Airspace Change Proposal

Appendix B

Safety in the vicinity of Farnborough Airport

Attitudes to risk

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Document Issued 2015 – original version

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1. Introduction

1.1. The TAG Farnborough safety commitment is to strive continually to improve our operational safety performance and to minimise our contribution to the risk of an aircraft accident as far as is reasonably practicable. This commitment applies across all activities in ATM including Airspace Design.

1.2. NATS Farnborough is contracted by TAG Farnborough to run the ATC operation and is fully involved in this commitment, referred to as NATS and TAG respectively.

1.3. This commitment is underpinned by a number of safety principles relating to controlling change. These principles include Risk Assessment and Mitigation through the formal application of hazard and safety analysis to ensure that due consideration is given to all elements of a system (environment, equipment, procedures and people). The documentation of the results, associated rationales and evidence of the risk assessment and mitigation process ensures that complete arguments are established to demonstrate that the system will remain **tolerably safe**.

1.4. Risk acceptance will occur only when there are positive answers to the questions:

a. Have we done all that is reasonably practicable to reduce the level of safety risk posed by the identified hazards, individually and in total?; and

b. Are they now broadly acceptable or tolerable and as low as reasonably practicable?

1.5. Within the context of the proposed airspace change for Farnborough the 'system' under consideration is the airspace environment around Farnborough Airport and its contribution to risk.

1.6. The overall aim of the safety discussion is to provide the necessary arguments and evidence to demonstrate that aircraft operations (both Commercial and General Aviation) within the revised airspace structure will remain tolerably safe.

1.7. In the absence of a formal risk classification scheme for ATSOCAS, the assessment of risk in these areas is subjective and based on an assessment of how the risk picture would change should the airspace design be implemented, when compared with the perceived risk picture that currently exists.

1.8. There is an important difference between the accepted risks (or developing risks) and the false positives. A false positive is a report of a vulnerability, which is made even though the vulnerability does not exist. For example, a report stating 'the system is subject to a risk against software X', even though software X does not exist on the system.

1.9. It is essential to ensure that accepted risks are not hidden under the false positive label.

1.10. A false positive is an error of the tool, and poses no risk to the organization. This discussion document will endeavour to demonstrate through safety indicators that the current ATSOCAS is a risk that is continually changing.

1.11. The false positive of 'there are few ATSOCAS incidents around Farnborough' must not disguise the actual issues, and the existing work that keeps them as 'few'.

1.12. Now that planning permission for more movements has been granted, and forecasts are for the 'most likely' increase to be realised between 2015 and 2019, action must be taken to ensure the airspace environment remains tolerably safe.

TAG and NATS support the ATSOCAS region around Farnborough

1.13. TAG supports mitigations of risk primarily by contracting NATS to provide ATS for the airport, including radar services. TAG provides significant financial and resource contributions to LARS West to mitigate the ATSOCAS risk to its IFR traffic, and commits to do so for the benefit of all airspace users regardless of the outcome of this ACP.

1.14. The control tower also hosts the other Farnborough LARS services (LARS North and East) which together with the extended range of LARS West, covers the LTMA outside CAS. All these LARS are cost-free to the end user.

1.15. TAG also supports NATS' provision of (cost-free) services to IFR arrivals into, and departures from, the 'Farnborough Group' airfields. These are smaller but competing airfields within 15nm of Farnborough including Lasham, Blackbushe, Dunsfold, Fairoaks and RAF Odiham (Civil).

1.16. These services provide an incomplete picture of the local traffic environment, in which TAG Farnborough Airport (and the Farnborough Group airfields') operators can fly within their risk acceptance level. These services also provide a framework in which the GA community can operate according to their own individual risk acceptance criteria.

1.17. TAG and NATS continually review the airspace and interactions to provide assurance that the framework is providing an acceptable level of risk, to remain **tolerably safe**.

2. Attitudes to risk

2.1. Acceptance of risk by any individual undertaking an activity is a fundamental shaper of the manner in which the activity is performed, ranging from 'not acceptable' and therefore not performed, to 'full acceptance' that life is at serious risk in performing the activity.

2.2. Once the individual has defined the risk that is acceptable to them, this becomes part of the wider environment in which the activity is to be performed and therefore is incorporated into the risk framework for other individuals. Examples of two fictional aviators:

Individual A

2.3. An individual chooses to fly a light aircraft of a certain type (known as a low risk type) outside CAS in the South East of England.

a. Individual A keeps his/her licence current, and adds more flight time than the bare minimum in order to maintain a higher degree of competence.

b. Individual A plans to fly a structured route according to their skill set and currency, makes regular contact with appropriate ATSUs including MATZ crossings and when in the vicinity of charted IAPs outside CAS, uses Mode A/C appropriately, takes into account surrounding airspace and other users' requirements such as, ATZs and CAS.

c. Individual A assesses the meteorological conditions, determines what affects their flight, and how other users may be flying in the airspace.

d. Individual A plans for disruption and considers fall-back options.

e. Individual A has a certain risk acceptance when engaged in their activity - flying a light aircraft outside CAS in the South East of England during known weather conditions. He/she has mitigated that risk as much as possible and considers it acceptable.

f. Individual A has based their flight on the assumption that other users in this environment will take similar steps to mitigate their own risk, and that to others.

Individual B

2.4. An individual chooses to fly a light aircraft of a certain type (known as a higher risk type) outside CAS in the South East of England.

a. Individual B flies the bare minimum time to keep their licence current.

b. Individual B has planned a route, but chooses to select Mode A 7000, Mode C off, and not make radio contact with ATSUs. That individual disregards MATZs, charted IAPs outside CAS, known traffic flows and published areas of intense aerial activity.

c. Individual B assesses the meteorological conditions and determines what affects their flight.

d. Individual B does not plan for disruption and does not consider fall-back options.

e. Individual B has a certain risk acceptance in completing their activity - flying a light aircraft outside CAS in the South East of England during known weather conditions. He/she is flying at or above the threshold of the inherent risk for that aircraft type.

f. Individual B has dismissed other users and ATSUs in this environment as an inconvenience and does not consider how other pilots might conduct their flight.

Individuals A and B

2.5. These two individuals are operating in the same piece of airspace and may interact. This particular volume of airspace is open FIR, but also has a LARS unit.

2.6. Each individual has used their acceptable tolerance of risk to decide where and how they will fly, but tolerance of that risk is based on each individual's assessment of other users.

2.7. With such differing attitudes, it is difficult to define the combined risk of these two individuals when they interact.

Airspace Users and ATSUs

2.8. The airspace surrounding Farnborough is extremely complex with areas of intense aerial activity, danger areas and CAS.

2.9. Airspace users are similarly diverse with Joint Helicopter Command operating Chinooks and Apaches, Farnborough operating jet traffic, Lasham gliding and Lasham heavy jet maintenance, light aircraft (Sport and Recreational) ranging from light twins to microlights and balloons to helicopters to historic aircraft.

2.10. Each of these users has their own acceptable level of risk individually, within a group, and as part of that group.

2.11. Farnborough is conservative with risk, which is tightly controlled and is acceptable only at a very low level. TAG and NATS have a certain threshold where the operation in the airspace surrounding the airport is considered to be tolerably safe. The users of the airport have a similar threshold. This threshold is mitigated and supported by the actions of the three parties and this includes regular review of the interactions in the airspace.

2.12. RAF Odiham has a similar conservative attitude, the differences between that unit and ours is the difference between military training and civilian private transport. Both are professional ATS units handling professional aviators.

2.13. LGS is generally comprised of experienced glider pilots but their attitude to risk seems to be somewhat different. A recent example illustrates this attitude:

a. When an IFR arrival is due at Lasham aerodrome, ATC Lasham (the aircraft maintenance company) provides a tower control service for that arrival and takes control of the runway/ATZ.

b. However, on 15th June 2015 the gliders refused to vacate the runway, leaving the IFR aircraft to hold airborne for 15-20 minutes.

c. LGS club management has previously stated that it is unable to guarantee their club members would follow any local agreements made. This seems to be the case here, between two tenants of the same aerodrome.

d. LGS management also stated that they would not support a pilot awareness programme should TAG be granted approval for CAS.

2.14. This leads TAG Farnborough to be reticent about attempting any formal Letter of Agreement with regards to airspace sharing arrangements.

3. Airspace dominance

3.1. The airspace around Farnborough has ‘dominant users’ which affect how it is used by others. Most group users can become dominant for a period of time in the airspace depending upon activity, weather conditions and time of day. TAG Farnborough can be a dominant user. When IFR is the only possible flight type, and when RAF Odiham is not flying, TAG can be highly dominant. This dominance is based on the highly conservative attitude to risk noted earlier.

3.2. The gliding community surrounding Lasham, extending to northwest to Oxford and south to the coast, is another dominant user of the airspace, and their attitude to risk is different.

3.3. This is due to the large volume of aircraft that can be launched in condensed time frames (up to 80 per hour). Other users should generally consider this, when they plan their movement through the region.

3.4. Farnborough and RAF Odiham already take LGS into account, by taking measures to avoid an area 3nm around Lasham. These include radar maps and ATC procedures contained within Unit documentation. This is self-imposed by both units, as part of a risk mitigation package.

3.5. Farnborough will only accept IFR arrivals from TC provided they are heading away from this area. Farnborough continues these restrictions even when no glider radar returns are observed, and also continues them when dark due to night flying by gliders.

3.6. Similarly RAF Odiham do not use their Runway 09 if gliding is taking place within the MATZ stub or nearby. They change to Runway 27 regardless of weather conditions.

Example of the impact of airspace dominance

3.7. During 2010, the AAIB published a report into the collision between a RAF Grob Tutor and a glider (AAIB 5/2010). In the time period of 1200-1330, 118 aircraft passed through the airspace situated between RAF Benson and RAF Brize Norton. Of these 118, 85 were gliders (72%).

3.8. Over the day 201 gliders transited the same airspace.

3.9. From AAIB5/2010 para 2.7.2:

The probability of a mid-air collision occurring is a quadratic of the number of aircraft involved, i.e. as traffic doubles, the risk of a collision quadruples.

The club from which the glider departed was conducting a routine busy summer days flying with 128 gliders launched at a peak rate of 70-80 gliders an hour during the morning. Had a formal gliding competition been taking place, a NOTAM would have been issued detailing the likely route and timings, thus alerting other airspace users of the probable concentration of gliders. The concentration of gliders involved in this task probably created the level of activity intended to be notified in accordance with AIC Y15/2009 (Notification of Unusual Aerial Activities). However, no formal competition was taking place and each glider was operating autonomously.

Although other UK aviation organisations have pre-planned events for which NOTAMs and AIC action is required, it is generally only gliding clubs which can generate the intense volumes of traffic, seen in the area near this accident, at short notice, on a regular basis. It is not practical for NOTAMs or AIC information to be issued for non-competition gliding activity, particularly as the weather may result in large variations in the number of participants on any particular day

3.10. When only general warnings of intense activity are issued rather than NOTAMS, other users have few options with regards to properly planning where they might fly in accordance with their own risk profile, as was demonstrated by the mid-air collision

Airspace dominance is not necessarily a risk

3.11. How each group accepts risk, and the effect that has on other users, is a key factor.

3.12. Farnborough will impose flow control or accept departure delay to mitigate the risk for its own operators *and* for other airspace users.

3.13. Other groups may just dominate the airspace without considering other users, or by assuming others will avoid them.

Individual flights can be dominant

3.14. Examples are:

a. Pilots who choose to fly through certain areas of airspace without communication, and/or transponders;

b. Pilots who choose to ignore, or do not understand, MATZ, ATZ, charted IAP fleches, danger areas, areas of intense aerial activity, traffic flows and the needs of other users.

3.15. The effect of these dominant users can be significant.

3.16. Farnborough LARS offers the highest form of radar service available to our own traffic outside CAS - a Deconfliction Service (DS) – as a default.

3.17. Lower levels (Traffic Service or Basic Service) are only offered on request or when workload is such that no other alternative is available. This is part of the management of the risk framework for Farnborough operators.

3.18. An unidentified airspace user becomes dominant due to the unknown environment surrounding Farnborough, in which it operates.

3.19. Farnborough controllers will aim to achieve 5nm lateral distance from an unidentified aircraft (including those wearing Mode A7000). If they are within 5nm, they should aim for 3,000ft vertical distance, but the LTMA does not allow 'headroom' for this to happen, meaning the only option for the controller is to aim for 5nm lateral. The avoidance of other traffic remains the pilot's responsibility.

3.20. The controller's only other option is to pass traffic information and it may be that the DS aircraft can obtain and maintain visual contact.

3.21. Acquiring and maintaining visual contact with any light aircraft is extremely challenging at these ranges, even for professional experienced pilots (Airprox 040/2012 provides useful background).

3.22. Farnborough controllers regularly vector the DS aircraft away from the conflict. If this is within the cone of final approach, they hold the DS aircraft off, waiting for the dominant aircraft to move.

3.23. This action moves the Farnborough aircraft out of the typical approach/departure areas and into areas where other aircraft may not expect to interact with a corporate jet. The jet may be held for considerable amounts of time.

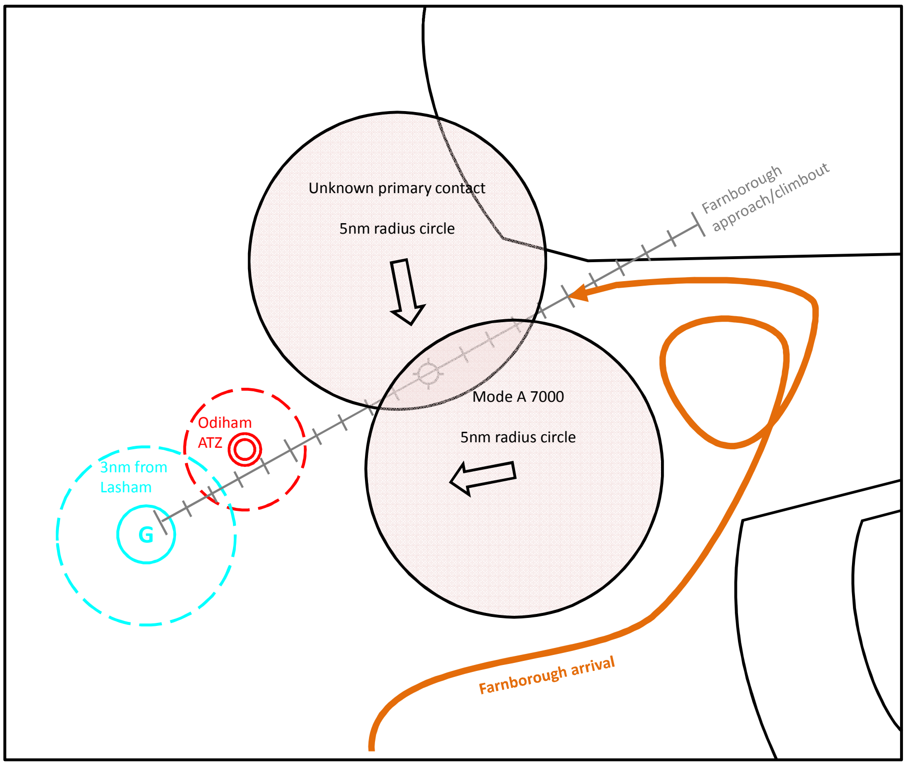


Figure 1 Example of two dominant individuals

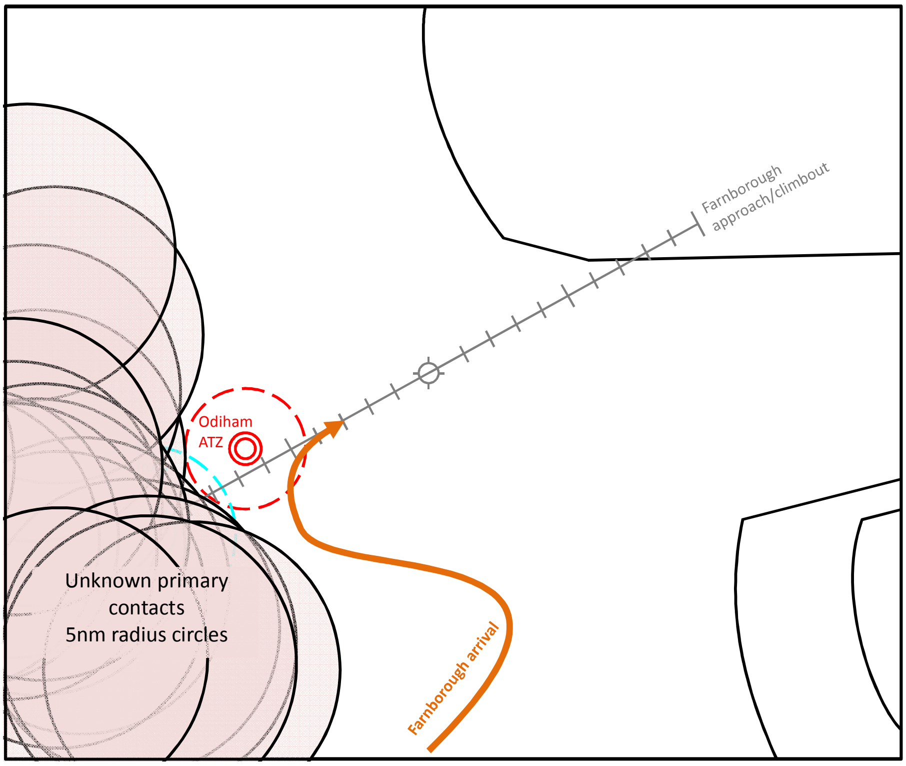


Figure 2 Example of Lasham gliding activity

3.24. Dominant users can also affect the behaviour of other users. We have already noted the interaction of gliders and RAF Odiham, and Odiham's immediate switch to Runway 27 regardless of weather. Farnborough controllers will offer visual approaches on a regular basis to ensure the pilot has an option to land, which is the safer alternative to being held airborne. Pilots will routinely consider whether they wish to complete a missed approach, or continue to land in acceptable but far-from-ideal conditions.

3.25. Controllers will routinely consider the best path available for their aircraft, subject to the numbers, density and locations of other airspace users. They will routinely reposition aircraft on final approach even after establishing on the ILS following 'pop-up unknown aircraft'.

3.26. There is a disproportionate workload required to maintain a safe operation for those users that are prepared to participate. As the workload increases, the spare capacity decreases. The increasing numbers of movements at Farnborough leads to the increasing need to take measures to ensure safety – by adding delays.

Dominant users – Numbers and geography

3.27. NATS Farnborough undertook to explore the numbers of dominant users in the surrounding airspace.

3.28. An analysis was conducted as part of the investigation into the application for CAS on three main criteria:

a. Primary-only radar contacts;

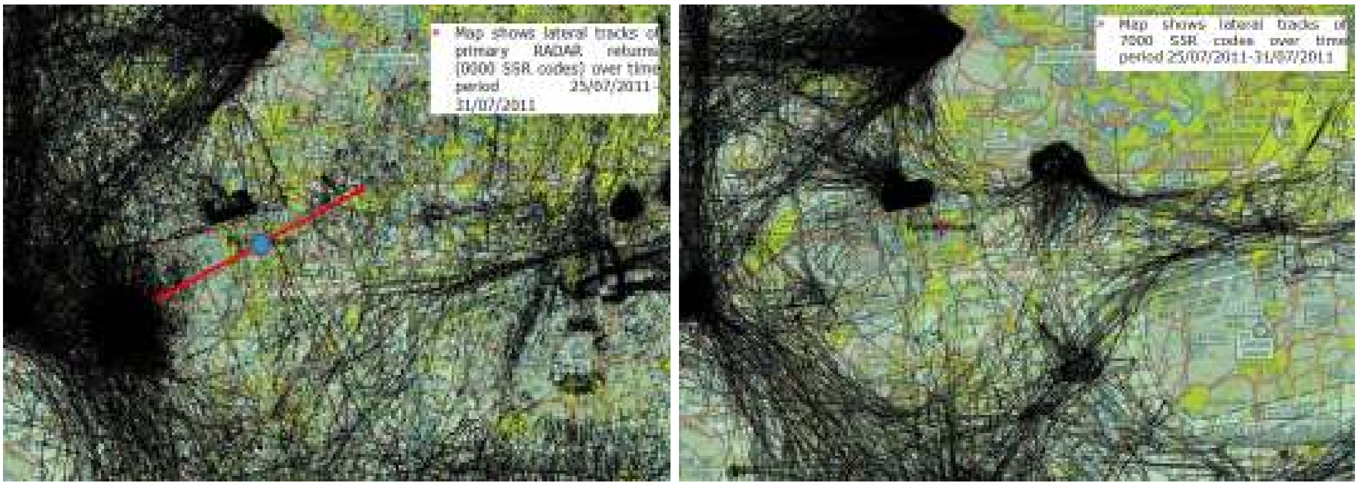
b. Conspicuity code aircraft (Mode A 7000);

c. Farnborough LARS transponder carriage in contact with LARS.

3.29. Where aircraft are in communication with Farnborough LARS West or Approach, the DS recommended minima can be reduced from 5nm to 3nm.

3.30. Farnborough LARS West coordinates with these aircraft to reduce the interaction for Farnborough Approach where possible, but each aircraft coordination request can be refused by the pilot. These requests can take the form of direction changes; routing or level changes, and orbit requests – or indeed, to make no change to his track at all without informing LARS first.

3.31. These requests are made only when absolutely necessary and to the minimum extent possible. In striking this balance the controller will often choose to minimise the disruption to the other (dominant) airspace user, instead extending the track of his DS flight.



(Left) Primary-only radar contacts **Conspicuity code contacts Mode A 7000 (Right)**

Figure 3 One week of radar contacts in July 2011

Figure 4 Radar contacts of Farnborough LARS West SSR codes (June 2014)

3.32. The following indicators contribute to the safety assessment of the operation. Each are discussed in the following sections.

Incidents in the airspace surrounding Farnborough:

Airproxes, TCAS MORs, Controller Observation Reports

Deconfliction Minima

Visual Approaches

Flight Data Monitoring (FDM) events

Farnborough Traffic break off data

Controlled airspace interactions

4. Incidents in the airspace surrounding Farnborough: Airproxes

4.1. From August 2007 to December 2014 the unit received or generated 58 airprox reports: Of these, 7 reports related to the airspace surrounding Farnborough and directly involved Farnborough, either through provision of a service by LARS West, or Farnborough Approach and contained a lesson learning element applicable to an ACP.

Report	Summary	ACP learning point
Airprox 121/07	A departing Gulfstream 5 came into conflict with a Cirrus Glider. The G5 was under a RIS due controller workload and intensity of VFR traffic. The incident occurred at 3400' just below and abeam Class A airspace to the south of Farnborough.	Late sighting by both pilots of two extremely different types. Would not have occurred in a CAS environment where SIDs would create a highly predictable track for departures.
Airprox 120/08	A Citation was transferred from TC SW (particularly busy and complex) on a heading that would take it close to Lasham Gliding. LGS had a notamed Competition taking place with operations within 5nm of Lasham to 5000'. On handover the Farnborough controller issued avoiding action turns due to primary-only contacts. A second aircraft then appeared heading westbound causing a second set of avoiding action turns. The latter was later identified as not being a Lasham glider.	LTC released an aircraft to Farnborough heading towards Lasham Would not have occurred in a CAS environment where STARs would create a predictable swathe for arrivals.
Airprox 015/09	A LJ45 routing IFR from Southampton to Biggin Hill was given a traffic service. The weather was good CAVOK with excellent visibility. The LJ45 came into conflict with a glider/tow combination in the vicinity of Lasham. Although the LJ45 saw the glider combination following multiple accurate and timely TI and manoeuvred to avoid the latter, the aero tow pilot considered that LJ45 had come close enough to cause an airprox. The LJ45 considered this a routine encounter in open FIR.	Executive jets are not ideal 'see/avoid' vehicles. Glider difficult to see on radar even when combined with tug. Would not have occurred in a CAS environment where IFR transits would be fully integrated with VFR flights.
Airprox 042/09	A BE200 was offered a descent out of CAS by TC probably to avoid a congested area of the LTMA whilst en-route to Shoreham. The BE200 could only be offered a TS (reduced) due high traffic density in the vicinity of Lasham. Despite accurate and timely TI and the pilot of the BE200 acquiring two gliders, the airprox occurred with another.	Another case where extremely professional pilots have flown close to gliders without seeing them. Would not have occurred in a CAS environment where IFR transits would be fully integrated with VFR flights.
Airprox 132/09	A PRM1 Jet was receiving a TS whilst inbound to Farnborough. The conflict was with a paramotor showing only intermittently on the radar as a stationary primary only return and was very faint. The PRM1 pilot acquired the target visually at 0.5nm and disengaged the autopilot and carried out a steep starboard turn.	Paramotor near invisible on radar Would not have occurred in a CAS environment where STARs would create a predictable swathe for arrivals.

Report	Summary	ACP learning point
Airprox 046/10	C510 inbound Farnborough Group airfield descending into an area of intensive aerial activity after transfer from TC, came into conflict with GA aircraft. Due to the rapidly increased workload and a number of contributory factors, the Radar controller did not agree a level of ATSOCAS service, or pass TI. Minimal traffic information passed due garbling although LARS W controller was trying to intervene. Farnborough Approach Radar was manned by a late stage trainee (level 4), under the supervision of a newly qualified OJTI. This was the first time the OJTI had worked with this particular trainee. The mentor was aware that no level of service had been agreed and subsequently debriefed the trainee on this point; however, the phraseology used by the trainee was consistent with a TS.	'See and avoid' especially difficult if aircraft have disparate speeds. Would not have occurred in a CAS environment where STARs would create a predictable swathe for arrivals towards Farnborough Group airfields. The arrival would then be vectored from the end of the STAR towards the Group airfield.
Airprox 018/13	See below	

Airprox 018/13

4.2. The final item in the table has been held up by some consultation respondents as an example of an ATC 'self-induced' incident.

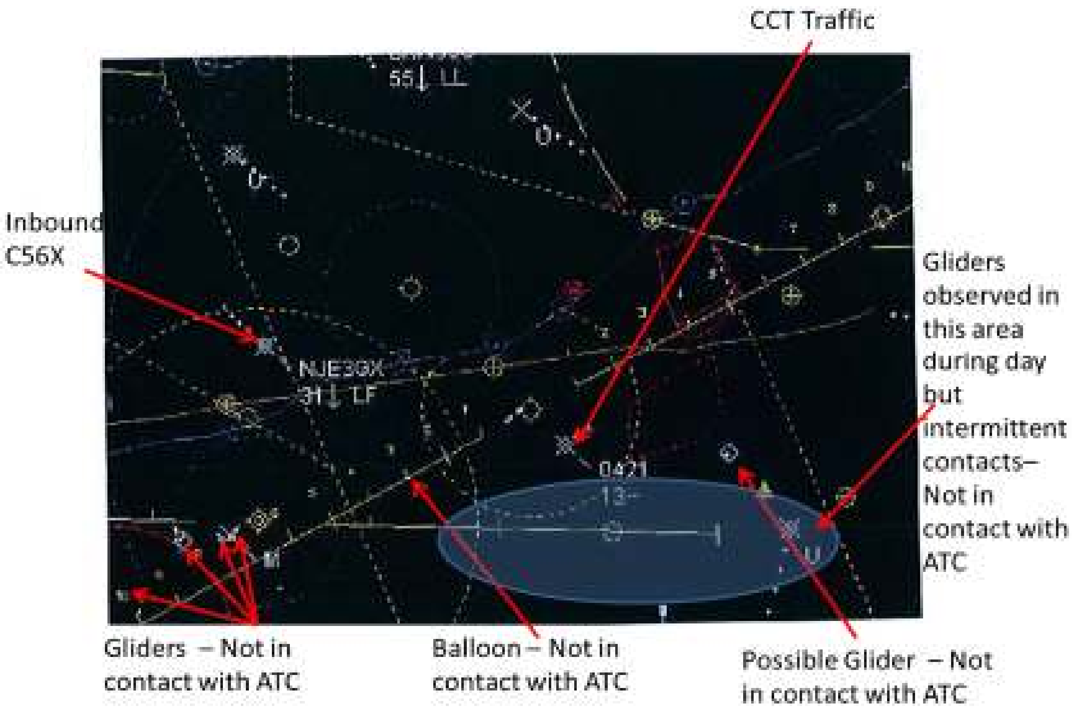
4.3. A C560XL was vectored for a visual approach which brought it into conflict with a PA28 operating in the circuit at Farnborough.

4.4. A balloon was operating on final approach Runway 06 at 3nm and 2,000ft-3,000ft but was not in contact with the ATSU.

4.5. All approaches were non-standard visual approaches from varying angles, bases and altitudes.

4.6. Due to weather and the fact it was a weekend, the unit had experienced heavy LARS traffic throughout the day. Odiham ATC was not manned. The gliders were active at Odiham and as the weather was above the minimum required for visual approaches (visibility greater than 10km and cloud ceiling greater than 2,000ft) all Farnborough IFR inbounds were making a visual approach to Runway 06. The Approach and LARS west positions were not band-boxed.

4.7. Throughout the day the unit had experienced multiple primary contacts believed to be gliders operating out of Lasham and Odiham tracking easterly towards Farnborough and the Hog's Back which resulted in a lot of inbound traffic being vectored onto a tight base leg for visual approaches. Throughout the day it was reported there was a significant amount of weather breakthrough on the radar which resulted in difficulties for controllers to distinguish between weather breakthrough and possible gliders.



4.8. The C56X was being vectored for a short pattern visual approach complying with an LoA with RAF Odiham Gliders to enable the latter to continue flying whilst Farnborough operates on Runway 06. The aircraft is high but confident that height can be lost. The balloon is spotted by the TWR controller and information passed to RADAR. Gliders have been observed throughout the day traversing the Hog's Back but only showing intermittently on radar: TWR ATC has been monitoring the situation visually as able. The C56X reports visual with the balloon and elects to continue rather than be broken off. Limited options for the radar controller (only left turn towards Blackbushe ATZ and Heathrow RMA for Runway 09 active). Coordination with the TWR was confused with the TWR controller assuming that the C56X would be broken off due height and proximity of balloon. ATC error contributed to the incident but the situational causal factors were influential. The MATS Part 2 was updated following the incident.

4.9. From an ACP point of view, not only would there be a predictable arrival path (which would not involve a tight-left-base join) but all the GA flights would be known traffic (if using CAS) or would be operating outside CAS. The ATC error that occurred stems from the unpredictability of the approaches – their paths and their execution – due to unknown GA.

Airprox summary

4.10. Within a 20nm radius of Farnborough there have been 70 airprox reports since 2008: 31 of these involved military helicopters or fixed wing, 13 involved gliders.

4.11. LARS West provides services to 50,000 GA/S&RA per year (DS, TS and BS) on average, and Approach services to 27,000+ (DS) per year.

4.12. Given these large number of users and low incident rate, it is reasonable to conclude that LARS West and Farnborough Approach Radar reduces the number of airproxes that occur.

4.13. The argument from others that 'there are only very few incidents' is more attributable to these efforts than it is to an equivalent 'raw' Class G environment without radar services.

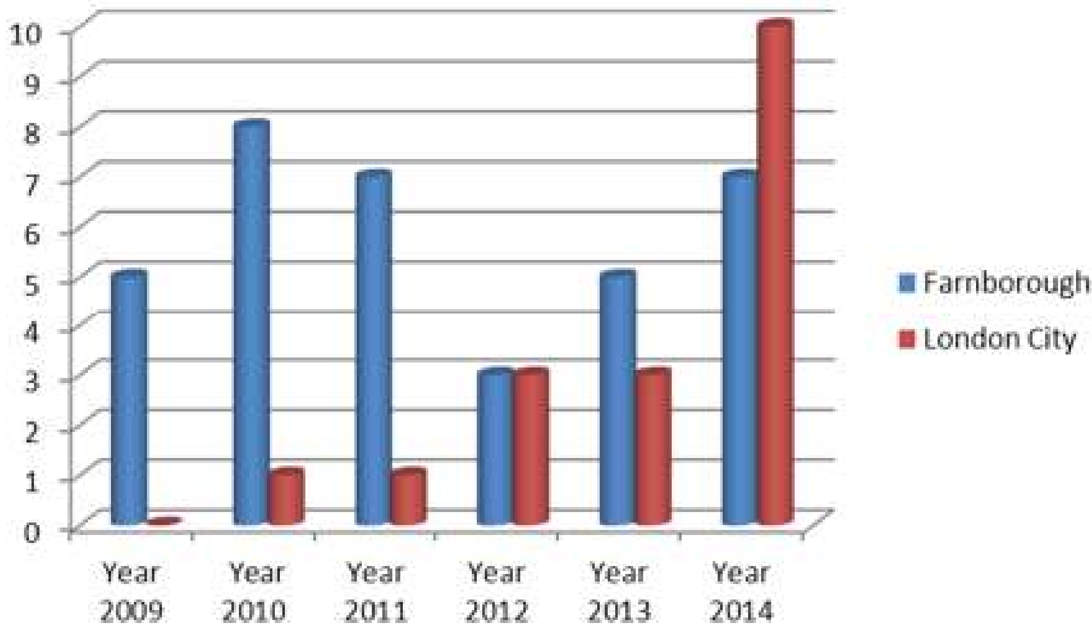
4.14. Electronic safety tools such as STCA have already been deployed to maintain these low incident rates. The next step would be CAS.

5. Incidents in the airspace surrounding Farnborough: TCAS MORs

5.1. Since May 2009, Farnborough ATC has received 34 TCAS RA reports and one TCAS TA report, all filed as MORs as required by the MOR system, involving Farnborough IFR inbound traffic.

5.2. TCAS has made a valuable contribution to flight safety and the benefits have begun to be shown in OCAS situations in the airspace surrounding Farnborough.

5.3. The chart below shows Farnborough (total 35) and London City (total 18) TCAS MOR reports, excluding those resulting in an airprox:



5.4. UKAB commented, in a recent TCAS Airprox (100/2013) in the vicinity of London City:

It was pointed out that it should not be 'normal procedure' to receive a TCAS RA on final approach (or at any other time in flight); the Board remained very concerned that TCAS RA warnings should not be considered as 'normal' at any time. It was therefore recommended that the CAA reviews TCAS interaction between local traffic and commercial air traffic inbound and outbound in order to determine how operating procedures might be modified to avoid similar occurrences.

5.5. NATS Farnborough has noted the increase in TCAS RA reports and monitors the situation through the Unit Safety Steering Group. There is a rising trend although it cannot be proved yet that this is statistically significant. In the same time period LC received 18 reports and Farnborough 35 reports. TCAS only provides protection against other transponding aircraft (Mode C or Mode S altitude).

Farnborough traffic's TCAS reports in the vicinity of the airport. Note the cluster on final approach to 24.

TCAS MOR summary

5.6. None of the Farnborough TCAS reports were airprox reports but the unit must ensure that these do not become 'Ops normal' as per the UKAB recommendation.

5.7. The unit, in investigating, determined that they met the criteria for reporting but, by analysis, it was determined that normal procedures, safety standards and parameters pertained for operations outside CAS.

5.8. These would have been highly unlikely to have occurred in a CAS environment.

6. Incidents in the airspace surrounding Farnborough: Controller Observation Reports involving airspace interactions

6.1. Farnborough controllers file observations in a comparable way with most NATS units.

6.2. Since 2009, 118 observations were filed in accordance with the NATS policy to enhance safety by involving the controlling teams and giving them an opportunity to report concerns.

6.3. The Farnborough controllers are pragmatic about working outside CAS. They rarely file an observation on issues outside CAS unless that issue is serious enough to cause considerable concern yet remains outside the MOR scheme.

Observation	Summary	ACP learning point
63364	Farnborough approach controller and TC coordinated an inbound level for (callsign). This coordination was broken by TC without informing Farnborough, resulting in the pilot taking avoiding action against a glider outside CAS.	Even if coordination was broken, aircraft would have remained within CAS and risk of interaction with glider would be minimal.
68610	(IFR Callsign) departed Fairoaks and climbed straight to 2,400ft whilst still inside the lateral boundary of the Fairoaks LFA (where the upper limit is 1,500ft). No other aircraft involved, hence Observation rather than other report type.	IFR departures from Fairoaks would be under positive control if joining controlled airspace
72626	Confirmed reports of paragliding activity in the immediate vicinity of the busy Runway 24 ILS base leg. These aircraft are difficult to detect on the radar, leading to possible risks to operations. Few aircraft were inbound, no incident occurred, but issue needed recording.	Reduced operational risk due to these paragliders being below CAS, and IFR arrival within CAS, at all times.
73915 (Discussed further below)	During a period of high traffic/controller workload on LARS West and Approach, several inbound aircraft were given avoiding action and were held off due to unknown or high-density FIR traffic in the vicinity of the final approach.	Lack of CAS, combined with density of FIR traffic, created safety implications when working IFR aircraft inbound to Farnborough. Would not happen with CAS environment.
89620	(Boeing 737 IFR arrival) reported glider sighting on final for Runway 06.	Gliders and IFR arrivals would be separated by CAS.
97019	Two safety observations filed for two consecutive dates where primary contacts were observed around the Runway 06 final approach, believed to be Lasham gliders. This resulted in DS unable to be provided and inbounds not being able to complete an ILS approach.	Gliders and IFR arrivals would be appropriately separated by CAS.
100316	(Unknown GA flight) not using transponder in EGLF final approach. Responded to EGLF LARS W calls and became identified known traffic. Left frequency after general handling by stating 'next time I would use the transponder'.	All traffic in final approach areas would be 'known' and able to be safely separated easily.

Observation 73915 in more detail

6.4. The highlighted report gives some essence of the level of complexity that needs to be raised to justify an observation in the controllers mind. The controller wrote:

I was working as Approach controller with 2 pending inbounds at a time when LARS West had multiple tracks on frequency. With the first aircraft (Aircraft A) on frequency I established the service and approach to expect. In accordance with unit procedures I phoned Fairoaks with a PET (Pattern Expiry Time). The FISO advised me they had 4 departures into the local area. I received a second aircraft (Aircraft B) on frequency 10nm behind the first aircraft and began to sequence him behind (Aircraft A) for the approach. As (Aircraft A) proceeded downwind left hand for Runway 24 I noticed a primary contact at Guildford which appeared to track towards final approach. Several tracks then began to appear outbound from Fairoaks and the workload on LARS West didn't allow for co-ordination between us, to assist with my inbound traffic. Aircraft C then called inbound 10nm behind (Aircraft B).

I turned (Aircraft A) onto a heading of North but quickly realised that I couldn't safely make an ILS approach due to unknown primary contact crossing final approach. I broke the aircraft off the approach. At the same time I observed un-coordinated traffic on a converging track to (Aircraft B) so I issued the pilot avoiding action to deconflict. During the next 15 minutes I was faced with multiple LARS tracks affecting the downwind and final approach at Farnborough. I was unable to safely vector the 3 aircraft inbound and was forced to issue several avoiding action turns, hold 3 aircraft outside controlled airspace and issue a number of updates on traffic information. Workload on approach and LARS West was now extremely high and I was unable to co-ordinate anything with LARS West. A departure received a delay in excess of 20 minutes while I sorted out the inbound traffic.

I eventually managed to find an area of clear airspace and vectored all 3 aircraft inbound as close together as was safely possible.

6.5. All observations in the table above have been acted upon by unit management as part of the ongoing commitment for safe management of the airspace.

Controller Observation Report summary

6.6. No incidents occurred, from an ATSOCAS point of view, that required reporting due to these observations.

6.7. These observations would be extremely unlikely to have occurred with CAS.

7. Deconfliction minima

7.1. MATS Part One says that:

In Class G airspace, separation between aircraft is ultimately the responsibility of the pilot; however, in providing a Deconfliction Service, controllers will provide information and advice aimed at achieving defined Deconfliction minima.

In high workload situations, which may not always be apparent from RTF loading, it may not be possible for controllers to always provide timely traffic information and/or Deconfliction advice. High workload situations may not necessarily be linked to high traffic density.

High traffic density can cause difficulty interpreting ATS surveillance system data and may affect RTF loading or controller workload to the extent that the controller is unable to pass timely traffic information and/or Deconfliction advice on all traffic.

The Deconfliction minima against unco-ordinated traffic are:

5nm laterally (subject to surveillance capability and CAA approval); or

3,000ft vertically and, unless the SSR code indicates that the Mode C data has been verified, the surveillance returns, however presented, should not merge. (Note: Mode C can be assumed to have been verified if it is associated with a deemed validated Mode A code. The Mode C data of aircraft transponding code 0000 is not to be utilised in assessing Deconfliction minima).

The Deconfliction minima against aircraft that are being provided with an ATS by the same controller, or that have been subject to co-ordination, are:

3nm laterally (subject to surveillance capability and CAA approval); or

1,000ft vertically.

7.2. Farnborough is approved to 3nm/1,000ft.

7.3. Unit Management regularly reviews the controller's discussions with UCEs and WM meeting reports on how often DS minima are being achieved. This review provides assurance that the DS minima are able to be achieved on the vast majority of occasions although the WM/UCE teams report that this is becoming increasingly difficult in summer.

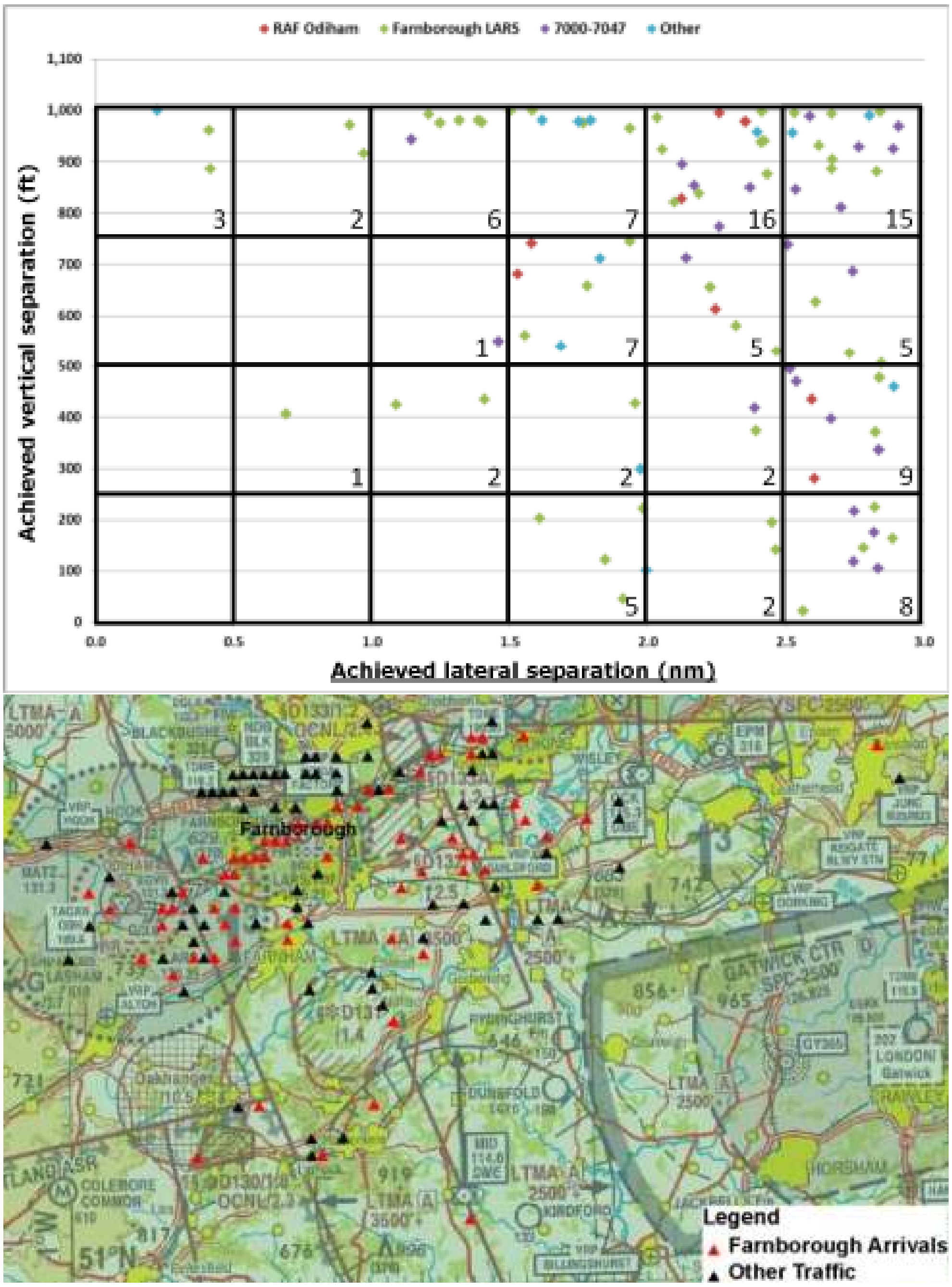
7.4. Mechanisms have been put in place to allow increased monitoring of traffic levels expected from TC sectors (including LFMP tools directly into the ops room).

7.5. The unit also reviewed a snapshot of the DS minima with regard to Farnborough IFR arrivals and conflicting traffic (data was collected over a 7 day period in July 2011).

7.6. The NATS Minimum Separation Tool examined where the achieved separations were less than 3nm laterally *and* less than 1,000ft vertically, for longer than 4 radar sweeps (24 secs). 98 aircraft pairs matched these criteria.

7.7. The colour key of the upper chart indicates which type of flight provided the confliction with the Farnborough IFR arrival. The numbers in the grid square show the count for each half nm lateral and 250ft vertical block.

7.8. The majority of aircraft pairs involved LARS traffic (green symbol), which are normally coordinated traffic (but are not always).



7.9. This analysis gives credibility to the WM/UCE assurance that DS minima are being achieved for the majority of aircraft (350 inbounds during the sample period), but that the 98 instances of less than 3nm/1,000ft illustrate the challenges associated with the current operating environment.

7.10. Note that the purple symbol (7000 for general FIR conspicuity, 7047 for Biggin Hill conspicuity) requires the *larger* minima of 5nm/3,000ft for unco-ordinated traffic, not the coordinated traffic minima of 3nm/1,000ft.
This happened on 24 occasions, which is approximately 24% of the total data sample.

DS Minima summary

7.11. This shows the effect of the dominant user (FIR conspicuity codes) on the operation, and also demonstrates the lack of room for manoeuvre presented to the Farnborough ATC team on a daily basis.

7.12. This also illustrates the fragility of any assumptions made by some GA/S&RA pilots of how other users will operate in the airspace when there is no room to do anything else – they become the dominant user because we must aim to achieve DS minima.

7.13. With a CAS environment, all traffic would become 'known', deconfliction minima would cease to apply, and standard separation would be applied instead.

8. Visual approaches

8.1. Farnborough ATC regularly use, or are requested for, visual approaches as a method of shortening the arrival aircraft exposure to OCAS operations.

8.2. On Runway 24 this predominately involves shorter pattern approaches from a left base due to the presence of Fairoaks traffic, and the flow of traffic between WOD and OCK outside the Heathrow CTR.

8.3. On Runway 06 the same short pattern exists. However, the main driver at weekends is to give flexibility to the RAF Odiham Gliding operations by using visual approaches in preference to ILS. This is because visual approaches could remain outside the Odiham ATZ in certain weather conditions, i.e. those when Odiham gliding is likely to occur.

8.4. Farnborough traffic will receive a considerable delay penalty for requesting an ILS in weather conditions that would allow a visual approach.

8.5. Farnborough ATC Management investigated the Runway 06 patterns following discussions with UCEs with regard to:

a. How far out are the aircraft establishing

b. Descent profiles

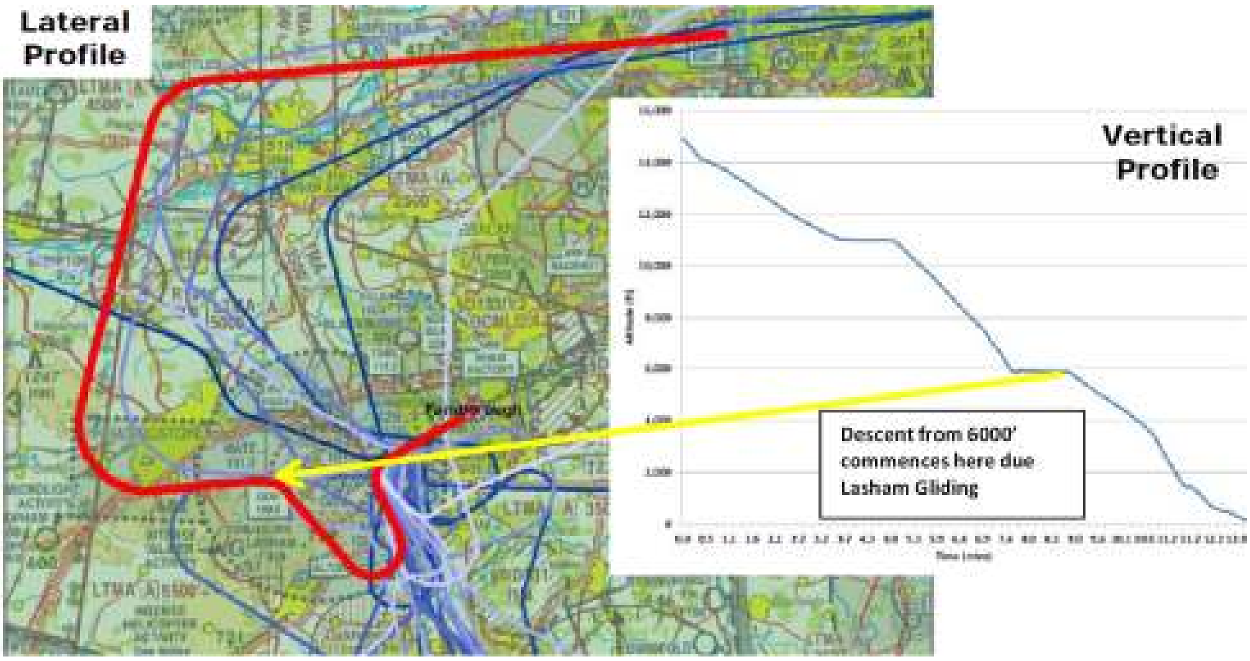
c. Failures to establish

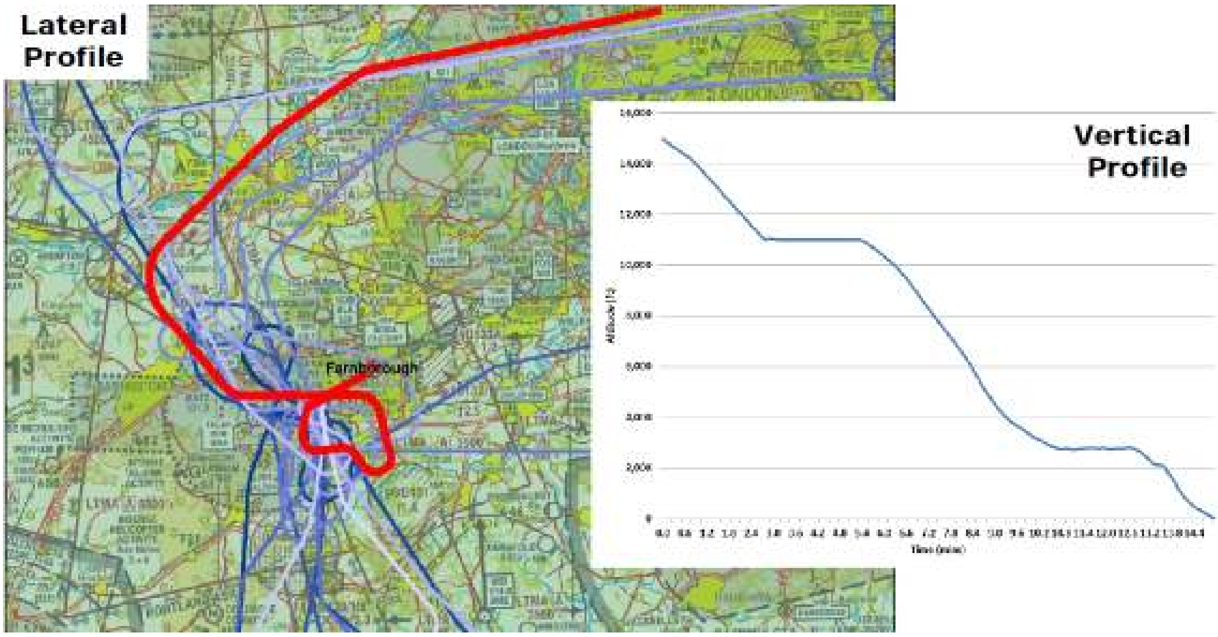
8.6. Due to the complexity of the data, a small sample of four days was taken when RAF gliding operations ('Kestrel') were known to be occurring (04, 05, 11 June, 30 July 2011).

8.7. 68 arrivals were affected (overview below).

8.8. (Above) zoomed image shows Odiham ATZ, which Farnborough avoids when RAF gliding is in progress at weekends and RAF Odiham ATC is closed.

8.9. (Below) an example flight from 04 June 2011 that was high when transferred from LTC.





8.10. (Above) an example flight from 30 July 2011.

Visual approaches - summary

8.11. Aircraft are establishing (consistent with the procedure) at between 2-3 miles.

8.12. Descent profiles especially from the CPT area can be steep but manageable for the type of aircraft involved when they come over 'high' from LTC. A significant number of approaches are vectored to extend track mileage once clear of the main gliding areas.

8.13. This is airspace management for the benefit of another user by Farnborough.

8.14. Visual approaches would still be used in a CAS environment, but their track would be much more predictable over the ground. Their descent profile would be more consistent and stable.

9. FDM (Flight Data Monitoring) events

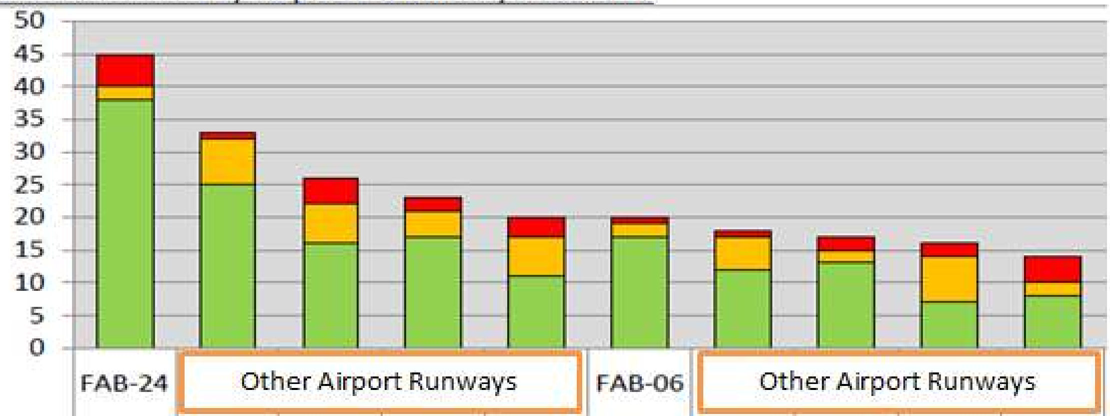
9.1. An FDM event is an auto-generated record by the aircraft system, following any event it considers 'unstable in one or more factors'.

9.2. Examples are excessive angle of bank, high rates of descent at low altitude, and other similar instabilities. These events are investigated by the operator.

9.3. The visual approach information was passed on to [redacted] for discussion, and led to a further piece of work.

9.4. [redacted] engaged with other Farnborough operators to produce a report (available for inspection upon request) looking into the safety aspects of Farnborough visual approaches for the year 2013.

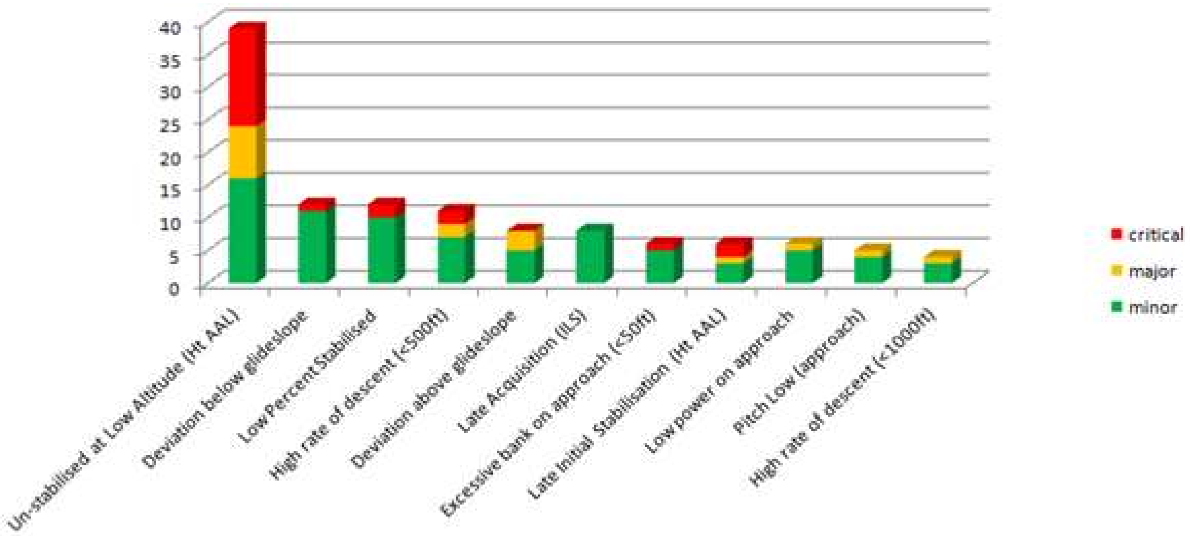
Top 20 Arrival Events By Airports & Runways For 2013



	FAB-24	Other Airport Runways				FAB-06	Other Airport Runways			
Critical	5	1	4	2	3	1	1	2	2	4
Major	2	7	6	4	6	2	5	2	7	2
Minor	38	25	16	17	11	17	12	13	7	8

9.5. (Above) The report concluded that visual approaches to Runway 24 triggered the highest number of FDM events for [redacted] in 2013 worldwide.

9.6. (Below) This report also identified the specific FDM events, showing that 'un-stabilised at low altitude' was the most commonly recorded.



9.7. The core information was gathered from the [redacted] FDM system and FDM third party provider [redacted].

9.8. Verbal reports were also collated from [redacted] pilots, NATS Farnborough Airport, and Farnborough based aircraft operators. The report was commissioned by [redacted] for Farnborough operators, to increase their awareness of the flight safety issues encountered when on approach to TAG Farnborough Airport.

9.9. Three major areas for investigation were identified:

a. Unstable approaches at low altitudes
b. High Rate of Descent (HROD) with 'below glideslope' indications
c. HROD <1,000ft, late initial stabilisation and late acquisition of glideslope

FDM summary

9.10. One of the main contributors to these events identified in this report is the complexity of airspace interactions, especially for pilots not familiar with Farnborough.

9.11. The causal factors in the events for Runway 06 started higher in the approach i.e. 1,000ft and above, which leads onto late acquisition of approaches. This indicates that aircraft are struggling to achieve a stable starting point for the final approach as they control their energy from their descent from upper altitudes.

9.12. If the airspace complexity is reduced and the tracks more predictable, these events would be far less likely to occur.

10. Farnborough arrivals broken off approach due FIR traffic

10.1. NATS Farnborough conducted a survey within the ATC team to approximate how often radar had to intervene in safety-critical areas:

a. Final approach including a 3nm base leg;

b. Held for at least one orbit in Class G, or extended vector over 10nm outside base leg/final due LARS traffic unable to cooperate;

c. Held for at least one orbit in Class G or extended vector over 10nm outside base leg/final due interactions with conspicuity code flights (Mode A 7000).

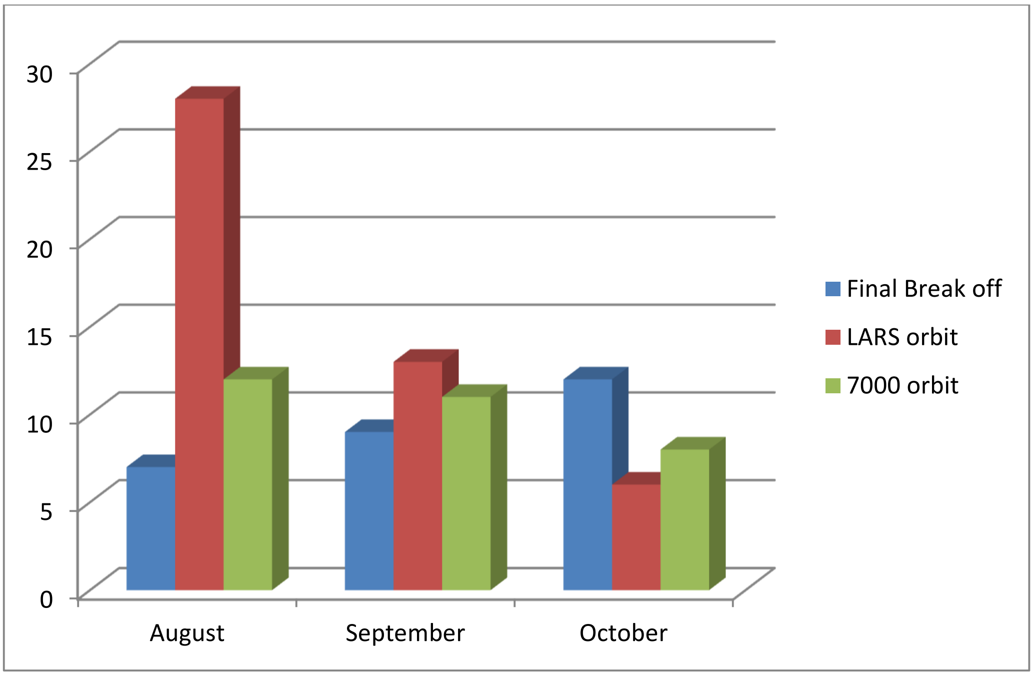
10.2. The data was recorded if the controller had time to safely note the details.

10.3. The unit estimates that this was possible for 70% of the time (even with the support of the radar assistant).

10.4. The main reasons for non-recording were traffic levels too busy, or controllers 'forgetting' due to it being a routine procedure to extend or to break off, and therefore not 'unusual'.

Month (2014)	Broken off final approach	Held for >1 orbit or extended vector (LARS)	Held for >1 orbit or extended vector (A7000)
August	7	28	12
September*	9	13	6
October*	12	11	8

10.5. The survey took place from 1st August 2014 to 31st October 2014 (*excluding two individual weeks, one in September and one in October, where data was not recorded due to an administrative error).



10.6. This matches the experience of Farnborough controllers. Break offs and orbits are due, in the main, to pop-up traffic, or to LARS (or unknown) traffic executing unexpected manoeuvres.

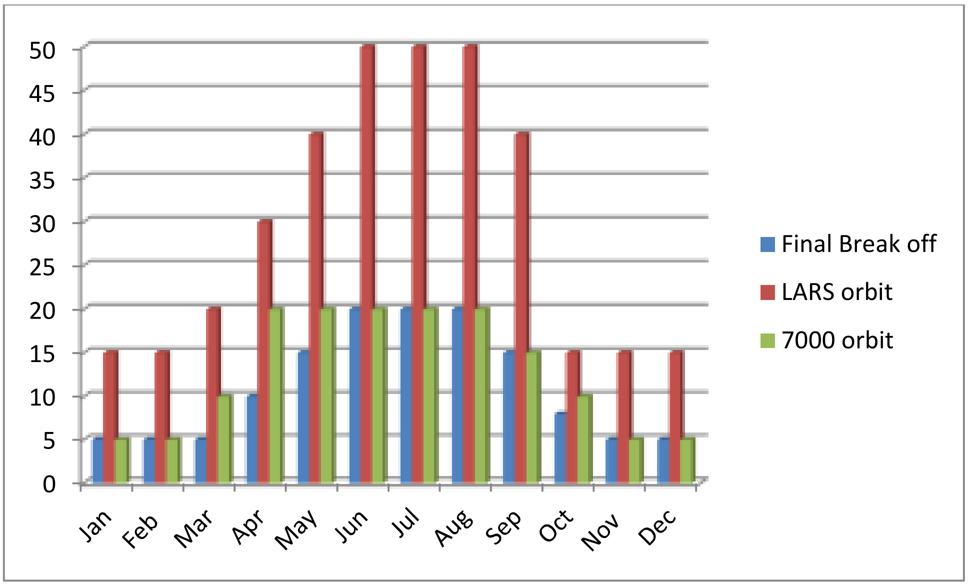
10.7. The controlling team at Farnborough suggested that break-offs would continue at about 10-20 per month, with under-reporting due to the workload increase in summer. In winter this would stabilise at between 3-5 break-offs per month. To check this we continued to record data for *break-offs only* in 2015. The same caveats about accurate recording due workload apply.

10.8. This generated:

Month (2015)	Broken off final approach
March	4
April	4
May	11
June (up to 20th)	13

10.9. Significant orbits would continue throughout the year, with summer months generating 30-70 per month depending on GA activity. These are very difficult to track and record accurately as discussed above.

10.10. An approximate extrapolation to one year, with summer/winter weighting, indicates the likely extent of the issue.



10.11. Farnborough would expect that business jet traffic would be broken off from final approach on more than 150 occasions, and given more than one orbit or extended vectoring on more than 390 occasions.

10.12. On 31 May 2014 the following occurred to an arriving Falcon 2000 (F2TH), callsign 'MORAD':

10.13. The F2TH is broken off on base leg and is repositioned – on the second approach the aircraft cannot be given descent on the ILS due to further interactions and is repositioned again.

10.14. A report from one operator illustrates the implications for the crew of these break offs:

Report Summary

Whilst on an intercept heading of 280° at 2,400ft Alt to intercept the localizer for runway 24 at Farnborough and at a range of seven miles, Farnborough ATC issued an avoiding action instruction of left turn heading 210° and maintain 2,400ft. The autopilot was disconnected and the aircraft manually flown onto the instructed heading. ATC then instructed us to climb to 3,400 feet and cleared us to enter controlled airspace. When ATC were asked for the reason for the avoidance they stated pop-up traffic north of the approach path not talking to Farnborough ATC and altitude unknown. ATC were very busy controlling at least 4 aircraft onto the ILS and we heard an avoiding turn instruction to at least one other aircraft.

Break-off/Orbit summary

10.15. These scenarios are routine at Farnborough, especially in summer.

10.16. Whilst they are handled to the highest safety standards, the dominance of the pop-up traffic causes complexity, extended track miles and delay to the arrivals.

10.17. CAS would vastly reduce the complexity. The likelihood of break-offs and extended orbiting/vectoring would be significantly reduced, enhancing safety.

11. Glider radar returns

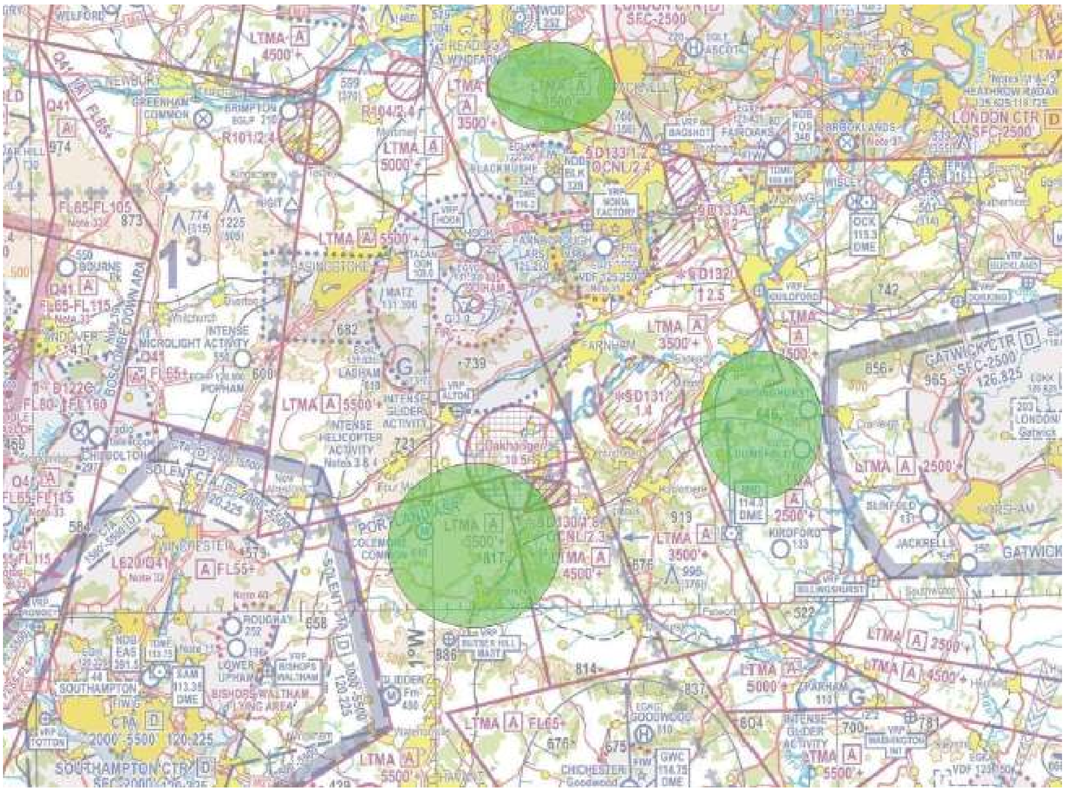
11.1. The ATC team monitors glider operations to be able to make informed decisions on which areas to avoid where possible, when vectoring Farnborough aircraft.

11.2. Primary-only returns are not always associated with gliders and can be weather generated. In certain weather conditions the radar team have to balance the risk of 'not seeing' gliders against the risk of clutter obscuring the vectored aircraft.

11.3. This anomalous propagation can be mitigated at Farnborough through polarisation of the beams and certain gain settings.

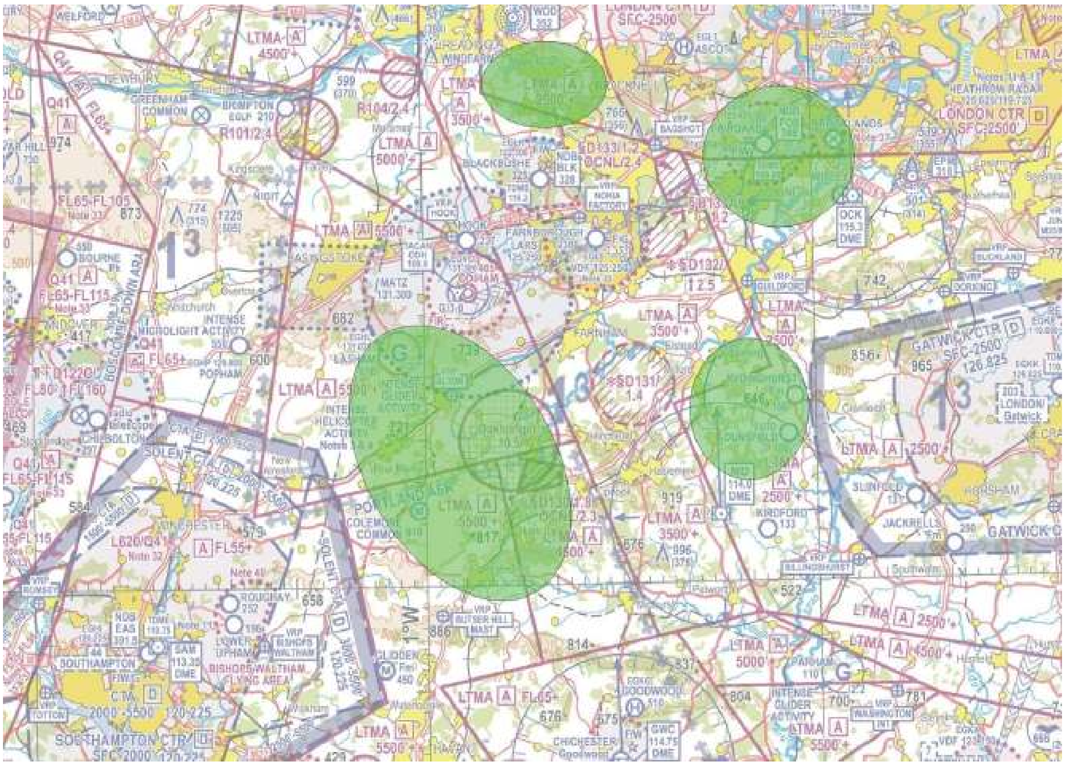
11.4. There are three maps which use increasing levels of suppression in order to reduce weather clutter. Maps two and three have areas of degradation. (Extract from MATS Part 2):

Map	Polarity	Suppressive Effect	Procedures
One	Circular	None	This is the default Radar configuration, and achieves the best coverage and operational performance available. The engineering authority has confirmed that reduction in traffic information/deconfliction advice is not required in this configuration.
Two	Circular	Reduced low beam coverage between 10 and 20nm, excluding the portions near Fairoaks and Lasham	This should only be used when controllers are faced with unacceptable anomalous propagation of a "speckling" nature. The engineering authority has confirmed that reduction in traffic information/deconfliction advice is not required in this configuration outside of known areas of degraded cover, as detailed below.
Three	Circular	Reduced low beam coverage between 10 and 20nm	This should only be used when unacceptable anomalous propagation remains in the Fairoaks and Lasham areas, despite selection of Map 2.



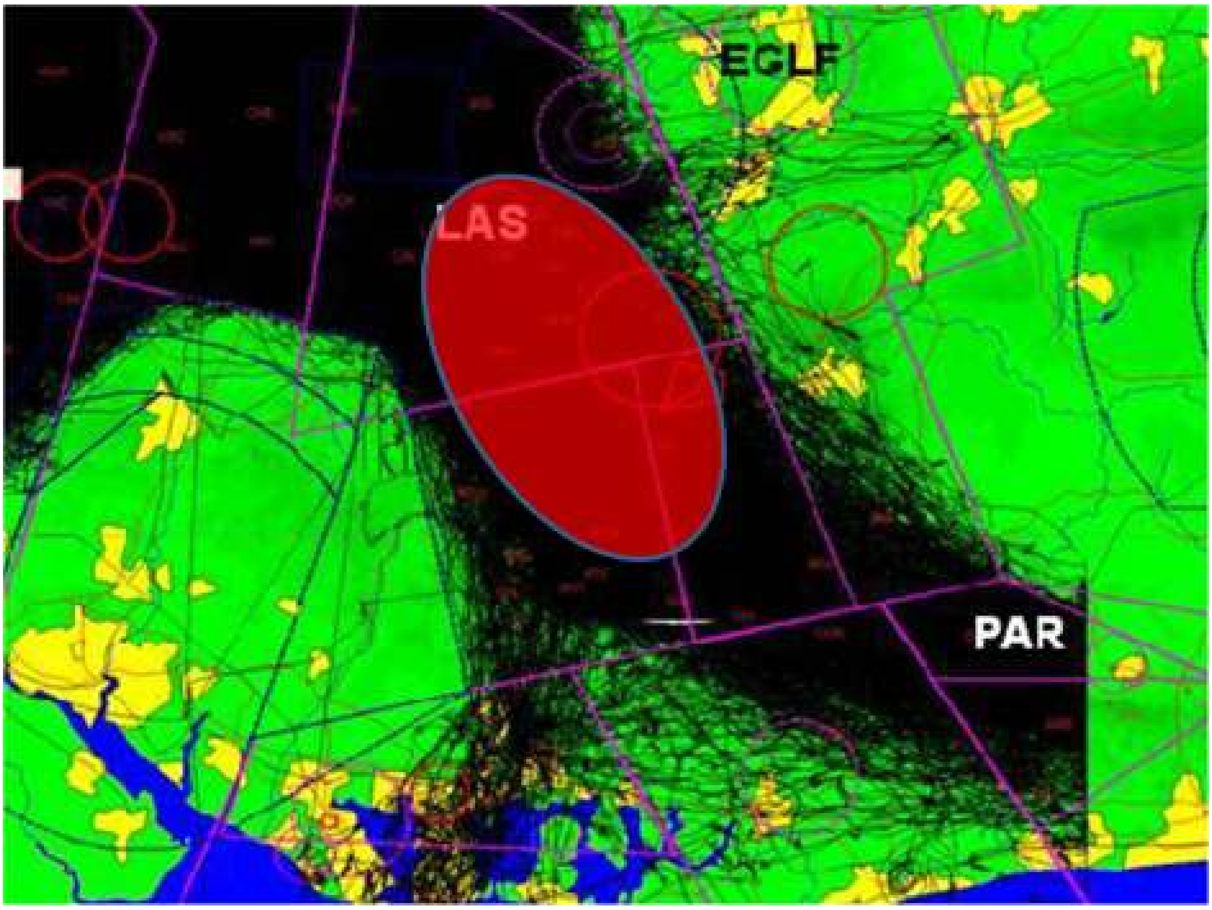
11.5. (Above) Map two's areas of degraded coverage

11.6. (Below) Map three's areas of degraded coverage



11.7. The Radar team regularly reviews the suppression throughout a shift and tries to balance it against weather propagation and gliding activity (known, observed or suspected).

11.8. Maps 1 and 2 are the commonest settings in summer. Map 3 is usually used when atmospheric conditions or weather inhibit radar performance



11.9. (Above) Radar suppression area (Map 3), shown with commonest glider routes (image supplied as part of Southdown Gliding Club's consultation response). Gliders operate when cloud is particularly convective, due to acquisition of lift.

11.10. To give as complete a picture as possible Farnborough LARS and Approach utilise Heathrow 10cm and Pease Pottage in addition to Farnborough ASR although all three will suffer 'clutter' issues to some degree.

11.11. The Grob/Glider collision (referenced earlier) resulted in the following safety recommendation:

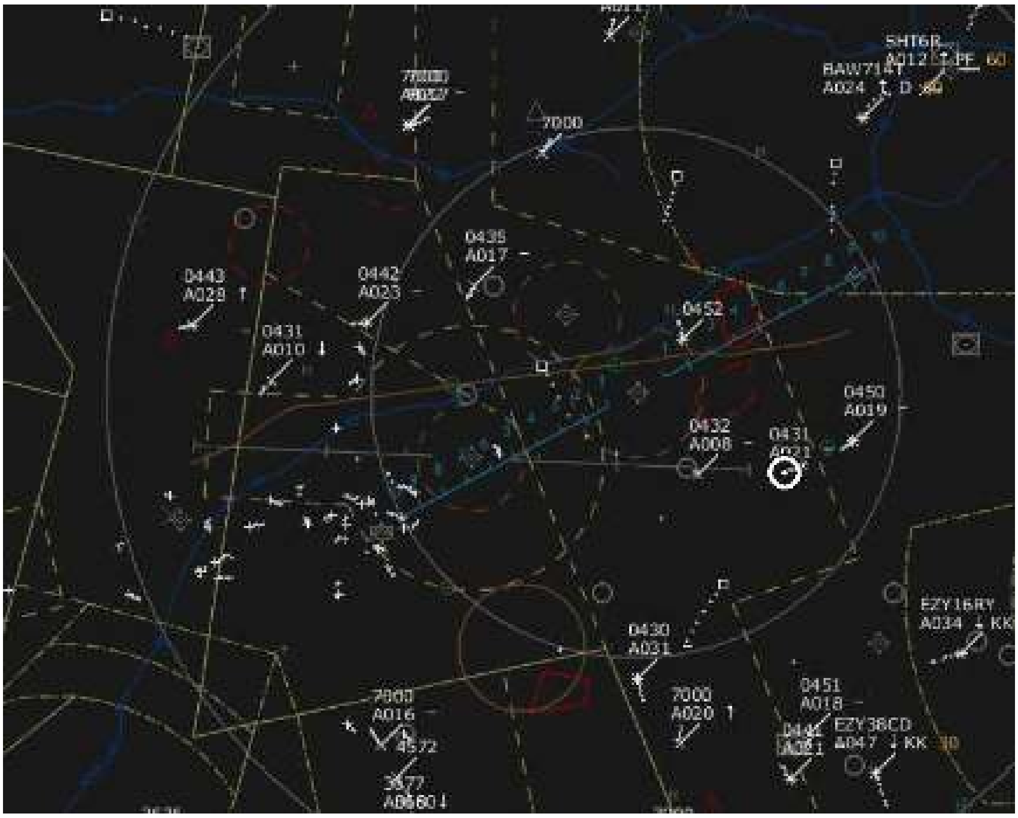
Safety Recommendation 2010-042: It is recommended that the Civil Aviation Authority liaise with the Sporting Associations and the Ministry of Defence, with a view to developing a web-based tool to alert airspace users to planned activities that may result in an unusually high concentration of air traffic.

11.12. Farnborough ATC anticipate further liaison with the local flying organisations, especially LGS, to help provide a more accurate picture of each days flying activities even if the ACP is unsuccessful.

Calibration of Runway 06 ILS (March 2015)

11.13. The watch log entry at 1318 – "06 ILS calibration cancelled due amount of gliders in the vicinity of Lasham and Odiham. Pilots decision. ILS calibration to be re-arranged."

11.14. The pilot stated he wasn't happy as he finds gliders difficult to see. They were flying in a BE200 this day instead of the normal DA42. RAF 'Kestrel' gliders were also active meaning the pilot would have to speak with Lasham, Kestrel and Farnborough all while flying the ILS.



11.15. (Above and below) Radar pictures showing radar returns southwest of Odiham the day of the Runway 06 ILS calibration. These returns are likely to be Lasham gliders, but could be weather-related clutter.

Glider radar returns – summary

11.16. Gliders are not only difficult to see by other professional pilots (as evinced by the Calibrator pilot and others in this document), they are difficult to see on radar and can be indistinguishable from weather clutter

11.17. Using alternate radar maps may reduce clutter but may also remove the glider radar data needed to provide relevant traffic information. As more suppressive maps are used, the greater the loss of data, the greater the likelihood that radar services need to be reduced.

11.18. The containment of Farnborough traffic within CAS would ensure that the radar services provided would be maintained even with suppressive maps.

12. Overall conclusion

12.1. This document shows that the Farnborough ATC team continually strives to understand and improve safety performance.

12.2. The airspace system is tolerably safe at current levels, bearing in mind the attitudes .

12.3. The fact that there are relatively few incidents in the LARS West area <u>does not mean</u> that nothing needs to be done at all – this is a false conclusion.

12.4. The fact that there are relatively few incidents in the LARS West area <u>should take account</u> of all the work being done behind the scenes by LARS West and Farnborough Approach Radar.

12.5. The introduction and review of procedures and tools to improve safety has reached its limit within the current ATSOCAS environment. To enhance safety, a known environment is required, where controllers can instruct GA aircraft to operate in a particular way (generally as per their desired path/altitude anyway) for the benefit of the majority of airspace users.

12.6. Now that planning permission for more movements has been granted, and forecasts are for the 'most likely' increase to be realised between 2015 and 2019, action must be taken to ensure the airspace environment remains tolerably safe.

12.7. Controlled airspace is the logical next step.