30 March 2012

CLASS G AIRSPACE FOR THE 21ST CENTURY

PART OF THE CAA'S FUTURE AIRSPACE STRATEGY

Executive Summary

S1. Background

S1.1 Class G airspace in the UK continues to evolve and contain a very broad range of activity from Commercial Air Transport to high energy military to all types of sport and recreational flying. There is an ongoing need to identify and conduct the work required to enable the continued evolution of UK Class G Airspace, and operations within it. The FAS NATMAC Sub Group has been tasked to do this work under the Future Airspace Strategy and contribute the output to the State Safety Programme.

S2. Analysis

S2.1 User requirements for 21st Century Class G airspace continue to be wide ranging and even include potential new users such as Unmanned Aerial Systems. Flexible access requirements to meet the needs of all users remain paramount. Study of mid-air collision in Class G airspace going back to 1997 highlights that most collisions are contained within user groups and occur where traffic density is high (circuit, ridge, soaring, thermalling etc). The number of random (open FIR) encounters is a much smaller proportion. The analysis of collisions and the conclusions being drawn from it now needs to be verified by a similar analysis of airprox incidents in Class G airspace, some 2,200, during the same period. Class G airspace is not a uniform volume in terms of traffic density, complexity or utilisation, ranging from low, say in the northwest of Scotland, to high in the southeast of the UK and every combination in between. There is still much more that can and needs to be done to understand the type and mix of activity within Class G airspace and more work is required to fully understand the risks and consequently the proportionate response appropriate to mitigate those risks.

S2.2 From the analysis conducted and the discussions held for this paper the main issues faced in Class G airspace today and for the future are encompassed by three high-level issues:

S2.2.1 The effectiveness of 'See-and-Avoid'.

S2.2.2 The interaction between different user groups.

S2.2.3 The interaction between different uses (and/or classifications) of airspace.

S3. Work Required

S3.1 Further work is required to complete the Class G airprox analysis work and from this work identify areas of increased risk and what specifically contributes to that increase. More also needs to be done to exploit existing modelling techniques to understand what can be delivered in terms of high quality, useable data. Overall we need to gain a full picture of the density and utilisation of Class G airspace both now and for the future, which amongst other things, will include the need to understand the impact of Unmanned Aerial Systems' operations on the unknown environment. Continuing work is also required on both visual and electronic conspicuity so that the user groups can make informed judgements on the balance between practical and cost implications against demonstrated reduction in risk to their specific operations.

S4 RECOMMENDATIONS

S4.1 The individual recommendations made in the 21st Class G paper cover the following areas:

S4.1.1 Retaining the current legislative requirements.

S4.1.2 Reducing the number of infringements of controlled airspace.

S4.1.3 Only establishing controlled airspace and other measures where there is a demonstrated need and the overall system safety is improved.

S4.1.4 Promoting greater visible conspicuity for light aircraft and gliders.

S4.1.5 Initiating a refreshed training programme on the effectiveness of See-and-Avoid.

S4.1.6 Enhancing electronic conspicuity.

S4.1.7 Reducing the risk of GA/GA mid air collisions in the vicinity of aerodromes and flying sites.

S4.1.8 Analysis of Class G Airprox reports.

S4.1.9 Providing a greater understanding of operations and interactions within Class G airspace.

S4.1.10 Indentify additional measures that could be used to enhance safety.

S4.1.11 Providing guidance on risk assessment and mitigation.

S4.1.12 Reporting of the above work through the Airspace Safety Initiative Coordinator Group.

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1. AIM

1.1 To identify the work required to enable the continued evolution of UK Class G Airspace, and operations within it, to support the achievement of the Future Airspace Strategy Vision.

2. INTRODUCTION

2.1 One of the work requirements following the publication of the CAA's Future Airspace Strategy (FAS), which endeavours to provide: *"**Safe efficient airspace, that has the capacity to meet reasonable demand, balances the needs of all users and mitigates the impact of aviation on the environment**"*, was to gain a better understanding of the UK Class G airspace environment; operations within it and its interaction with other airspace classifications. The CAA's work on the FAS, published in June 2011, included the need to further develop and take account of the General Aviation (GA) requirements within the FAS. As GA is predominately, but not exclusively, Class G activity one of the work strands for this further development was the consideration of the UK's Class G environment. For the purposes of this paper the Class G environment includes all such airspace, including where other protection measures are in place, such as Aerodrome Traffic Zones, Danger Areas or Transponder Mandatory Zones, but the background airspace classification remains Class G. This paper has been produced, in collaboration with the FAS NATMAC[1] Sub Group, to consider the Class G airspace user groups' requirements and how those requirements can best be balanced to the benefit of the system as a whole. The membership and terms of reference for the FAS NATMAC Sub Group are at Annex A. The group was drawn from a representative cross section of the NATMAC.

2.2 This paper sets out the context for Class G airspace and operations by considering current operations by the various user groups, the rules under which flight can be conducted in the airspace and the legal foundations on which the rules and operations are conducted. In considering the airspace as a whole there is an inevitable focus on GA as a prime user, not only in terms of numbers and breadth of operations but also because in some cases, due to airframe, equipment and pilot capability, it is the only classification of airspace within which their operations can be conducted. This focus on GA is only used in the context of understanding the airspace and the various interactions within it as a complete system, rather than for singling out GA issues in isolation. Having set the context of the airspace, safety aspects are taken into account to highlight both what has been achieved in the past and what needs to be looked at for the future. In particular the CAA Safety Plan, the Airspace Safety Initiative and the LAA/GAA work on collisions risk in Class G airspace are taken into account. This leads to a consideration of visual acquisition and electronic conspicuity within the air traffic management and airspace system and correlation of this work against the opinions and recommendations of the Air Accident Investigation Branch (AAIB)[2]. The final section summarises the issues and sets out what we need from Class G airspace

[1] NATMAC – National Air Traffic Management Advisory Committee (NATMAC) is a non-statutory advisory body sponsored by the CAA. The Committee is consulted for advice and views on any major matter concerned with airspace management. It assists the CAA's Directorate of Airspace Policy in the development of airspace policies, configurations and procedures in order that due attention is given to the diverse requirements of all users of UK airspace, civil and military. Full terms of reference are set out in CAP 724 – The Airspace Charter available via this link: http://www.caa.co.uk/docs/33/CAP724.PDF.

[2] The AAIB website can be accessed via this link: www.aaib.gov.uk

for the future before making recommendations. A list of abbreviations associated with this paper is at Annex B.

2.3 There is a wide range of activity that can legitimately take place in Class G airspace and we have to ensure it can all be conducted in a proportionate and sensible manner. It is not only a question of what works for today; we also need to look forwards and question whether the current arrangements are adequate for the future. A future that involves new technology, avionics and the eventual integration of Unmanned Aerial Systems (UAS) that will undoubtedly result in further evolution of the environment.

3. THE CONTEXT FOR CLASS G AIRSPACE IN THE UNITED KINGDOM

3.1 Current Use of Class G Airspace

3.1.2 The UK's airspace system has to balance the supply of airspace capacity with demand from a diverse range of users. For the purpose of the FAS, and this paper, these users are considered in three broad groups: Commercial Air Transport (CAT), the General Aviation (GA) Community and the Military. There are a number of definitions in common use for these user groups but to allow for a better understanding of requirements of the different user groups, the following definitions are used for the purposes of this paper:

3.1.2.1 **Commercial Air Transport (CAT)**: CAT is defined as any aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire.

3.1.2.2 **General Aviation (GA):** Defined as a civil aircraft operation other than CAT. The sector operates fixed-wing aircraft, helicopters, gliders, self-launched motorgliders, microlights, hang gliders, paragliders, para motors and parachutes and lighter than air craft.[3]

3.1.2.3 **The Military:** In airspace terms covers Army, Navy, Air Force and Visiting Forces aviation activity, ultimately falling under the responsibility of the Ministry of Defence and Secretary of State for Defence rather than civilian rules and regulations.[4]

3.1.3 **Commercial Air Transport**. CAT operations in Class G airspace, for larger passenger and cargo carrying aircraft, is generally an, "*only if there is no other option*" operation and for commercial passenger carrying flights a least preferred option. However, where the point of origin / destination for a CAT flight has no controlled airspace connectivity to the main airway system then operations have to include transit through Class G airspace. In addition to point-to-point operations, Class G airspace can also be used for check flights and ferry flights. All of these flights will be fully cooperative in terms of the air traffic management system and may well operate under a deconfliction service. Some additional protection and collision avoidance is provided by the aircraft's ACAS[5], but this only mitigates collisions risk against aircraft fitted with and operating a transponder. There is some cross over in the CAT category with the Business Aviation element of GA. Using the definition of CAT set out above, air taxi and similar activity falls under this category. These operations include a significant element of activity within Class G airspace and the operators' safety management and risk assessment methodologies will have given proper consideration to the level of safety for the activity being conducted. Such mitigations will often, but not always, require the receipt of an air traffic service.

[3] This papers often considers sub sectors of the General Aviation Community but where the term General Aviation (GA) is used it should be taken to mean the entire community as defined above.

[4] Includes use of ranges to test munitions, R&D and developmental flying conducted in certain volumes of airspace.

[5] Aircraft Collision Avoidance System.

3.1.4 **General Aviation.** GA is a diverse sector, ranging from powered aircraft through gliders to balloonists. It represents 96% of UK civil aircraft, some 26,000 in total. It is assessed that the vast majority, but by no means all, of GA activity currently takes place in Class G airspace. GA activity is expected to continue to grow in the period to 2030 and with it the public demand for continued access to Class G airspace[6]. The number of light aircraft on the UK register continues to increase and the number in the "microlight" category has increased at a higher rate in recent times. The pattern of demand is likely to change, with potential for an increase in the use of Very Light Jets (VLJs) for the personal and air taxi market and the civil application of unmanned aerial systems (UAS). At the risk of over generalising, the core of the GA activity can be summarised as single pilot Visual Flight Rules (VFR) operations below FL 100 and mostly below FL 50. There is a mixture of point-to-point flights as well as manoeuvring flights including aerobatics, stalling and spinning. Although most of the activity is day VFR operations there are still some day Instrument Flight Rule (IFR) and night operations. Precise figures are not known.

3.1.5 **Military.** Military activity in Class G airspace includes a wide range of operational training and missions covering all aspects of aviation. This includes the carriage of military passengers (point-to-point operations), air-to-air refuelling, general handling, air-to-air and air-to-ground training. General handing and other training is completed in the full range of aircraft from high performance, single-seat jet aircraft to powered gliders and covering everything from basic to combat-ready training; the term 'aircraft' here includes helicopters and unmanned aircraft systems[7]. The Defence requirement for segregated airspace for all types of weapons from small arms to modern artillery systems requiring large volumes of airspace must also be woven into the competing requirements for the limited UK airspace resource.

3.1.6 In support of the work on Class G airspace the user groups produced individual requirements in summarised form, which have been considered in the production and conclusions of this paper. This work set out how each group saw their current operations and the operations they envisaged for the future. The individual user requirements are included in annexes as follows:

- GA including microlights at Annex C.
- Gliders at Annex D.
- Military at Annex E.
- Rotorcraft at Annex F.
- Commercial Air Transport at Annex G.
- Commercial Air Transport (BALPA) at Annex H.
- Balloons and Airships at Annex I.
- Sport Parachuting at Annex J.
- Unmanned Aircraft Systems at Annex K.

[6] This assumption is based on general assessment for the Class G environment based on technical expert opinion. There are no definitive data sets to confirm this assumption. More data is required to be certain of the precise percentages.

[7] Unmanned Aircraft System are currently only permitted in segregated airspace, albeit it that segregated airspace retains a background Class G classification if appropriate.

- Hang gliders and paragliders (both powered and unpowered) at Annex L.

3.2 Class G Airspace Flight Rules

3.2.1 The totality of the activity outlined above covers everything from large commercial aircraft, fully equipped with the latest navigation and flight technology, though modern and sophisticated state-of-the-art light aircraft, to military and ex-military aircraft, through amateur built to minimally equipped craft. Perhaps the greatest strength of Class G airspace is that it permits this full range of activity from all the varying types and capabilities. To accommodate this broad mix of activity a proportionate regulatory environment is set for flight in Class G airspace and the rules are as follows:

3.2.1.1 **Under the Instrument Flight Rules (IFR)[8]** – A separation service is not provided but ATSOCAS[9] Services may be available as appropriate. There is a speed limitation of 250 Kts Indicated Air Speed below FL100[10]. It is not compulsory to operate a radio and an Air Traffic Control Clearance is not required. Aircraft in level flight above 3,000 feet above mean sea level or above the appropriate transition altitude, whichever is the higher, shall be flown at a level appropriate to its magnetic track in accordance with the tables published in the Air Navigation Order.

3.2.1.2 **Under the Visual Flight Rules (VFR)[11]** – A separation service is not provided but ATSOCAS Services may be available as for IFR flight. Above FL100 pilots must maintain a flight visibility of at least 8 km, 1500 m horizontal separation from cloud and 1000 ft vertically clear of cloud. Below FL100 the flight visibility requirement reduces to 5 km with separation from cloud remaining the same unless operating at or below 3000 ft AMSL where the requirement is for at least 5 km flight visibility whilst remaining clear of cloud and in sight of the surface[12]. The speed limitation below FL 100 remains 250 Kts Indicated Air Speed and radio and Air Traffic Control Clearance is not required.

3.2.2 The military in some cases have additional rules and amongst other things, to reduce the risk of a collision, flight in IMC is only permitted for military aircraft in the following circumstances[13]:

- When in receipt of a radar or procedural service, or;
- Where a radar or procedural service is not available or cannot be obtained, then above 3000ft AMSL or the Safety Altitude (whichever is the higher), pilots must fly at cruising levels according to the quadrantal or semi-circular rule as applicable based on the standard altimeter setting, or,
- When following a published approach or departure procedure, or;
- In an emergency, or;

[8] For the definitive source for the IFR see The Rules of the Air Regulations 2007 Section 6.

[9] Air Traffic Services Outside Controlled Airspace – as detailed in the UK Integrated Aeronautical Information Publication (IAIP) ENR 1.1.2 - HERE

[10] The military has an exemption from this speed restriction for operational and training purposes as approved by the appropriate military authority.

[11] For the definitive source for the VFR see The Rules of the Air Regulations 2007 Section 5.

[12] Aircraft at or below 3000 ft AMSL at 140 Kts Indicated Air Speed or less may operate clear of cloud with the surface in sight with a flight visibility of at least 1500 m. Helicopters at a speed which having regard to the visibility is reasonable may operate clear of cloud with the surface in sight in a flight visibility of at least 1500 m.

[13] Joint Service Publication (JSP) 550 Military Aviation Policy, Regulations and Directives R307.145 Collision Avoidance During IMC Flight

- When special dispensation has been granted by MOD, or;

- Where specific approval is given in Command / Group Orders.

3.2.3 Likewise, and in addition to the CAA requirements, the military directs that except for aircraft conducting authorised operational missions, aircraft should not enter the United Kingdom Low Flying System (UKFLS) without a serviceable transponder.[14]

3.3 Legal Context for Class G Airspace

3.3.1 The Class G environment is the classification of airspace that enables the needs of all airspace users to be met and thereby permits the CAA to meet its statutory obligations. The Transport Act 2000 states that "*the CAA must exercise its air navigation functions in the manner it thinks best calculated –*

- *to secure the most efficient use of airspace consistent with the safe operation of aircraft and expeditious flow of air traffic;*

- *to satisfy the requirements of operators and owners of* ***all classes of aircraft****;*

- *to take account of the interests of any persons (other than an operator or owner of an aircraft) in relation to the use of any particular airspace or the use of airspace generally;*

- *to take account of any guidance on environmental objectives given to the CAA by the Secretary of State after the coming into force of this section;*

- *to facilitate the integrated operation of air traffic services provided by or on behalf of the armed forces of the Crown and other air traffic services;*

- *to take account of the interests of national security;*

- *to take account of any international obligations of the United Kingdom notified to the CAA by the Secretary of State (whatever the time or purpose of the notification)*

If in a particular case there is a conflict in the application of the provisions of subsection (2) [the provisions above], in relation to that case the CAA must apply them in the manner it thinks is reasonable having regard to them as a whole."

3.3.2 It is only by the use of Class G airspace, and the application of other airspace classifications set out in the ICAO Airspace Classifications Policy Statement[15], that the CAA, on behalf of the UK, can ensure that the requirements of owners and operators of all classes of aircraft are met. It is this principle that the least restrictive classification of airspace (Class G) should be the norm, with more restrictive classifications only being established where necessary, that is one of the key means by which the CAA meets its statutory obligations for the safe efficient use of airspace permitting the expeditious flow of all air traffic, whilst ensuring that all airspace users have reasonable and safe access to the national asset that is airspace.

[14] UK Military Low Flying Handbook 01.03.06 Use of SSR.

[15] The Application of ICAO Airspace Classifications in UK Flight Information Regions dated 31 August 2010 is available via this link: http://www.caa.co.uk/docs/7/20100831ApplicationOfAirspaceClassificationInUKPolicyV3.pdf

3.4 Strategic Review of General Aviation in the UK 2006

3.4.1 The Strategic Review of GA in the UK published in 2006[16] estimated that all aspects of GA (including commercial operations) made £1.4bn of direct economic contribution. It is also estimated to employ over 11,000 people in the UK. In November 2011 there were a total of 28,401 private pilot licence holders with a current medical. The sector is extremely diverse and represented by a multitude of bodies / groups including the Aircraft Owners and Pilots Association (AOPA), Light Aircraft Association (LAA), British Microlight Aircraft Association (BMAA), British Business and General Aviation Association (BBGA) and British Gliding Association (BGA). Several of these bodies (e.g. LAA, BGA and BMAA) are able to undertake oversight of their sector for some airworthiness and licensing tasks. Although this review was published six years ago and some of the figures may have changed, the principles underpinning the diversity of the sector and its importance to the wider aviation community remain valid.

3.4.2 Most of the issues emanating from the Strategic Review are dealt with elsewhere however, airspace infringements, where an aircraft enters controlled airspace or some other formal airspace construct (eg RA(T), Danger Area), without permission, normally through navigational error, are a serious safety issue as they potentially bring the infringing aircraft into conflict with airliners or other conflicting activity. Statistical evidence indicates most infringers are recreational aviation aircraft. Significant work to raise awareness, tackle airspace issues and use technology to provide pilots with more information has helped to reduce numbers but incidents remain high. GA representative bodies are engaged with the CAA and the Air Navigation Service Providers (ANSP) in trying to combat the issue.

4 SAFETY ASPECTS OF CLASS G AIRSPACE

4.1 The CAA, as the civil regulator, has a primary duty to ensure that safety standards relating to civil aircraft and air navigation are maintained or enhanced. As the specialist aviation body in the UK, it also has an interest in the wider, strategic and policy issues that affect the aviation sector as a whole. In airspace terms it has a duty to have regard to the safety of all operations. The pace of change affecting Class G operations has increased in recent years, as the growth of CAT at regional airports has accelerated, and as required regulatory changes in the UK and Europe have gathered momentum. Safety in an aviation context is a complex subject and there are a range of views on how it should be assessed, measured and mitigated and also different requirements for what the acceptable level of risk is (ie different target levels of safety). This paper has limited itself to the strategic safety issues in the context of Class G airspace operations by focusing on the CAA Safety Plan, work conducted on GA mid-air collisions by the LAA/GAA, the Airspace Safety Initiative and Air Accident Investigation Board opinion.

4.2 The CAA Safety Plan

4.2.1 The work to produce the CAA Safety Plan[17] involved the UK aviation community in highlighting the key safety risks affecting the sector. This will be developed and integrated into the CAA plans for new safety oversight through Enhanced Safety Performance. The CAA Safety Plan sets out, amongst other things some key issues with regard to General Aviation:

[16] Strategic Review of General Aviation in the UK – July 2006 available via this link: http://www.caa.co.uk/docs/33/StrategicReviewGA.pdf

[17] The information under this heading, including the sub paragraphs is based primarily on the CAA Safety Plan 2011 to 2013 available via this link: http://www.caa.co.uk/docs/978/CAA_Safety_Plan_2011.pdf

4.2.2 As part of its Safety Plan work the CAA is considering its oversight of Recreational Aviation and is seeking views from GA as to the key safety risks. The CAA remains committed to working with the community to improve GA safety in a proportionate manner. The CAA continues to discuss safety concerns on GA matters through the GA Consultative Committee (GACC) and airspace issues through NATMAC. The CAA has additionally committed to a wider review of Recreational Aviation. This will involve working closely with industry and EASA, to identify and act on opportunities to adopt a different, more proportionate approach, while ensuring that the key safety issues related to this community are addressed. The Desired Safety Outcomes are:

- Reduce the risk of mid-air collisions involving GA aircraft.
- Reduce the risk of accidents due to pilots making wrong decisions over the conduct of a flight.
- Reduce the risk of accidents due to the effects of helicopter and wind turbine induced wake turbulence on light aircraft.

4.2.3 This paper is in direct support of *'working with industry to improve GA safety in a proportionate manner*[18]*'* by considering Class G operations in the round and historical collision risk data in particular.

4.3 Airspace and Safety Initiative

4.3.1 The Airspace and Safety Initiative (ASI) is a joint CAA, NATS, AOA, GA and MoD effort to investigate and tackle the major safety risks in UK airspace; the focus is on Class G operations. It emerged from a top-level discussion between the then CAA Chair, NATS Chief Executive and MoD Assistant Chief of the Air Staff following a number of incidents where light aircraft infringed controlled airspace, or military and commercial flights lost separation outside controlled airspace. The ASI has included a major review covering a number of different areas, with the aims of:

- Enhancing safety outside controlled airspace.
- Identifying the hazards associated with the use of UK airspace.
- Identifying the needs for all airspace users.
- Prioritising the hazards / risks.
- Developing a strategy to mitigate those risks while meeting the needs of all airspace users.

4.3.2 Under ASI there are working groups on Air Traffic Services Outside Controlled Airspace (ATSOCAS), infringements, airspace design and classification, equipment carriage and off-route commercial operations. The Initiative has achieved much, but work remains ongoing. The ASI website together with the Fly On Track[19] website provides a wealth of information for the safe conduct of Class G airspace operations.

4.3.3 This paper is just the latest iteration of continuous work by various and many Class G airspace user groups. Work has been conducted in collaboration to ensure that the culture of a continuous improvement in safety is maintained and the risks to those

[18] CAA Safety Plan 2011/13 Page 8 – General Aviation (GA)

[19] Fly On Track is an independent website for private pilots covering airspace infringement issues. The site is run on behalf of the General Aviation Safety Council (GASCo) as part of the Airspace Safety Initiative and is available via this link: www.flyontrack.co.uk.

operating in Class G airspace, and those on the ground, is as low as reasonably practical and mitigated in an effective and proportional manner.

4.4 Visual Conspicuity Trials

4.4.1 As part of the ASI work and as a result on of an AAIB recommendation, trial work is being undertaken on the visual conspicuity of gliders but which has read across to visual conspicuity generally. Trials conducted in 2011 suffered from poor weather and full trial evaluation and validation of reflective mirror film applications remain incomplete. Trials are planned to complete this work in the late spring 2012.

4.5 Study on Managing Risk in Class G Airspace

4.5.1 As part of the cooperative work on Class G airspace operations the LAA, BGA and BHPA produced a paper on behalf of the General Aviation Alliance (GAA), which they shared with the FAS NATMAC Sub Group, with the aim of informing the discussion on Class G airspace safety using actual collision data.

4.5.2 The LAA concluded that predominately, powered aircraft collide with other powered aircraft and gliders collide with other gliders. In the 37 years considered, only 5 collisions occurred between powered aircraft and gliders, two during Aerodrome Traffic Zone transits by powered aircraft, one during powered aircraft aerobatics and two in cruising flight. Whilst 47% of powered aircraft collisions occur in cruising flight, only 3% of glider collisions (with powered aircraft) were in the cruise. No gliders have collided with other gliders in cruising flight. Collisions appear to be closely related to traffic density with 53% of powered aircraft collisions occurring over or near an airfield and glider collisions being divided 80% over or near the launch site and 20% in cross country thermal or cruise. All of the above must be viewed in the context of overall risk; collisions have thus far accounted for only 1% of all GA accidents and 6% of fatalities.

4.5.3 The data set was considered against Category A Airprox events by the UK Airprox Board (UKAB) but the comparison was inconclusive. The data shows that risk has taken two forms; concentrated high risk over and around busy GA airfields and launch sites and distributed low risk throughout the Flight Information Region. Whilst the increased traffic density around controlled airspace and choke points might be expected to increase risk, the limited analysis of the collision and Airprox data, so far conducted, does not support the theory. Other factors may be mitigating this risk as the number of collisions has been very low in this environment. It has been hypothesised that the boundaries of controlled airspace act as a barrier narrowing the area that pilots must search to acquire conflicting traffic and that combined with heightened pilot awareness this may markedly reduce the probability of collision. As reported following conspicuity trials carried out in 2002,[20] even when crews are hyper vigilant and are searching for an aircraft which they know is on a potential collision course, occasionally they will not see the other aircraft. (See discussion on See-and-Avoid below.)

4.6 Electronic Conspicuity

4.6.1 Under the Future Airspace Strategy, work on Surveillance Strategy is being led by the CAA's Directorate of Airspace Policy Surveillance and Spectrum Management Section, who are also collaborating on electronic conspicuity under the Airspace & Safety Initiative. Whilst this work aims to consider electronic conspicuity in the widest sense, and not be constrained by currently available equipment and views, the debate and concerns do centre on the carriage of existing equipment and its operation.

[20] Conspicuity Trials RAF Bicester June & October 2002, Dr T Head

4.6.2 The most established form of electronic conspicuity is the SSR transponder. Older systems respond with simple data like an octal four digit code and altitude information, while more modern Mode S systems transmit more data derived from onboard systems in complex aircraft. More detail is available at Annex M. Currently the carriage of SSR Transponder Equipment is mandated in controlled airspace classification A, B and C and under Instrument Flight Rules within class D and E. Elsewhere carriage is mandated above FL 100 (except within non-SSR Glider Areas) and below this within Transponder Mandatory Zones where established[21]. The limits of the mandated requirements have been set in recognition of the limitations of some GA users operating within class G airspace below FL 100. Although Transponder Mandatory Zones are not supported by all of the Class G users they are a pragmatic way of mitigating a significant airspace incursion risk. The CAA policy for Transponder Mandatory Zones (TMZ) was set out in a Policy Statement in April 2009[22].

4.6.3 However, operating a transponder does not in itself allow the detection of other aircraft, and thus it does not in itself reduce collision risk for uncontrolled flights, unless the flights are receiving an air traffic service. Separate equipment (which for the purposes of this document will be described as traffic alerting systems) is required to detect other aircraft and alert the crew. These systems are detailed in Annex M.

4.6.4 Another electronic conspicuity system is Automatic Dependent Surveillance Broadcast (**ADS-B**). Rather than using interrogation-response, an ADS-B system broadcasts its data, including position, typically derived from a GNSS[23] system. Additionally the British Gliding Association (BGA) has done much to mitigate the risk of collisions between gliders operating in close proximity (such as multiple gliders using the same thermal), by the introduction of FLARM. The name FLARM is derived from “flight alarm”. Its principle is the same as ADS-B. FLARM obtains its position from an internal GPS and a barometric sensor and then broadcasts this with forecast data about the future 3D flight track. More detail on ADS-B and FLARM are included in Annex M.

4.6.5 The universal carriage and operations of transponders is postulated by some as a universal panacea to both actual and perceived risk in all classes of airspace. Such arguments can often polarise the debate and have led to entrenched positions being taken. One end of the range of options is the universal equipage of transponders and some form of traffic alerting system together with the universal provision of air traffic services. Such equipage and service provision is impractical for the following reasons:

4.6.5.1 Passive traffic alerting systems are the only ones feasible for most GA aircraft and have limited utility in the situations where the majority of collisions have historically occurred.

4.6.5.2 Many GA aircraft are weight limited whilst the majority would not have the power generating capability required by current systems.

4.6.5.3 Some airframes have little or no physical structure on which to mount equipment.

4.6.5.4 There is no universal radar coverage for the provision of a universal ATS even if the ATS system capacity could be significantly increased to meet such demand.

4.6.5.5 The cost benefit case for universal carriage of transponders and traffic alerting systems in Class G airspace remains unproven.

[21] The requirements for the carriage of SRR Transponder Equipment are notified under Article 39(2) and Schedule 5 of the Air Navigation Order 2009 in the UK IAIP GEN 1-5-14 via this link: http://www.ead.eurocontrol.int/eadbasic/pamslight-7F9D156E18F1BE5ABEF55A22081E71CE/7FE5QZZF3FXUS/EN/AIP/GEN/EG_GEN_1_5_en_2011-11-17.pdf

[22] TMZ Policy Statement is available via this link: http://www.caa.co.uk/docs/7/20090417CAATMZPolicyStatement.pdf.

[23] Global Navigation Satellite System

4.6.6 This has led to a view, in some GA quarters, that the status quo is the way ahead, but the CAA view, supported by that of GA organisations remains that in keeping with the UK's culture of pursuing continuous improvement in aviation safety we must continue to challenge the status quo and make safety improvements where appropriate and proportionate. Only in this way can we ensure and constantly check that risks in the system are "as low as reasonable practical" (ALARP)[24]. For risk to be ALARP it must be possible to demonstrate that the cost involved in reducing the risk further would be highly disproportionate to the benefit gained. Infinite time, effort and money could be spent on reducing the risk towards zero. ALARP can never be just a quantative measure of cost / benefit judgement must be exercised in balancing all the issues involved. Whilst understanding that it is not currently practical and / or economically possible for all aircraft to be fitted with equipment to permit electronic conspicuity and fully cooperative ATM systems, it is generally accepted that the higher the proportion of aircraft so equipped the greater the benefit to the system as a whole. Nevertheless this does not necessarily address all of the risks associated with mid-air collisions in Class G airspace.

4.6.7 It is logical that the instances of collision avoidance will improve with each aircraft that is fitted with a transponder or traffic alerting system - an aircraft with a traffic alerting system is less likely to collide with an aircraft carrying and operating a transponder- which is an advantage to every aircraft carrying a transponder. Whilst this has direct benefits between different user groups, say by aiding the prevention of GA collisions with commercial air traffic and military equipped aircraft in Class G airspace the LAA's study of GA collisions reveals that such collisions represent about 3% of the collision risk to GA aircraft, so if all GA aircraft, microlights and gliders were all fitted with a transponder or some form of traffic alerting system (there would be significant technical and cost issues to overcome to even make this possible) this element of the collision risk could be reduced, but never completely removed as no system can remove all risk. Furthermore the carriage and operation of transponders by GA, whilst providing some benefit between the user groups, would do little to prevent collisions with other GA aircraft by direct interaction which is their greatest risk. Greater transponder carriage would therefore do little to address the risk of GA on GA collisions which is one of the risks this community is currently trying to address. Statistical evidence shows that the risk of collisions is relatively low in the FIR generally but is significant in the vicinity of busy GA airfields and flying sites as detailed above in the paper on Managing Risk in Class G Airspace.

4.6.8 The overall case for transponder carriage in certain classes of airspace is accepted and it can be concluded that:

4.6.8.1 Electronic Conspicuity (currently through transponder carriage) is mandated and accepted for controlled airspace and Class G airspace above FL 100 to provide a safety net mitigating against separation failure.

4.6.8.2 Whilst not supported by all users, Transponder Mandatory Zones enable safety levels to be maintained in specific areas without the need to move to a universal mandate and thereby a far greater impact on some Class G users.

4.6.8.3 The benefit of traffic alert systems has been accepted and hence TCAS is mandated for certain larger category aircraft.

[24] ALARP – CAP 760, Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases defines ALARP thus: "A risk is low enough that attempting to make it lower, or the cost of assessing the improvement gained in an attempted risk reduction, would actually be more costly than any cost likely to come from the risk itself. This does not automatically mean the risk is acceptable though; a judgement will need to be made and justified."

4.6.8.4 Aircraft falling outside the legal requirement for ACAS but nevertheless operating some form of traffic alerting system have found they help to increase pilot situational awareness thereby reducing collision risk.

4.6.8.5 The current policy is that "one size does not fit all" and there is no mandatory requirement for the carriage of transponders by all aircraft in Class G below FL 100 (excepting TMZs where established).

4.6.8.6 Whilst understanding that it is not at present practical and / or economically possible for all aircraft to be fitted with equipment to permit electronic conspicuity and thereby fully cooperative ATM systems, it is accepted that the higher the proportion of aircraft so equipped the greater the benefit to the system as a whole. But carriage of conspicuity equipment (e.g. Mode S or ADS-B out) only significantly reduces risk for users who have the corresponding ability to detect (ADS-B in, TCAS, or receiving an ATS). The higher the proportion of airspace users equipped with conspicuity equipment, the greater the potential benefit to those who are able to and choose (or are required) to equip with compatible detection equipment. The experience with FLARM in the gliding community has demonstrated that voluntary equipage with conspicuity equipment can reach a significant fraction of a user group if it is combined with detection equipment that allows the user to derive a valuable benefit.

4.7 Air Accident Investigation Branch (AAIB) Opinion

4.7.1 The UK AAIB has expressed an opinion on GA mid-air collision on a number of occasions as a result of their investigations into aircraft accidents. Broadly speaking the AAIB conclusions underpin the LAA/GAA work on collisions covered above, particularly with regard to a key area of concern being collision risk within the aerodrome visual circuit. **Some of the AAIB's opinions and conclusions are paraphrased below**, starting with the AAIB's consideration of the See-and-Avoid principle.

4.7.2 Visual search is not 100% effective and even in ideal conditions there is no guarantee that a conflicting aircraft will be sighted in sufficient time to avoid a collision. Studies show that, in essence, a visual search is more likely to be effective when the searcher knows there is a target to find and approximately where to look for that target. Collision avoidance within the aerodrome circuit in Class G airspace is primarily achieved by pilots visually acquiring conflicting traffic and arranging their flight to avoid it. This visual search is aided by listening for specific instructions or information from ATC or for transmissions from other aircraft. Pilots develop detailed mental models to assist in deciding where to visually search. Visual detection is subject to numerous limitations and its success is not assured. In addition, there is a lower probability of seeing traffic if it is not where it is expected to be. There are limitations inherent in a system that ultimately relies on see-and-avoid for collision prevention and the AAIB refers to 'The *Australian Transport Safety Bureau report on the Limitations of the See-and-Avoid Principle*[25]' to support their view. These limitations are well known and much discussed across the aviation community, especially amongst the Class G user groups and a range of publicity and educational material is available. In February 2011 the CAA published a General Aviation Safety Sense Leaflet on Collision Avoidance[26], covering, amongst other things, some of the issues associated with See-and-Avoid.

[25] Limitations of the See-and-Avoid Principle; ATSB Research Report, April 1991, http://www.atsb.gov.au/publications/1991/limit_see_avoid.aspx

[26] The CAA's Safety Sense Leaflet 13 – Collision Avoidance can be accessed via this link: http://www.caa.co.uk/docs/33/20110217SSL13.pdf

4.7.3 With regard to GA mid-air collisions in the UK a common AAIB observation is that the aircraft involved were not on a common ATC frequency or were not electronically conspicuous. As such, no form of alerting was practicable. However, whilst accepting that traffic alerting systems bring benefits the AAIB points out that those systems will not detect aircraft that are not equipped with transponders. The AAIB also references the Andrew's Study[27] from 1991 which showed that, under the trial conditions set up for the study, azimuthal alerting information increased the efficacy of see-and-avoid by a factor of eight. These AAIB opinions can be summed up as a view that alerted see-and-avoid has a role to play in increasing the effectiveness of see-and-avoid in certain circumstances and user interactions.

4.7.4 Notwithstanding the above view the only outstanding AAIB recommendation, albeit referring to two earlier recommendations, relevant to Class G airspace and which the CAA has accepted and committed to considering how to resolve was made following the mid-air collision between G-BYXR and G-CKHT in 2009[28]. The AAIB Safety Recommendation was numbered 2010-041 and it recommended that:

"The Civil Aviation Authority, in light of changing technology and regulation, review their responses to AAIB Safety Recommendations 2005-006 and 2005-008 relating to the electronic conspicuity of gliders and light aircraft. The CAA accepted this recommendation and in March 2011 updated the AAIB with their progress. The CAA highlighted the complexities of the situation and the difficulties of finding a certificated but low cost and low power solution, such that it could reasonably be mandated to the large number of light aircraft and gliders on the UK register. The CAA concluded that no short term solution was available, but that through the Future Airspace Strategy (FAS) and the Airspace & Safety Initiative (ASI) they would establish a cooperative workstream to address electronic conspicuity." (The CAA will continue to progress this work under the DAP Surveillance and Spectrum Section workstream covered earlier in this paper.)

5 21st CENTURY CLASS G AIRSPACE

5.1 The Conflict in the Current System

5.1.1 Disadvantages of the current modus operandi appear to rest largely on your operating perspective. So for a CAT operation transiting Class G airspace additional mitigation has to take place to allow the operation to be completed safely whereas the establishment of Controlled Airspace wherever there is a CAT aircraft would remove the need for these additional mitigation methods. From the sport and recreational perspective the expansion of Controlled Airspace over the last 50 years, and especially in the last 20 years, has seen the volume of airspace to GA in areas that are most accessible to them, (ie overland and in the large urban conurbations) reduce significantly. There is an understandable concern, given the anticipated growth in commercial aviation, that expansion of Controlled Airspace will continue and further airspace will be restricted to GA flight. Any individual group looking at their current activity can find aspects of the system they would like to operate differently to their advantage. Unfortunately what works to the advantage of one user group can often work to the detriment of another group. The balancing of these different requirements and desires is both the greatest weakness and strength of the current Class G system. Where such a fine balance exists it is essential that the balance is periodically challenged, reviewed and confirmed as appropriate. Similarly as new technology is embraced by the commercial aviation industry, and indeed society at large, it is only right and proper that consideration is given to its utility within Class G airspace.

[28] AAIB Aircraft Accident Report 5/2010. The full report can be accessed via this link: http://www.aaib.gov.uk/cms_resources.cfm?file=/AAR%205-2010%20Grob%20G115E%20(Tutor),%20G-BYXR%20and%20Standard%20Cirrus%20Glider,%20G-CKHT.pdf

5.2 Class G Airspace for the Future

5.2.1 The development of the UK's airspace system (including Class G) will, by the continuous nature of evolving airspace demand and technological advancements, need to be evolutionary rather than revolutionary. By improving the clarity of potential improvements, coordinating their implementation and ensuring the right supporting policy and regulation, achieved via consensus, it should be possible to make the evolutionary process move more quickly than in the past.

5.2.2 Not only do we need to consider how the Class G environment needs to evolve to continue to meet the current users requirements but how it might meet the needs, or at least easily evolve to meet the needs, of potential new users such as Unmanned Aerial Systems (UAS) and emerging requirements for space tourism and low earth orbit satellite launches. Whilst current policy on these types of activity requires temporary segregation of airspace on safety grounds, thereby denying it to other users, we need to develop and challenge potential safety risk mitigations that enable airspace segregation to be minimised. Indeed as new users increase in number the CAA statutory duties demand that the CAA balances the needs of these new users as much as that of the current users.

5.2.3 It remains the CAA's intention, in keeping with its statutory obligations, to continue to work with all sectors of the aviation community and balance all their needs. The CAA believes that as work is completed to develop the Flexible Use of Airspace (FUA) concept further and move closer to real-time airspace allocation, this will help to ensure that that airspace is only restricted where absolutely necessary and for the minimum period of time. There are significant challenges to increasing the dynamism of the airspace safely, not least the need for effective promulgation and notification of changes that can be expected to reach all potential users in a timely manner if the benefits of the FUA concept are to be fully realised. As changes are made and new, practical equipment becomes available, it is possible that if GA aircraft operators are able to invest in the appropriate equipment then there will be an increase in the volumes of airspace they can easily access. It will be for the individual owner / pilot to decide if the extra access merits the investment. In this context it is important to remember that controlled airspace does not automatically exclude aircraft but it does set requirements (depending on the classification of the airspace) for entry and if those requirements can be met then access is permitted to all airspace users. As the FUA concept is enhanced the CAA will continue to engage with stakeholders and seek to identify new, innovative and effective means of information distribution and availability.

6 THE MAIN ISSUES FOR FUTURE CLASS G AIRSPACE

6.1 From the evidence summarised in this paper, AAIB recommendations and the views expressed by the user groups the main issues faced in Class G airspace today and for the future are encompassed by three high-level issues:

6.1.1 The effectiveness of 'See-and-Avoid'.

6.1.2 The interaction between different user groups.

6.1.3 The interaction between different uses (and/or classifications) of airspace.

6.2 The key aspects of these three overarching issues are:

6.2.1 **Effectiveness of See-and-Avoid**:

6.2.1.1 The issues associated with the effectiveness of See-and-Avoid increase as traffic density and user group interaction increases.

6.2.1.2 The effectiveness decreases as average aircraft (closing) speed increases.

6.2.1.3 Some aircraft can have a limited field of vision and some operations can lead to "head in the cockpit" limiting both the time spent on, and the effectiveness of, lookout.

6.2.1.4 See-and-Avoid is more effective when the searcher knows there is a target to find and approximately where to look for that target.

6.2.2 Increased mitigation for See-and-Avoid can be provided by all of the following either singularly or combined[29]:

6.2.2.1 From experience and / or pre-flight planning the pilot knows the likely threats and their likely origin limiting the arc of view from where conflicts are likely to occur. (For example where Class G traffic is funnelled between two portions of controlled airspace and the pilot is aware he has to concentrate his search to look for opposite direction traffic.)

6.2.2.2 From the information included in routine R/T calls from other aircraft, either 'blind' transmission or those to / from a ground station.

6.2.2.3 From the information provided under an appropriate air traffic service.

6.2.2.4 From the situational awareness or information provided by an on board traffic alerting system. (Only provides information on transponding traffic, FLARM equipped traffic or ADS-B equipped traffic as appropriate.)

6.2.2.5 A greater understanding of See-and-Avoid principles, leading to a more intelligent look out scan, would help to increase effectiveness.

6.2.3 **Interaction between different user groups**:

6.2.3.1 Many of the issues associated with Class G operations are due to the interaction of the differing user groups and their different operational requirements.

6.2.4 Examples of such interactions highlighting the type of issues involved and how they are or can be mitigated are:

6.2.4.1 Sport parachuting – needs clear line of sight to the landing zone and due to the limited ability to manoeuvre need other aircraft to avoid the area between the jump aircraft and the landing zone. This is generally achieved via pre-notification of parachuting sites and activity depicted on Aviation Charts and promulgated via NOTAM. This has its limitations such as when wind aloft may require an aircraft exit that is not directly overhead the drop zone.

6.2.4.2 Intense gliding activity – major gliding sites are marked on Aviation Charts and large competitions are promulgated via NOTAM enabling powered aviators to avoid the sites / areas rather than individual gliders.

[29] No attempt has been made here to provide detail of the efficacy of these five factors in this paper but generally speaking traffic alerting with azimuthal information would be the most effective, followed by traffic deconfliction service from ATC. For other aspects benefits could be variable and potentially marginal.

6.2.4.3 Military Aerodromes – Within Class G airspace the increased activity around military aerodromes is managed and mitigated by the establishment of Military Aerodrome Traffic Zones (MATZ) and the provision of MATZ crossing services and Lower Airspace Radar Service (LARS). MATZs are also marked on Aviation Charts.

6.2.4.4 Intense Military Activity – Major military exercises are notified via NOTAM and more routine areas of activity are marked on Aviation Charts (for example activity in and around air-ground ranges). Likewise activity in the UK Military Low Flying system is managed so that military crews are aware of likely additional activity through the Low Level Civil Aircraft Notification Procedures (CANP) and the Pipeline Inspection Notification System (PINS). For military danger areas a Danger Area Crossing service is provided by the operating authority.

6.2.4.5 Commercial Air Transport – CAT flights to airports not directly connected to the controlled airspace system will be assessed under the operators Safety Management System (SMS) and risks mitigated as appropriate with the normal requirement to be in receipt of an Air Traffic Service.

6.2.4.6 Emergency Restrictions of Flying (ERF) – Restrictions to flying activity set up under the ANO by use of Statutory Instrument approved by the Secretary of State for certain police and or medevac missions.

6.2.4.7 Temporary Restricted Airspace (RA(T)) – set up for air displays and other activity requiring temporary segregation through the CAA's Airspace Utilisation staff.

6.2.5 As can been seen from the examples above, many of the mitigations used to manage the greater threats from increased cross user group interaction are the same as those used to improve the effectiveness of See-and-Avoid. This is important as it should enable activity to focus on key issues that mitigate the greatest range of issues possible that exist in the Class G operating environment.

6.2.6 **Interaction between different uses of airspace**:

6.2.6.1 This area has some read across from the previous issue but is meant to cover the interaction between formally notified different uses of airspace, such as that between Class G airspace and adjacent Controlled Airspace. The issues associated with this area are highlighted by the infringement rate of Controlled Airspace, special rules airspace and / or segregated airspace. The threats under this area are greatest where the density of traffic, both inside and outside Controlled Airspace, is greatest. So the threat is greatest in the south-east of England where the level of Class G activity and the complexity and level of activity in controlled airspace (both CTR / CTA) is greatest. Whilst much has and is being done within the ASI work to reduce the risks as a result of infringements, current statistics show that the threat (ie the number of infringements) is still high.

6.2.6.2 Where the requirements for the establishment of controlled airspace is not warranted but nevertheless additional measures to ensure the safe efficient conduct of air traffic are required, then proportionate measures are introduced. The establishment of Transponder Mandatory Zones (TMZs) is one such example for which policy has been published[30], albeit in principle, other measures could be used or developed for the future. A TMZ is only established for overriding safety reasons, where the airspace classification would not ordinarily require aircraft to carry a transponder.

[30] The DAP Policy for Transponder Mandatory Zones (TMZs) can be found via this link: http://www.caa.co.uk/docs/7/20090417CAATMZPolicyStatement.pdf

7 CONCLUSIONS

7.1 Class G airspace users have various and sometimes conflicting requirements which have to be addressed under UK legislation. The greatest strength, and the greatest challenge, of the UK Class G airspace is that it permits such a wide variety of users operating in aircraft of vastly differing capability. The UK requires that the needs of all users are catered for and any conflicting requirements are balanced, taking a view as to the benefits of the system as a whole. Safety risks must be properly assessed and mitigating measures should be proportionate. This legislative backdrop has ensured that aviation has been given significant latitude in its freedom to operate within UK airspace. If safety risks are to be fully understood, and where necessary appropriate mitigation measures developed, we need to understand in greater detail the use of Class G airspace and the interactions within it.

7.2 There is a whole range of activity that legitimately needs to take place in our airspace and we have to find a way to allow it all to happen in a proportionate and sensible way. The effectiveness of see-and-avoid will continue to be limiting factor for some operations in Class G airspace. Some users will need, or wish to, adopt additional measures to enhance the effectiveness of see-and-avoid, possibly by providing cooperative systems that provide increased situational awareness, if not universally in Class G airspace then certainly for given portions of airspace. Class G airspace cannot operate in isolation and whilst primarily a controlled airspace issue the infringement rate by aircraft operating in Class G airspace into controlled airspace remains a significant safety concern. Continued action is needed to further reduce the infringement rate.

7.3 The main conclusions drawn from this paper and the associated work are:

7.3.1 The CAA's statutory duty to "satisfy the requirements of operators and owners of all classes of aircraft" has enabled the principle that the lowest acceptable categorisation of airspace (Class G) is the norm with greater classification being permitted where the safety need is demonstrated clearly. The CAA will continue to work with stakeholders, current and new, to ensure the requirements of operators and owners of all classes of aircraft are satisfied to the greatest extent possible and if there is a conflict in use then the CAA must provide a solution in the manner it thinks is reasonable having regard to the system as a whole.

7.3.2 Traffic density is a key factor with regard to risk in the Class G environment:

7.3.3 The effectiveness of See-and-Avoid can be enhanced by other factors based on experience, training, pre-flight briefing, service provision or electronic conspicuity all increasing situational awareness.

7.3.4 Electronic conspicuity in certain circumstances enables aircraft to work cooperatively and can provide a range of safety mitigations for some operations in Class G airspace.

7.3.5 Increased situational awareness reduces the risk from the threat of any potential conflict situation.

7.3.6 Historical data on GA mid air collisions demonstrates that whilst there is some risk in the transit / cruise element of flight, the greater risk is in the vicinity of busy aerodromes or flying sites or areas where density is increased such as in thermals or on soaring ridges. Moreover the risk tends to be mainly contained within groups; collisions within the powered aircraft group and collisions within the glider group by virtue of the nature of the activity they are conducting.

7.3.7 The more the operations within Class G airspace are understood, the more predictable they become. The more predictable they become the more the effectiveness of See-and-Avoid can be enhanced.

7.3.8 Where the interaction of Class G users or the interaction between Class G airspace and adjacent Controlled Airspace is such that the safe and expeditious flow of all air traffic is in doubt the case for appropriate mitigation will need to be made on a case-by-case basis.

7.3.9 The evidence and opinion seen during the work for this paper indicates that all Class G airspace users continue to be able to satisfy themselves that they can conduct their flying activity safely, albeit the training, equipment and ATS provision requirements to achieve individual safety requirements varies from user to user. Risk continues to be driven down using ALARP[31] principles which helps to ensure that all factors are taken into account in collective and individual risk assessment.

8 RECOMMENDATIONS

8.1 Based on the above conclusions the following recommendations are made:

8.1.1 The current legislative requirements for CAA DAP, to meet the needs of users of all types and classes of aircraft, are retained. **(Conclusion 7.1)**

8.1.2 Work is led by the CAA, with full the engagement of stakeholders to continue to reduce the number of infringements of controlled airspace. **(Conclusion 7.2)**

8.1.3 Controlled airspace and other measures should only to be established where there is a demonstrated need for such airspace or measures, based on an objective assessment of risk, and appropriate consultation should be completed to mitigate the effect of greater restrictions on all airspace users, as far as is possible, having regard to users as a whole. **(Conclusion 7.3.1)**

8.1.4 Work is led by CAA into promoting greater visible conspicuity for light aircraft and gliders where possible. **(Conclusion 7.3.3 / 7.3.5)**

8.1.5 Work is completed by the CAA, with appropriate stakeholder support, to initiate a refreshed training programme setting out how the effectiveness of See-and-Avoid can be maximised for Class G airspace users. Including, where appropriate, the provision of air traffic services, enhanced electronic conspicuity and the use of traffic alerting systems[32]. **(Conclusion 7.3.3)**

8.1.6 Work is led by CAA into enhancing electronic conspicuity, were technically feasible and financially viable, of aircraft operating in Class G airspace. **(Conclusion 7.3.4)**

8.1.7 Work is led by the CAA with LAA / BGA/ GAA into reducing the risk of GA/GA mid air collisions in the vicinity of aerodromes and flying sites[33]. **(Conclusion 7.3.6)**

[31] ALARP – As Low As Reasonable Practical.

[32] A considerable amount of educational material has already been developed relating to the ATSOCAS services. A number of articles have been published in GA magazines. NATS Safety Partnership has also produced an ATSOCAS guide for commercial operations in Class G airspace. The CAA Safety Sense leaflet has been revised and reissued and a new AIC on ATSOCAS is currently being produced. All of these publications emphasise the importance of a good lookout to enhance see-and-avoid. The first element of this task will therefore need to be an assessment of what, if any additional material is required.

[33] Analysis of recent Airprox data for GA/GA incidents, in this context, has been carried out by the CAA. A draft paper will shortly be ready for discussion on the safety issues relating to VFR flight in the circuit, joining the circuit and operating in the vicinity of aerodromes.

8.1.8 To provide a clearer understanding of collision risk in Class G airspace the UK Airprox Board (UKAB) completes a detailed analysis of Class G Airprox reports starting from 1975 to cover the same time span as the GAA collision analysis work. (The CAA has agreed to support additional resource for the work to be completed by the end of 2012). **(Conclusion 7.3.7)**

8.1.9 On the assumption that the UKAB work above will highlight areas of greater risk in Class G airspace work is then completed by the CAA to provide a greater understanding of operations and interactions within Class G airspace, in these areas of greater risk, to enable the identification and prioritisation of hazards, threats and risks, associated with the use of UK airspace, and enabling work to mitigate those risks while meeting the needs of all airspace users. **(Conclusion 7.3.7** but also supporting many of the other conclusions)

8.1.10 Work is completed to identify and consider if there are additional measures, that stop short of the establishment of controlled airspace that could be used to enhance the safety of air traffic in areas of high traffic density and diversity. **(Conclusion 7.3.8)**

8.1.11 The CAA should publish, following engagement with stakeholders, appropriate guidance, on risk assessment and mitigation, for GA pilots intending to operate in Class G airspace. **(Conclusion 7.3.9)**

8.1.12 The recommendations, progress and identification of subsequent work should be reported to the ASICG[34] who will have the responsibility for delivering the improvements supported by the work recommended in this paper. This should include a roadmap for improvements once the initial data gathering exercises, listed above at Recommendation 8.1.3 and 8.1.4, have been completed. **(Tracking task to ensure recommendations are delivered)**

- end -

List of Annexes

A – FAS NATMAC Sub Group TOR and Membership.

B – List of Abbreviations Used.

C – Class G Requirements – GA and Microlights.

D – Class G Requirements – Gliders.

E – Class G Requirements – Military.

F – Class G Requirements – Rotorcraft.

G – Class G Requirements – Commercial Air Transport.

H – Class G Requirements – Commercial Air Transport (BALPA).

I – Class G Requirements – Balloons and Airships.

J – Class G Requirements – Sport Parachuting.

K – Class G Requirements – Unmanned Aircraft Systems – Visual Line of Sight / Extended Visual Line of Sight.

[34] ASICG – Airspace Safety Initiative Coordinators Group

L – Class G Requirements – Hang Gliding and Paragliding, both unpowered and powered.

M – Electronic Conspicuity

TERMS OF REFERENCE FOR THE FUTURE AIRSPACE STRATEGY NATMAC SUB GROUP

Aim

1. The purpose of the Future Airspace Strategy NATMAC[35] Sub Group (FASNSG)) is to enable stakeholder engagement in, and overview of, the Future Airspace Strategy (the Strategy), its development and implementation. The FASNSG will also provide a check function, and challenge to, the work of the FAS Programme Board (FASPB) to confirm that on-going work is coherent with the aims and aspirations of the agreed and published Strategy.

Future Airspace Strategy NATMAC Sub Group

2. The FASNSG is responsible for the review of the Strategy and ensuring that ongoing work is coherent with the Strategy and communicating the Strategy and changes to their stakeholders. The FASNSG will maintain close co-ordination with the FASPB to confirm that work and progress are coherent with, and deliver on, the aspirations set out in the Strategy. The interactions with the FASPB and other groups are shown in Figure 1.

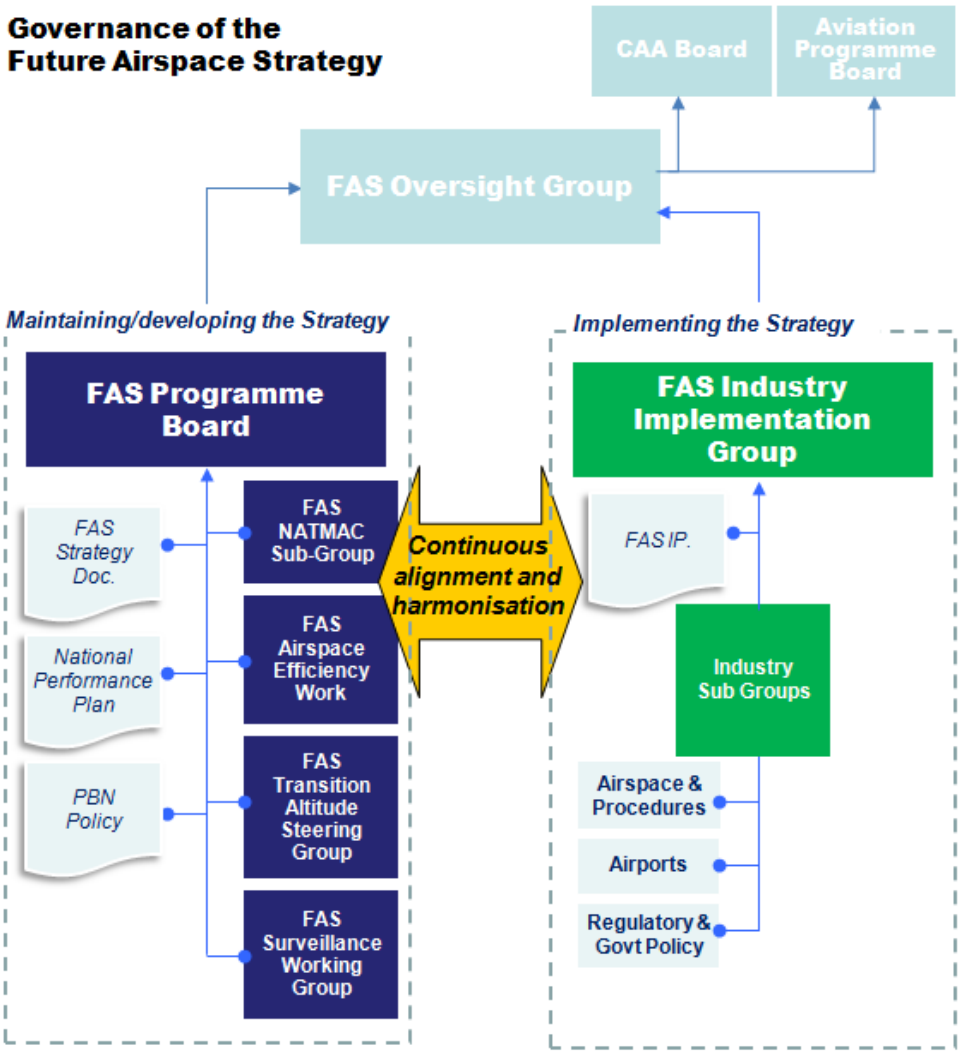

Figure 1

[35] National Air Traffic Management Advisory Committee

Terms of Reference

3. The FASNSG will:

- Keep under review the working of the procedures set out in these ToR, and, where appropriate, make recommendations for change.

- Review the Strategy document to ensure it is up-to-date and coherent with any recent developments, or emerging technology. Where appropriate, it will recommend amendments and update action to the FASPB.

- Maintain an overview of the actions from the 'Recommendations' and 'Risks' from the Strategy as set out in Annex A & B of the Strategy document and make recommendations to the FASPB accordingly.

- Via individual members, communicate the Strategy, and any changes to it, to their representative organisations as appropriate.

- Maintain an effective partnership between the NATMAC and the FASPB to ensure on-going work is coherent with the Strategy and effectively articulated between these groups

4. Membership of the FASNSG is:

- CAA DAP ADAP 1(Chair)
- CAA SRG
- LAA/GAA
- UAVS Association
- PPL/IR Europe
- BAA
- MoD
- MAA
- NATS
- BHA
- BALPA
- BGA
- BA
- Low cost Airlines
- BBAC
- CAA DAP Pol Coord (Secretary)

5. In addition to the members above, appropriate advisors/subject experts may be invited to attend meetings, as and when required by the agenda.

WORKING ARRANGEMENTS

6. The FASNSG will meet as required but at least once every six months, unless otherwise agreed and directed by the Chair. Agenda items will be agreed ahead of each meeting with FASNSG members being able to table subjects of interest ahead of any meeting.

7. The secretariat and coordination role will be fulfilled by DAP Policy Coordinator.

January 2012

List of Abbreviations

A

AAIB	Air Accident Investigation Branch
ACAS	Airborne Collision Avoidance System
ADS-B	Automatic Dependent Surveillance – Broadcast
AIRPROX	Air Proximity
ALARP	As low as reasonably practicable
AMSL	Above Mean Sea Level
ANO	Air Navigation Order
ANSP	Air Navigation Service Provider
AOA	Airport Operators Association
AOPA	Aircraft Owners and Pilots Association
ASI	Airspace Safety Initiative
ASICG	ASI Coordinators Group
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Service
ATSOCAS	Air Traffic Services Outside Controlled Airspace
ATZ	Aerodrome Traffic Zone

B

BALPA	British Airline Pilots' Association
BBGA	British Business and General Aviation Association GACC
BGA	British Gliding Association
BHPA	British Hang Gliding and Paragliding Association
BMAA	British Microlight Aircraft Association

C

CAA	Civil Aviation Authority
CANP	Civil Aircraft Notification Procedures
CAT	Commercial Air Transport
CTA	Control Area
CTR	Control Zone

D

DA	Danger Area
DAP	Directorate of Airspace Policy

E

EASA	European Aviation Safety Agency
ERF	Emergency Restrictions of Flying
FAS	Future Airspace Strategy
FIR	Flight Information Region
FL	Flight Level
FLARM	Flight Alarm
ft	feet
FUA	Flexible Use of Airspace

G

GA	General Aviation
GAA	General Aviation Alliance
GACC	General Aviation Consultative Committee
IAIP	Integrated Aeronautical Information Publication
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules

IMC	Instrument Meteorological Conditions
K	
km	Kilometre
Kts	Knots
L	
LAA	Light Aircraft Association
LARS	Lower Airspace Radar Service
M	
M	Meter
MATZ	Military Aerodrome Traffic Zone
MoD	Ministry of Defence
N	
NATMAC	National Air Traffic Management Advisory Committee
NOTAM	Notice to Airmen
P	
PINS	Pipeline Inspection Notification Service
R	
R&D	Research and Development
R/T	Radio Telephony
RA(T)	Restricted Airspace (Temporary)
S	
SRG	Safety Regulation Group
SSR	Secondary Surveillance Radar
T	
TMZ	Transponder Mandatory Zone
TOR	Terms of Reference
U	
UAS	Unmanned Aerial Systems
UK	United Kingdom
UKAB	United Kingdom Airprox Board
V	
VFR	Visual Flight Rules
VLJ	Very Light Jet
VMC	Visual Meteorological Conditions

HIGH LEVEL STATEMENT OF USER REQUIREMENT FOR 21st CENTURY CLASS G
General Aviation Including Microlights

1. USER GROUP: GA Aeroplanes and, Microlights

2. GENERAL NATURE OF OPERATION (WRITTEN DESCRIPTION):

The fixed wing element of the GA sector is the largest part of the UK civil aircraft fleet encompassing recreational, commercial and some public transport aviation and includes flight training for each of those segments. Aircraft types range from flex wing microlights through single and twin-engine piston and turboprop to fractional ownership and business jets, VLJs and high-performance ex-military jet aircraft. Cruise speeds vary from 50kts to 250 kts IAS below FL100 and 540kts TAS above. The vast majority of operations are single pilot.

The segment uses all types of airspace at all levels throughout the UK FIR and into adjacent FIRs. The majority of operations are day/VFR mainly in class G airspace but an important minority of aircraft operate routinely H24, IFR in class G and CAS. Whilst CAT operations are almost entirely contained within CAS, this element of GA frequently needs to pass between CAS and class G airspace.

Whilst there is a base level of activity throughout the year, overall activity rises in the summer and peaks occur at week-ends and associated with particular events. The geographical distribution of activity is shaped by controlled and regulated airspace and varies from day to day but can be difficult to predict. The distribution is affected by varying airspace restrictions.

Many flight profiles are local to the point of departure and operate between 1000ft agl and FL50. These involve manoeuvring flight including aerobatics, stalling and spinning and some formation flight. A significant proportion involves one or more sectors to a different landing point and whilst many small aeroplanes tend to be flown at about 3000ft agl, the more capable aircraft cruise at higher levels.

3. SCALE OF USER COMMUNITY:

(APPROX NO OF PILOTS/AIRFRAMES INVOLVED): 28,000 pilots and 16,000 aircraft

(NUMBER OF SITES): A large number

(FREQUENCY OF ACTIVITY): Daily mostly day but some H24

(APPROX NUMBER OF HOURS FLOWN/YEAR): 1.4 M

4. GEOGRAPHIC DISTRIBUTION OF ACTIVITY:

SITE SPECIFIC (20nms OF LAUNCH): 40% estimate

LOCAL (50nms OF LAUNCH): 60 % estimate

REGIONAL (INCL THOSE AREAS WHERE ACTIVITY DOES NOT TAKE PLACE)

NATIONAL: 100%

5. ALTITUDE / FL DISTRIBUTION OR ACTIVITY:

ALL LEVELS BELOW FL 245 98%

ALL LEVELS BELOW FL 195 95%

ALL LEVELS BELOW FL 100 85 %

ALL LEVELS BELOW FL 50 80 %

6. DAY / NIGHT: Both **IMC/VMC** Both

7. GENERAL OPERATIONAL REQUIREMENTS: GA needs access to airfields and sites throughout the UK and to the near continent, by day and night, VFR and IFR. Airspace for local flying including aerobatics within reach of all airfields and sites. Routing between all places in the UK maintaining adequate terrain and congested area clearance. GA does not need further operational control.

8. SPECIFIC OPERATING REQUIREMENTS:

The vast majority of GA operations do not need or benefit from control or oversight by ATS organisations. GA aircraft ownership and activity levels are cost limited so cost increases always damage the sector. Additional charge imposition cannot be passed on into a customer chain so it always depresses activity often frustrating the objective of the charge increase.

9. EQUIPMENT CARRIAGE LIMITATIONS: (IF ANY) (E.G. POWER SUPPLY, WEIGHT, SIZE ETC) GA does not support the imposition of equipment carriage unless the requirement is mature, stable, suited to the nature of GA aircraft and operations and delivers a measurable safety benefit to those aircraft at proportionate cost. Most GA installations are very cost sensitive. Some airframes are very weight limited and some are without surplus power generating capability. Some have little physical structure to mount equipment.
10. REMARKS: This statement covers GA aeroplanes only.

HIGH LEVEL STATEMENT OF USER REQUIREMENT FOR 21st CENTURY CLASS G
Gliding

1. USER GROUP: Gliding

2. GENERAL NATURE OF OPERATION (WRITTEN DESCRIPTION):

Gliding is a weather dependent air sport activity and the activity takes place throughout the year during daylight hours. The vast majority of gliders launch from 90 notified gliding sites. A number of self-launching gliders operate from other sites.

Gliding sites routinely experience intense activity within 5nm of the operating site and, subject to meteorological conditions and airspace limitations, up to the condensation level or inversion. Gliders routinely fly cross country A-B-C-A tasks of up to 500 kms. Tasks of over 1000km have been flown in the UK. Occasionally, large numbers of gliders fly the same cross country route. In certain parts of the country gliders routinely fly above FL100 in the lee of mountain ranges, or at lower levels along ridge lines. They will also seek to derive the maximum benefit from rising air along less obvious vertical features.

3. SCALE OF USER COMMUNITY:

(APPROX NO OF PILOTS/AIRFRAMES INVOLVED): 6000/2000

(NUMBER OF SITES): 90

(FREQUENCY OF ACTIVITY): 7 days/week all year

(APPROX NUMBER OF HOURS FLOWN/YEAR): 130,000

4. GEOGRAPHIC DISTRIBUTION OF ACTIVITY: All figures very approximate.

- 30% of activity occurs locally to launch sites, ie within 10nm radius
- A further 50% of activity occurs within 50nm radius of the launch sites
- A further 20% of activity occurs outside the 50nm radius of the launch sites
- Gliders rarely fly over the sea, other than to cross estuaries or in lee wave in N Scotland/NI

5. ALTITUDE / FL DISTRIBUTION OR ACTIVITY:

- Limited activity in lee wave areas between FL195 and FL245
- Significant level of activity in lee wave areas between FL100 and FL195
- Most active between Surface and FL60

6. DAY / NIGHT: Day **IMC/VMC** 20% / 80%

7. GENERAL OPERATIONAL REQUIREMENTS:

With access to soaring conditions from all gliding clubs and to the need to facilitate the maximum sporting potential in mind;

- Access to areas of unrestricted airspace to at least 6000’ amsl (the average height of thermal soaring conditions)
- Unlimited vertical access to areas of unrestricted airspace in areas where lee waves occur

NB - These areas of unrestricted airspace must be connected by similarly unrestricted airspace. Areas of CAS which block movements from one region to another are real problems (eg Edinburgh\Glasgow "gap") and the threats from new regional airport controlled airspace aspirations - which may not be so bad in isolation - can as a whole have a catastrophic effect on connectivity.

8. SPECIFIC OPERATING REQUIREMENTS:

- Operating sites geographically spread to match population densities and soaring opportunities
- Large areas of unrestricted airspace

9. EQUIPMENT CARRIAGE LIMITATIONS: (IF ANY) (E.G. POWER SUPPLY, WEIGHT, SIZE ETC) Battery weight/size and therefore power supply issues limit the length of time gliders can use transponders, etc. The cost eg of transponder equipage – not listed above – is also a signification limitation.

10. REMARKS:

1. The BGA has access to glider GPS flight logger data that provides a very clear picture of gliding activity across the UK.

2. The demands of soaring flight and following energy lines mean that pilots use a significant amount of capacity looking out, navigating and staying airborne. Class D may in theory be open to us, but the demands of soaring mean that 99% of us see it as a brick wall. See connectivity point at 7 above.

HIGH LEVEL STATEMENT OF USER REQUIREMENT FOR 21st CENTURY CLASS G
Military

1. USER GROUP: Military

2. GENERAL NATURE OF OPERATION (WRITTEN DESCRIPTION):

The military conducts a wide range of operational training and missions covering all aspects of aviation and has a requirement for airspace over the whole of the UK FIR and UIR (plus the High Seas) for the Royal Navy, Army, Royal Air Force, Joint Helicopter Command, United States Air Force Europe-United Kingdom, and other MOD procurement and evaluation organisations. Examples of these requirements include carriage of military passengers to destinations both within the UK and throughout the world (with requirements for safety equivalent to CAT); air-to-air refuelling between tanker aircraft and other aircraft; general handling flying for pilot basic and advanced training to eventually develop and practise air to air and air to ground combat skills (from singleton aircraft (the term 'aircraft' includes helicopters and Unmanned Aircraft Systems) to complex formations of aircraft); the dropping and launching of weapon systems from platforms (that may or may not include aircraft) to a target in the air, on the ground, in space (Class G also exists above FL660), or at sea; firing of weapon systems into airspace from ships or vehicles or equipment on the ground to targets at sea, on the shore or inland; simple rifle and gun shooting on a range to modern artillery systems requiring volumes of protected airspace up to 60,000ft or greater; Air Defence missions; surveillance operations; SAR; parachuting; gliding; and also air experience flying for Air Cadets and students with the Air Experience Flights and University Air Squadrons.

3. SCALE OF USER COMMUNITY:

(APPROX NO OF PILOTS/AIRFRAMES INVOLVED): Over 2,700 / 1,380.

(NUMBER OF SITES): Multiple but greater than 50 (and changing due to SDSR -could increase with the move of army units from Germany back to the UK).

(FREQUENCY OF ACTIVITY): H24

(APPROX NUMBER OF HOURS FLOWN/YEAR): Over 740,000 / 2010

4. GEOGRAPHIC DISTRIBUTION OF ACTIVITY:

SITE SPECIFIC (20nms OF LAUNCH): Yes

LOCAL (50nms OF LAUNCH): Yes

REGIONAL (INCL THOSE AREAS WHERE ACTIVITY DOES NOT TAKE PLACE): Military activity may take place in all airspaces depending on the Defence mission.

NATIONAL: Yes

5. SPEED RANGE ALTITUDE / FL DISTRIBUTION OF ACTIVITY:

SPEEDS GREATER THAN SUPERSONIC	Daily	**ALL LEVELS ABOVE FL 660**	Sometimes
SPEEDS GREATER THAN 250 KTS	Frequently	**ALL LEVELS BELOW FL 245**	Frequently
SPEEDS GREATER THAN 150 KTS	Frequently	**ALL LEVELS BELOW FL 195**	Frequently
SPEEDS GREATER THAN 75 KTS	Frequently	**ALL LEVELS BELOW FL 100**	Frequently
SPEEDS GREATER THAN 25 KTS	Occasionally	**ALL LEVELS BELOW FL 50**	Frequently

Military aircraft frequently operate in Class G at greater than 250 Kts at all Altitudes / FL distributions, including supersonic. Additionally, military Fast Jets frequently operate below 500 ft and at greater than 250 Kts. The Fast Jet profile may include a high level transit, a descent into the low level system with recovery reversed via a high level transit and landing. Military aircraft and systems use all altitudes /FL distributions. Also, missiles, artillery rounds, and ship weapons utilise the entire envelope (although normally within segregated airspace or Danger Areas, with background classification of Class G).

6. DAY / NIGHT: Yes **IMC/VMC** Yes

7. GENERAL OPERATIONAL REQUIREMENTS: The military requires the freedom to operate tactically with as few constraints on its activities as possible. Operational training missions are dependant particularly upon the weather and platform/equipment serviceability as well as the availability of airspace (where segregated airspace to meet the mission requirements must be booked) and if restrictions are placed upon activity times or areas that can be used, this would reduce the training output and could reduce the training value of an activity if parts of the airspace is denied as the full tactical capabilities might not be able to be exercised and false outcomes could result.

8. SPECIFIC OPERATING REQUIREMENTS: Certain activities require protection from other airspace users to ensure that other users are safely protected from the activity taking place, this includes activity within Temporary Segregated Airspace, Restricted Areas, and Danger Areas (it is accepted that the current regulations for Danger Areas do not prevent access by other airspace users, particularly over the High Seas, unless the area is protected by a By-law).

9. EQUIPMENT CARRIAGE LIMITATIONS (IF ANY) (E.G. POWER SUPPLY, WEIGHT, SIZE ETC): This is too wide in scope against the multiple different assets in the military inventory. Some platform equipment would fall into this section and have limitations but the greatest issue for the military is actually one of a lack of resources to equip platforms (although most platforms would be able to follow the spirit of any requirements but they would not necessarily carry a specific item of equipment. Military equipment is equal to or better than most of the requirements but there is no formal acceptance of the equipment as 'equivalent' as there is no resource available to enable the equipment to be certified as formally meeting the requirements).

10. REMARKS: Certain activity, particular Army and the Royal Navy, involves the bringing together of multiple organisations, platforms, equipment, manpower. Serviceability or weather issues are examples that may mean that the activity could be delayed; hence, airspace that can be managed or activated by AiP or NOTAM times (including airspace with a background classification of Class G) is booked to encompass a reasonable period of time to allow for contingencies as the cost of having to re-plan and bring the assets back together would outweigh any savings made by other users being able to plan to route across the airspace being used. Airspace is handed back as soon as it can be released following completion of the activity under the Flexible Use of Airspace concept.

HIGH LEVEL STATEMENT OF USER REQUIREMENT FOR 21st CENTURY CLASS G Rotocraft

1. USER GROUP: ROTORCRAFT

2. GENERAL NATURE OF OPERATION (WRITTEN DESCRIPTION):

Extensive range of operations from private sport, training, Aerial Survey, Underslung loads, Corporate, Business, Emergency Service, State Security, Scheduled Commercial Transport, Charter, Ship Transfer and offshore hydrocarbon support. Nature of flights range from VFR to IFR day and night as follows:

Low level survey, medium level transit and protected (HMR) high density offshore operations at ABZ, NWI and BPL in support of hydrocarbon activity

Low-level VFR routes to coastal airfields

Offshore wind turbine maintenance

No Notice Police, HEMS, SAR and Air Ambulance operations in all airspace classes and military LFAs

Low-level survey operations at low airspeed following HT cables, gas pipelines etc in all classes of airspace and LFAs

Low-level underslung load operations in all airspace classes and LFAs

Flights in London CTZ on prescribed routes

3. SCALE OF USER COMMUNITY:

(APPROX NO OF PILOTS/AIRFRAMES INVOLVED): Approx 1450 UK reg aircraft

(**NUMBER OF SITES):** Multiple

(FREQUENCY OF ACTIVITY): H24

(APPROX NUMBER OF HOURS FLOWN/YEAR): Unknown

4. GEOGRAPHIC DISTRIBUTION OF ACTIVITY:

SITE SPECIFIC (20nms OF LAUNCH)

LOCAL (50nms OF LAUNCH): 30%

REGIONAL (INCL THOSE AREAS WHERE ACTIVITY DOES NOT TAKE PLACE) UK Wide

NATIONAL: Yes

5. ALTITUDE / FL DISTRIBUTION OR ACTIVITY:

ALL LEVELS BELOW FL 245

ALL LEVELS BELOW FL 195

ALL LEVELS BELOW FL 100 YES

ALL LEVELS BELOW FL 50

6. DAY / NIGHT: YES…… **IMC/VMC:** YES…

7. GENERAL OPERATIONAL REQUIREMENTS:

Access to licensed, unlicensed and private landing sites, offshore installations and ships. Access to restricted airspace for survey and emergency services/security operators

8. SPECIFIC OPERATING REQUIREMENTS:

Weather avoidance including overland icing conditions, thunderstorms and severe turbulence

No-notice access to LFAs and CAS for SAR, Police, HEMS and Air Ambulance flights by day and night

Future low-level IFR operations will require electronic collision avoidance measures between all airspace users.

9. EQUIPMENT CARRIAGE LIMITATIONS: (IF ANY) (E.G. POWER SUPPLY, WEIGHT, SIZE ETC) Sub 2700kg aircraft may have electrical power, weight, size and cost restrictions

10. REMARKS:

Future tilt-rotor operations will require airspace up to FL245

HIGH LEVEL STATEMENT OF USER REQUIREMENT FOR 21st CENTURY CLASS G
Commercial Air Transport (excluding Business Aviation)

1. USER GROUP: ……**Commercial Air Transport**(excluding Business Aviation)…

2. GENERAL NATURE OF OPERATION (WRITTEN DESCRIPTION):

The use of Class G airspace is generally a least preferred option and will only be used when needed for any commercial passenger carrying flight; however, it can be also used for check flights, ferry flights, etc.

3. SCALE OF USER COMMUNITY:

(APPROX NO OF PILOTS/AIRFRAMES INVOLVED): 10,000+ (estimated)
(NUMBER OF SITES): <15
(FREQUENCY OF ACTIVITY): Daily
(APPROX NUMBER OF HOURS FLOWN/YEAR): Unknown

4. GEOGRAPHIC DISTRIBUTION OF ACTIVITY:

SITE SPECIFIC (20nms OF LAUNCH) …
LOCAL (50nms OF LAUNCH): All activity would normally take place within 50Nm's of a launch site
REGIONAL (INCL THOSE AREAS WHERE ACTIVITY DOES NOT TAKE PLACE) …
NATIONAL: Some regional airlines may extend the use of Class G airspace on certain routes.

5. ALTITUDE / FL DISTRIBUTION OR ACTIVITY:

ALL LEVELS BELOW FL 245: Speed 290Nm in the climb phase
ALL LEVELS BELOW FL 195: Speed 250-270Nm in the descent phase
ALL LEVELS BELOW FL 100: Speed 250Nm Variable approach/climb speeds
ALL LEVELS BELOW FL 50: <220Nm approach/climb speeds

6. DAY / NIGHT: Both…… **IMC/VMC:** Both

7. GENERAL OPERATIONAL REQUIREMENTS:

Generally a de-confliction service is required to provide a known traffic environment.

8. SPECIFIC OPERATING REQUIREMENTS: Some airlines would require a sufficient surveillance provision to support a de-confliction service.

9. EQUIPMENT CARRIAGE LIMITATIONS: (IF ANY) (E.G. POWER SUPPLY, WEIGHT, SIZE ETC)

Primary mitigation for collision avoidance is by the use of TCAS, however, if the TCAS is unserviceable, it should be noted that it is currently permitted to operate for a short period (3-10 days) without it being serviceable. Therefore it must not be assumed that all CAT aircraft are protected by TCAS at all times.

10. REMARKS:

……
……

HIGH LEVEL STATEMENT OF USER REQUIREMENT FOR 21st CENTURY CLASS G
Commercial Air Transport (BALPA)

1. USER GROUP: UK Commercial pilots.

2. GENERAL NATURE OF OPERATION (WRITTEN DESCRIPTION):

Civil Air Transport (CAT), passenger and cargo, and Aerial Work (AW), both fixed and rotary wing. Much CAT work is 'big jet' national or international operation between major airports which makes little or no use of Class G airspace except in a few cases where transit of Class G gives significant savings but CAT also includes smaller operators at airfields that may not be connected to the controlled airspace network.

AW is enormously variable and involves flight in any and every flight regime.

3. SCALE OF USER COMMUNITY:

(APP. NO OF PILOTS/AIRFRAMES): CAT 10,000/1000 (remark 1). AW 500+/? (remark 2)

(NUMBER OF SITES): CAT 150+. AW many hundreds or possibly a few thousand, often ad hoc.

(FREQUENCY OF ACTIVITY): Daily/Continuous.

(APPROX NUMBER OF HOURS FLOWN/YEAR): CAT 200,000 but Class G much less. AW unknown.

4. GEOGRAPHIC DISTRIBUTION OF ACTIVITY:

SITE SPECIFIC (20nms OF LAUNCH) CAT no, AW yes, percentage unknown.

LOCAL (50nms OF LAUNCH): CAT no, AW yes, percentage unknown.

REGIONAL (INCL THOSE AREAS WHERE ACTIVITY DOES <u>NOT</u> TAKE PLACE) CAT & AW yes %age unknown

NATIONAL: CAT & AW yes, percentage unknown.

5. ALTITUDE / FL DISTRIBUTION OR ACTIVITY:

ALL LEVELS BELOW FL 245 CAT Sometimes, AW less than at lower levels.

ALL LEVELS BELOW FL 195 CAT Sometimes, AW less than at lower levels.

ALL LEVELS BELOW FL 100 CAT sometimes, AW frequently.

ALL LEVELS BELOW FL 50 CAT sometimes, AW frequently.

6. DAY / NIGHT: Both. **IMC/VMC:** Both

7. GENERAL OPERATIONAL REQUIREMENTS:

CAT: Ability to operate within Class G airspace with a level of safety comparable to that achieved in controlled airspace. Access to airfields not connected to the CAS network.

AW: Ability to operate with an acceptable level of safety anywhere within Class G airspace. Some types of AW may need an air traffic service to achieve this.

8. SPECIFIC OPERATING REQUIREMENTS: Ability to be aware of all traffic that might present a hazard. Ability to access Class G airspace where a significant commercial or environmental penalty would otherwise be caused.

9. EQUIPMENT CARRIAGE LIMITATIONS: (IF ANY) (E.G. POWER SUPPLY, WEIGHT, SIZE ETC)

CAT: Few or none.

AW: Most AW operations use aircraft which can support any system appropriate to their type of operation.

10. REMARKS:

1) The fraction of the CAT numbers that make use of Class G airspace is unknown but probably fairly small, probably less than 10%. Similarly the number of CAT sites that are used by such traffic is probably small. Probably the majority of AW takes place in Class G.

2) UK REGISTERED AIRCRAFT AS AT 1 JAN 2010 BY AIRCRAFT CLASS AND COFA/PERMIT CATEGORY from CAA website has 327 aircraft of all types engaged in AW, however has 0 under 'fixed wing landplanes'.

HIGH LEVEL STATEMENT OF USER REQUIREMENT FOR 21st CENTURY CLASS G
Balloons and Airships

1. USER GROUP: Balloons & Airships

2. GENERAL NATURE OF OPERATION (WRITTEN DESCRIPTION):
Sport and commercial operations with hot air balloons (and very occasionally hot-air airships and gas balloons)

3. SCALE OF USER COMMUNITY:
(APPROX NO OF PILOTS/AIRFRAMES INVOLVED): 1200
(NUMBER OF SITES): multiple country-wide
(FREQUENCY OF ACTIVITY): daily 2hrs post-sunrise and pre-sunset. Occasional middle-of-day in winter. Higher frequency at weekends
(APPROX NUMBER OF HOURS FLOWN/YEAR): 6-7000

4. GEOGRAPHIC DISTRIBUTION OF ACTIVITY:
SITE SPECIFIC (20nms OF LAUNCH) almost 100%.
LOCAL (50nms OF LAUNCH):
REGIONAL (INCL THOSE AREAS WHERE ACTIVITY DOES NOT TAKE PLACE) Little activity around coastlines or in highland areas such as Scottish Highlands and Welsh Mountains
NATIONAL:

5. ALTITUDE / FL DISTRIBUTION OR ACTIVITY:
ALL LEVELS BELOW FL 245
ALL LEVELS BELOW FL 195
ALL LEVELS BELOW FL 100
ALL LEVELS BELOW FL 50: Almost 100%

6. DAY / NIGHT: almost 100% **IMC/VMC:** 100%VMC

7. GENERAL OPERATIONAL REQUIREMENTS:
Balloons cannot be steered on pre-determined courses and always travel downwind. They can fly quite accurate levels if required, and can climb or descend at rates up to 1000fpm if required.

8. SPECIFIC OPERATING REQUIREMENTS: Low-level penetration of Class D airspace, MATZ etc required on occasion

9. EQUIPMENT CARRIAGE LIMITATIONS: (IF ANY) (E.G. POWER SUPPLY, WEIGHT, SIZE ETC)
Battery power only available as required for hand-held VHF RTF. Space and weight limited so carriage of transponders etc only when specifically required

10. REMARKS: Balloons are big (15-30m diameter) and generally travel at less than 25kt….
They rarely operate in surface winds in excess of 15kt or in thermic conditions

HIGH LEVEL STATEMENT OF USER REQUIREMENT FOR 21st CENTURY CLASS G
Sport Parachuting

1. USER GROUP: Sport Parachuting

2. GENERAL NATURE OF OPERATION (WRITTEN DESCRIPTION):

Sport parachuting (which includes free fall parachuting or skydiving) takes place at notified permanent sites, or temporarily notified display sites, within the UK throughout the year, with busiest days usually being at weekends. It takes place in daylight VMC conditions up to FL 150. Activity outside of these parameters (e.g. night or high altitude jumping) is rare and only performed with special notification and approval. All sport parachuting activity in the UK is currently regulated under CAA Approval by the British Parachute Association (BPA) and is conducted under the terms of the BPA Operations Manual. Parachute flights are typically made in aircraft approved for the purpose and usually with seating capacities of less than 19 persons.

3. SCALE OF USER COMMUNITY:

(APPROX NO OF PILOTS/AIRFRAMES INVOLVED): 180 pilots / 60 aircraft.

(NUMBER OF SITES): 27 permanently notified

(FREQUENCY OF ACTIVITY): all days of the year (daylight hours).

(APPROX NUMBER OF HOURS FLOWN/YEAR): 11,000 hours p.a

4. GEOGRAPHIC DISTRIBUTION OF ACTIVITY:

SITE SPECIFIC.

95% of activity takes place within 1.5 nm of the 27 permanently notified sites

5% takes place at temporarily notified display sites.

5. ALTITUDE / FL DISTRIBUTION OR ACTIVITY:

All levels below FL150 (80% below FL 130)

6. DAY / NIGHT: Day (with some rare, specially notified night jumping) **IMC/VMC** VMC only

7. GENERAL OPERATIONAL REQUIREMENTS:

Drop Zones in uncongested areas of aviation activity where possible, but with local ATSU arrangements where necessary.

8. SPECIFIC OPERATING REQUIREMENTS:

Large open parachute landing areas approved by BPA.

Clear visibility with maximum wind speed of 20 kts

9. EQUIPMENT CARRIAGE LIMITATIONS: (IF ANY) (E.G. POWER SUPPLY, WEIGHT, SIZE ETC)

The size of aircraft utilised generally means that there are few practical limitations on carriage of equipment, but imposed avionics requirements (e.g.TAWS) can be prohibitively expensive and not always necessary given the nature of parachute operations in daylight VMC with flights remaining local to base.

10. REMARKS: The sport parachuting community involves up to 50,000 separate users performing 250,000 parachute jumps per annum. Weather constraints mean that most parachute sites only operate on 50% of the days of the year. The activities listed above refer to sport jumps only and not military activity.

The BPA regards the current operating arrangements for airspace usage as satisfactory. We hope you don't 'fix' it.

HIGH LEVEL STATEMENT OF USER REQUIREMENT FOR 21st CENTURY CLASS G
Unmanned Aircraft Systems – Visual Line of Sight / Extend Visual Line of Sight

1. **USER GROUP:** Unmanned Aircraft Systems - Visual Line of Sight (VLOS) / Extend VLOS
Note: Visual Line of Sight has the meaning as set out in CAP 722 for UAS Operations
Beyond LOS (BLOS) not considered here

2. GENERAL NATURE OF OPERATION (WRITTEN DESCRIPTION):
Operation of Unmanned Aircraft Systems (UAS) specifically below 500ft for Emergency Services, Oil/Gas/Electricity infrastructure inspection, Land survey, Building and Construction inspection and General Surveillance including Aerial Photography.

3. SCALE OF USER COMMUNITY:
(APPROX NO OF PILOTS/AIRFRAMES INVOLVED):
Approximate today: 200 pilots / 400 airframes
Predicted in 10 years: 20,000 pilots / 10,000 airframes
(NUMBER OF SITES):
Approximate today: 20-50 different sites / daily (i.e. no fixed T/O areas)
Predicted in 10 years: 2,000 – 5,000 different sites / daily
(FREQUENCY OF ACTIVITY): Daily / short duration 15-30min flights on average
(APPROX NUMBER OF HOURS FLOWN/YEAR):
Approximate today: 5,000 hrs/yr
Predicted in 10 years: 500,000 hrs/yr

4. GEOGRAPHIC DISTRIBUTION OF ACTIVITY:
SITE SPECIFIC (20nms OF LAUNCH) :
Approximate today: All within 500m of launch site
Predicted in 10 years: Mostly within 1nm of launch site.
LOCAL (50nms OF LAUNCH): Some launches and recovery over water.
REGIONAL (INCL THOSE AREAS WHERE ACTIVITY DOES NOT TAKE PLACE)
NATIONAL: Launch sites anywhere in the U.K. Mostly land launched but also ship launched.

5. ALTITUDE / FL DISTRIBUTION OR ACTIVITY:
ALL LEVELS BELOW FL 245
ALL LEVELS BELOW FL 195
ALL LEVELS BELOW FL 100
ALL LEVELS BELOW FL 50: 95% of all activity below 500ft.

6. DAY / NIGHT: Mainly Day Operations with some Police/Emergency Services night operations.
IMC/VMC VMC except for special cases.

7. GENERAL OPERATIONAL REQUIREMENTS: All operators will operate generally within a defined 500m horizontal and 400ft vertical "bubble" in Visual Line of Sight (VLOS). Increasingly Extended VLOS (EVLOS) will be employed.
Beyond Line of Sight (BLOS) is currently seen to be largely equivalent to manned aircraft operations.

8. SPECIFIC OPERATING REQUIREMENTS:.

9. EQUIPMENT CARRIAGE LIMITATIONS: (IF ANY) (E.G. POWER SUPPLY, WEIGHT, SIZE ETC).
Aircraft sizes and power availability prohibits in most cases any form of equipment carriage such as SSR Transponders , VHF/UHF Transceivers or collision avoidance equipment. However aircraft positions will be known accurately by ground based control stations and could be relayed to supporting ATM infrastructure elements.

10. REMARKS: Suggest that the FAS Development process is fed periodically with the current situation for VLOS UAS growth so that at appropriate intervals the degree of understanding and growth of activity is put in context and any impacts for other air users and infrastructure development assessed accordingly.

HIGH LEVEL STATEMENT OF USER REQUIREMENTS CONTRIBUTING TO 21st CENTURY CLASS G
Hang Gliding and Paragliding unpowered and powered

1. USER GROUP: Hang gliding and paragliding, both unpowered and powered

2. GENERAL NATURE OF OPERATION (WRITTEN DESCRIPTION):

Hang gliding and paragliding (both unpowered and powered) is a weather dependent air sport activity and the activity takes place throughout the year during daylight hours. Launch methods are: hill, winch tow, aerotow, self powered.

Hill sites routinely experience intense activity within 1nm of the operating site and, subject to meteorological conditions and airspace limitations, up to the condensation level or inversion. Unpowered hang gliders and paragliders fly cross country tasks, mainly A to B of up to 270 kms. Occasionally, large numbers of gliders fly the same cross country route. In certain parts of the country gliders fly above FL60 in the lee of mountain ranges, or at lower levels along ridge lines. They will also seek to derive the maximum benefit from rising air along less obvious vertical features.

2. SCALE OF USER COMMUNITY:

(APPROX NO OF PILOTS/AIRFRAMES INVOLVED): 6,600 / 6,600

(NUMBER OF SITES): 850 hill sites,
25 winch towing sites,
unknown number of powered take off sites

(FREQUENCY OF ACTIVITY): 7 days/week all year

(APPROX NUMBER OF HOURS FLOWN/YEAR): unknown but estimated at 130,000

4. GEOGRAPHIC DISTRIBUTION OF ACTIVITY:

All figures very approximate.

- 70% of activity occurs locally to launch sites, ie within a 1nm radius
- A further 25% of activity occurs within a 50nm radius of the launch sites
- A further 5% of activity occurs outside the 50nm radius of the launch sites

Hang gliders and paragliders rarely fly over the sea, other than to cross estuaries

5. ALTITUDE / FL DISTRIBUTION OR ACTIVITY:

- Some activity in lee wave areas above FL60
- Most active between Surface and FL60

6. DAY / NIGHT: Day **IMC/VMC** 20% / 80%

7. GENERAL OPERATIONAL REQUIREMENTS:

- Access to areas of unrestricted airspace to at least 6000’ amsl (the average height of thermal soaring conditions)
- Unlimited vertical access to areas of unrestricted airspace in areas where lee waves occur

NB - These areas of unrestricted airspace must be connected by similarly unrestricted airspace. Areas of CAS which block movements from one region to another are real problems (eg Edinburgh\Glasgow "gap") and the threats from new regional airport controlled airspace aspirations - which may not be so bad in isolation - can as a whole have a catastrophic effect on connectivity.

8. SPECIFIC OPERATING REQUIREMENTS:

- Operating sites geographically spread to match population densities and soaring opportunities
- Large areas of unrestricted airspace

9. EQUIPMENT CARRIAGE LIMITATIONS: (IF ANY) (E.G. POWER SUPPLY, WEIGHT, SIZE ETC)

The lack of practical storage for equipment and batteries to power it. The lack of ability to carry any equipment weighing more than grams rather than kilograms. The lack of locations to mount equipment with controls that require in flight manipulation rather than kilograms. Relative cost is also an issue where a complete aircraft can cost £1000.00.

10. REMARKS:

We perceive that a significant number of “conventional” GA and microlight pilots contact any A/G or ATC they pass, and somehow get a warm (but usually unjustifiable) sense of security by doing so. The demands of soaring flight and following energy lines mean that pilots use a significant amount of capacity looking out, navigating and staying airborne. Class D may in theory be open to us, but the demands of soaring mean that 99% of us see it as a brick wall. See connectivity point at 7 above.

Our slow airspeed relative to most other GA aircraft means that we are effectively stationary objects with few, if any, means of avoiding a collision.

Electronic Conspicuity

1. SSR Transponders

1.1 The most common established form of electronic conspicuity is the SSR transponder. An interrogation at 1030 MHz receives a response at 1090 MHz with coded information. Older systems respond with simple data like an octal four digit code and altitude information, while more modern Mode S systems transmit more data derived from onboard systems (e.g. heading and selected altitude) if the aircraft is capable of this, effectively creating a datalink known as 1090ES (1090 MHz extended squitter).

2. Traffic Alerting Systems:

2.1 The most sophisticated airborne systems for detecting transponder equipped aircraft are Airborne Collisions Avoidance Systems (ACAS) as required on larger CAT aircraft. These interrogate the transponders of other aircraft and provide azimuth (relative bearing), distance and level information. Where the other aircraft is also appropriately equipped, the resolution advice is coordinated. The requirements for the carriage of ACAS in the United Kingdom airspace are set out in the UKAIP GEN 1-5-16, as based on Article 39(2) and Schedule 5 of the Air Navigation Order 2009. The requirement is only mandated for aircraft having a maximum takeoff weight exceeding 5700 kg or a maximum approved passenger seating configuration of more than 19 passengers and is for an ACAS as specified in line with ICAO / ECAC requirements. The vast majority of the Class G user community falls outside the requirement for ACAS and no ACAS equipment is available that could be fitted to the majority of GA aircraft. Such systems are beyond the cost, power and weight that would make them viable for the majority of class G airspace users.

2.2 Other similar active detection systems falling under the generic heading of traffic alerting systems are an order of magnitude less expensive than the mandated ACAS requirements and although they work on a similar principle, they are not capable of providing resolution advice and generally work at lower powers and ranges. They are still beyond the budget of most users. Notwithstanding this the military has had significant success with a traffic alerting system in both the Tucano (for the last 5 years) and more recently in the Grob Tutor. Informal Military Aviation Authority (MAA) analysis and opinion indicates that the systems increase pilot situational awareness. This increase in awareness has led to an increase in Airprox reporting rates but a decrease in actual safety risk.

2.3 Passive systems do not interrogate other transponders, but rather rely on detecting responses to the interrogations of ground stations or ACAS. As a result, while they display the altitude of nearby aircraft (decoded from the digital SSR transponder response) with good reliability, they are less capable of assessing distance, and provide very limited (e.g. quadrantal) or no azimuthal information. The inability to support visual acquisition with azimuth information leads some to question their effectiveness in busy airspace. At a further order of magnitude less cost (£1000 or less for a portable system), and with very low power consumption, they are becoming popular with some airspace users.

3 ADS-B

3.1 Another electronic conspicuity system is Automatic Dependent Surveillance Broadcast (ADS-B). Rather than using interrogation-response, an ADS-B system broadcasts its data, including position, typically derived from a GNSS[36] system. This transmission can be received by other aircraft, and by comparing positions and levels, the receiving

[36] Global Navigation Satellite System

aircraft can infer the azimuth, distance and relative level of the other. The broadcast system is usually known as ADS-B OUT, while the detection system is called ADS-B IN. They may be installed separately, but commonality of components means that they are typically used together. A number of datalink layer options exist for ADS-B. In Europe, 1090ES will be used, and the associated ADS-B data format is compatible with SSR transponder responses. This leads to some commonality of equipment, and some SSR transponders are capable of acting as ADS-B OUT systems. An EU mandate for ADS-B is proposed from 2015, but only for those aircraft above 5700 kg or faster than 250 knots. Moreover, even if the equipment is available on board to enable ADS-B OUT over 1090ES, certification requirements mean that few users of class G airspace are equipped and no recreational aircraft are equipped.

4 FLARM

4.1 In recent times the British Gliding Association (BGA) has done much to mitigate the risk of collisions between gliders operating in close proximity (such as multiple gliders using the same thermal), by the introduction of FLARM. The name FLARM is derived from "flight alarm". Its principle is the same as ADS-B. FLARM obtains its position from an internal GPS and a barometric sensor and then broadcasts this with forecast data about the future 3D flight track. The FLARM receiver listens for other FLARM devices within typically 4-8 km and processes the information received. Future conflicts for up to 50 signals are then predicted and warnings are provided to the pilot using audio and visual means.

4.2 FLARM differs from ADS-B over 1090ES in a number of key respects:

- It operates in the ISM band[37] rather than in protected aeronautical spectrum
- The equipment is uncertified and generally portable
- It is designed for use at shorter ranges than ADS-B, hence is much lower power.

4.3 For these reasons FLARM is not interoperable with ADS-B. More recently, PowerFLARM has been introduced. This equipment has a longer range and integrates FLARM technology with an internal 1090ES receiver. This enables it to display both FLARM and 1090ES ADS-B targets. It also displays the level of and estimated distance to SSR transponder returns.

[37] Industrial, Scientific and Medical radio band