The Quiet Flying Programme Review including the Evaluation of the Farnborough Airport Noise Abatement Trials 2007/8

1. Introduction

Following the Public Inquiry into the weekend flight increase in early 2007 it became clear that noise was the main environmental issues concerning local residents. Consequently, the FACC established a working group charged with investigating means by which noise might be mitigated.

The first meeting of the working group was on 9th March 2007, attended by;

TAG – Brandon O'Reilly, CEO; Roger Walker, Director Airport Ops; Miles Thomas, Environment Manager; Alan Brember, Chief Pilot; Rob Wells, CEO TAG Aviation Holdings.
ATC – Paul Jones, GM Farnborough, Andy Foyston, Watch Manager.
Farnborough Airport Residents Association – Geoff Marks.
Fleet & Church Crookham Society – Jenny Radley.
Mytchett, Frimley Green & Deepcut Society – Daphne Knowles.

Note:- Philip Riley, FACC Chairman was subsequently invited to attend the meetings in 2008.

At this initial meeting TAG introduced the Quiet Flying Programme, a wide reaching concept that would attempt to address the issue of noise, both airborne and ground, and how specific items could be mitigated against to give as little disturbance to the surrounding community as possible.

On the advice of the residents representatives it was agreed that a significant part of the groups work would be to concentrate on airborne aircraft disturbance that affected the community, particularly at both ends of the runway.

A further eight meetings have taken place since March 2007 during which the group has developed and trialled several new procedures for arriving and departing aircraft. Whilst work continues with other aspects of the Quiet Flying Programme, this report is presented to the FACC to show what has happened specifically with the flying trials and the findings to date.

2. Aims & Objectives

It was brought to the attention of TAG by the residents representatives that arrival and departure flight tracks were the biggest issue for their members, both in terms of noise and visual disturbance.

This led to the initial aim of the working group which was to reduce the noise impact on the greatest number of people on the ground and give more certainty to airborne aircraft tracks whenever possible, not withstanding the complicated airspace environment surrounding Farnborough. This would be done by trialling different take –off and landing procedures, using alternative routes, assessing the feasibility and quantifying the impact.

As the trial progressed and findings were reported, it became apparent that amendments to the procedures would be required, particularly at the western end of the airport with the objective of relieving some of the impact of departing flights over the residential areas of Church Crookham by moving the tracks over the unpopulated area of MoD land to the south of the extended runway centreline.

As with any trial, measurement of success or failure of the various aspects of the trial would be important in considering whether to fully adopt trial procedures. Whilst complaints and anecdotal data play an important part for the feedback during the trial, the group agreed that an objective must be to collect some scientific evidence of the trial that could be used to look at ways to provide meaningful information. TAG was therefore tasked with gathering data from the fixed monitors used in the normal day to day activities, augmented by comparative data collected in parallel from the portable monitor (a replica of the fixed monitors) set in various appropriate locations

3. Method

The framework which allowed the trial to be undertaken can be found in TAG's obligations under its planning agreement with Rushmoor;

The Company will attempt to achieve a reduction over time in the noise impact of flying. This shall be assessed by comparing the land area and position of the 55db and 60db contours (specified in clause 2a) determined at the beginning and end of rolling 5 year periods. (For example comparing contours at the end of years 1 and 5, 2 and 6)

(Schedule 1, clause 2d, of the Deed, October 2000)

This assessment is reported in the Annual Performance Report submitted to RBC in February each year and can be seen in **Appendix 1**.

Any modifications or improvements to the preferred noise routes or their tolerance limits may from time to time be made in the interests of public and environmental amenity in agreement with the Council acting reasonably and subject to their acceptance by the CAA.

(Schedule 1, clause 2g, of the Deed, October 2000)

Prior to the start of the trial the following procedures were in use at the Airport;

Pilots are to ensure that their aircraft are operated in a manner likely to cause the least disturbance in the areas surrounding the aerodrome.

All departures are to use best rate of climb until at or above altitude 3000 ft. If the initial departure clearance involves levelling off below 3000 ft, power settings used must not result in excessive noise levels at points on the ground underneath the flightpath, especially when climb is re-commenced.
Additionally, for all jet aircraft and other aircraft in excess of 5700 kgs MTWA departing from Runway 24: if the assigned heading requires a right turn after take-off, this turn must be delayed until passing altitude 1800 ft or 2.5 DME from I-FNB whichever comes sooner.

(UK AIP, EGLF 2.21)

Note – See glossary of terms on page 18.

Advice from the residents and representatives at the first meeting identified operational issues for arriving and departing aircraft that led to an examination of all 4 runway scenarios;

- **24 Arrivals** – Late downwind turns to establish on the runway centreline, particularly from Visual flights led to disturbance of the community around South Farnborough/North Camp & Mytchett.

- **06 Departures** – Early right turns immediately after take-off led to disturbance of the community around South Farnborough/North Camp.
- **06 Arrivals** – Late turns to establish on the runway centreline led to disturbance of the Ewshot and Church Crookham community
- **24 Departures** – Early right turns, compliant with procedures, led to disturbance of the community around Fleet and the variation and uncertainty of left turns.

The group decided that a series of new procedures would be trialled to ascertain whether this would achieve the mitigation required. The trials had to take into account the following considerations;

- The trials must be safe from an aircraft capability perspective and in air traffic control terms based on the airspace within the control of Farnborough Airport.
- An appropriate balance is required between any operational constraints and the environmental impact to the community.
- Be feasible, practical and straight forward for the airport and aircraft pilots to operate.

From 1st May 2007 – Phase 1

- **24 Arrivals** – Establish on final approach before 3 nm DME for VFR & IFR flights.
- **06 Departures** – Straight ahead to 2.5 nm DME before turning right.
- **24 Departures** – Straight ahead to 2.5 nm DME before turning left or right.
- **06 Arrivals** – Establish on final approach before 3 nm DME for VFR & IFR flights.

From 9th May 2007

- **06 Departures** – Straight ahead to 2 nm DME before turning right.
  (ATC requirement to avoid conflict with Heathrow traffic)

From 21st May 2007

- Applicable weight lowered from 5700kgs to 2730kgs to capture the majority of aircraft.

From 8th June 2007

- **24 Departures** – Straight ahead to 2 nm DME.
  (ATC requirement to avoid conflict with RAF Odiham traffic)

To demonstrate these procedures, TAG invited the Residents Associations, Councillors and local press to experience a local flight in a Falcon 2000. This took place on June 16th 2007 and received substantial media coverage in both local press and TV.

Feedback from the residents representatives indicated that the trial for 24 departures was causing significant disturbance amongst the Church Crookham community and so a revision of the trial was initiated to determine if unpopulated areas could be overflown.

From 0800 to 1700 on January 18th & 25th 2008 a number of aircraft were given instruction by ATC to fly over these unpopulated areas to give group members an opportunity to visually assess the impact of the proposed revision.

From 8th May 2008 – Phase 2

- **24 Departures** – Southerly departures; Climb to 500ft then turn left onto track 220º.
  - Northerly departures; Straight ahead to 2 nm DME before turning right.

4. Measurement & Data Collection

The group agreed that decisions on how best to achieve the aims of the QFP must be based on data that is comprehensive, robust and readily understood by those who have little or no scientific knowledge of noise metrics.

As part of the RBC planning permission, TAG were required to install a Noise and Track Monitoring system. This includes two fixed monitors located at either end of the runway on the extended centreline.

In order to collect data that would allow scientific analysis, TAG purchased a portable monitor identical to the fixed monitor. This was then placed in a series of locations to allow comparison of noise levels with the two different routes. The locations are shown in **Appendix 2**.

The main location for the portable monitor was the SE Water Compound at Bourley Road. This secure location enabled the monitor to be left out for periods of up to five days (maximum battery life). The location is a similar distance from the end of runway 24 when compared to the fixed monitor and directly under the track of the southbound aircraft, as is the fixed monitor for northbound aircraft, therefore allowing for direct comparisons to be made. Monitoring was carried out between August and November 2008.

The data will be used to show if there is a reduction of noise recorded by the fixed monitor for southbound flights comparable to northbound flights and by the portable monitor for northbound flights comparable to southbound flights.

Similarly, by placing the portable monitor at the 6 residential/school locations, the data will be used to show the impact of the 2 routes at that specific location in terms of the mean rate of difference of noise when compared to the fixed Twelseldown monitor. Monitoring was carried out between October 2008 and January 2009.

The following definitions are used to analyse the data collected at the trial.

Decibel (dB) = Noise is the result of rapid sinusoidal changes in air pressure. The decibel is the unit used as the measure of sound pressure level.

dB(A) = A-weighted decibels. The 'A' Frequency Weighting network is the most widely used, and is used to represent the response of the human ear to loudness. This weighting gives lesser emphasis on the low frequency end of the scale and greater emphasis on the higher frequencies to which the human ear is more sensitive.

Lmax = The highest sound level recorded in any given "noise event" (the noise from a single aircraft movement)

E LEQ =Event Equivalent Continuous Sound Level. This is the AVERAGE sound level over a period of time (in this case a single aircraft noise event), that equates to the same energy level, of the actual noise event that would fluctuate in terms of sound level over the event time period.

E SEL = Event Sound Exposure Level. This is the E LEQ of an aircraft event, normalized in to a one second duration (therefore allowing noise events of differing duration to be directly compared).

5. Complaints & Community Feedback

Although complaint data can be seen as subjective, the importance of community feedback and anecdotal evidence from pilots and ATC cannot be discounted.

The heightened publicity surrounding the application to increase weekend movements and the Quiet Flying Programme raised awareness the airports operations.

The table below shows the number of complaints during a period preceding the trial, during Phase 1 (all R/w 24 departures straight ahead) and Phase 2 (southbound trial initiated).

Table 1 – Total Complaints received by Operation – Pre trial, Phase 1, Phase 2

Aircraft Operation	(Pre) 1 May 06 – 31 Jan 07	% increase between trial phases	(Ph 1) 1 May 07 – 31 Jan 08
24 ops	181	266%	663
06 ops	49	43%	70
Other	59	356%	269
24 Dep	109	440%	589
24 Arr	54	37%	74
06 Dep	19	0%	19
06 Arr	27	89%	51
Other	80	236%	269
Total	**289**	247%	**1002**

Flight Numbers	**20415**	**13%**	**23052**

Aircraft Operation	(Pre) 1 May 06 – 31 Jan 07	% increase between trial phases	(Ph 2) 1 May 08 – 31 Jan 09
24 ops	181	99%	361
06 ops	49	90%	93
Other	59	134%	138
24 Dep	109	269%	293
24 Arr	54	26%	68
06 Dep	19	205%	58
06 Arr	27	30%	35
Other	80	73%	138
Total	289	105%	592

Flight Numbers	**20415**	**3%**	**21020**

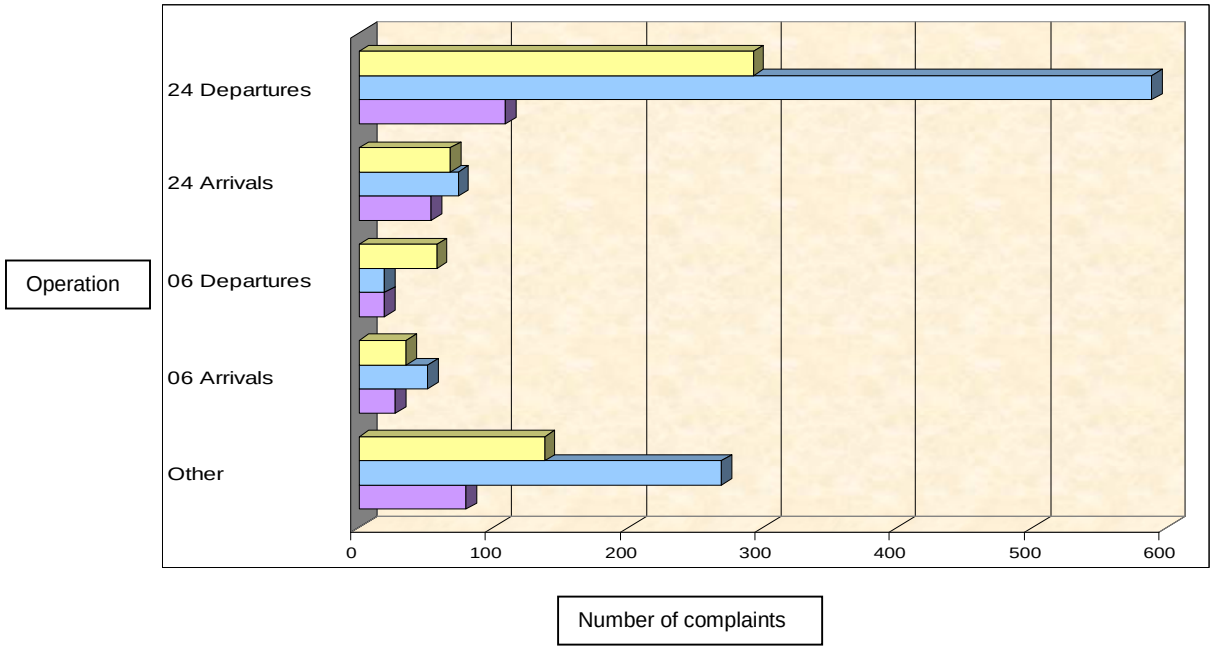
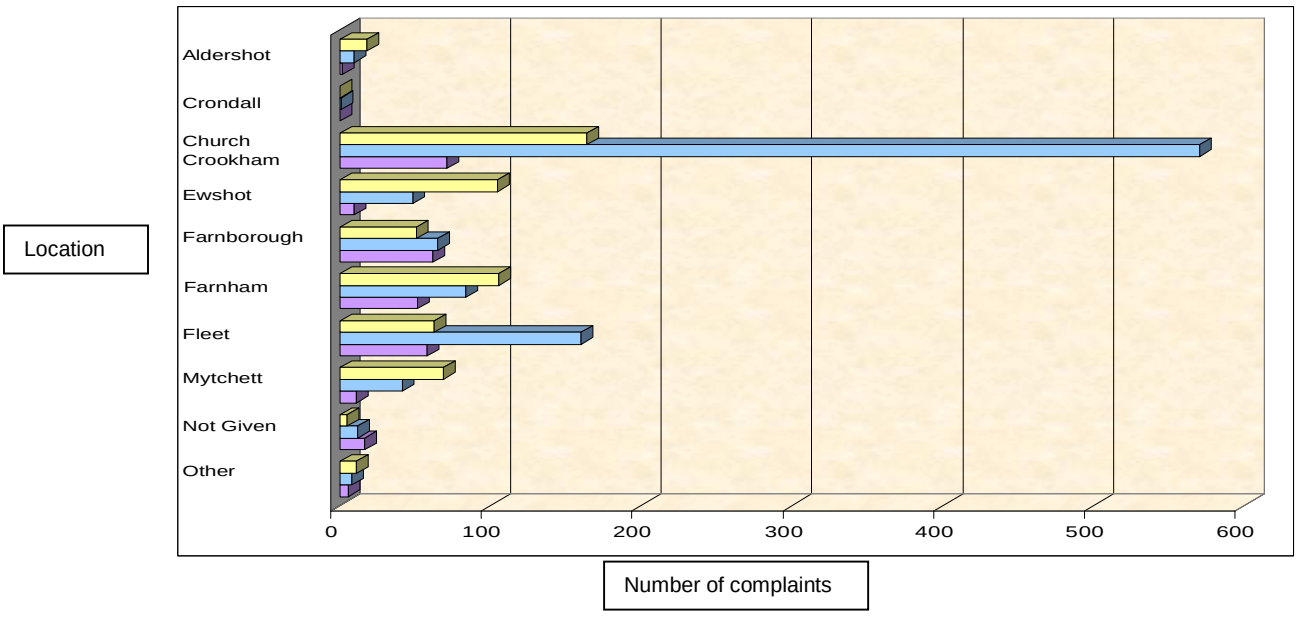


Table 2 – Total Complaints received by Residential Area – Pre trial, Phase 1, Phase 2

LOCATION	(Pre) 1 May 06 – 31 Jan 07		% increase between trial phases	(Ph 1) 1 May 07 – 31 Jan 08	
	complaints	% of Total		complaints	% of Total
Fleet	58	20%	176%	160	16%
Church Crookham	71	25%	704%	571	57%
Crondall	0	0%	0%	1	0%
Ewshot	10	3%	390%	49	5%
Farnham	52	18%	62%	84	8%
Aldershot	2	1%	400%	10	1%
Farnborough	62	21%	5%	65	7%
Mytchett	11	4%	282%	42	4%
Other	6	2%	33%	8	1%
Not given	17	6%	-29%	12	1%
Total	289	100%	247%	1002	100%
Flight Numbers	20415		13%	23052	

LOCATION	(Pre) 1 May 06 – 31 Jan 07		% increase between trial phases	(Ph 2) 1st May 08 – 31 Jan 09	
	complaints	% of Total		complaints	% of Total
Fleet	58	20%	9%	63	10.5%
Church Crookham	71	25%	131%	164	27.5%
Crondall	0	0%	0%	0	0%
Ewshot	10	3%	950%	105	18%
Farnham	52	18%	104%	106	18%
Aldershot	2	1%	800%	18	3%
Farnborough	62	21%	-18%	51	8.5%
Mytchett	11	4%	527%	69	11.5%
Other	6	2%	83%	11	2%
Not given	17	6%	-71%	5	1%
Total	289	100%	105%	592	100%
Flight Numbers	20415		3%	21020	



6. Results & Discussion

Although the noise abatement trials have been the most substantial element of the Quiet Flying Programme, TAG has introduced a number of measures since its inception as follows;

- Delaying engine starts and encouraging early engine stops to minimise the noise created by aircraft on the ground.
- Offering free use of the quiet Fixed Electrical Ground Power Units located around the apron to minimise the use of aircraft Auxiliary Power Units.
- Encouraging rolling take-offs to minimise power required on runway.
- Minimising use of reverse thrust by controller encouragement to use full length runway when landing.
- Work with Flight Safety International to ensure that all students are aware of Farnborough Quiet Flying Programme.
- Publicise airports quiet credentials on all company literature.
- Develop Quiet Flying Programme ground school with associated literature for all pilots using the airport.

Farnborough is a growing airport and it is recognised that a greater number of flights has the potential to increase annoyance for the local community. Total number of movements over the 3 periods of the trial is as follows;

- Pre–trial; May 06 to Jan 07 19430
- Phase 1; May 07 to Jan 08 23054
- Phase 2; May 08 to Jan 09 20135

During phase 2 of the trial 53% of runway 24 departures have used the southbound route.

Results from the various aspects of the noise abatement trials are as follows;

24 Arrivals

Instigating the procedure where all VFR aircraft must be established on final approach before 3 nm from touchdown has ensured the aircraft is trimmed and configured to make the quietest approach possible. This is particularly true for visual approaches where the visual impact had previously caused annoyance.

Complaints associated with 24 arrivals increased by 37% during phase 1 compared with the similar pre-trial period, with a 26% increase in phase 2 against the pre-trial period.

06 Departures

The straight ahead 2 nm DME before turning procedure has enabled the majority of aircraft to be higher has they climb over the residential areas of Farnborough.

It is much simpler to police and gives a greater certainty to the community.

Complaints associated with 06 departures did not increase during phase 1 when compared to the similar pre-trail period but there was a 205% increase in phase 2. This increase may have been influenced by prevailing weather conditions throughout May & June 2008 during which 06 was the runway in use for the majority of the time, an unusual occurrence.

06 Arrivals

In terms of ATC, this aspect of the trial has been the most difficult to implement. The proximity of RAF Odiham and its associated airspace and traffic means that establishing before 3 nm can sometimes result in that distance reducing.

Complaints associated with 06 arrivals increased by 89% during phase 1 compared with the similar pre-trial period, but the increase reduced to 30% in phase 2 against the pre-trial period.

24 Departures

This aspect of the trial has proved the most controversial with an increase in complaints associated with 24 departures of 440%. While some credence should be given to the increase in overall movements and an exceptionally heavy use of runway 24 during the summer of 2006, feedback from the residents of Church Crookham meant that the group had to revisit this aspect.

It became clear that the initial aim of reducing the impact on the greatest number of people on the ground and giving more certainty to airborne aircraft tracks, was not being achieved with this procedure and so work was undertaken by TAG to try to overfly some of the uninhabited army land to the south of Church Crookham and balance a reduction in noise nuisance incurred by other sections of the community by 'sharing the load'.

The initial objective of the phase 2 was for those aircraft with a southbound destination to fly over an 'ATC significant point' which would guarantee certainty of track over the army land. Unfortunately this was ruled out due the nature of the uncontrolled airspace around the airport and so a procedure involving a bearing turn was initiated to give a corridor of tracks.

A map showing a typical days departure tracks from runway 24 is shown in **Appendix 3**.

Data gathered from the 2 monitors showed that Lmax at the Twelseldown monitor was reduced by an average of 6.3dBA when the southbound route was exclusively flown, with SEL reducing by 5.4dBA. This is illustrated by the map shown in **Appendix 4**.

Tables 3 & 4 give a more detailed analysis of how this data was recorded using specific aircraft types.

Table 3 – Mean Lmax readings from specific aircraft types from portable and Tweseldown monitors

		Portable NMT Mean Lmax Readings (under NPR S)					Tweseldown NMT Mean Lmax Readings (under NPR N)				
Type	Route	Min	Max	Range	Mean	(NPRS - NPRN)	Min	Max	Range	Mean	(NPRS - NPRN)
H25B	NPR N	59.1	82.4	23.3	67.6	5.0	69.8	87.2	17.4	78.4	-9.1
	NPR S	70.6	75.6	5.0	72.6		65.5	72.9	7.4	69.3	
C500	NPR N	61.6	67.6	6.0	64.8	6.0	75.0	78.5	3.5	77.0	-11.0
	NPR S	65.4	75.6	10.2	70.8		64.6	67.1	2.5	66.0	
C56X	NPR N	61.6	66.5	4.9	63.9	3.1	71.2	73.2	2.0	72.0	-6.9
	NPR S	63.2	70.5	7.3	67.0		63.2	66.5	3.3	65.1	
BE40	NPR N	66.0	69.1	3.1	68.0	2.4	72.7	81.7	9.0	76.2	-8.2
	NPR S	66.8	73.9	7.1	70.4		68.0	68.0	0.0	68.0	
GLF4/5	NPR N	60.0	70.6	10.6	64.9	6.7	65.3	82.1	16.8	75.8	-5.3
	NPR S	68.6	75.6	7.0	71.6		63.0	76.2	13.2	70.5	
LJ40/45	NPR N	59.5	65.1	5.6	63.1	10.0	67.2	76.1	8.9	70.4	-3.8
	NPR S	69.9	77.4	7.5	73.1		65.5	67.3	1.8	66.6	
B461/2/3	NPR N	61.3	69.6	8.3	64.5	N/A	73.8	81.6	7.8	77.3	N/A
	NPR S	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
ALL FLIGHTS	NPR N	57.8	82.4	24.6	65.4	7.6	65.3	91.5	26.2	75.6	-6.3
	NPR S	63.2	88.2	25.0	73.0		63.0	84.4	21.4	69.3	

Table 4 – Mean SEL readings from specific aircraft types from portable and Tweseldown monitors

		Portable NMT Mean SEL Readings (under NPR S)					Tweseldown NMT Mean SEL Readings (under NPR N)				
Type	Route	Min	Max	Range	Mean	(NPRS - NPRN)	Min	Max	Range	Mean	(NPRS - NPRN)
H25B	NPR N	68.2	90.5	22.3	76.2	4.2	79.8	94.6	14.8	86.0	-7.4
	NPR S	78.7	83.5	4.8	80.4		76.3	81.3	5.0	78.6	
C500	NPR N	69.8	74.9	5.1	72.7	6.3	82.9	87.8	4.9	84.8	-9.5
	NPR S	74.4	82.9	8.5	79.0		72.5	78.0	5.5	75.3	
C56X	NPR N	70.1	76.3	6.2	73.3	2.0	79.0	80.6	1.6	80.0	-7.2
	NPR S	74.1	76.2	2.1	75.3		71.3	74.3	3.0	72.8	
BE40	NPR N	74.7	79.9	5.2	76.9	1.6	82.4	87.0	4.6	84.5	-7.9
	NPR S	76.9	80.1	3.2	78.5		76.3	76.9	0.6	76.6	
GLF4/5	NPR N	65.2	79.4	14.2	73.1	7.4	72.0	89.1	17.1	83.7	-4.7
	NPR S	78.0	84.5	6.5	80.5		72.4	84.3	11.9	79.0	
LJ40/45	NPR N	66.6	74.8	8.2	72.2	9.1	75.8	83.0	7.2	79.2	-4.7
	NPR S	78.0	85.2	7.2	81.3		73.0	75.5	2.5	74.5	
B461/2/3	NPR N	70.2	79.7	9.5	75.0	N/A	84.2	89.5	5.3	86.3	N/A
	NPR S	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
ALL FLIGHTS	NPR N	65.2	90.5	25.3	74.2	6.9	72.0	95.3	23.3	83.6	-5.4
	NPR S	74.1	94.9	20.8	81.1		71.3	94.1	22.8	78.2	

As expected from the monitor comparison results shown in **Appendix 4**, those locations nearest the northern route receive a reduction in both Lmax and SEL when the southbound route is exclusively flown, while those nearest southbound route receive an increase in noise, therefore confirming the 'share the load' objective.

Table 5 below shows the results of the data gathered at the various locations by the portable monitor when compared against the fixed monitor at Twelseldown. By comparing the difference in noise from the fixed Tweseldown monitor to the data gathered by the portable monitor at the various locations, it is proved that there is generally a greater difference in noise the further the specific location is from the southbound track.

Table 5 – Mean difference of Lmax & SEL readings from runway 24 departures against Twelseldown Monitor at specific locations

		Mean Lmax diff dB(A)	Mean SEL diff dB(A)
Moore Road	NPRN	8.2	6.4
	NPRS	13.4	13.3
	Difference	5.2	6.9
Ewshot Lane	NPRN	4.9	4.7
	NPRS	6.7	6.7
	Difference	1.8	2.0
Kestrel Close	NPRN	14.5	11.8
	NPRS	3.7	3.3
	Difference	-10.8	-8.5
Church Crookham Infants School	NPRN	9.3	7.8
	NPRS	12.6	10.0
	Difference	3.3	2.2

Heatherside Infants School	NPRN	8.7	9.6
	NPRS	17.5	26.4
	Difference	8.8	16.8
Tweseldown Infants School	NPRN	1.8	1.5
	NPRS	8.5	7.6
	Difference	6.7	6.1

Further analysis of the data is shown in tables 6 (Lmax) & 7 (SEL) which examines noise for the aircraft that registered the highest recorded levels at each location during the monitoring periods.

Table 6 – Mean difference of Lmax readings at specific locations for common types using the Airport.

	Route	% of aircraft triggering Tweseldown NMT	% of aircraft triggering Portable NMT	Highest recorded Lmax (Portable)	Highest recorded Lmax (Tweseldown)	Diff in Lmax between Tweseldown and Portable	Aircraft type
Moore Road	NPRN	91%	88%	75.4	72.6	-2.8	C25A
	NPRS	70%	29%	70.2	84.5	14.3	B737
Ewshot Lane	NPRN	92%	90%	77.0	76.9	-0.1	B462
	NPRS	83%	77%	78.2	79.4	1.2	GLF4
Kestrel Close	NPRN	94%	55%	68.0	79.0	11.0	B462
	NPRS	88%	93%	77.9	70.7	-7.2	H25B
Church Crookham Infants School	NPRN	100%	70%	77.6	78.7	1.1	F900
	NPRS	94%	25%	64.8	82.3	17.5	GLEX
Heatherside Infants School	NPRN	93%	3%	70.5	74.6	4.1	C550
	NPRS	71%	0%	no data	84.9	n/a	FA7X
Tweseldown Infants School	NPRN	90%	78%	79.2	83.1	3.9	GLEX
	NPRS	84%	62%	80.9	85.2	4.3	MD82

Table 7 – Mean difference of SEL readings at specific locations for common types using the Airport.

	Route	% of aircraft triggering Tweseldown NMT	% of aircraft triggering Portable NMT	Highest recorded SEL (Portable)	Highest recorded SEL (Tweseldown)	Diff in SEL between Tweseldown and Portable	Aircraft type
Moore Road	NPRN	91%	88%	83.8	79.9	-3.9	C25A
	NPRS	70%	29%	79.5	92.3	12.8	B737
Ewshot Lane	NPRN	92%	90%	84.8	86.0	1.2	B461
	NPRS	83%	77%	85.4	92.0	6.6	B738
Kestrel Close	NPRN	94%	55%	88.1	85.7	-2.4	GLF4
	NPRS	88%	93%	85.7	83.1	-2.6	F900
Church Crookham Infants School	NPRN	100%	70%	85.6	86.9	1.3	F900
	NPRS	94%	25%	76.0	79.6	3.6	LJ45
Heatherside Infants School	NPRN	93%	3%	76.7	82.4	5.7	C550
	NPRS	71%	0%	no data	93.3	n/a	FA7X
Tweseldown Infants School	NPRN	90%	78%	87.2	89.8	2.6	GLEX
	NPRS	84%	62%	89.3	95.1	5.8	MD82

N.B.

The data contained within the tables above is taken from actual data collected from the fixed Noise Monitoring Terminal and the portable Noise Monitoring Terminal during a number of different monitoring periods. When analysing these data sets it should be noted that there are a number of variables that must be taken in to account:

- ★ Monitoring periods at each site were for approximately 4 days (due to NMT battery performance).
- ★ Monitoring was carried out between August '08 and January '09 and therefore meteorological conditions were not constant throughout. Changes in cloud cover, wind speed and wind direction can affect the levels aircraft noise recorded and perceived. Additionally temperature, wind speed and wind direction can also influence the operational performance of aircraft.
- ★ The number of flights operated during each monitoring period is variable due to the unscheduled nature of airport operations.
- ★ The runway in use during the monitoring periods was variable to the previously noted meteorological variations and hence the number of runway 24 operated departures also varies across different monitoring periods (i.e. some data sets are less in number even though the duration of the monitoring period was comparable).
- ★ The locations for the portable noise monitor are not at the same altitude (above mean sea level) as each other or in comparison to the fixed Noise Monitoring Terminal at Tweseldown Racecourse
- ★ The environment in which the portable Noise Monitoring Terminal is placed can affect the noise levels recorded. This is due to surrounding structures that can cause reflection of noise and hence altered readings e.g. walls, fences, trees, etc.
- ★ Due to the nature of the Noise Abatement Procedures in use at Farnborough Airport, aircraft do not follow the same precise track on each departure. Some variation will occur and as a result, a corridor of departure tracks becomes apparent. The noise levels recorded at any given point will therefore be influenced by the position within the acceptable corridor than each recorded departure track has achieved.
- ★ The range of aircraft types operated at Farnborough is great, as is the range of performance.

Complaints associated with 24 departures rose by 440% in Phase 1 when compared with the similar pre-trial period, confirming the disturbance associated with Phase 1 of the trial. During phase 2 this increase had dropped to 269% against the pre-trial period.

7. Conclusion & Recommendations

The work of the Quiet Flying Programme can be broadly split into two sections; ground mitigation and flying mitigation.

It is the group's belief that many of the initial concerns around ground noise have now been effectively addressed so that ground operations at the airport in terms of noise are better policed since the beginning of the trial.

Noise generated by flight operations was the main concern of the community and the group believes that some degree of success has been achieved.

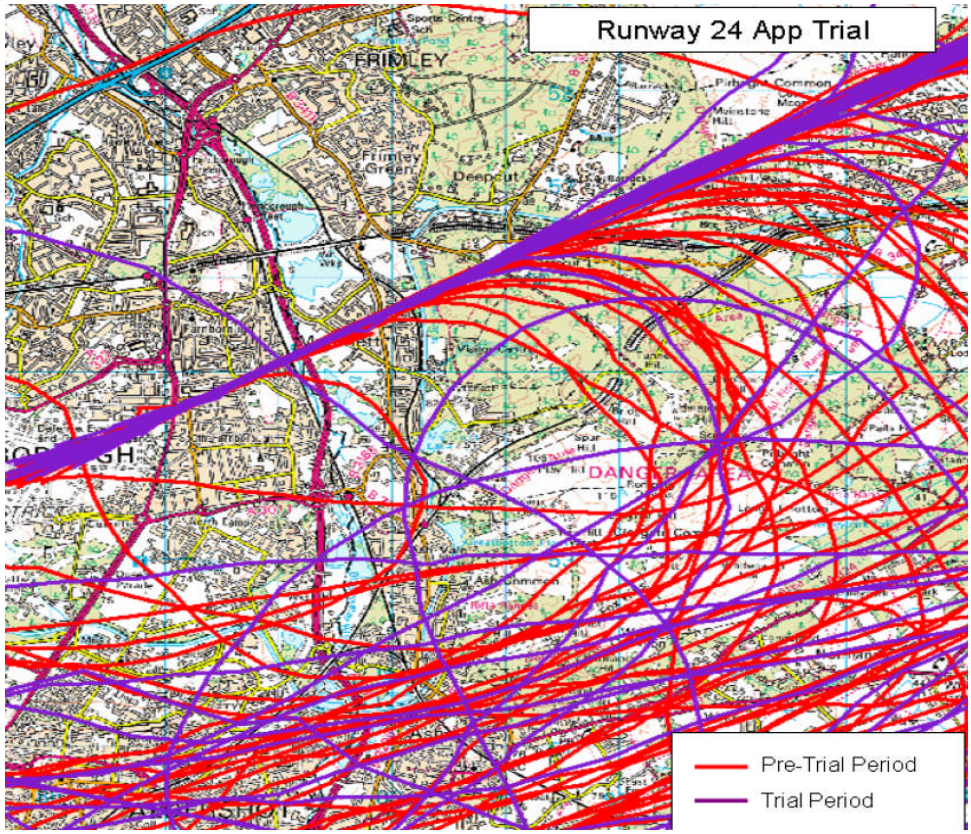
The fundamental difficulty in tackling this issue is the airspace environment surrounding the Airport. Farnborough has an ATZ of 2.5 nm radius (centred on the middle of the runway) to an altitude of 2000ft. Other controlled areas of airspace around Farnborough include Blackbushe, Odiham, Fairoaks and several periodic military danger zones. The rest of the airspace is Class G uncontrolled airspace in which anyone can fly, and do not have to speak to ATC at Farnborough and effectively become 'unknown' traffic. In addition to airfields with controlled airspace, Lasham, one of the busiest gliding sites in the world is close by.

Air Traffic Control at Farnborough are legally required to maintain safety distances, both vertically and horizontally, between ‘known’ traffic (i.e. aircraft they are talking to) and ‘unknown’ traffic, which accounts for the vast majority of ‘noise cancelled’ flights at Farnborough.

The other issue surrounding airspace is the inability to design and implement standard approach and departure routes. At all the larger commercial airports, certainty of aircraft tracks is achieved due to the class of controlled airspace that surrounds these airports. This allows the CAA to approve the use of standard routes that will be followed every time. When TAG approached the CAA prior to Phase 2 of the runway departure trial, track certainty in the form of a notified ‘significant point’ was refused due mainly to the uncontrolled nature of the airspace surrounding our ATZ.

One long term objective might be to apply to the CAA for an Airspace Change Proposal. This is a formidable piece of work that may result in an area of controlled airspace, bigger than the existing ATZ that would allow standard approach and departure routes to be implemented. Best estimate for this is a 4 year project which would require consultation of all airspace users in the area, including the military and which has no guarantee of being approved. TAG is currently considering this option.

For arriving aircraft, the legal requirement for aircraft to be established on the ILS is not less than 5 nm (CAP 493, Manual of Air Traffic Services Part 1) which is a mandatory document and has always been in use at Farnborough. However, the procedure that required aircraft flying visually to establish at not less than 3 nm was introduced in Phase 1 at both ends of the runway and has removed the visual impact of a manoeuvring, tightly turning aircraft particularly for runway 24 arrivals as shown in the map below. Approximately 8% of aircraft flew a visual approach prior to the trial with a reduction to approximately 4% in 2008.



For departing aircraft, the implementation of the procedure for runway 06 to stop any turns before 2 nm after take-off has lead to the majority of aircraft being higher as they pass over residential Farnborough. Aircraft that are flying straight can generally be said to be less noisy than an aircraft carrying out a turn and certainly the visual impact is less widely spread. Using altitude data from the BBJ type, the largest aircraft allowed to use Farnborough, it is shown that when passing over the A331 (1.5 nm from take-off) the aircraft

tends to be approximately 400ft higher when proceeding straight ahead than when initiating a turn before 2 nm. (1600ft against 1200ft)

With regard to runway 24 departures we now believe there are only 5 options (not withstanding any noise abatement cancellations);

A. Return to a revised version of the original procedures that would require aircraft to reach 1800ft before turning right and leave the left turn to the pilots discretion or ATC instruction.

B. Return to a revised version of the original procedures that would require aircraft to reach 2 nm DME before turning right and leave the left turn to the pilots discretion or ATC instruction.

C. Return to Phase 1 of the trial that would send all aircraft straight ahead to 2 nm DME before turning right or left.

D. Instruct all aircraft to turn to 220° when at a height safe to do so and continue on track to 2 nm DME before turning.

E. Continue with Phase 2 of the trial with split departures decided by onward routing.

TAG believe that option A would be operationally difficult for ATC and could lead to a return to more aircraft turning right over residential Fleet & Pondtail and that option D would increase workload dramatically for pilots & ATC (northbound aircraft would have to manoeuvre to the west of RAF Odiham) and should therefore discounted.

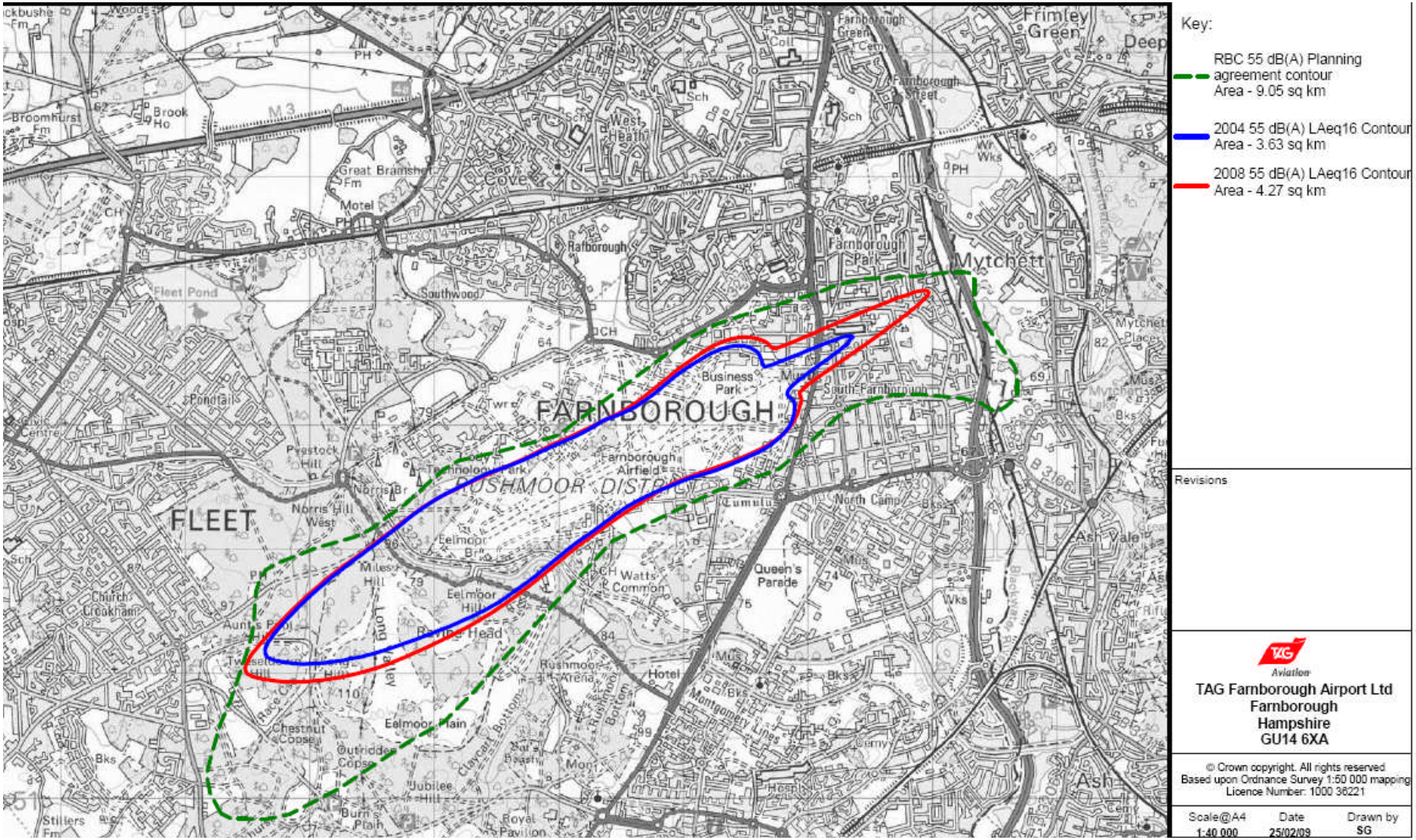
The reaction from the community to Option C was the reason that Phase 2 was initiated but gives the greatest degree of certainty.

Option B and E are of a similar nature with option E giving slightly more certainty that result in the broad corridor of tracks over Caesars Camp.

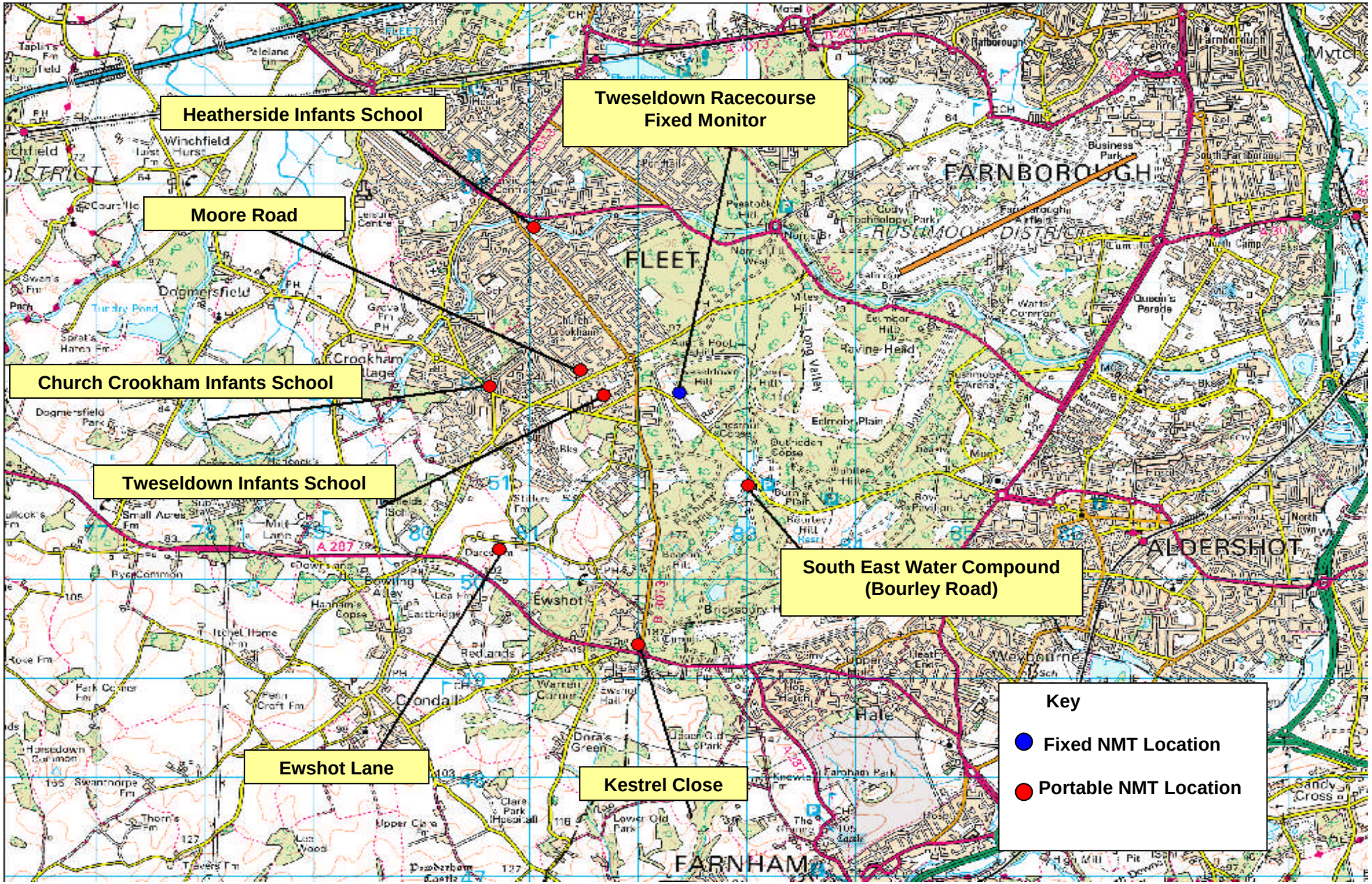
In conclusion, it has been found that noise abatement options for the residential areas close to the airport are limited due to the nature of the airspace, the legal requirements of the CAA and the unscheduled nature of business aviation. TAG is conscious of trial fatigue and the additional workload it imposes on both ATC and pilots. To change to option B would require another change to publications. A large amount of data has been collected which the group would like to analyse further and would therefore recommend that we continue with the Phase 2 procedures for runway 24 departures.

TAG is grateful for the enormous amount of time and effort that the resident's representatives have given to the QFP. It should be noted that the amount of work and the understanding of some very technical complexities has been challenging, but look forward to continuing to work together to find solutions which will be acceptable.

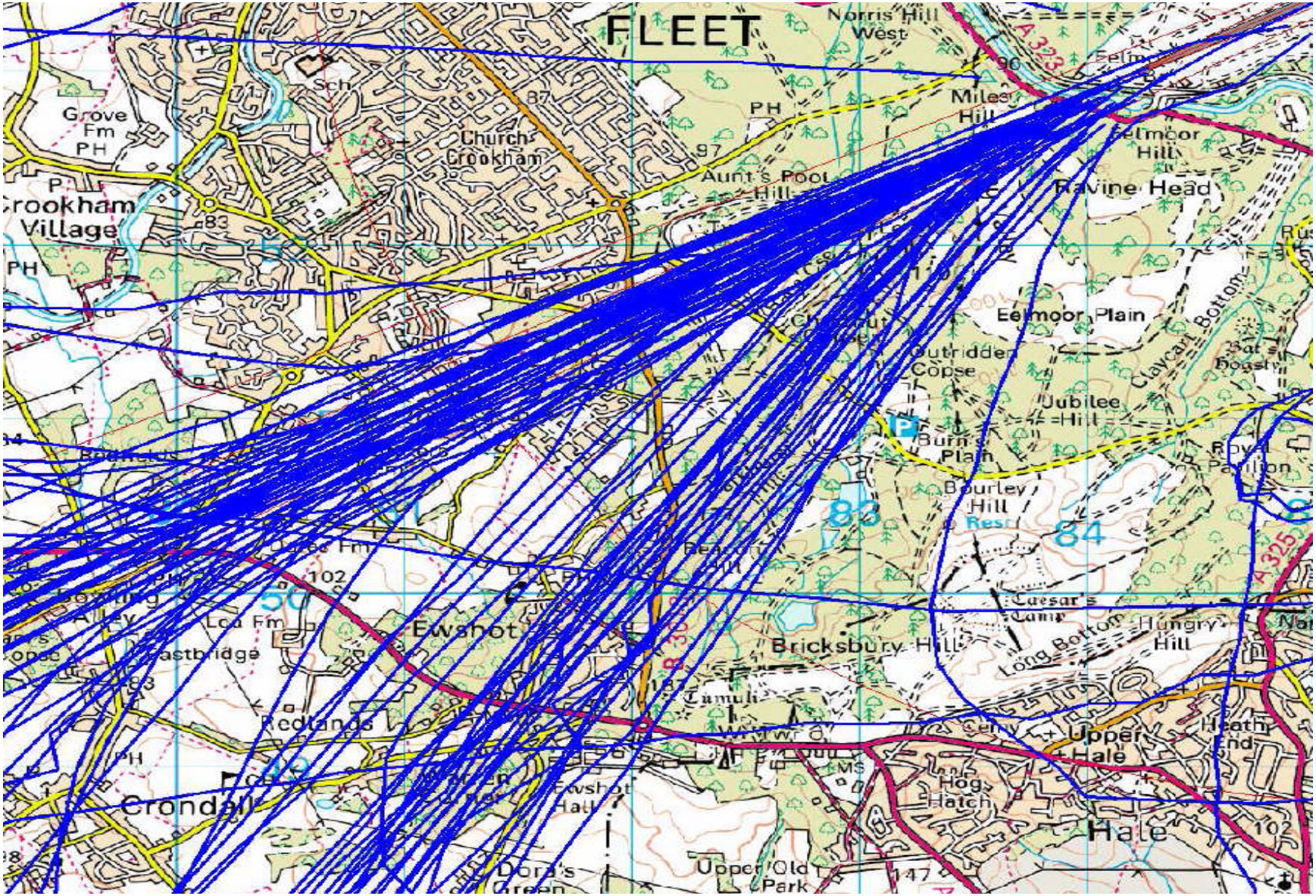
Appendix 1 – Comparative Noise Contours



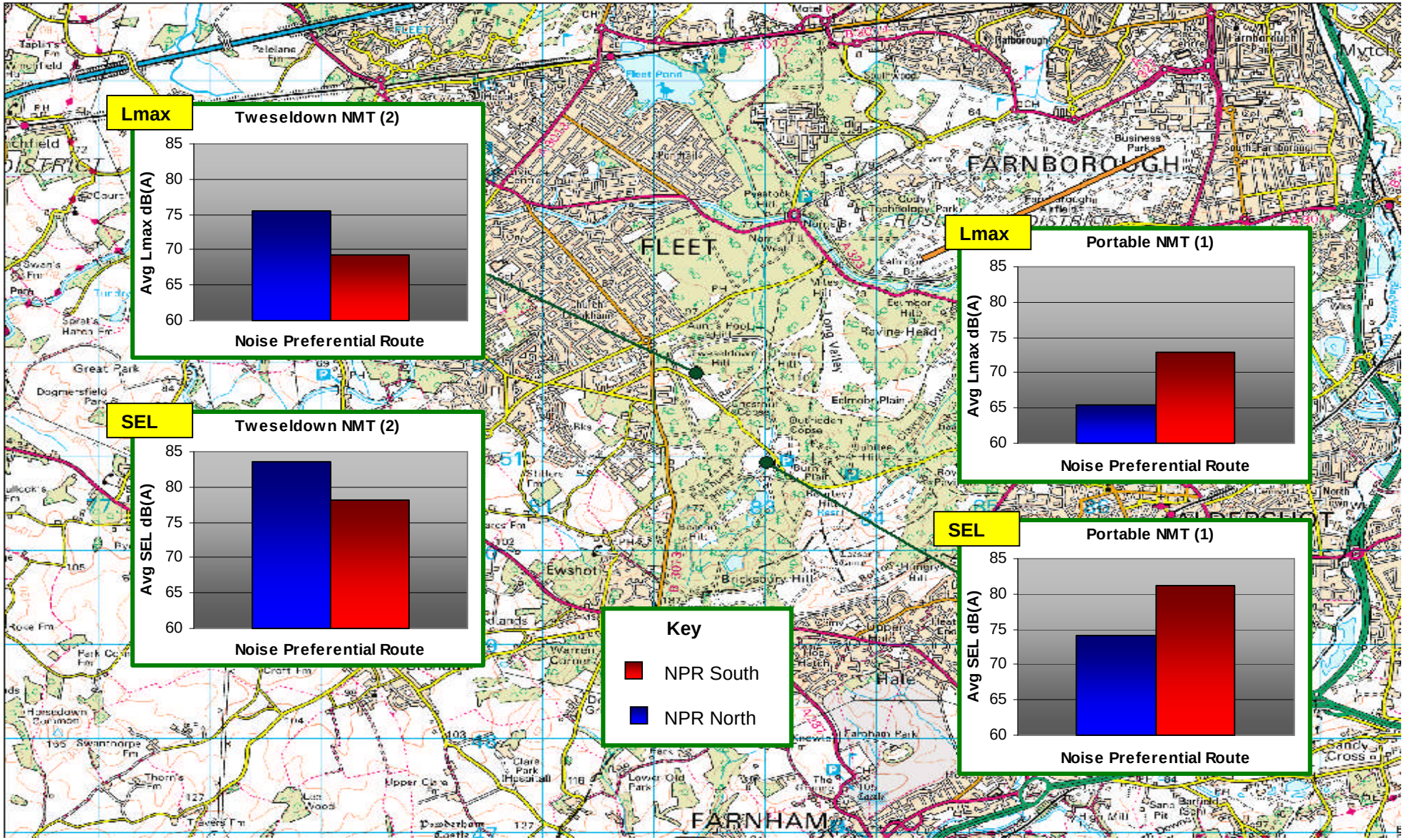
Appendix 2 - Quiet Flying Program Noise Monitoring Terminal (NMT) Locations



Appendix 3 – **Typical day showing runway 24 departures during Phase 2 of trial**



Appendix 4 - **Average Lmax & SEL of all departing aircraft from runway 24* during the monitoring period recorded by the Monitors**



Glossary of Terms

Term	Abbreviation	Definition
Aerodrome Traffic Zone	ATZ	Airspace of 2.5nm radius centred on the middle of Farnborough's runway extending from surface to 2000ft altitude. All aircraft require permission from Farnborough ATC to enter the airspace.
Altitude	ALT	The vertical distance of an aircraft measured from mean sea level.
Controlled Airspace	CAS	Airspace within which all aircraft must contact ATC and comply with their instructions. A known traffic environment; sometimes referred to as Class A, C or D airspace.
Distance Measuring Equipment	DME	The distance in nautical miles from an air navigation beacon.
Farnborough DME	I-FNB	The air navigation beacon located at approximately the mid-point of Farnborough's runway.
Glidepath	GP	That element of an ILS that provides elevation information. At Farnborough the Glidepath angle is set at 3.5 Degrees which equates to approximately 350ft of height for every 1nm from the runway touchdown point.
Height	-	The vertical distance of an aircraft measured from the earth's surface.
Instrument Flight Rules	IFR	A set of rules that permit aircraft to operate in certain airspace and within cloud. The vast majority of business aviation flights at Farnborough operate under IFR.
Instrument Landing System	ILS	A navigation system comprising two radio aerials: one providing azimuth (left/right) and one providing elevation (up/down). An ILS provides precision guidance to an aircraft from approximately 10nm and 3500ft to touchdown on the runway. Controllers vector aircraft towards the azimuth beam and either the pilot or onboard systems ensure the aircraft follows both beams accurately.
Localizer	LLZ	That element of an ILS that provides azimuth information.
Maximum Take-off Weight Authorized	MTWA	The maximum weight at which an aircraft is permitted to take-off.
Nautical mile	nm	A distance used in aircraft navigation. One nautical mile is equal to 1.15 nm or 1.85 kilometres.
Track	-	The flight-path of an aircraft as projected on the earth's surface in relation to (normally) magnetic north.
Uncontrolled airspace	-	Airspace within which all aircraft may operate without any reference ATC. An unknown traffic environment; sometimes referred to as Class F or G airspace.
Visual Approach	-	An approach made by an aircraft operating under IFR, but one whereby the pilot elects to fly without reference to navigation aids (i.e. ILS).
Visual Flight Rules	VFR	A set of rules that permit aircraft to only fly clear of cloud and within defined visibility limits. Very few business aviation flights operate at Farnborough under VFR.