The Case for More Flexible Use of Lower-Level Airspace Within the UK

A Strawman Paper

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Executive Summary

The Case for More Flexible Use of Lower-Level Airspace[1] Within the UK

Within the UK there has been a steady growth in the volume of airspace restrictions[2] at lower levels where the impact is felt particularly by the recreational General Aviation (GA) pilot[3]. As the volume of such airspace increases, the volume of un-restricted airspace obviously decreases. Whilst much of these airspace restrictions are already accessible to the GA pilot within certain constraints, the majority tend to fly within un-restricted airspace.

The growth of airspace restriction has operational and safety implications in terms of the creation of interstitial choke points of Glass G airspace into which such non-commercial traffic is funnelled, creating a correspondingly higher mid-air collisions (MAC) hazard in such airspace. The funnelling effect may also be reflected to some extent in Airspace Infringement statistics.

There may be benefits to all parties accruing from a more flexible approach to the use of airspace. Such flexibility might include the handing-back to general use on a temporary and geographically defined basis (limited in dimensions and measured in perhaps hours or days) some of those blocks of airspace which for that limited period do not actually need to be restricted at that time. The paper sets out examples of such airspace and offers examples of how such flexible use might work.

Self-evidently, it will not be realistic to apply any such flexible use model to all restricted airspace. Certain airspace restrictions, for example nuclear power stations, prisons and some busy CTRs, will simply not be suitable for flexible use under any foreseeable circumstances; however, other areas could be.

This work ties in with the current Airspace Modernisation Strategy Initiative 10. It provides potential advantages to the non-commercial user, but it may also provide potential economic advantages to the ANSPs and other airspace managers (although that is less easy to define). Some safety and communications issues arise. But, as this paper will show, there are solutions to these issues.

This strawman paper proposes the development and trialling of a flexible-use model in at least two areas of the UK's airspace as a preliminary step towards a potential roll-out on a wider basis.

It envisages doing so in very close cooperation between the Regulator, the ANSPs/airspace managers, and with the recreational flying community such that

[1] Lower-Level Airspace is an undefined term. For the purposes of this paper it is considered as airspace below an altitude of 6,000' AMSL.
[2] Airspace restrictions encompasses all controlled airspace, danger areas, restricted areas (temporary or permanent), RMZs and TMZs, and any other areas into which a pilot may not fly without conforming to some form of additional requirements in terms of planning, communication or electronic conspicuity.
[3] ICAO defines General Aviation (GA) as: *all civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire*. With this in mind the terms GA, Recreational Pilots, Recreational Traffic and Recreational Flying are used interchangeably throughout this paper in order to wrap together all non-commercial Powered Flying, Gliding, Ballooning, Sport Parachuting and any other form of recreational activity conducted in the air.

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each has a stake in the process. There would be a formal review process after the trial.

In parallel with this work the paper also recommends potential action to help the GA community improve its own standards of airmanship, thereby lowering some of the hazards associated with the introduction of flexible use of lower-level airspace.

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Airspace Restrictions Within the UK

1. The common features of all airspace restrictions are that: 1) they exist in order to manage risk; and 2) pilots wishing to fly within such airspace must generally conform to additional rules and procedures which may be generic to the class of airspace present or specific to a particular block of airspace.

2. For the purposes of this paper airspace restrictions include controlled airspace (Class E upwards), danger areas, restricted areas, RMZs and TMZs.

3. Whilst some of this restricted airspace is enacted temporarily, the majority of airspace restrictions within the UK are to all practical purposes permanent in nature once established. Examples of non-permanent airspace restrictions include Restricted Areas (Temporary) imposed to cover such events as air-displays and small blocks of temporary Class D airspace imposed to cover royal flights. These are exceptions to the general picture.

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The Principle of Necessity

4. Whilst not articulated as such within CAP 740, the Principle of Necessity *applies insofar as that within the UK the use of airspace should be restricted only to the extent necessary in order to mitigate the risks faced by those operating within it, around it, or both. For example, range danger areas provide for the safe use of systems including weapon systems within areas from which unauthorised users are excluded, to the obvious safety benefit principally of the latter. Likewise, Control Zones (CTRs) are established around busy airports in order to provide a known environment within which air traffic may be managed efficiently and safely. The underlying principle is that within the UK the minimum volume of airspace is restricted in this way in order to provide for those purposes. The corollary applies: no more airspace than is required should be restricted this way. The maximum volume of airspace should remain unrestricted where possible.*

5. This principle is enshrined in the MoD's policy expressed by the Defence Infrastructure Organisation. *The MoD has a policy presumption in favour of public access whenever this is compatible with operational and military uses, public safety, security, conservation and the interests of tenants*. Whilst not framed specifically in the context of access to airspace, the policy is good indication of the underlying principle at work.

6. Hitherto such airspace restrictions have tended to be binary in nature; it is either restricted or not. The concept underpinning this paper is that some of this airspace might in future become flexible in character. In other words that some of it could be switched between two states as required. As such it would be restricted by default but might be capable of being in effect 'switched off' to become un-restricted for defined periods in order to provide for more flexible use. Whether that would entail temporary reversion from, for example, Class D to Class G is for further consideration.

7. As an aside it should be stressed at the outset that merely because a block of airspace is restricted in some way does not necessarily mean that it is inaccessible to GA pilots. With appropriate pre-planning, coordination and, in some cases, the carriage of compulsory electronic conspicuity4 it is usually possible for GA traffic to access most airspace restrictions for at least some of the time. That said, there is a strong perception amongst many GA pilots that most airspace restrictions are, by their nature, difficult to access - if not actually out of bounds. Whether factually accurate or not, such a perception helps drive resistance to the notion of increasing areas of airspace restrictions or introducing TMZs/RMZs more widely. By contrast, the linking of measures such as these to the sharing of airspace through flexible use may engage the GA community more positively. As a by-product it may also improve the standards of recreational flying though a general GA pilot education initiative.

[4] For the purposes of this paper *Electronic Conspicuity* may be achieved by a transponder or any other device capable of providing a reliable degree of positional information in three dimensions.

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Existing Flexibility at Upper Levels

8. Flexible use of airspace already exists in parts of the upper airspace (above FL195) in respect of the interaction of military and commercial users. In this region military danger areas are often switched on and off on a daily or even part-daily basis in accordance with MoD needs. That information is then passed to commercial operators in sufficient time for them to plan routes either through or around such blocks of airspace, thereby providing them with operational flexibility.

9. Such flexibility balances the needs of one user (in this case the military) against the needs of the other (in this case the commercial operators) such that whenever a block of danger area is not required for military use it is passed back to the commercial operators in such a way as it can then be used by them until it is required again by the military. The Principle of Necessity can be seen in application.

10. The same philosophy could be applied to lower levels of airspace. However, when comparing the existing upper airspace measure to the potential application of flexibility in other airspace, there are a number of important factors that must be borne in mind.

10.1. Within upper airspace there are effectively three parties to this process: the military, commercial operators and the ANSP. Coordination is therefore essentially bi-party and relatively straightforward.

10.2. The nature of commercial and military operations is such that there is a high level of mutual confidence in the reliability of the process for notifying the switching on and off of such blocks of airspace.

10.3. There is a high level of mutual confidence in the professionalism of pilots using such flexibly operated airspace.

10.4. The blocks of airspace in question are large, and as such savings made through flexible use are worth pursuing.

10.5. The operational cycle is relatively long. The decision to switch off a particular area and to notify commercial carriers routinely takes place in a cycle of not less than 12-24 hours in order to permit re-routing.

11. Nonetheless, whilst these factors must be considered when examining the potential for flexible use of airspace restrictions at lower levels they do not of themselves rule out the introduction of such flexibility.

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Potential Scope for Flexibility at Lower Levels

12. On the face of it there is scope for flexibility at lower levels. For the purposes of this paper the term Lower level Airspace is taken to mean airspace at or below 6000' AMSL[5]. Ideally that would also represent the Transition Altitude. However, in the UK the Transition Altitude is not standardised at one altitude. In open FIR (Class G) the Transition Attitude is 3000'. Within some CTRs it is higher, for example 6000' in most CTRs including London, Edinburgh and Belfast, but it is 5000' in Liverpool and Manchester[6].

13. Separately from this piece of work, from the perspective of flexible use of lower-level airspace it would obviously be useful if the Transition Level were to be harmonised across the UK. The most obvious level for such harmonisation to occur is 6000' to align with most but not all CTRs. For the purposes of this paper it is assumed that such harmonisation level might in the future reasonably occur at 6000' across the UK.

14. Airspace restrictions in this sub-6000' band takes up around 25% by area of the whole UK but is not uniformly spread across the UK. Parts of southern and central England are relatively densely packed with airspace restrictions of one kind or another, creating chokepoints and significantly limiting the flight options for GA pilots.

15. However, a proportion of this airspace restrictions is likely to be unused and indeed, strictly speaking, unnecessary for a proportion of the time. This is because, notwithstanding the imperative to keep all airspace restrictions to the minimum dimensions necessary, the original design of such airspace will have taken into account all of the likely use-scenarios justifying its imposition.

15.1. For example, at a given airport served by a number of runways and with differing arrival and departure options any CTR will have been designed to cater for any eventualities of runway direction and procedures at any time. Of course, not all the runway directions or all the arrival or departure procedures are likely to be in use at any particular time. Therefore, by definition, some of the CTR is likely to be redundant in its purpose for at least some of the time.

15.2. Similarly, a given danger area will have been designed to cater for the most demanding use-case in terms of weapon ranges permitted there in order to define its dimensions. However, for much of the time there may be no actual live firing taking place, or the systems being used there will require less volumes of airspace than are provide. Therefore, some of the volume of that danger area is likely to be redundant for at least some of the time. Many

[5] All altitudes in this paper are Above Mean Sea Level (AMSL)
[6] The overwhelming bulk of recreational powered flying, gliding and ballooning activities in the UK fall within the sub-6,000' band of altitudes. However, parachuting and some gliding also takes place at higher altitudes.

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Danger Areas also operate Danger Area Crossing Services (DACS) which can provide a pilot with up-to-date information about the status of a danger area and clear crossings when possible. In that sense many of them are already operating flexibly in the context of this paper.

16. In theory at least therefore, provided that it could be done safely and effectively, these redundant portions could be 'switched off' for the periods within which they are not required. Such 'switched off' portions could then be treated on a limited and temporary basis as unrestricted airspace (potentially temporary Class G) to the benefit of GA traffic – in just the same way as the upper airspace danger areas are switched off from time to time.

17. Self-evidently such temporary 'switching off' must be of tangible benefit to any potential users, which will usually be non-commercial traffic. The duration of the period within which the airspace is turned off must be sufficient for GA traffic to be able to respond to it in their planning cycles. If there is no take-up then there will be no point to any such flexibility.

18. Equally importantly, the fact that some portions of the airspace may have been turned off must not detract from the safety of users using the remaining parts of the airspace restrictions. This may require, for example, that for GA traffic to be permitted to use such switched-off airspace they must carry electronic conspicuity equipment. Carriage and operation of suitable EC equipment may represent the price that GA pilots would have to pay in order to use such flexible use airspace.

19. A number of issues therefore emerge from the concept of such flexible use:

19.1. Where parts of a block of airspace restrictions may be switched off or on then such parts must be clearly identifiable, preferably with reference to ground features. This is not as simple as it may sound since the airspace will have been designed originally to cater for IFR traffic in the main. It may therefore also be necessary to further sub-divide existing blocks of airspace in order to selectively switch on or off convenient portions whilst leaving others switched on. Such sub-division must have regard to the potential for over-cluttering charts.

19.2. For such switching off and on of airspace restrictions (in whole or in part) to be of any benefit to an external user (usually a GA pilot) the switching on and off must be communicated in manner that is timely, clear and aligned to the planning cycle of such pilots.

20. There are essentially two separate GA planning cycles within which a regime of flexibly operated airspace might operate.

20.1. Within the context of GA flight, a realistic planning cycle would cater for appropriate pre-flight planning which is generally done either shortly before take-off or within the 12 hours prior to take-off. Therefore, for the pre-

flight planning cycle it will be sufficient to provide information in the flight planning period used by most GA pilots; ie on 6-12-hour planning cycle.

20.2. In the future, however, and subject to some extent to the provision of in-flight data to GA pilots it is possible to envisage a shorter in-flight planning cycle permitting a pilot to modify a routing in-flight in accordance to the flexible activation or de-activation of airspace. Currently this could be provided by verbal information passed by ATC or ATIS. In the future it might be provided to pilots in flight using, for example, electronically through data passed to moving-map devices.

21. Risk mitigation measures will be required in order to ensure that the safety of users using the remaining parts of airspace restrictions is not compromised. Such measures may include the compulsory operation of electronic conspicuity measures by pilots using such flexible-use airspace, or the compulsory briefing of pilots exercising such enhanced access.

22. Fail-safe measures will also be required in order to ensure that there is minimum scope for ambiguity as to whether at a given time a particular block of flexible use of lower-level airspace is switched off or on.

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Potential Advantages of Flexible Use to ANSPs and Airspace Managers

23. It is reasonable to assume that there is an economic cost attributable to managing areas of airspace restrictions that are not, strictly speaking, necessary. It follows therefore that there should be an economic advantage to being able to switch off such blocks where appropriate. Calculating this potential advantage is outside of the scope of this paper but there is a presumption of at least some economic benefit to ANSPs and other airspace managers by being able to flexibly hand-back areas of airspace restrictions when they are not required.

24. Critical to whether or not there is an economic benefit will be the issue of whether or not traffic using the switched-off portion of any block of airspace restrictions adds to the workload of the ANSP or airspace managers such as DACS managing the rest of that airspace. This paper will shortly consider risk-mitigation measures, but the underlying principle should be that the switching off of unused portions of airspace restrictions must not add to controller workload.

25. The causal factors at work behind the UK's airspace infringement statistics is a complex and poorly understood picture. It is beyond dispute, however, that the complex structure of some parts of UK controlled and restricted airspace is a contributary factor. In places three-dimensional chokepoints are also created between blocks of controlled airspace into which GA traffic is funnelled, sometimes unsuccessfully. Switching-off areas of controlled airspace may 'decompress' some of these choke points, especially if combined with a requirement to carry electronic conspicuity equipment. Whilst difficult to prove at this point, it seems at least arguable that a reduction in the overall volume of airspace restrictions is likely to have a beneficial effect on the airspace infringement statistics. However, the creation of any ambiguity about the status of a particular block of airspace restrictions is likely to have a negative effect on those statistics. Consequently, a sophisticated communications strategy will be required together with due regard to the human factors issues in order to avoid the potential for an initial spike in infringements due to pilots misunderstanding the principles or practices at work in Flexible Use Airspace.

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The Aviation Counter-Parties: Recreational Flying (Including Recreational Powered Flight, Gliding, Ballooning and Parachuting)

26. The issue of lower airspace is complicated by the fact that there are a number of different user-groups who might benefit from the flexible use of airspace and which fall within the broad ICAO definition of General Aviation[7]. The main user-groups are as follows:

26.1. **Recreational Powered Flight**. For the purposes of this paper the term General Aviation includes all light fixed-wing, flex-wing, light rotary and microlight operations whether conducted as part of flight training, travel ancillary to business use, pure pleasure, or for reward. This is a very broad church in terms of the level of pilot competence, the level of aircraft equipment carried, and the mission requirements of each.

26.2. **Parachute Operations**. For the purposes of this paper the term Parachute Operations includes the use of aircraft to drop parachutists for non-military purposes either in free-fall or on static-lines and at altitudes up to 18,000'.

26.3. **Gliding**. For the purposes of this paper the term Gliding includes the use of gliders, powered gliders, glider tugs, hang gliders and paramotors, either in proximity to glider fields or cross-country at altitudes up to 6,000'; excluding wave which may be very much higher.

26.4. **Ballooning**. For the purposes of this paper the term Ballooning includes the use of manned balloons on cross-country flights at altitudes up to 6,000'.

27. Each of these components have somewhat different requirements but all, broadly speaking, operate predominantly in the <6,000' altitude band and would benefit from a reduction in the volume of restricted airspace in this lower airspace region.

[7] ICAO defines General Aviation (GA) as: *all civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire*.

Case Studies

28. Flexible-use airspace is already with us in some forms. This paper offers a number of case studies by way of illustrating how the flexible use of airspace restrictions at lower levels currently operates or could in the future be developed to operate to the benefit of everyone.

29. **Case Study 1** – the flexible use of parts of Luton's CTR by the London Gliding Club at Dunstable.

29.1. Over a considerable period of time Luton's CTA/CTR has grown to surround the Dunstable site operated by London Gliding Club. In order to balance the needs of both parties, for some years the gliding club has had an arrangement with Luton Airport such that when operations at Luton permit, areas of Luton's CTR are switched off to provide for glider access without the need for a clearance to enter controlled airspace. The key considerations in evidence are:

29.1.1. The arrangement is specific to gliding at Dunstable only. Pilots operating from the site are briefed in detail and are required to sign the Flying Orders Book. They are required at all times to comply with the special rules applicable.

29.1.2. The relevant portions of the CTA are switched on and off on a daily or part-daily basis.

29.1.3. Notification is by telephone to the gliding club.

29.1.4. Flexible use of this airspace is not made available to other parties. No visitors are allowed to use the privilege without going through the same formal briefing process.

29.1.5. No special electronic conspicuity requirements are in force.

30. **Case Study 2** – the flexible use of parts of Southampton's CTR by Roughay and Lower Upham airfields, known as the Bishop Waltham Flying Area.

30.1. For many years the two small GA airfields at Roughay and Lower Upham (lying 3-4 nm to the east of Southampton Airport) have had a Letter of Agreement (LoA) in force with Southampton which permits flying within the Southampton CTR in the vicinity of these airfield without the requirement to obtain a clearance to enter controlled airspace. The key considerations in force are:

30.1.1. Such flying is performed within certain lateral and vertical constraints only. In effect, a portion of the CTA is carved-out for local GA use as if it were Class G.

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30.1.2. It is not flexibly switched on and off and is not re-designated as Class G.

30.1.3. The flexibility is available to any traffic using the two airfields, not just to local traffic.

30.1.4. No special electronic conspicuity requirements are specified.

31. **Case Study 3** – the flexible use by parachute aircraft of parts of the UK's Class A, C and D airspace.

31.1. For some years the British Parachute Association (BPA) has had an LoA in place between the BPA and NATS to support the operation of parachute-dropping aircraft as they climb, descend or drop through Class A, C and D airspace. The key considerations in force are:

31.1.1. The LoA covers multiple sites.

31.1.2. The LoA is limited to aircraft operated under the auspices of the BPA.

31.1.3. Entry into controlled airspace and is by clearance and clearance to drop is specified.

31.1.4. Carriage and operation of a transponder (Mode C or S) is mandated.

31.1.5. The procedures for obtaining clearances to enter and drop through controlled airspace are set out in detail, together with safety measures such as comms failure procedures.

32. **Case Study 4** – the flexible application of the upper limits of Salisbury Plain Danger Areas.

32.1. For many years the vertical extents of some of the RDAs on Salisbury Plain have been varied in order to 'switch off' unnecessary portions when not required. The key considerations in force are:

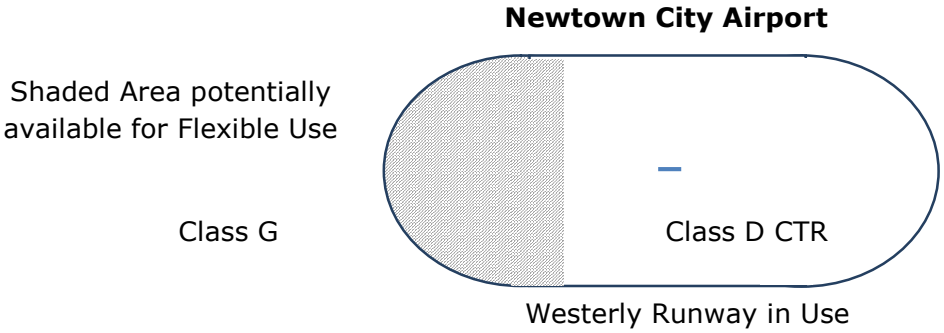
32.1.1. The flexibility is applied to the vertical limits only. For example, D123 has a usual extent from ground level to 50,000' but is sometimes reduced to have a ceiling of 3,000' thereby enabling overflight by GA traffic.

32.1.2. The flexibility tends to be fairly coarse grain. The ceiling is reduced over the Christmas or other national holiday periods, for a period of days, rather than for single days or parts of days.

32.1.3. The information is published by NOTAM and by the SPTA telephone information service. It is also available in flight to pilots calling the SPTA range control frequency.

32.1.4. No electronic conspicuity measures are mandated.

33. **The Shape of the Possible Future – Case Study 5** – use of parts of the notional Newtown City Airport CTR when switched off.



33.1. In this notional scenario Newtown City Airport has an east/west runway with a Class D CTR established around it with its lateral dimensions of 5nm to north and south, 10nm to east and west of the centre-point, and a vertical extent from the surface to 5,000' to where it joins a Class A TMA. The airport has IFR Commercial Air Traffic arriving and departing on SIDs and STARs.

33.2. The CTR has been designed to cater for the use of either the easterly or westerly runway. The westerly stub is designed primarily to protect IFR traffic approaching from the west to land on the easterly runway; the easterly stub is designed to protect IFR traffic approaching the westerly runway. The prevailing wind is westerly and consequently the easterly runway is used for only 20% of the time on average.

33.3. For approximately 80% of the time therefore the westerly stub of the CTR is largely unused except to the extent necessary to protect traffic taking off from it and climbing into the TMA.

33.4. In this notional scenario the area shaded in grey is designed as Flexible Use Area West (FUA West) and 'switched off' (in effect downgraded to Class G airspace) when the airspace manager determines on the basis of the weather forecast that the likelihood is that it will not be used for approaches to the easterly runway within the next few hours.

33.5. When it is switched off a NOTAM is issued to the effect that FUA West will temporarily become Class G airspace from date/time X to date/time Y. The NOTAM also specifies that special rules apply within FUA West for the period that it reverts to that of a TMZ in Class G (as set out below).

33.5.1. The specified Special Rules are that all aircraft transiting through FU Area West must until they are clear of FUA West:

33.5.1.1. Operate a transponder in Mode C or S; and

33.5.1.2. *either* establish RT contact with Newtown City Approach and obtain an Air Traffic Service outside controlled airspace; *or* listen out on Newtown City Approach and squawk the relevant FMC.

33.5.2. The information is included in Newtown City Airport's ATIS transmission.

33.5.3. The NOTAM information is picked up by the providers of commercially available flight planning apps as part of the routine data-download and the change in status is shown to customers in graphical form, available in flight where appropriate.

34. **German Example**. For completion it should also be pointed out that in Germany, for example, there are mechanisms to routinely share controlled airspace with gliders on a flexible-use basis. Sectors (in three categories: Public, Regional or Local) are allocated in Class C and D airspace within which gliders may operate without a clearance or a transponder whilst monitoring an appropriate frequency. Germany also operates some of its Class D CTRs on an 'opening-hours' basis. Outside of these hours the CTR reverts to its background class of airspace.

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The Safety Imperative, Risk and Risk Mitigation Measures

35. Stepping back from the Case Studies illustrated above, there are clearly some safety issues to be considered. The first is the Safety Imperative.

36. The Safety Imperative is that the introduction of flexible-use airspace must not adversely impact the safety of either the GA pilot use of such airspace on a flexible basis, or any other regular traffic or users.

37. Since the introduction of flexibility potentially degrades the existing risk-management measures that gave rise to the airspace restrictions in the first place, critical to the acceptability of such flexible use is the identification and introduction of measures to manage any resulting increase in risk.

38. The Risks to be mitigated are Loss of Separation (LOS) and Mid-Air Collision (MAC). In relation to these Risks the following areas of additional Hazard areas have been identified and are grouped into Hazard Groups for convenience:

38.1. **Hazard Group 1**. Permitting uncontrolled traffic to use part of what was previously controlled airspace (Class D or A), danger or restricted areas carries with it the risk that such traffic will then be in closer proximity to other traffic or systems using the remaining volume of such airspace restrictions. There would be, in effect, a reduction in 'buffer space' and a potential increase in the risks associated with an aircraft straying out of the flexibly used portion and infringing the reduced portion of still-restricted airspace. There are a set of potential hazards therefore around the issue of permitting potentially unknown and uncontrolled traffic to operate in closer proximity than hitherto to controlled traffic.

38.2. **Hazard Group 2**. The introduction of flexible boundaries for some areas of airspace restrictions carries with it the risks that pilots may misunderstand, mis-identify or mis-apply the boundaries and so inadvertently to infringe parts of the airspace that are not designated for flexible use. There are therefore a set of hazards around user competences.

38.3. **Hazard Group 3**. The introduction of flexible use in a particular block of airspace may require the agreement of special measures specific to that block – in the form of 'terms and conditions of use' specific to that block. Pilots using such airspace would then be required to observe those measures on a local basis. This carries the risk that other pilots may seek to use the flexible-use airspace without being aware of the special measures. There are therefore a set of hazards around inappropriate use of such flexible use of lower-level airspace by pilots who may not be aware of (and potentially do not comply with) the special measures in use.

38.4. **Hazard Group 4**. The promulgation of information relating to the flexible use of airspace carries with it various communication risks around the issues of the clarity of changes, the timeliness changes, and the availability of information whilst in-flight. There are therefore a set of hazards around the fidelity, reliability and responsiveness of the notification of status-changes.

39. There are also, however, a number of mitigation measures that may be employed to manage the hazards associated with each of these Risk Groups. These clearly need to be explored and quantified as part of follow-on work, but as examples:

39.1. **Hazard Group 1**. Some or all of the following measures might be employed to mitigate the hazards:

39.1.1. The compulsory use of electronic conspicuity to create a known environment within such airspace. In other words, such airspace could become a Transponder Mandator Zone (TMZ) when it is being used flexibly. This would provide controllers with certainty of an aircraft's location and, importantly, its level.

39.1.2. The compulsory use of RT to create 'passive control' within such airspace. In other words, such airspace could become a Radio Mandator Zone (RMZ) when it is being used flexibly. SERA.6005(a) requires that aircraft within a RMZ establish and maintain continuous 2-way RT with the controlling station. Within the UK, however, some operators of RMZs have stated that they consider that an aircraft correctly using a FMC (thereby enabling a pilot to be called, if necessary) satisfies this requirement. On that basis such contact need not be active and thereby add to the workload of both parties; the use of a Frequency Monitoring Code (FMC or Listening Squawk) may be sufficient.

39.2. **Hazard Group 2**. Some or all of the following measures might be employed to mitigate the hazards associated with misinterpretation of flexible-use airspace boundaries:

39.2.1. The compulsory use of TMZ or RMZ may assist in early identification of an aircraft that has misinterpreted or misunderstood the extent of flexible use of lower-level airspace.

39.2.2. Clear marking of flexible-use airspace on electronic and paper charts will help differentiate flexible-use airspace from non-flexible-use airspace. Such marking exists already in terms of some danger areas[8] activated by NOTAM which are depicted on charts with

[8] For example, D122A and D122B are two fairly large Danger Areas to the south of the main Salisbury Plain Danger Areas with a base of FL80 and a top of FL160. These are shown as dotted-boundary danger areas and are active only when notified.

dotted boundaries and appropriate notes. On modern commercially available moving map displays such areas can be highlighted or faded as part of the provider's data provision. In any event, such depictions need to be clear and not contribute to over-cluttering of charts. An appropriate information campaign will be required to highlight such changes.

39.2.3. Any wider introduction of flexible use of lower-level airspace or adoption of a policy for use will need to be accompanied by an appropriate information campaign so that potential users understand the terminology, benefits, risks and obligations associated with using such airspace.

39.3. **Hazard Group 3**. Some or all of the following measures might be employed to mitigate the hazards associated with the potential requirement for special measures in certain flexible use of lower-level airspace:

39.3.1. It may be necessary to have two levels of flexible use of lower-level airspace:

39.3.1.1. Level 1 which is open to all pilots, subject to the risk mitigation measures applicable there.

39.3.1.2. Level 2 which is open only to authorised pilots. Current examples exist. For example, only local glider pilots are permitted to take advantage of the flexible use of some of Luton's airspace and are required to counter-sign the rules associated with such use.

39.3.2. Alternatively, it may be necessary to introduce a means by which a pilot, when planning a route and contemplating the use of a portion of flexible use of lower-level airspace with special measures in force, can download the specials measures applicable to that airspace and to acknowledge that they have read and understood them.

39.4. **Hazard Group 4**. Some or all of the following measures might be employed to mitigate the hazards associated with the communication of information:

39.4.1. It will be necessary to establish a clearly defined default state for such flexible use of lower-level airspace. In other words, there should be no doubt about the state of such airspace and in the absence of information to the contrary it should be assumed as live/hot.

39.4.2. It will be necessary to identify an appropriate level of responsiveness in terms of switching off and on such airspace. Specifically, there will be a minimum period in which, for practical

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planning and use purposes, it will be appropriate to switch off a portion of flexible-use airspace. Likewise, there will be a minimum notice in which for practical planning purposes it will be possible to notify users of the switching off or on of such airspace.

39.4.3. The process for promulgating such information must be suitably flexible and reliable. The obvious medium is promulgation by NOTAM. Such NOTAMs may be accessed directly via the AIS website or more commonly are accessed by GA pilots via one of the commercially available planning apps. Initial discussion with one of the providers of these apps indicate that the turn-around time to push notifications out via the app is measured in minutes rather than hours once the information is received from the AIS. So in theory the timely promulgating of such information itself is feasible whilst pilots are in the planning phase of their flight.

39.4.4. The process for promulgating such information to pilots once in the air is a separate and more challenging issue at present, in the absence of a wide area information network. However, as systems develop by which to pass, for example, relayed traffic information and weather to GA pilots in flight it is entirely feasible that such information might include notification of changes to airspace. In the meantime, such information may be made available to pilots in flight by RT; either by requesting it on a 'pull basis' from ATC or FIS providers, or by inclusion on a 'push basis' within ATIS broadcasts where appropriate.

39.4.5. There is an area of hazard in the period between the planning of a flight (which might be carried out by a GA pilot the night before) and the execution of it. Consideration will need to be given to the notice within which flexible use of lower-level airspace is switched on or off to avoid such airspace being off when the flight is planned but on by the time it is flown. Additionally, consideration should be given to the inclusion of the status of flexible-use airspace in dial-up automated messaging systems such as that used to notify RA(T)s.

39.5. Whilst there are certainly potential hazards implicit in the flexible use of airspace as envisaged by this paper it seems clear that there are also a broad span of appropriate mitigation measures available which could adequately mitigate such resulting risk. Further work will be required to define and refine such measures which must then be appropriately validated in order to produce a robust safety case acceptable to the Regulator, ANSPs/managers, and the user community.

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Human Factors, Pilot Performance and Pilot Training

40. Implicit within the introduction of flexible-use airspace is the reasonable expectation of an appropriate level of airmanship[9] from the users of such airspace who are likely to be, in the main, non-professional pilots. As it stands the spectrum of airmanship found amongst UK GA pilots as a whole is very wide[10]. At one end it is characterised by pilots actively developing and maintaining their own skills; embracing new technology and practices; and generally operating in a manner comparable to that of a professional pilot. At the other end it is characterised by pilots who in some cases have not developed or maintained their own skills, sometimes suffering many years of gradual decline; who do not embrace new technology such as moving-map technology or electronic conspicuity; and who are resistant to change. In between these two poles is a classic bell-curve of skills and attitudes, with the majority of GA pilots doing their best to keep up with developments in technology and regulations.

41. Given that greater demands are likely to be placed on a pilot's airmanship by the introduction of flexible-use airspace then it is not unreasonable that, in return for such flexibility, an appropriate level of performance is required as part of the price paid for such access. In other words, if a pilot cannot be relied upon to play his or her part in terms of adequately planning a flight and appropriately conforming with any conditions applicable to such flexible use then it would not be unreasonable to deny to such a pilot the advantages of using that airspace. The issues arising from this are: 1) what is an appropriate level of airmanship; 2) how would such performance be assessed; and 3) how would it be monitored?

42. As an aside, there is an obvious and useful parallel with the challenge around the introduction of Performance Based Navigation (PBN) in the context of IFR flight. The challenge arose due to the fact that very many Instrument Rated pilots had qualified prior to the development of PBN (navigation based solely on GPS). The introduction of PBN therefore brought a requirement to up-skill both new and existing pilots. The solution to this challenge was consequently two-pronged: 1) to modify the training syllabus for new IR pilots such that training for PBN is now wrapped into the IR syllabus; and 2) with regard to existing IR-holders, to require that such pilots demonstrate at their next IR revalidation[11] an appropriate level of PBN knowledge before being awarded a PBN endorsement on their ratings. This approach appears to have been successful in ushering in a new era of navigation

[9] Airmanship is a difficult term to define. Good Airmanship implies a sustained effort on the pilot's part to learn and to develop as a pilot, an active and intelligent application of Threat and Error Management, and the maintenance of a considerate and responsible attitude to other airspace users. Bad Airmanship implies the opposite of these. Airmanship is therefore partly a function of a pilot's Skills, and partly one of the pilot's Attitudes and Behaviours.

[10] In making this non-scientific observation the Author is able to draw on some years of personal experience gained as a UK-based Flight Examiner operating almost exclusively in the GA sector; ie at recreational pilot (PPL/LAPL holder) level.

[11] Unlike SEP or MEP ratings a pilot's Instrument Rating must be revalidated by a Flight Test, necessitating an interaction with a Flight Examiner and a formal assessment of the pilot's knowledge and performance at each revalidation.

based on PBN. It provides a useful indication of how a new era of flexible use of lower-level airspace might also be ushered in.

43. In the context of the envisaged introduction of flexible use of lower-level airspace it is worth considering the following potential measures by which to address a similar challenge:

43.1. For pilots under training or pilots undergoing training in the future it will be relatively simple to create a modification to those elements of the PPL/LAPL syllabus that address Flight Planning and Operational Procedures theoretical knowledge to address the issue of flexible use of lower-level airspace. Such modifications should have the effect of teaching student pilots at the outset of their flying about the advantages, opportunities and demands implicit in flexible use of lower-level airspace.

43.2. For pilots already operating under the privileges of their non-professional licenses and ratings there is a further challenge around both communication and post-qualification training, recognising that there is much less contact between the qualified GA pilot and the regulatory or training system.

43.2.1. The communication of the issues around flexible use of lower-level airspace is a stand-alone piece of work. It must recognise that whilst perhaps 50% of GA pilots may be relatively easy to access via flying clubs, online resources, aviation organisations such as AOPA and by other means, the remaining 50% may be very much harder to access. Furthermore, the record of effectively communicating with the body of GA pilots is patchy at best. Consequently, a well thought-through communications strategy should be drawn up which should aim to communicate to the widest possible audience the advantages, opportunities and demands implicit in the introduction of flexible-use airspace.

43.2.2. Addressing the training element is more challenging given the current situation pertaining to post-qualification pilot training at the non-professional level. To recap that situation as it currently stands; in order to revalidate a pilot's Single Engine or Multi-Engined Rating (SEP or MEP) that pilot must, inter alia, at some point every 24 months invest in an hour's flight with an instructor. On the face of it this represents an excellent opportunity for re-training, up-skilling or merely up-dating. However, there is no mandated content for this hour's training. Consequently, whilst some pilots use the hour to usefully brush-up faded skills and knowledge, others do not. Furthermore, the flight is a training flight and not an assessment of any sort; nor indeed are there any standards against which such a pilot might be assessed; nor any standardisation of instructors or examiners

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who might carry out such an assessment. Finally, a flight instructor is not empowered to refuse to sign-off such a flight once it is completed. The requirement is merely to complete the flight and, for the process of revalidating the rating, the requirement is only that the holder shows evidence of having completed the flight. It can be seen therefore that whilst there is a huge opportunity for using this biennial 'hour with an instructor' as one of the vehicles by which to up-skill GA pilots, currently it is an unreliable vehicle at best.

43.3. Whether or not the biennial 'one hour with an instructor' could or should have a more formal role in the development or maintenance of pilots' skills and/or knowledge is a larger discussion and lies outside of the framework of this paper. Nonetheless, it is easy to see that *if* such an hour had some mandated content (which might perhaps include discussion of flexible-use airspace, counter-infringement tips and techniques, or whatever were hot topics at the time) and *if* it were open to the flight instructor or examiner to assess whether a pilot had demonstrated an appropriate level of knowledge or skills in these areas before signing-off the hour then this *could* become a central plank in the drive to improve the airmanship of GA pilots, with implications for the successful introduction of flexible use of lower-level airspace. Further work on this is required in conjunction with the CAA's FCL department.

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Further Expansion on the Theme of Flexibility

44. At a slightly tangential angle to the main thrust of this paper, some of the user-groups consulted during its drafting have highlighted further scope for flexibility arising out of a tendency for certain aviation activities to file NOTAMs that are excessively broad in time-span, thus unnecessarily constraining the activities of other pilots. Examples given include:

44.1. Areas NOTAM'd as used for UAV or Model Aircraft Flying. These areas are increasing in proliferation and are often NOTAM'd as H24 despite that fact that they are usually used on a much more limited basis; sometimes only at weekends and in other cases only occasionally.

44.2. Aerobatics Practice Areas which can sometimes be NOTAM'd as H24 over a period of months, but which are often used on a very much more limited basis.

45. Neither of these examples give rise to airspace restrictions in a formal sense, but the growth of such areas of formally notified 'hazard areas' further compresses the areas of un-restricted airspace. Furthermore, when pilots with local knowledge realise that the area in question is seldom if ever used, it brings the whole NOTAM/hazard notification process into disrepute because they are then routinely ignored.

46. Therefore, whilst not strictly within the scope of this strawman paper, it seems that, in the interests of flexibility in its broadest sense, the notification of these activities should become more targeted and less broad-brush. An area should only be notified as active when it is active. In order to promote and police this there should also be more scrutiny of NOTAM requests.

Opportunities for Flexible Use of Lower-Level Airspace

47. The start point in the process of enacting flexible use of lower-level airspace will be to identify likely candidates for such use, potentially on a trial-basis initially. A consultation process will be required to identify areas that appear from a user perspective to be suitable for the introduction of flexible use of lower-level airspace. That process should engage the GA users.

48. The process should move in step with the Airspace Modernisation Strategy Initiative 10 and aim to identify a number of areas of airspace restrictions which, if opened to flexible use, would have a measurably beneficial effect on GA users' use of airspace in general. Following an initial sweep for such airspace with which to start the project, an ongoing process should be put in place by which future blocks of airspace can be nominated for consideration on perhaps an annual review basis.

49. Following identification of such potential areas, a process of initial validation is required in close consultation with the ANSPs or relevant agencies. The purpose of this initial valuation is to ascertain whether introducing flexibility there is potentially feasible. If it is not for good operational reasons, then there is no point pursuing that opportunity in the face of opposition. For the project to stand any chance of success it must be explored in a collaborative spirit.

50. Opportunities that pass the initial validation screening might include, for example:

50.1. Areas of airspace restrictions that create vertical or lateral choke points for other traffic and which might be switched off when not required.

50.2. Areas of airspace restrictions which appear to be infrequently used and which might be switched off when not required.

50.3. Areas of airspace restrictions the purpose for which is not clear, supported by evidence where possible.

51. As part of this process it will become clear which nominated portions of airspace are worthy of detailed consideration. Such areas should then be taken forward to the next stage of consideration.

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Considerations to be Made When Assessing an Opportunity

52. Once the initial coarse grain validation is done the process should be left with a list of areas of airspace that appear worthy of more detailed consideration and prioritisation. The key questions to be considered when applying this more detailed consideration are:

52.1. Is there a genuine benefit to be obtained from applying flexible use to that particular block of airspace? In other words, is the gain worth the cost in terms of time, effort and risk? In terms of a priority hierarchy it is suggested that the order is as follows:

52.1.1. **Priority One**. Areas that have a clear safety-related benefit attached to flexible use – for example they are likely to open up existing choke points or reduce the likelihood of airspace infringements.

52.1.2. **Priority Two**. Areas that may be flexibly used for the benefit of the general body of GA users.

52.2. Which additional risks arise from the introduction of flexible use in that particular block of airspace?

52.3. What CAP 1616 related issues need to be considered?

52.4. What risk mitigation measures are required and are they adequate to mitigate the risks in that particular block of airspace?

52.5. Does the block of airspace require further sub-division laterally or vertically in order to more effectively introduce flexibility of use?

52.6. How responsive should the switching on/off process be? In other words, what cycle-time that is achievable or is required in order to switch on or off that block of airspace. It is desirable to have greed a single applicable cycle-time across all areas of flexible use of lower-level airspace.

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Process for Enacting Flexible Use of Lower-Level Airspace

53. The objective should be to develop a single model for flexible use of lower-level airspace that can be applied to multiple sections of airspace; rather than to develop multiple location-specific models.

54. There will need to be a formal process for applying flexible use to any particular block of airspace and of promulgating that information.

55. There may need to be a standard set of terms for inclusion in LOAs if they need to be put in place between airspace managers and local user groups.

56. On occasions where a particular user-group (such as an airfield owner) enters into a Letter of Agreement with a local airspace manager there need be no further process for enacting flexible use of that particular portion of airspace other than the bringing into force of that Letter of Agreement. In effect such an arrangement would be a private deal between two parties.

57. For the introduction of flexible use airspace on a broader basis, especially where that may require further sub-division of existing blocks for clarity, amendment to charts etc, then such arrangements will require the support of the CAA.

58. Further discussion with the CAA will determine what process will need to be taken in order to enact flexible use on a broader basis. However, on the basis of informal discussions held so far there appear to be no obstacles in principle to the introduction of flexible use of lower-level airspace.

Promulgation of Change (Policy)

59. Subject to the completion of the measures set out in Next Steps below it is envisaged that the CAA will in due course publish a policy on the introduction of flexible use of lower-level airspace. Such a policy may be promulgated as a CAP.

60. Such a policy should set out:

60.1. The processes to be taken when identifying candidate blocks of airspace.

60.2. The assessment process.

60.3. The formal consultation process.

60.4. The format of any agreements to be set in place.

60.5. The periodic review process required to ensure that such measures remain appropriate.

61. It is envisaged that the outcomes of A4A work proposed by this Paper will provide much of the material for any such CAA policy in due course.

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Next Steps

62. The route-plan envisaged by this paper is as follows:

62.1. Consultation with recreational aviation user-groups, ANSPs and the CAA (underway).

62.2. Agreement in principle to trial the use of flexible use of lower-level airspace in at least two areas.

62.3. Publication of an interim policy to cover the trial.

62.4. Conduct of the trial over a 12-month period.

62.5. Trial review with user-groups, ANSPs and the CAA.

62.6. Subject to the results of the review, identify a roll-out plan for flexible use of lower-level airspace within the UK.

62.7. Publication of a formal policy to cover such use.

62.8. Separately, but potentially in coordination with these steps, discuss with CAA FCL the potential for introducing measures to assist the GA community in improving the standards of airmanship within it.