitigated with wider planning using the aerodromes' websites.

## Conclusion

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The Airspace Infringement Team was fortunate to have over 1,000 pilot reports to supplement MORs. From reviewing all occurrences, except those involving military pilots<sup>1</sup>, the Team has made the following conclusions relating to root cause and contributory factors associated with pilot action/inaction which led to airspace infringements:

A lack of detailed understanding of the application of UK FIS and the provision of a Basic Service from LARS units and London Information frequently gives pilots a false belief that the service provided has the ability, or responsibility, to prevent an infringement from taking place. The CAA is actively encouraging pilots to make a greater use of FMCs to enable controllers to, where capacity exists, exercise 'defensive controlling' by offering advice to prevent an occurrence and also to enable occurrences to be resolved quicker.

Altimetry still plays a significant part in many occurrences particularly on days when low pressure exists and when pilots are operating on the RPS. Whilst some service providers will issue the RPS to mitigate Controlled Flight into Terrain, pilots should not use that altimeter setting when operating under controlled airspace; instead, they should ask for the relevant QNH and advise the service provider of the altimeter setting they are then using.

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<sup>1</sup> As of 2025, it is anticipated that the CAA will have access to pilot reports from military pilots that are subject to airspace infringement related MOR.

Whilst the uptake in the use of VFR Moving Maps has increased significantly in recent years, it is evident that some pilots are unsure how to optimise their use and, instead of using them as a 'blend' in preflight planning are using them as their sole means of planning. Not only are they unregulated, but their depiction of airspace boundaries, NOTAM and temporary airspace structures and aerial activity vary. The matter of alert fatigue is not unusual with pilots missing essential airspace alerts and warnings when cancelling/accepting significant numbers of other alerts. The devices that host the Moving Map applications are also subject to a number of Threats and Errors that can be found in Safety Sense Leaflet 31.

The two principal areas that underpin almost every occurrence are insufficient pre-flight planning/preparation and lapses in applying effective Threat and Error Management. With the increased use of VFR Moving Maps, some pilots feel there is less need to give adequate lateral margins from the boundary of controlled airspace. That, when coupled with the most significant Human Factor threat of distraction, increases the risk of a lateral infringement.

Planning should make use of regulated sources of aeronautical information such as the NATS AIS website to source NOTAM information, airspace and communication information. This should then be supplemented with aerodrome specific information from the Aerodrome Directory for licenced aerodromes along with valuable local-specific information from aerodrome websites. In addition, a great deal of useful information can be obtained during PPR and in discussion with aerodrome staff or referencing aerodrome operations manuals along with a final call to the NATS AIS Information line on 0808 535 4802.

In the planning stage, use of regulated meteorological information from the UK Met Office aviation site can mitigate many weather-related risks; in addition to the MetForms and GAMETS, the site offers METARs/TAFs and satellite imagery.

## Appendix 1: Reasons for Investigation of Airspace Infringements

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The CAA's Infringement Coordination Group reviewed 425 airspace infringements during 2023 in accordance with CAP1404. Some of these events occurred in 2022 but due to reporting and casefile compilation the cases were not reviewed until 2023. These infringements were selected because:

1. The airspace infringement resulted in a loss of standard separation between air traffic operating within notified airspace and an infringing aircraft; or
2. The airspace infringement resulted in a safety implementation measure (controlling action) being initiated to establish or maintain standard separation between air traffic operating/intending to operate within controlled airspace and an infringing aircraft. It should be noted that this action is taken as a safety measure to prevent a loss of separation from occurring. This may include one or more of the following actions:
  - a. Avoiding action instructions
  - b. Issuing of radar vectors
  - c. Instructions to stop climb/descent
  - d. Instructions to suspend SUAS operations
  - e. Suspension of departures
  - f. Implementing a 'Check' on departures (where free-flow departure operations are cancelled)
  - g. Issuing of traffic information
3. The airspace infringement was carried out by a pilot who has been recorded as having previously infringed notified airspace within the previous two years as outlined in CAP1404.

The CAA's Airspace Infringement Team reviewed a further 733 airspace infringements. These occurrences were categorised as minor in accordance with CAP1404 as they did not compromise flight safety, there was no requirement for the implementation of a safety intervention measure or where the pilot had not previously infringed.

In addition, 84 cases were closed without review as they involved military pilots operating military aircraft.

## Appendix 2: 2023 Airspace Infringement Statistical Data

<b>Total number of reported airspace infringements</b>	<b>1231</b>
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### Reported airspace infringements by airspace type

<b>Airspace type</b>	<b>Percentage</b>
Control Zones (CTR)	43.5%
Control Areas (CTA) including airways	21%
Terminal Control Areas (TMA)	13.5%
Special Use Airspace: Prohibited/Restricted/Danger Areas (permanent and temporary)	7%
Radio Mandatory Zones (RMZ)	1%
Transponder Mandatory Zones (TMZ)	5.5%
Aerodrome Traffic Zones (ATZ)	8.5%

### Reported airspace infringements by airspace location

<b>LAIT locations in 2023 or locations with 10 or more reported infringements</b>	<b>Number</b>
Stansted CTR/CTA/TMZ	148
London Terminal Control Area (all areas)	137
Southampton CTR/Solent CTA	98
Farnborough ATZ/CTR/CTA	93
Manchester CTR/CTA/TMA	64
East Midlands CTR/CTA	62
Luton CTR/CTA	58
Southend CTR/CTA	39

<b>LAIT locations in 2023 or locations with 10 or more reported infringements</b>	<b>Number</b>
London CTR	38
Bristol CTR/CTA	30
Channel Islands (includes all airspace in both FIR)	25
Glasgow CTR/CTA	24
Birmingham CTR/CTA	23
Edinburgh	18
Hawarden RMZ	14
Newcastle CTR/CTA	14
Cotswold CTA (all areas)	11
Belfast & Belfast City CTR/CTA/TMA	10
Cardiff CTR/CTA	10
Syerston ATZ	10
Manchester Barton ATZ	9
London City CTR/CTA	8
Liverpool CTR/CTA	7
Leeds Bradford CTR/CTA	5
Brize Norton	4
Oxford ATZ	2