Safety and Airspace Regulation Group

CAP 2093

CAA Impact Analysis – Changes to VMC Minima in UK Class D Airspace

Safety and Airspace Regulation Group

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Executive summary

On 20 May 2021, the Aviation Safety (Amendment) Regulations 2021 will amend the visual meteorological conditions (VMC) visibility and distance from cloud minima in class D airspace.

This analysis, conducted by the CAA on behalf of the Department for Transport (DfT), identifies and evaluates the impacts of the revised VMC minima on the safe and efficient operation of UK class D airspace.

The adoption of the revised VMC minima returns UK class D airspace to the situation that existed prior to 27 March 2020. It is reasonable to argue that the UK must have considered the class D airspace environment that existed prior to 27 March 2020 to be acceptably safe. Thus, by inference, the class D airspace environment that will exist from 20 May 2021 should also be acceptably safe.

The CAA has concluded that, whilst the revised VMC minima in class D airspace reduces the efficacy of the 'see and avoid' barrier to the risk of mid-air collision (MAC), they consider that the negative effects of this can, generally, be mitigated to an acceptable level; primarily by the way that an air traffic control service is provided in UK class D airspace. However, these statements reflect the general situation and the CAA is concerned that, at present, the changes to the VMC minima have an unacceptable impact on the safe operation of helicopters in the Manchester Low-Level Route.

The DfT is invited to note that:

(1) The flight crew human factors elements associated with this change remain unquantified. While the provision of an air traffic control service is a key mitigation to the risk of MAC, airspace users' understanding of the applicable requirements and the importance of effective threat and error management has been highlighted within this analysis as key concerns associated with the change. The CAA is continuing work to identify how these can be ensured, both initially and as an ongoing activity.

(2) Additional mitigations will be required to address the increased risk of MAC to helicopters operating VFR in the Manchester Low-Level Route. The CAA is working with NATS to address this by 20 May 2021.

(3) Subsequent to the satisfactory resolution of the CAA's concerns regarding the operation of helicopters in the Manchester Low-Level Route, the CAA believes that, on balance, the impact of this change is neutral.

1 Introduction

Background

1.1 On 20 May 2021, the Aviation Safety (Amendment) Regulations 2021 will amend the visual meteorological conditions (VMC) visibility and distance from cloud minima in class D airspace[1], and will incorporate the UK's existing general permission relating to flight visibilities in class G airspace[2].

1.2 Following the introduction of Implementing Regulation (EU) No 923/2012 the Standardised European Rules of the Air (SERA), the UK had exempted any aircraft being flown within the UK at or below 3,000 ft AMSL and within class D airspace from the requirements of SERA.5001 (VMC visibility and distance from cloud minima) Table S5-1, subject to specific conditions. However, the UK's exemption case was not supported by the EASA and European Commission (EC) (Commission Decisions 2016/7654 and 2019/1957). Consequently, the exemption was allowed to expire at midnight on 26 March 2020 and, on 27 March 2020, the UK implemented the requirements of SERA.5001 Table S5-1.

1.3 Following the end of the EU Exit Transition Period, the Department for Transport (DfT) developed a Statutory Instrument (The Aviation Safety (Amendment) Regulations 2021) to amend SERA.5001 Table S5-1 to reintroduce the operational environment that existed prior to 27 March 2020.

1.4 ICAO's Safety Management Manual (Doc 9859)[3] asks that States evaluate and manage the impact of change in their aviation system, highlighting the potential for significant impact to the safety risks of the State associated with changes in the regulatory environment. It goes further, saying that the State needs to analyse the impact of the change on the existing system and analyse, assess and if appropriate mitigate any new or altered safety risks.

1.5 The Department for Transport (DfT) has requested that the CAA analyse the impact of the changes to the VMC minima on its behalf and advise them of our

[1] As detailed in SERA.5001 Table S5-1.

[2] ORS4 No.1341.

[3] ICAO Doc 9859 Safety Management Manual Section 8.5.6.

findings. This will enable Ministers to determine whether the impacts of the change are acceptably safe.

Purpose and Scope

1.6 The purpose of this analysis is for the CAA to identify and evaluate the impacts of the revised VMC minima in those volumes of class D airspace within which the UK is responsible for the provision of air traffic services.

1.7 The DfT will utilise the CAA's analysis in order to assure themselves that the effects of the changes to the VMC minima are acceptably safe in those volumes of class D airspace within which the UK is responsible for the provision of air traffic services.

1.8 The revision to SERA.5001 Table S5-1 relating to flight visibility in class G airspace is out of scope of this analysis as it does not pose a change to the UK's existing airspace environment.

Responsibilities

1.9 The CAA is responsible for the completeness and accuracy of their impact analysis and any recommendations made to the DfT therein.

1.10 The DfT is responsible for:

(a) evaluating whether the effects of the changes to the VMC minima are acceptably safe in those volumes of class D airspace within which the UK is responsible for the provision of air traffic services; and

(b) the ownership of residual safety risk where it has derived from the change to the VMC minima, as identified in the CAA's analysis.

Referencing

1.11 References to SERA.5001 Table S5-1 being amended by the Aviation Safety (Amendment) Regulations 2021, and references to other Rules within SERA that are applicable within the UK, refer to Reg UK (EU) No 923/2012 as retained (and amended in UK domestic law) under the European Union (Withdrawal) Act 2018.

2 System Description

Introduction

2.1 In order to consider the impacts of the change, it is necessary to describe the current and future systems; i.e. the system that existed before and will exist after the change to the VMC minima[4].

Current System Description

2.2 At present, the VMC visibility and distance from cloud minima detailed in SERA.5001 Table S5-1[5] (see Annex A) are applicable in UK law.

2.3 In class D airspace, this requires visual flight rules (VFR) flights at and below 3 000 ft above mean sea level (AMSL), or 1 000 ft above terrain, whichever is the higher, to operate in a flight visibility of 5 km and to remain at least 1 500 m horizontally and 1 000 ft vertically distant from cloud. These VMC minima are intended to provide pilots of VFR flights with the meteorological conditions considered necessary by ICAO to discharge their collision avoidance responsibilities[6]; visually acquiring conflicting aircraft, and, within the bounds of their air traffic control (ATC) clearance, taking action necessary to avoid collision.

2.4 In class D airspace, ATC is not required to separate instrument flight rules (IFR) flights from VFR flights, nor to separate VFR flights[7]. It is the pilot's responsibility to 'see and avoid' other aircraft, aided by ATC through the provision of traffic information and, when requested, advice on collision avoidance[8] [9]. By doing so, ATC discharges its responsibilities regarding the prevention of collisions, the

[4] The future system description describes the requirements which exist in law (i.e. SERA, as transposed from the requirements detailed in ICAO Annex 2) and does not include any additional mitigations identified as being necessary to mitigate the safety impacts resulting from the implementation of the revised VMC minima.

[5] Text originates from ICAO Annex 2 Section 3.9 Table 3-1.

[6] SERA Section 3 Chapter 2 Avoidance of Collisions.

[7] SERA.6001, SERA.8005(b) and Appendix 4.

[8] ICAO Doc 4444 PANS-ATM Section 5.10.

[9] ATC may also issue routing instructions to assist pilots by reducing or eliminating points of conflict with other flights.

expedition and maintenance of an orderly flow of air traffic and the provision of advice and information useful for the safe and efficient conduct of flight[10].

Future System Description

2.5 The amendment proposed to SERA.5001 Table S5-1 VMC visibility and distance from cloud minima is detailed in Annex B. It will permit VFR flights operating at or below 3 000 ft AMSL, or 1 000 ft above terrain, whichever is higher, to fly clear of cloud with the surface in sight if the aircraft is flying:

(a) during day;

(b) at an indicated airspeed of 140 kts or less to give adequate opportunity to observe other traffic or any obstacles in time to avoid collision; and,

(c) for aircraft other than helicopters, with a flight visibility of at least 5 km; or, for helicopters, with a flight visibility of at least 1 500 m.

2.6 Acknowledging the conditions described in 2.5 (a) to (c) above, it is clear that where a VFR flight operates 'clear of cloud with the surface in sight' (rather than 1 000 ft vertically and 1 500 m horizontally clear of cloud), in certain meteorological conditions, this will restrict the pilot's ability to visually detect IFR flights flying in instrument meteorological conditions (IMC) (i.e. in cloud) in proximity to them. Moreover, it reduces the time available for IFR flights to visually detect VFR flights, once that IFR flight manoeuvres from IMC into VMC. This issue will be explored further in Chapter 4.

2.7 The safety mitigation provided by ATC and described in 2.4 above will still apply but it is reasonable to argue that, without additional mitigation being applied, the risk of mid-air collision (MAC) is increased as a result of the effect of the changed minima on a pilots' ability to visually detect conflicting flights.

[10] SERA.7001 General – Objectives of the air traffic services.

3 Impact Analysis Methodology

Introduction

3.1 The purpose of this impact analysis is to:

- identify and evaluate the impacts of the revised VMC visibility and distance from cloud minima in class D airspace; and,
- provide the DfT with the information that they need to assure themselves that the impact of the change in the VMC minima is acceptably safe, in airspace within which the UK is responsible for the provision of air traffic services.

Conduct of the Impact Analysis

3.2 To inform the impact analysis, the CAA facilitated a workshop attended by a small multi-disciplinary team composed of CAA personnel from a variety of technical backgrounds and one external stakeholder with significant commercial and private flying experience.

3.3 The purpose of the workshop was to:

- identify and evaluate the impacts of the change on UK class D airspace against the following criteria:
  - security;
  - financial;
  - environment;
  - efficiency of the air traffic management (ATM) system; and
  - safety.
- identify and consider residual safety effects relating to specific operating environments and conditions; and,
- identify and consider any other issues that relate to the revised VMC minima.

3.4 To facilitate the team's evaluation of the impacts on safety, a table-top exercise was undertaken consisting of two class D airspace scenarios involving IFR and VFR flights. A description of the table-top exercise and summary of participants' discussions is at Annex C. The outcomes from the workshop activity then

informed the drafting of this impact analysis, which was subsequently peer reviewed within SARG, and approved by Head of Airspace, ATM & Aerodromes.

4 Impact Analysis

Introduction

4.1 In undertaking its analysis of the impacts of the change to the VMC minima in UK class D airspace, the CAA has considered the following criteria:

- **Security.** What impact might the proposal have on aviation security?
- **Financial.** What financial impact might the proposal have? Will implementation have a financial cost?
- **Environment.** What impact might the proposal have on the environment; for example, increased fuel burn, increased CO2 emissions?
- **Efficiency.** What impact might the proposal have on the efficiency of the ATM system?
- **Safety.** What impact might the proposal have on safety?

4.2 Against each of these criteria, using the output from the impact analysis workshop (see also Annex C), the CAA has determined whether the revised minima have a positive impact, a neutral impact, a negative impact, or no impact.

Security

4.3 The CAA considers there to be no impact on aviation security resulting from the change to the VMC minima in UK class D airspace.

Financial

4.4 Whilst the CAA has not been able to quantify the impacts that have been identified, it considers there to be both positive and negative financial impacts resulting from the change to the VMC minima in UK class D airspace.

4.5 The implementation of the revised VMC minima will have a negative impact upon industry by imposing costs as follows:

- Air navigation service providers:
  - conduct of safety assessments of the change to the functional system;
  - review of and amendments to unit instructions; and

  - delivery of training to air traffic controllers in the revised minima and, where necessary, operational procedures.
- Commercial aircraft operators:
  - review of aircraft operating risks;
  - review of and amendments to operations manuals; and
  - provision of training and awareness material to flight crew.

4.6 The implementation of the revised VMC minima may have a positive impact in that it will be possible for flight crew to request and for ATC to issue a VFR clearance more often. This may offer an opportunity for VFR flights to follow their optimum routing which could result in reduced fuel burn and thus reduced cost.

4.7 Overall, the CAA considers there to be a negative financial impact upon industry resulting from the revised VMC minima.

Environment

4.8 The CAA considers that there may be both positive and negative environmental impacts on the environment as a result of the revised VMC minima.

4.9 Where the prevailing meteorological conditions permit a VFR flight to optimise its' routing, this may result in reduced fuel burn which would reduce engine exhaust emissions. However, NATS has indicated that they will review, and may need to reduce, the recommended operating altitudes for helicopters on the London Helicopter Routes. At present, these operating altitudes are predicated on the requirement for VFR flights to remain 1 000 ft vertically and 1 500 m laterally clear of cloud. The change to the distance from cloud minima may mean that the recommended operating altitudes are reduced in order to increase the likelihood that the 'see and avoid' barrier to MAC will be effective. A reduction in operating altitude may result in an associated increase in noise pollution for those on the ground.

4.10 Overall, the CAA considers that the impact on the environment is neutral; however, it has not been possible to quantify these impacts.

Efficiency

4.11 The CAA considers there to be both positive and negative impacts on ATM efficiency as a result of the revised VMC minima.

4.12 The revised VMC minima are likely to reduce the need for pilots to request special VFR clearances to fly within control zones, thus permitting these flights to be undertaken in accordance with the VFR. Special VFR flight can increase air traffic controller workload[11] and reduce airspace capacity, thus making the ATM system less efficient. Consequently, it is reasonable to argue that a reduction in the number of requests for special VFR clearances may improve efficiency which could be seen as a positive impact.

4.13 However, in 'marginal' VMC and in the vicinity of an aerodrome and, specifically, the aerodrome traffic circuit, the revised VMC minima will reduce the likelihood that a VFR pilot will be able to visually detect an IFR flight on final approach[12], or other VFR and special VFR flights. In order to mitigate the associated risk of MAC and discharge their responsibilities regarding the prevention of collisions and the provision of advice and information useful for the safe and efficient conduct of flight, air traffic controllers will:

- employ controlling techniques that seek to reduce or remove the risk of conflict between the IFR and VFR flights; and,
- provide traffic information and, when requested, advice on collision avoidance.

4.14 Whilst reducing or removing the risk of conflict can serve to reduce the air traffic controller's "workload associated with passing extensive traffic information"[13], developing the plan to do this imposes a mental workload upon the air traffic controller. Moreover, where conflict exists between VFR flights in 'marginal' VMC, the provision of advice and information to assist pilots in visually acquiring other aircraft can impose significant workload on the air traffic controller. In turn, these can reduce airspace capacity and efficiency, manifesting as a less efficient routing for the VFR flight, a request to hold their position or, possibly, an inability to issue a clearance to the VFR flight to enter class D airspace.

[11] ATC are required to separate special VFR flights from both IFR flights and other special VFR flights (SERA.8005(b) refers). The meteorological conditions pertaining to special VFR flight are detailed in SERA.5010(b) and (c).

[12] "'Final approach' means that part of an instrument approach procedure which commences at the specified final approach fix or point, or where such a fix or point is not specified, (a) at the end of the last procedure turn, base turn or inbound turn of a racetrack procedure, if specified: or, (b) at the point of interception of the last track specified in the approach procedure; and ends at a point in the vicinity of an aerodrome from which: (1) a landing can be made; or, (2) a missed approach is initiated" (ICAO Doc 4444 PANS-ATM).

[13] Manual of Air Traffic Services (MATS) Part 1 CAP 493 Section 1 Chapter 5 Paragraph 3.3.

4.15 Overall, the CAA considers that the impact on ATM efficiency is neutral.

Safety

4.16 The CAA considers there to be both positive and negative impacts on safety as a result of the revised VMC minima.

4.17 The revised minima pose a Difference to an ICAO Standard[14], "the uniform application of which [ICAO states] is recognised as necessary for the safety or regularity of international air navigation"[15]. In consulting with industry on our plans to implement the SERA VMC minima[16], the CAA stated that it considered the application of the SERA vertical distance from cloud minima to be a safety benefit. Specifically, the CAA believed that "application of the SERA vertical distance from cloud requirements without variation simplifies the regulatory framework…and removes a Difference from ICAO Standards and Recommended Practices. Such simplification reduces the level of complication associated with the rules of the air, thus engendering greater understanding of these when applied in the UK and elsewhere". It is thus reasonable to argue that the introduction of a Difference to ICAO could be interpreted as having a negative impact upon safety.

4.18 As identified in paragraph 2.6 and touched upon in paragraph 4.13, where a VFR flight operates 'clear of cloud with the surface in sight' (rather than 1 000 ft vertically and 1 500 m horizontally clear of cloud), in certain meteorological conditions, this will restrict the pilot's ability to visually detect an IFR flight flying in IMC in proximity to them. Moreover, it reduces the time available for IFR flights to visually detect VFR flights, once that IFR flight manoeuvres from IMC into VMC. The CAA has identified three specific scenarios where the revised VMC minima will reduce the efficacy of the 'see and avoid' mitigation, and negatively impact upon safety:

- the interaction between an IFR flight, particularly one exceeding 140 kts, and a VFR helicopter that will be permitted to operate in a reduced flight visibility of 1 500 M;

[14] ICAO Annex 2 Section 3.9 Table 3-1..

[15] ICAO Annex 2 Foreword.

[16] CAP 1779 Proposed Changes to VMC Minima in class D Airspace dated 24 April 2019.

- the interaction between 2 VFR helicopter flights operating in a reduced flight visibility of 1 500 M; and,
- the interaction between an IFR flight descending out of cloud in close proximity to a VFR flight operating clear of cloud, at the base.

4.19 Turning to those aspects of the change that may have a positive impact on safety, in terms of flight crew workload, the pilot's task of flying 'clear of cloud with the surface in sight' is technically 'easier' than judging a distance from cloud of 1 000 ft vertically and 1 500 m horizontally. This could result in reduced pilot workload, allowing them to focus on other tasks, thus providing a positive impact on safety. However, this positive impact must be balanced against the effect on the pilot's ability to 'see and avoid' when operating at the base of cloud. Particularly where conflicting flights are also operating at the base of cloud, and where variation in the height of the cloud base prevents timely conflict detection.

4.20 A clear outcome from the CAA's impact analysis workshop (see Annex C) was that the primary means to mitigate the effect of the reduced VMC minima on a pilot's ability to visually detect airborne conflict are:

- ATC through the provision of traffic information, traffic avoidance advice when requested by the pilot or considered necessary by the air traffic controller, and the issuance of routeing instructions, clearance limits and level restrictions such as to reduce or eliminate points of conflict with other flights; and,
- 'see and avoid', which is dependent upon the airspace user having a detailed understanding of the applicable requirements and of them considering 'threat and error management' during the pre-flight and in-flight phases.

These have a positive impact upon safety, addressing the negative effect of the revised minima on a pilot's ability to visually detect airborne conflict. However, it must also be noted that participants in the workshop considered that:

- in certain scenarios, the maintenance of the level of safety in class D airspace was reliant upon ATC; and,

- in one specific airspace environment, the effect of the revised minima on these mitigations was such as to create an unacceptably negative impact on safety; we will turn to this in paragraph 4.22 below.

4.21 Overall, the CAA considers that the impact of the revised minima upon safety in UK class D airspace is neutral; however, there are residual safety effects in specific operating environments and conditions that must be noted, and action taken to ensure an acceptably safe operating environment is maintained.

Residual Safety Effects

4.22 Whilst overall the impact of the revised minima upon safety is considered by the CAA to be neutral, there are specific operating environments/scenarios where the revised minima will have a negative impact upon safety.

4.23 As indicated in 4.20 above, the primary means to mitigate the effects of the reduced VMC minima on a pilot's ability to visually detect airborne conflict are ATC and 'see and avoid'. In most UK class D airspace environments, the ATC related mitigations described above will be available; however, in the Manchester Low-Level Route, aircraft may be flown in accordance with the VFR without an ATC clearance, with pilots of these aircraft being entirely responsible for their own separation from all other flights. As such, the mitigation offered by ATC is not available. Yet at the same time, the efficacy of the 'see and avoid' mitigation for VFR helicopter flights has been negatively affected by the reduction in the flight visibility requirement to 1 500 m.

4.24 Research has shown that, in normal circumstances, from the point that a conflicting aircraft has been visually acquired, the average pilot needs between 9 to 12.5 seconds to process the closure geometry and manoeuvre to avoid a potential collision in a controlled manner[17]. In the circumstances described above, helicopter pilots operating VFR at or below 3 000 ft AMSL in a flight visibility of 1 500 m would have around 10 seconds to visually detect a conflicting flight and undertake the tasks described above[18]. As such, the CAA is concerned that, at present, the changes to the VMC minima have an

[17] Cited in 'Airprox' (the publication of the UK Airprox Board) 2017.

[18] Based on a worst case 'head-to-head' conflict with a combined closing speed of 280 kts.

unacceptable negative impact on safety as regards the operation of the Manchester Low-Level Route.

4.25 NATS, as the ANSP providing ATS at Manchester, are required to undertake safety assessment and assurance of changes to their functional system[19] that are posed by the revised VMC minima. The CAA has expressed its concerns to NATS regarding VFR helicopter operations in the Manchester Low-Level Route, and we are working with them to ensure that appropriate additional mitigations are employed to assure an acceptable level of safety by 20 May 2021. Such additional mitigations are likely to include a requirement for helicopters to be operated with an increased flight visibility, as was the case prior to 27 March 2020[20].

4.26 Finally, the requirement for a VFR flight to maintain 1 000 ft vertically and 1 500 m horizontally distant from cloud whilst complying with SERA.5005(f)(1) on minimum heights[21] has the potential, in certain meteorological conditions, to 'compress' air traffic into a narrow vertical band and thus increase the likelihood of airborne conflict. By permitting VFR flights to operate 'clear of cloud, with the surface in sight', it provides greater flexibility to enable pilots of these VFR flights to comply with SERA.5005(f)(1). This could have a positive impact upon safety. However, we must balance this against the risk that, where the cloud base is low, flight crew may exploit the reduced distance from cloud minimum in class D airspace to continue to operate VFR in a narrow vertical band whilst complying with SERA.5005(f)(1). Such practise increases the risk of MAC and controlled flight into terrain (CFIT); albeit, this situation existed prior to 27 March 2020. This highlights the necessity for flight crews to undertake threat and error analysis during pre-flight and in-flight to consider the risks of operating in this manner, and to manage these risks accordingly in order to mitigate this negative impact on safety.

[19] Reg (EU) No 2017/373 the 'ATM/ANS IR' Annex IV 'Part-ATS' ATS.OR.205

[20] Prior to the implementation of the SERA VMC minima on 27 March 2020, there was a requirement (detailed within the Manchester AIP (AD2.22)) for a flight visibility of 4 km for all aircraft.

[21] SERA.5005(f)(1) states that, over the congested areas of cities, towns or settlements or over an open-air assembly of persons, a VFR flight shall not be flown at a height less than 1 000 ft above the highest obstacle within a radius of 600 m from the aircraft.

Other Issues

4.27 Two further issues have been identified as resulting from the VMC minima change that necessitate further exploration and consideration.

Airspace Modernisation Strategy

4.28 One concept that is being considered in the context of the Airspace Modernisation Strategy is the designation of class E airspace, rather than class D airspace, for control areas (CTA) at some aerodromes with class D control zones[22]. The CAA believes that, at certain aerodromes, when that class E airspace is additionally notified as a transponder mandatory zone, this may have the potential to satisfy the need for controlled airspace at such aerodromes, whilst retaining flexibility and airspace access for VFR flights.

4.28 However, the revision to the VMC minima in class D airspace introduces an incongruity between the VMC minima in airspace classes D and E at and below 3 000 ft; class E airspace retaining the requirement for VFR flights to operate with a flight visibility of 5 km and a distance from cloud of 1 500 m horizontally and 1 000 ft vertically. Were class E CTAs to be introduced, the differing VMC minima would create complexity and reduce ATM efficiency. Before the implementation of SERA, through the Rules of the Air 2007[23], this incongruity did not exist, and the VMC minima in airspace classes D and E at and below 3 000 ft AMSL were identical.

4.29 Informed by further work to assess the impacts of such a change, the DfT and CAA could investigate a subsequent amendment to SERA.5001 Table S5-1 to align the VMC minima for airspace classes D and E.

Channel Islands' Airspace

4.30 In response to a CAA press release promulgating the amendment of SERA.5001 Table S5-1, the Director of Civil Aviation (DCA) for Jersey has highlighted the potential impacts of the change upon Channel Islands' airspace.

4.31 89% of Channel Islands' airspace lies within the Brest FIR, whilst 11% of the airspace lies within the London FIR; see the extract from Jersey's AIP entry at Annex D. EASA has questioned whether the UK's amendment to the VMC

[22] Note that ICAO Annex 11 Section 2.6.1 and SERA.6001(a)(5) state that "Class E shall not be used for control zones."

[23] Specifically, Rule of the Air 2007 Rule 27(3).

minima in class D airspace might result in the utilisation of different minima in Channel Islands' airspace, depending on whether the flight was in the London or Brest FIR, which would thus lead to increased complexity and a reduction in safety[24].

4.32 It's important to note that the principle behind the amendment to SERA.5001 Table S5-1 is to return to the operating environment that existed before 27 March 2020. In the case of Channel Islands' airspace, this would see the continuance of use of the 'original' SERA.5001 VMC minima contained in Regulation (EU) No 923/2012[25]. As it pertains to the Channel Islands' Airspace, the CAA agrees with this principle, believing that the 'original' SERA.5001 VMC minima must be applied in that volume of the London FIR that constitutes Channel Islands' airspace. The CAA met with the DCA and agreed to subsequent engagement with DfT and other CAA stakeholders to bring the matter to a conclusion.

Editorial note 17 March 2021. Subsequent to the completion of this impact analysis and its submission to, and acceptance by, the DfT, the DfT has agreed with the CAA that the 'original' SERA.5001 VMC minima (contained in Commission Implementing Regulation (EU) No 923/2012 of 26 September 2012) must be applied in that volume of the London FIR where the responsibility for the provision of ATS is delegated to Jersey ATC.

[24] Note that the Channel Islands are not part of the UK but are self-governing possessions of the British Crown, with their own independent legislature. Further information is available here.

[25] Adopted by the Channel Islands without derogation in 2017.

5 Conclusion

5.1 The CAA has identified and evaluated the impacts of the revised VMC minima in UK class D airspace, in the context of a number of criteria. In doing so, the CAA considered that, as a result of the revised VMC minima, there:

- was no impact on aviation security;
- was a negative financial impact; albeit this could not be quantified;
- was a neutral environmental impact;
- was a neutral impact on ATM efficiency; and
- overall, a neutral impact on safety.

5.2 In undertaking its analysis, the CAA also identified that the change introduces:

- an incongruity between the VMC minima in airspace classes D and E at and below 3 000 ft which may impact upon work associated with the Airspace Modernisation Strategy; and
- a potential inconsistency between the VMC minima that will be in effect within Channel Islands airspace which, without further action, would increase complexity and may reduce safety.

5.3 The CAA's main focus in this analysis was the evaluation of the impacts on safety of the revised VMC minima. The CAA identified that, whilst the reduced VMC minima in class D airspace reduces the efficacy of the 'see and avoid' mitigation to the risk of MAC, the effects of this may be balanced by:

- ATC through the provision of traffic information, traffic avoidance advice when requested by the pilot or considered necessary by the air traffic controller, and the issuance of routeing instructions, clearance limits and level restrictions such as to reduce or eliminate points of conflict with other flights; and,

- airspace users having a detailed understanding of the applicable requirements, and of them considering 'threat and error management' during the pre-flight and in-flight phases.

5.4 The adoption of the revised VMC minima returns UK class D airspace to the situation that existed prior to 27 March 2020. It is reasonable to argue that the UK considered the class D airspace environment that existed prior to 27 March 2020 to be acceptably safe. Thus, by inference, the class D airspace environment that will exist from 20 May 2021 must also be acceptably safe and as such, the CAA has concluded that the overall impact of the revised minima in UK class D airspace is neutral. However, this is a broad statement that encompasses the general situation in UK class D airspace.

5.5 Firstly, the flight crew human factors elements associated with this change remain unquantified. While the provision of an air traffic control service has been identified as a key mitigation to the risk of MAC, airspace users' understanding of the applicable requirements and the importance of effective threat and error management, during pre-flight and in-flight, have also been highlighted as key concerns associated with the change. The CAA is continuing work to identify how these can be ensured, both initially and as an ongoing activity.

5.6 Secondly, the CAA is concerned that, at present, the changes to the VMC minima have an unacceptable impact on safety as regards VFR helicopter operations in the Manchester Low-Level Route. The CAA is working with NATS (as the ANSP providing ATS at Manchester) to address these concerns by 20 May 2021 and considering what additional mitigations may be deployed. This is likely to include a requirement for helicopters to be operated with an increased flight visibility, as was the case prior to 27 March 2020.

5.6 Subsequent to the satisfactory resolution of the CAA's concerns regarding the operation of helicopters in the Manchester Low-Level Route, the CAA believes that, on balance, the impact of this change is neutral.

Civil Aviation Authority

February 2021

Annexes

Annex A: SERA.5001 VMC Visibility and Distance from Cloud Minima

Note. The text of SERA.5001 Table S5-1 below is that reprinted from Westlaw Edge UK, with permission of Thomson Reuters, and reflects that which is retained and amended in UK domestic law under the European Union (Withdrawal) Act 2018 and published on the CAA website here.

VMC visibility and distance from cloud minima are contained in Table S5-1.

Table S5-1 [1]

Altitude band	Airspace class	Flight visibility	Distance from cloud
At and above 3050 m (10000 ft) AMSL	A[2] B C D E F G	8 km	1500 m horizontally 300 m (1000 ft) vertically
Below 3050 m (10000 ft) AMSL and above 900 m (3000 ft) AMSL, or above 300 m (1000 ft) above terrain, whichever is the higher	A[2] B C D E F G	5 km	1500 m horizontally 300 m (1000 ft) vertically
At and below 900 m (3000 ft) AMSL, or 300 m (1000 ft) above terrain, whichever is the higher	A[2] B C D E	5 km	1500 m horizontally 300 m (1000 ft) vertically
	F G	5 km[3]	Clear of cloud and with the surface in sight

Notes

1 When the height of the transition altitude is lower than 3050 m (10000 ft) AMSL, FL 100 shall be used in lieu of 10000 ft.

2 The VMC minima in Class A airspace are included for guidance to pilots and do not imply acceptance of VFR flights in Class A airspace.

3 When so prescribed by the competent authority:

(a)

flight visibilities reduced to not less than 1500 m may be permitted for flights operating:

(1)

at speeds of 140 kts IAS or less to give adequate opportunity to observe other traffic or any obstacles in time to avoid collision; or

(2)

in circumstances in which the probability of encounters with other traffic would normally be low, e.g. in areas of low volume traffic and for aerial work at low levels;

(b)

helicopters may be permitted to operate in less than 1500 m but not less than 800 m flight visibility, if manoeuvred at a speed that will give adequate opportunity to observe other traffic or any obstacles in time to avoid collision.

Annex B: Amendment to SERA.5001 VMC Minima

The Aviation Safety (Amendment) Regulations 2021 amends the last row of Table S5-1 and the associated footnotes, as represented below.

At and below 900 m (3 000 ft) AMSL, or 300 m (1 000 ft) above terrain, whichever is the higher	A[b] B C D[c] E	5 km	1 500 m horizontally 300 m (1 000 ft) vertically
	F G	5 km[d]	Clear of cloud and with the surface in sight

c A VFR flight in airspace class D is also deemed to have complied with Table S5-1 if the aircraft is flown:

(a) during day;

(b) at or below 900 m (3 000 ft) AMSL, or 300 m (1 000 ft) above terrain, whichever is the higher;

(c) at an indicated airspeed of 140 kts or less to give adequate opportunity to observe other traffic or any obstacles in time to avoid collision; and

(d) remaining clear of cloud, with the surface in sight and:

(1) for aircraft other than helicopters, with a flight visibility of at least 5 km;

(2) for helicopters, with a flight visibility of at least 1 500 m.

d A VFR flight in airspace class F or G is also deemed to have complied with Table S5-1 if the aircraft is flown:

(a) during day;

(b) at or below 900 m (3 000 ft) AMSL, or 300 m (1 000 ft) above terrain, whichever is the higher;

(c) indicated airspeed of 140 kts or less to give adequate opportunity to observe other traffic or any obstacles in time to avoid collision; and

(d) with a flight visibility at least 1 500 m.

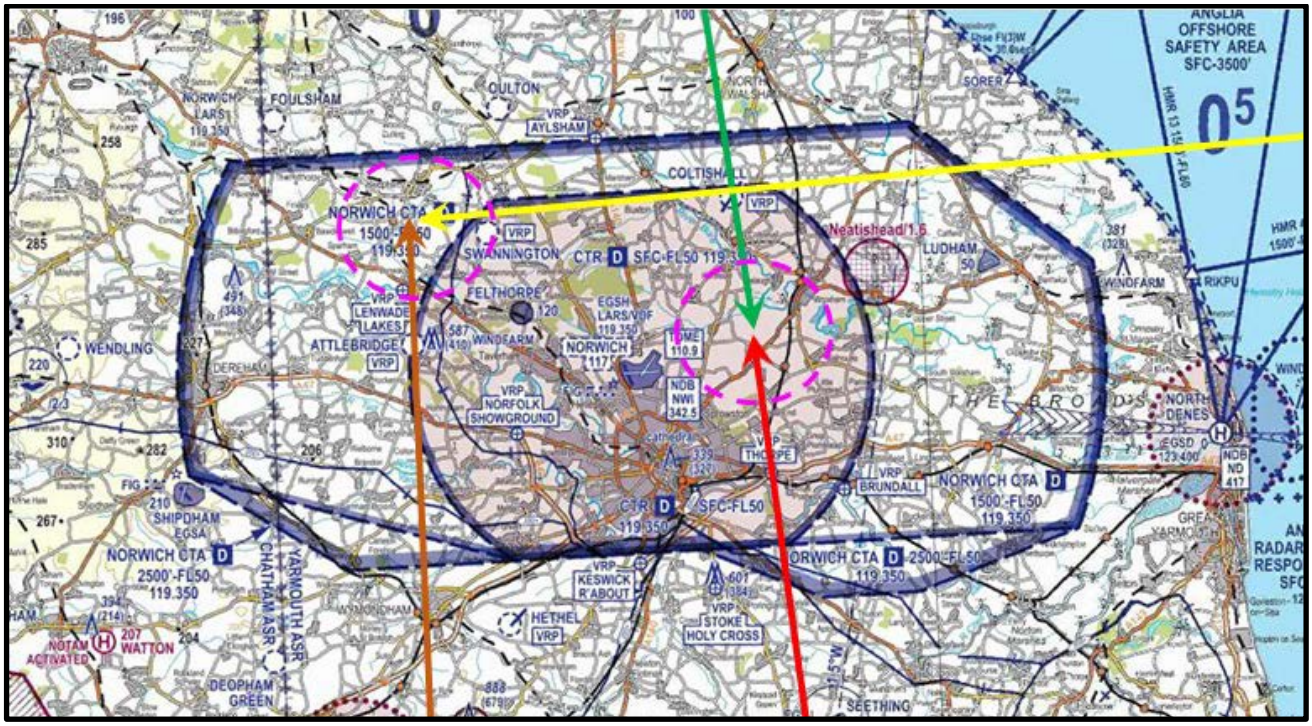
Note. The footnote referencing in the amendment to Table S5-1 above (i.e. the letters in superscript) does not match the same footnotes in Table S5-1 – as reprinted from Westlaw Edge UK (see Annex A) reflecting that which is retained and amended in UK domestic law under the European Union (Withdrawal) Act 2018 – nor the original Table S5-1 as contained within Reg (EU) No 923/2012. A key to the equivalence of the footnotes is below; not applicable (n/a) is shown because the footnote is introduced by the Aviation Safety (Amendment) Regulations 2021:

Aviation Safety (Amendment) Regulations 2021	a	b	c	d
Reg (EU) No 923/2012 (retained EU law)	1	2	n/a	3
Reg (EU) No 923/2012	*	**	n/a	***

Annex C: Workshop Table-top Exercise

C1 The table-top exercise consisted of 2 scenarios in which the revised VMC visibility and distance from cloud minima were applied[26]:

- Scenario 1. Cloud base approximately 2 500 to 2 600 ft AMSL. Aircraft 1 is flying the RED track at 2 500ft AMSL in excess of 140 kts and is thus operating in accordance with the IFR. Aircraft 2 is flying the GREEN track at 2 500 ft AMSL at less than 140kts and would thus be permitted to operate in accordance with the VFR in the prevailing conditions.
- Scenario 2. Cloud base approximately 2 800 ft AMSL. Aircraft 3 is flying the YELLOW track descending in IMC to 2 000 ft AMSL, in excess of 140 kts and is thus operating in accordance with the IFR. Aircraft 4 is flying the BROWN track at 2 500 ft AMSL at less than 140 kts and would thus be permitted to operate in accordance with the VFR in the prevailing conditions.



C2 Scenario 1 was considered using the Hazard Identification (HAZID) technique[27], whilst scenario 2 was considered using the Structured What-If checklist Technique (SWIFT)[28].

[26] The use of the extract from the Topographical Air Chart of the UK 1:250 000 depicting Norwich airport and the surrounding airspace was only to establish a context for the scenarios. No identification with Norwich airport, its operations or the surrounding airspace is intended or should be inferred.

[27] HAZID is a combination of identification, analysis and brainstorming by the HAZID participants. Its purpose is to identify hazards arising from the proposed change and to identify appropriate mitigations to prevent or control these.

[28] SWIFT combines the use of checklists with a brainstorming 'What if?' approach. It was initially developed for hazard identification in the

C3 Discussion

C3.1 Participants identified that, in essence, both scenarios posed the same basic challenge to the VFR and IFR pilots, that of 'seeing and avoiding' the conflicting flight. It was confirmed that ATC was required to provide traffic information to both the IFR and VFR flights, and that, in an 'ATS surveillance environment'[29] would provide traffic avoidance advice on request[30]. This was considered a key mitigation to the risk of mid-air collision (MAC).

C3.2 Participants observed that, generally, for an IFR flight to be proximate to a VFR flight, then both must be experiencing the same meteorological conditions. This could be considered to have a positive safety effect in mitigating the risk of MAC, by increasing the likely effectiveness of the 'see and avoid' mitigation. However, participants were keen to stress that in three specific scenarios, the change to the VMC visibility and distance from cloud minima prejudiced the 'see and avoid' barrier; namely:

- the interaction between an IFR flight, particularly one exceeding 140 kts, and a VFR helicopter that will be permitted to operate in a reduced flight visibility of 1 500 M;
- the interaction between 2 VFR helicopter flights operating in a reduced flight visibility of 1 500 M; and
- the interaction between an IFR flight descending out of cloud in close proximity to a VFR flight operating clear of cloud, albeit at the base of cloud.

In these scenarios, participants considered that the only available mitigations to MAC were an airborne collision avoidance system (ACAS), an ATC service supplemented by information from an ATS surveillance system (see C3.1 above) and providence.

C3.3 Traffic Alert and Collision Avoidance System (TCAS) II is accepted as a suitable ACAS[31] but requires both aircraft to be equipped in order to provide coordinated and complementary Resolution Advisories (RA), once a risk of collision has been

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chemical process industry. The technique was developed as an efficient alternative to HAZOP for providing highly effective hazard identification in situations and systems where HAZOP is not appropriate. SWIFT can also be used in conjunction with or complementary to a HAZOP.

[29] In this context, an 'ATS surveillance environment' is considered to mean that the ATC service is supplemented by information from an ATS surveillance system and that aircraft in receipt of an ATC service are electronically conspicuous to ATS (i.e. operating a SSR transponder) and that the aircraft requesting traffic avoidance advice has been identified by ATS.

[30] SERA.7002(a)(1).

[31] UK AIP GEN 1.5 Section 5.4.1.

identified. Where only one aircraft is fitted with TCAS II then an RA may still be issued but it will only take into account the conflicting aircraft's horizontal and vertical trajectory. Moreover, the ACAS safety net is reliant on the carriage and operation of secondary surveillance radar (SSR) transponders by both interacting aircraft. As such, in order to understand the efficacy of the ACAS safety net, we must also consider the UK's carriage requirements.

(a) **ACAS.** With some exceptions[32], all turbine-powered aeroplanes with a maximum certificated take-off mass exceeding 5 700 KG or authorised to carry more than 19 passengers are to be fitted with, and operate, TCAS II (software Version 7.1) within UK Airspace[33]. As such, many smaller aeroplanes and helicopters are not fitted with ACAS.

(b) **SSR Transponders.** Considering only the airspace in scope of this impact analysis, only aircraft operating under IFR in UK class D airspace are required to carry and operate a SSR transponder[34].

C3.4 Whilst the mitigation to MAC offered by ACAS is limited by the carriage requirements detailed above, they are targeted and proportionate from a risk-based perspective. Moreover, the effectiveness of this mitigation may be enhanced as the UK CAA considers developments in its electronic conspicuity strategy; specifically, the carriage of automatic dependent surveillance – broadcast (ADS-B) technology which may, depending upon the aircraft fit, be inter-operable with ACAS.

C3.5 In considering both scenarios, participants identified that it was essential that airspace users fully understood the applicable requirements, and were able to put this understanding into practise; specifically:

- the responsibilities of pilots of VFR and IFR flights regarding collision avoidance in class D airspace;
- that pilots of VFR and IFR flights understand the provision and limitations of the ATC service;
- the VMC visibility and distance from cloud minima, and how to accurately assess flight visibility; and,

[32] See UK AIP GEN 1.5 Section 5.4.3.

[33] UK AIP GEN 1.5 Section 5.4.2.

[34] Specifically, SSR Mode S Elementary Surveillance transponder, see UK AIP GEN 1.5 Section 5.3.1(d).

- that pilots undertake threat and error analysis during pre-flight and in-flight that considers the appropriateness of flight at the base of cloud, given the prevailing meteorological conditions and air traffic situation.

C3.6 In discussing airspace user understanding, participants considered whether there was a safety risk relating to pilots from outside the UK operating VFR in class D airspace and being unaware of the applicable requirements. In this regard, it was identified that the pilot would default to the ICAO Annex 2 requirement to maintain a distance from cloud of 1 000 ft vertically and 1 500 M horizontally. This was considered to have a positive impact on safety.

C3.7 Discussion then turned specifically to the ATC aspects of the scenarios. Accepting that air traffic controllers are not required to separate IFR flights from VFR flights in class D airspace, participants highlighted that the primary objective of air traffic services (ATS) is to prevent collisions between aircraft[35]. Participants considered that, in order to maintain the current level of safety, it was essential for air traffic controllers to utilise what could be termed 'defensive controlling techniques' to mitigate the risk of MAC. Specifically, they would issue routeing instructions and level restrictions to VFR flights such as to reduce or eliminate points of conflict with other flights, particularly IFR flights.

C3.8 This practise of reducing or eliminating points of conflict with other flights is already embedded in UK ATC and was the means by which the level of safety in UK class D airspace was assured prior to the implementation of the SERA VMC minima in March 2020; however, in the purest sense, it poses a difference to the related ICAO procedures published in ICAO Doc 4444 PANS-ATM[36] and it has a cost.

C3.9 Whilst this practise serves to manage overall air traffic controller workload by increasing the predictability of the environment and so aid the safe, orderly and efficient conduct of flight, it can have the opposite effect in individual cases. As meteorological conditions worsen, although VFR flight may continue to be possible, air traffic controllers are more likely to utilise 'defensive controlling techniques' to 'protect' IFR flights on final approach because there is a reduced likelihood that 'see and avoid' will be successful. As air traffic controllers deploy

[35] SERA.7001.

[36] The CAA will consider whether this poses a 'significant difference' to the related ICAO procedures and, if necessary, will list this within AIP GEN 1.7 in accordance with ICAO Annex 15

solutions to reduce or eliminate points of conflict between VFR and IFR flights, this can increase their workload and thus reduce ATM efficiency. This reduction in efficiency could manifest itself as a less efficient routing for the VFR flight, a request to hold their position or, possibly, an inability to issue a clearance to the VFR flight to enter class D airspace. It is noteworthy that flight crew participants considered that, following the implementation of the revised VMC minima, in certain scenarios, the maintenance of the level of safety in class D airspace was reliant upon ATC.

C3.10 Finally, the participants considered how certain contextual conditions might affect the interactions between IFR flights and VFR flights and thus the level of safety.

(a) **Multi-crew aircraft.** Participants agreed that operating in a multi-crew aircraft had a positive safety effect:

- In a multi-crew aircraft situational awareness would, typically, be better than in a single-pilot operated aircraft; and
- In a multi-crew aircraft, there is an increased likelihood that the 'see and avoid' mitigation will be successful.

(b) **Manchester Low-Level Route and London Helicopter Routes.** Participants agreed that these routes through class D airspace served to 'compress' air traffic, increasing the likelihood of airborne conflict, and that the efficacy of the 'see and avoid' mitigation was key to maintaining the level of safety. Participants expressed concern that helicopters would be permitted to operate VFR in a reduced flight visibility of 1 500 M which significantly reduced the available time for the pilot to visually acquire the conflicting aircraft and to determine a course of action and put it into effect.

Participants considered it noteworthy that:

- prior to 27 March 2020, the flight visibility requirement in the Manchester Low-Level Route was 4 KM irrespective of aircraft classification (i.e. 4 KM for all aircraft); and,
- the current requirement for helicopters operating special VFR on the London Helicopter Routes is to maintain a flight visibility of at least 5 KM should they wish to agree to maintain their own visual separation from other helicopters[37].

[37] AIP AD2 EGLL AD2.22 Section 10h.

C4 Summary and outcomes

D4.1 Participants agreed that the main mitigations required to maintain the required level of safety in UK class D airspace were:

- ATC through the provision of traffic information, traffic avoidance advice when requested by the pilot or considered necessary by the air traffic controller, and the issuance of routeing instructions and level restrictions such as to reduce or eliminate points of conflict with other flights; and,
- 'see and avoid', which is dependent upon the airspace user having a detailed understanding of the applicable requirements and of them considering 'threat and error management' during the pre-flight and in-flight phases.

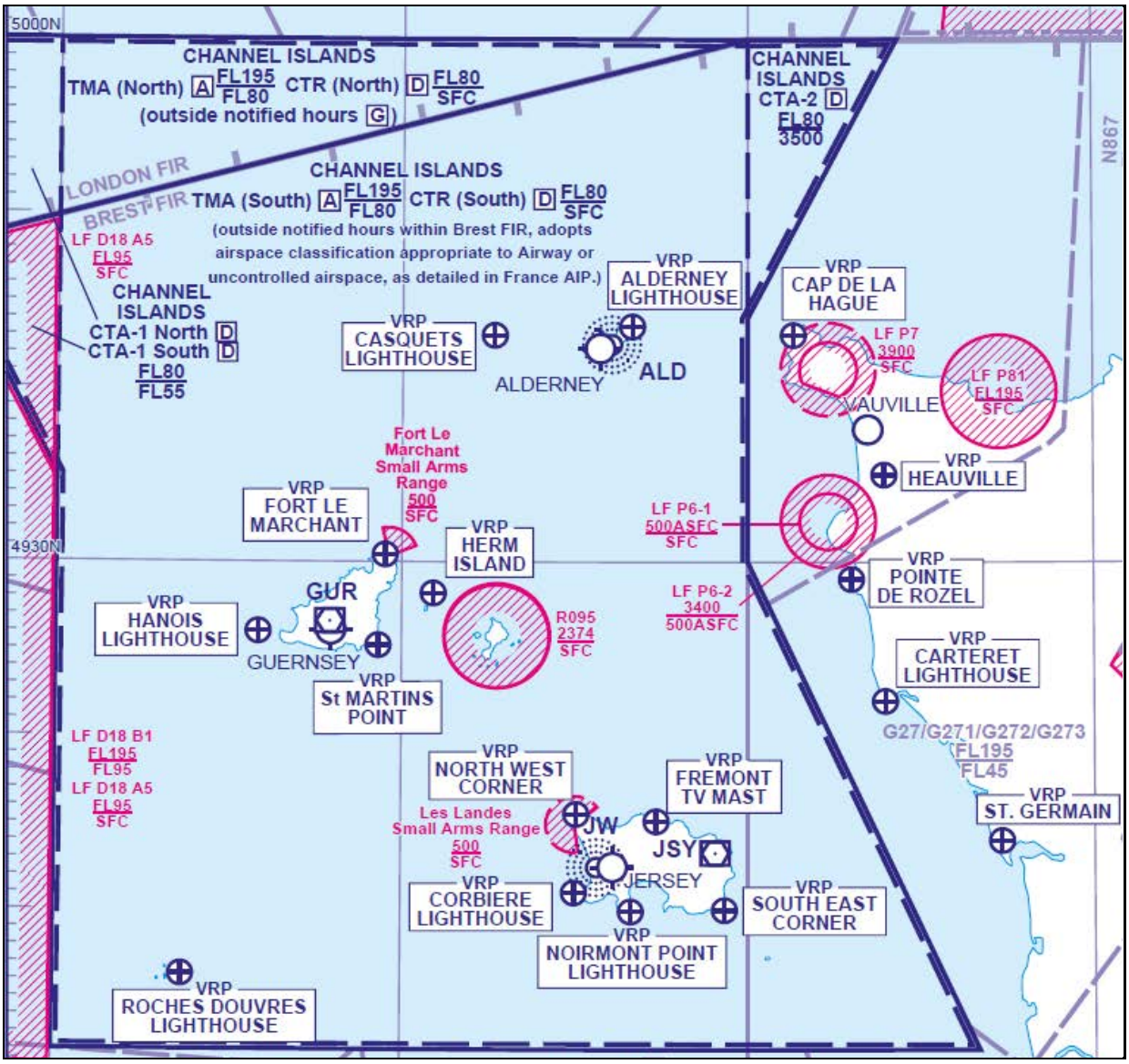
C4.2 In terms of outcomes from the table-top element of the workshop, participants considered that:

(a) No changes were required to ATC procedures. The information garnered from the workshop emphasised the importance of the mitigation offered by ATC and the CAA would consider how to use this information in its engagement with and oversight of ATC service providers.

(b) It was essential that the changes to the VMC minima and the importance of effective threat and error management were promulgated to airspace users. It was considered important that we should seek out opportunities for active engagement with airspace users to educate them on the changes, rather than be reliant on traditional notification mechanisms such as SkyWise alerts and the Integrated Aeronautical Information Publication (IAIP).

Annex D: AD2.EGJJ-3-1 Channel Islands Control Zone

D1 CTR (North) of the Channel Islands airspace is contained within the London FIR, whilst the remainder of the airspace is contained within the Brest FIR.



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