HEPWORTH
ACOUSTICS
Noise and Vibration Consultants

FARNBOROUGH AIRPORT
NOISE IMPACTS OF BUSINESS AVIATION

On behalf of:

Rushmoor Borough Council

Report no: 30432.1v2

October 2009

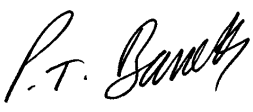
Report No. 30432.1v2

October 2009

FARNBOROUGH AIRPORT
NOISE IMPACTS OF BUSINESS AVIATION

Report prepared by:
Hepworth Acoustics Ltd
5 Bankside
Crosfield Street
Warrington WA1 1UP

On behalf of:
Rushmoor Borough Council

Report prepared by: **Peter Hepworth BSc FIOA – Managing Director**	
Report checked by: **P Bassett BSc MSc MIOA – Technical Director**	

CONTENTS

1.0 INTRODUCTION

1.1 Hepworth Acoustics was commissioned by Rushmoor Borough Council to carry out an assessment of noise impacts of business aviation at Farnborough Airport.

1.2 The assessment has been commissioned in relation to the preparation by the Council of the Farnborough Airport Area Action Plan and the Core Strategy. The aim of the project is to provide the evidence base on noise issues for the policies within the proposed documents.

1.3 This report provides the full documentation of the study carried out. A brief introduction is provided to the background of business aviation use of the airport to provide the context for the current study. The current controls on airport operations relating to noise are discussed. Relevant guidance on the assessment of aircraft noise impact is discussed in the context of existing noise levels and future potential noise levels if increased movements at the airport are allowed. An assessment is made of alternative noise control options, and finally, recommendations are made for noise policies to be included in the Farnborough Airport Area Action Plan

1.4 In addition to this report, a separate non-technical summary report is available.

1.5 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 BRIEF

2.1 The tender document from Rushmoor Council provided the following aim for the project:

> *In summary, the aim of the project is to prepare a study of the noise impacts of business aviation at Farnborough Airport, providing clear and robust evidence on the current and predicted effects. This is to support the development and consideration of options for the future of the Airport.*

2.2 The following objectives for the project were provided:

> *1. In the context of current annual flight movements and aircraft mix, to verify the existing noise and disturbance impacts of the Airport;*
>
> *2. To consider this impact in the context of options for increased annual flight movements of;*
>
> *i) 35,000*
> *ii) 50,000*
> *iii) 60,000+*
>
> *3. To consider the effect of potential future restrictions on weight and types of aircraft (including helicopters) on noise and disturbance, within the parameters set out under point 2 above;*
>
> *4. Assessment of alternative means of seeking to control the impact of noise and disturbance on the surrounding area (e.g. noise budget approach).*

2.3 This report deals with the business aviation operations associated with the airport. Other aviation uses of the airport such as the SBAC airshow, military use and the DERA Flying Club are referred to, but it was not part of this brief to consider any limits on these operations. The other land uses on the airport site are also not included in this assessment.

3.0 DEVELOPMENT OF BUSINESS AVIATION AT FARNBOROUGH AIRPORT

3.1 Farnborough Airport has a long history of aviation use and developed as the home of the Royal Aerospace Establishment. Farnborough Airport was declared surplus to Ministry of Defence requirements in 1991. The first business aviation operator at the airport was established in 1989. In 1998, TAG was confirmed as the future operator of the business aviation airfield.

3.2 Current Council policy on the use of the airport is contained in the Rushmoor Local Plan Review (1996-2011). A Local Plan Inquiry for this document was held in 1998 and the document was adopted in August 2000. This document contains a number of policies specifically relating to flying operations at the Airport.

3.3 In October 2000, TAG Farnborough was granted planning permission for the use of the airport for business aviation and various works associated with bringing the airport up to CAA standards. This planning consent, together with the associated 2000 Deed, introduced a number of controls on the flying operations (and other noise generating activities) at the airport. These controls specified limits on the overall numbers of business aviation movements including a restriction on the number of movements at weekends and bank holidays.

3.4 In October 2005, a planning application was submitted by TAG Farnborough to increase the number of movements at weekends and bank holidays, whilst keeping within the overall annual movement limit. The application was rejected by the Council in June 2006. Following a public inquiry in 2007, planning permission for the increase was granted in 2008.

3.5 TAG Farnborough commenced public consultation in 2008 on a Master Plan for the development of the airport to 2019. This has lead to a planning application in June 2009 for an increase in the number of business aviation movements at the airport to 50,000 per annum by 2019.

4.0 CURRENT NOISE CONTROLS AT THE AIRPORT

4.1 Farnborough Airport is subject to a number of restrictions and measures which directly and indirectly limit the noise exposure of surrounding areas. The restrictions and measures are generally either planning conditions or clauses in the 2000 Deed relating to the use of the Airport. The Rushmoor Local Plan Review (1996-2011) contains policies relating to noise from the airport. Most, but not all, of these policies have been translated in to planning conditions. In addition, some noise control initiatives have been developed by the operator as part of the work carried out for Farnborough Aerodrome Consultative Committee. A summary of the current noise control measures is given below.

4.2 The planning consent of October 2000 contained a noise limit for operations at the Airport, planning condition 10. This was carried forward in the 2008 consent following the public inquiry. The condition is shown below. Further details in relation to the noise contours were provided in the 2000 Deed.

> *The number of aircraft movements pursuant to this permission shall not result in levels of noise exceeding those that would be generated by 20,000 movements per annum of a mix of aircraft similar to the mix of civil aircraft movements to and from Farnborough Aerodrome in 1997.*

4.3 The original planning limit on numbers of aircraft movements has been amended by the 2008 consent. It now effectively reads (for 2009 and beyond)

> *No more than a total of 28,000 aircraft movements per annum shall take place, of which no more than 5,000 movements shall be at weekends and Bank Holidays. Furthermore, no more than 270 aircraft of the 1,500 larger aircraft movements shall take off or land at weekends and bank holidays.*

4.4 The hours of flying at the Airport are restricted by a planning condition that was carried forward to the 2008 consent.

> *All flying pursuant to this permission shall only take place between 07:00 – 20.00 hours on weekdays and between 08:00 – 20.00 hours on Saturdays, Sundays and Bank Holidays,*

except in an emergency. No flying pursuant to this permission shall take place on Christmas Day and Boxing Day.

4.5 The hours of maintenance at the Airport are restricted by a planning condition that was carried forward to the 2008 consent.

The maintenance of business aviation aircraft shall only take place between 07:00 – 20.00 hours on weekdays and between 08:00 – 20.00 hours on Saturdays, Sundays and Bank Holidays, except in an emergency. No maintenance shall take place on Christmas Day and Boxing Day.

4.6 The type of flying is also restricted by condition in the 2000 planning consent. This condition has been carried forward to the 2008 consent.

No bulk freight services, scheduled passenger services, or "inclusive tour" charter flying shall take place. No training or recreational flying (other than recreational flying by the DERA Aero Club or essential familiarisation, training and flying checks by aviation crews) shall take place.

4.7 The restrictions on freight services are amplified in the 2000 Deed. Section 5 of Schedule 1 of the Deed specifies that no aircraft shall carry more than 100k (presumably 100kg) of freight in to or out of the Aerodrome, and that no more than 100 aircraft movements a year may involve the transportation of racehorses.

4.8 The size of aircraft is restricted by a 2000 planning condition that has been carried forward to 2008.

With the exception of up to 1,500 movements per annum by aircraft not exceeding 80,000 Kg maximum take-off weight, no aircraft exceeding 50,000 Kg maximum take-off weight and no helicopters exceeding 10,000 Kg maximum take-off weight shall take off or land at the Aerodrome pursuant to this permission.

4.9 Policy FA2.2(A) of the Rushmoor Local Plan Review (1996-2011) contains a restriction of:-

No flying by aircraft with an average EPNdB greater than 98.9 at maximum take off weight.

4.10 In addition to the above EPNdB limit, the 2000 Deed Schedule 1 Section 2c contains a clause that would prohibit the movement of aircraft that give rise to a Sound Exposure Level (SEL) greater than an amount to be agreed with the Council. This clause does not appear to have been implemented.

4.11 The 2000 Deed also includes a number of other noise controls that are not replicated in planning conditions or the Local Plan. The Company banned Chapter 2 aircraft from using the airport from 1 January 2001. Preferred Noise Routes have been agreed with the Council, and trials have been carried out to attempt to refine these routes. A track monitoring system is in place and the Company has committed to enforcing compliance with the preferred noise routes. Further requirements relating to the use of reverse thrust, engine testing, the use of Auxiliary Power Units (APU), noise monitoring, noise prediction modelling and reporting are included in the 2000 Deed. Performance monitoring reports are submitted by the Company to the Council and are published on the Council website.

4.12 The 2000 Deed also includes a commitment by TAG to *"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 determined at the beginning and end of rolling five-Year periods."*

4.13 A scheme for the provision of sound insulation to residential, healthcare and academic premises is specified in the 2000 Deed, but no properties have been assessed as meeting the noise level requirements for this work under the current planning consent.

4.14 The 2000 Deed also contained an obligation on Rushmoor Council to set up an Airport Consultative Committee in consultation with TAG. The Farnborough Aerodrome Consultative Committee was duly set up and has been operating for a number of years. The Committee consists of 24 members and a chairman. The 24 members are equally divided between representatives of Airport Users, Local Authorities and Local Interest Groups. The Quiet Flying Programme that has been set up by TAG reports to the Committee. The Quiet Flying

Programme has been set up to investigate a number of noise issues including changes to flight routing to determine whether or not these would reduce noise impact from airport operations.

5.0 NOISE GUIDELINES AND CRITERIA

5.1 In undertaking the assessment of noise, account has been taken of the following documents:

- Rushmoor Local Plan Review (1996 – 2011)
- Planning Policy Guidance, PPG 24 'Planning and Noise' (1994)
- Department of Transport, A Study of Community Disturbance Caused by General and Business Aviation Operations, (1988)
- World Health Organization – Guidelines for Community Noise (1999)
- MVA Consultancy - Attitudes to Noise from Aviation Sources in England – (2007)
- Attitudes to Noise from Aviation Sources in England Non SP Peer Review – (2007)

5.2 These documents contain current guidance on aviation noise levels and provide a context for the assessment of the noise aspects of the future use of the airfield. Government policy on aviation and airfields is not specifically discussed, although it is acknowledged that the policy envisages continued growth of commercial flight numbers including business aviation flights.

5.3 The aircraft noise requirements of the Rushmoor Local Plan Review (1996-2011) are specified in Section 4 where they are not reflected in the 2000/2008 Planning Consent or 2000 Deed.

5.4 The latest guidance for assessing the impact of noise for planning purposes is set out in PPG 24 'Planning and Noise' (PPG 24). This document recommends that $L_{Aeq, 16h}$ (07:00 – 23:00) be employed for the assessment of aircraft noise, but that for small aerodromes an assessment should not rely solely on L_{Aeq} where this is based on less than about 30 movements per day. The numbers of aircraft movements allowed under the current planning consent are well over the 30 movements per day referred to above.

5.5 The impact of aircraft noise on proposed new residential development is set out in PPG 24. Whilst not directly relevant to this situation, the criteria for new residential developments help to put the noise levels in context. The noise exposure categories in PPG 24 for sites exposed to airborne aircraft noise are set out in Table 1.

Table 1: PPG 24 Noise Exposure Categories for Airborne Aircraft Noise

	Noise Exposure Category (dB L_{Aeq})			
	A	**B**	**C**	**D**
Daytime (0700-2300 hrs)	<57	57-66	66-72	>72

5.6 For Category A - Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.

5.7 Category B -Noise should be taken into account when determining planning applications and, where appropriate conditions imposed to ensure an adequate level of protection against noise.

5.8 For Category C - Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.

5.9 For Category D -Planning permission should normally be refused.

5.10 The level of 57 dB L_{Aeq} was chosen as the boundary for NEC A and NEC B because previous noise measurement and social survey research had identified this level as the onset of annoyance for aircraft noise. This level was taken from the Aircraft Noise Index Study (ANIS) that was published in 1985.

5.11 Further guidance on acceptable levels of environmental noise is provided in the World Health Organization (WHO) 'Guidelines for Community Noise'. The WHO guidelines suggest that *'to protect the majority of people from being **seriously** annoyed during the day time the sound pressure level in outdoor living areas should not exceed 55 dB $L_{Aeq,16h}$*'. It also suggests that '*to*

*protect the majority of people from being **moderately** annoyed during the day time the sound pressure level in outdoor living areas should not exceed 50 dB $L_{Aeq,16h}$'.*

5.12 The Department of Transport Study of Community Disturbance Caused by General and Business Aviation Operations made a number of findings related to specific aircraft noise levels. It found that below about 50 dB L_{Aeq}, General Aviation noise disturbance does not vary noticeably with changes in aircraft noise level. General Aviation noise disturbance increases noticeably at aircraft noise levels above 50 dB $L_{Aeq,}$ and at higher levels General Aviation noise is significantly more disturbing than noise around major commercial airports. This study included a number of airfields where circuit flying was a significant part of the noise exposure. This is not the case at Farnborough.

5.13 The most recent UK study of response to aviation noise is the Attitudes to Noise from Aviation Sources in England (ANASE) that was published in 2007. The study has been the subject of a considerable amount of debate regarding the robustness of some of its findings. It was subject to an extensive peer review process that recommended against 'using the detailed results from ANASE in the development of government policy'. However, the Department of Transport press release of 2 November 2007 confirms that the study concludes that people are more annoyed by all levels of aircraft noise than they were in 1985 when ANIS (the previous aircraft noise study) was published.

5.14 One of the main concerns expressed about the findings related to aircraft noise annoyance, was the possible impact of the scope of the study on the results of the social surveys. The ANASE study was attempting to look at the willingness of residents to put a monetary value on the reduction of aircraft noise as well as the relationship between annoyance and aircraft noise level. The monetary value element of the study involved playing tape recordings of aircraft noise to residents during a questionnaire session, after they had been questioned about their 'annoyance' responses to aircraft noise. There is concern that the annoyance response of residents could have been affected by the procedures involved in the monetary value questions.

5.15 However, at some of the questionnaire locations around Heathrow, the questions were limited to the 'annoyance' questions and the other questions and installation of a tape recorder were not carried out. These sites are referred to as the 'Restricted Sites'. The methodology for the Restricted Sites answered a number of the concerns that were expressed about the main study. Figure A9.5 in the study shows the results of the Restricted Sites in comparison with the ANIS results and the full ANASE results. These results indicate that at the Restricted Sites a given level of annoyance is occurring at noise levels approximately 3 dB(A) lower than with ANIS.

5.16 The results still need to be treated with caution, because there were differences in the questionnaires used for ANIS and all of the ANASE locations, and the order and content of questions can affect respondents' replies. However, the figures for the Restricted Sites do appear to provide an indication of the magnitude of the change in annoyance response confirmed in the press release by the Department for Transport on 2 November 2007.

6.0 NOISE IMPACT OF BUSINESS AVIATION OPERATIONS TO DATE

6.1 The first Business Aviation movements at Farnborough took place in 1989. Figures grew reasonably steadily from approx 1,000 in 1989 to around 15,000 in 2000, and 26,500 in 2007. The military Procurement Executive flying ceased in 1994, with military movements of approx 7,000 before this time reducing to around 100 per annum now.

6.2 TAG has produced an Environmental/Performance Monitoring Report each year since 2003. This has included information on noise survey data, noise complaints and noise contours calculated on the basis of actual movements and flight tracks. Information on complaints and infringements of noise preferential routes has been added over the years, although not always with consistent categorisation of information.

6.3 The noise contours have been produced by TAG using the INM aircraft noise prediction program. The predictions have used the actual aircraft movement tracks taken from radar records and the aircraft type data obtained from Air Traffic Control. The prediction methodology was checked by the Civil Aviation Authority. However, the noise contours produced for the recent Environmental Statement (ES) submitted with the June 2009 planning application, whilst using INM, have used a number of different aircraft substitutions within INM to reflect the actual aircraft noise levels measured by the Farnborough permanent noise monitors. It is not therefore possible to directly compare the TAG noise contours with those produced in the ES.

6.4 Noise survey data has been collected from the two fixed noise monitoring terminals installed in 2003, and a mobile noise monitoring terminal. The two fixed terminals are located at Farnborough College of Technology and Tweseldown Racecourse. TAG has provided graphs of noise levels monitored at the two fixed terminals in the Environmental Reports submitted to the Council. The results of measurements from the mobile terminal have not been presented in the Environmental Reports. There has not been any documentation produced by TAG comparing INM predicted noise levels with the noise levels measured at the two fixed noise monitoring terminals, although subsequent analysis has been carried out by Bickerdike Allen

Partners (BAP) for use in the recent ES. No analysis has been provided in the Environmental Reports on trends shown by the monitoring data other than that the measurements show that average EPNdB levels from the top 10 aircraft types are well within the 98.9 EPNdB limit contained in the Local Plan policy.

6.5 Noise complaint data has been included in the TAG Environmental Reports for 2005 onwards. The figures show 116 complaints in 2005, 329 in 2006, 1075 in 2007 and 701 in 2008. It is likely that the publicity regarding the public inquiry for the increased number of weekend and bank holiday flights, and the changes to flight tracks as part of the Quiet Flying Programme have contributed to the increase in numbers of complaints, but it does seem that there is an upward trend in complaints greater than would be anticipated from the increased number of aircraft movements.

6.6 Information regarding noise abatement infringements of aircraft has also been included in the TAG Environmental Reports. The number of infringements has also increased from 14 in 2005 to 159 in 2008.

6.7 Noise contour areas have been reported in the TAG Environmental Reports for the full year from 2004 onwards. The calculations have been carried out after the event and use actual flight track data obtained from the Noise and Track monitoring system, together with the actual aircraft type (or an appropriate substitute if the aircraft type is not included in the INM database). These contours are referred to as retrospective predicted noise contours. Helicopter movements have not been modelled by TAG as the version of INM used by them does not support helicopter modelling.

6.8 The results of the contour area predictions are shown below in Table 2.

Table 2: TAG Retrospective Predicted Noise Contour Areas in km^2

Year	55 dB $L_{Aeq,16hr}$	60 dB $L_{Aeq,16hr}$
2004	3.62	1.56
2005	3.62	1.57
2006	4.87	1.98
2007	4.66	1.88
2008	4.27	1.73

6.9 The contours show an overall increase from 2004 to 2008, but not in direct proportion to the number of movements. The contours peaked in 2006 and reduced for the next two years, whilst flight numbers peaked in 2007 before reducing slightly in 2008. Noise contour areas will change from year to year, even if the number of movements and aircraft types is the same, because of weather effects. Wind speed and direction can affect aircraft performance and hence noise levels. For example, an aircraft taking off in to a strong wind will climb quicker and hence produce a smaller noise contour area than an aircraft taking off under calm conditions, which will climb at a slower rate.

6.10 The BAP noise contour predictions used in the recently submitted ES vary in a number of ways from the methodology used by TAG in demonstrating compliance with their planning obligations. The ES predictions use a different version of the INM program, have used the results of a validation exercise based on actual aircraft measurements and have also taken account of local terrain. Subsequent to the submission of the ES, calculations have been carried out which include helicopters. The overall effect of these changes is to reduce the size of the noise contours, compared with TAG predictions (and also those which form the basis of the 2000 Deed noise contours). A comparison of the TAG and BAP noise contours is shown in Table 3 below.

Table 3: Comparison of TAG and BAP ES noise contours in km^2

Scenario	**55 dB $L_{Aeq,16hr}$**	**60 dB $L_{Aeq,16hr}$**
2008 TAG	4.27	1.73
2008 BAP	3.23	1.25
2000 Deed "Farnborough Noise Budget"	9.09	4.01

6.11 It is considered that the BAP prediction methodology gives the most accurate assessment of the size of the current noise contours. This is mainly because BAP have carried out a validation exercise between the predictions and the results of the noise measurements carried out at the fixed noise monitoring terminals at Farnborough. This has identified that a number of aircraft types produce different noise levels than those indicated by the limited data within INM. Whilst some aircraft are slightly underpredicted by INM, more aircraft are overpredicted by the INM model used by TAG. This accounts for the BAP contour areas being smaller than those predicted by TAG.

7.0 NOISE IMPACT OF FUTURE EXPANSION OPTIONS

7.1 Noise predictions of contour areas have been carried out for the three movement scenarios specified by Rushmoor Council for this assessment. The contours have been produced using the same prediction methodology used by BAP for the ES noise predictions and therefore take in to account the results of the validation exercise. The results have been checked by Hepworth Acoustics. The results of the noise contour areas are shown in Table 4 below.

Table 4: Comparison of noise contours for different movement scenarios in km^2

Scenario	**55 dB $L_{Aeq,16hr}$**	**60 dB $L_{Aeq,16hr}$**
35,000 movements	4.48	1.67
50,000 movements	5.91	2.17
60,000 movements	6.84	2.50

7.2 The noise contour figures presented in Table 4 do not include helicopter movements. Following work carried out in assessing the recently submitted ES it has been established that the 55 and 60 dB $L_{Aeq,16hr}$ contour areas increase by approximately 2% as a result of adding the helicopter movements.

7.3 Comparing Table 4 with the 2000 Deed "Farnborough Noise Budget" contours shown in Table 3 shows that all three scenarios are within these contour areas. Retention of the 'Farnborough Noise Budget' contours would potentially allow an increase in business aviation movement numbers to around 100,000 per annum without exceeding the contour areas.

7.4 Information submitted within the ES for the June 2009 planning application provided noise contours for the 2019 Without Consent scenario. These contours are the maximum noise contours that could be generated within the existing planning consent, and model the maximum number of Airbus/Boeing Business Jets allowed under the consent, with the existing fleet mix of other business aviation aircraft factored up to produce 28,000 business aviation

movements in total. Subsequent to the submission of the ES, further noise contours were produced that included helicopters, the phase out of Chapter 3 aircraft and a calculation tolerance of 0.5 dB. A comparison of these contours with the current and 2000 Deed contours is shown in Table 5 below.

Table 5: Area of noise contours in sq km

Scenario	**55 dB $L_{Aeq,16hr}$**	**60 dB $L_{Aeq,16hr}$**
2008 BAP	3.23	1.25
2019 BAP Without Consent	3.80	1.44
2019 BAP Revised With Consent (including helicopters, Chapter 3 phase out and tolerance)	6.6	2.4
'Farnborough Noise Budget'	9.09	4.01

7.5 Information submitted in Section 11.6 of the ES demonstrates that the increase in Air Noise levels from 2008 to 2019 Without Consent would be in the range 0-1 dB $L_{Aeq,16hr}$.

7.6 The difference between 2019 Without Consent and 2019 With Consent would be around 1 dB for $L_{Aeq,16hr}$ for 35,000 movements, around 2 dB $L_{Aeq,16hr}$ for 50,000 movements and around 3 dB $L_{Aeq,16hr}$ for 60,000 movements.

7.7 In view of the low number of passengers per business aviation movement, it is not considered that any of the scenarios considered will lead to any perceptible increase in road traffic noise on surrounding highways.

8.0 ASSESSMENT OF NOISE CONTROL OPTIONS

8.1 In assessing continued noise control of the airport, the first question is whether the current control measures provide sufficient control for any future increase in Business Aviation movements at Farnborough. Any planning consent for increased movements would obviously need to change the movement figures contained in the current consent. However, the other main item of planning control of noise levels is the restriction on the size of noise contours that can be generated by operations at the airport. The original view of the airport operator was that the contours fixed as part of the 2000 Deed (and referenced in the Rushmoor Local Plan Review 1996-2011) fixed a "noise budget" that should be applicable to future increased movements.

8.2 Now that the 1996-2011 Local Plan Review is coming to the end of its period of applicability, and the Council is in the process of formulating the Farnborough Airport Area Action Plan and the Core Strategy for the period 2006 – 2026, it is considered that it is appropriate to review this aspect of the noise control scheme in particular. In addition, in June 2009 TAG submitted a planning application to increase the number of business aviation movements allowed at Farnborough Airport, and the ES justifies the acceptability of the noise impact by stating that the "noise budget" will not be exceeded. It is therefore appropriate to consider whether the 2000 Deed noise contours are still relevant as part of Council policy for the period through to 2026.

8.3 In considering the relevance of the 2000 Deed noise contours, it is useful first of all to look at the origin of the contours referenced in the 1996-2011 Local Plan Review and 2000 Deed accompanying the planning consent. The contours were a notional set of noise contours that would occur if the 1997 fleet mix was upped to 20,000 movements per annum. However, these contours did not actually occur as a result of business aviation in 1997 or any year after. The reasons for this are that the 20,000 business aviation movements figure was not exceeded until 2006, and by 2006 all Chapter 2 aircraft had been phased out in the UK (Farnborough Airport banned Chapter 2 aircraft from 1 Jan 2001). However, as the calculations were based on the 1997 fleet mix, the 2000 noise contours included a number of Chapter 2 aircraft. The

noise contours produced by Acoustic Technology Ltd (ATL) in their report no: AT4769/1 Rev 0, which were the basis of the 2000 noise contours, used a figure of 5.2% Chapter 2 movements in the total for business aviation. However, the Chapter 2 movements have a significant and disproportionate impact on the size of the noise contours, because Chapter 2 aircraft were significantly noisier than similar sized Chapter 3 aircraft. This can be seen from the following table that is extracted from information in Table 1 of the ATL Report referenced above.

Table 6: Noise contour areas calculated by ATL

Operating Conditions	Noise Contour Areas (in km^2)		
	55 dB L_{Aeq}	60 dB L_{Aeq}	65 dB L_{Aeq}
20,000 business movements per annum, 1997 mix of business aircraft (includes DERA flying club and military)	9.09	4.01	1.72
28,000 business movements per annum, AVMAR prediction of fleet mix - no Chapter 2 (includes DERA flying club and military)	5.01	2.10	0.99

8.4 It would appear that the AVMAR fleet mix prediction and ATL predictions have turned out to be substantially correct, when compared to TAG's retrospective noise contour predictions. In 2007 there were 25,100 fixed wing business aviation movements. The TAG predictions of noise contour areas for 55, 60 and 65 dB L_{Aeq} are 4.66, 1.88 and 0.98 km^2. Therefore, the inclusion of the Chapter 2 aircraft within the calculation of the 2000 Deed contours has led to

contours that are nearly twice the area of the contours that were predicted for 28,000 movements with no Chapter 2 aircraft, using a similar methodology.

8.5 In addition to the above point about the fleet mix used in the noise contours, the BAP predictions used in the ES vary in a number of ways from the methodology used in calculating the 2000 Deed contours (and also the methodology used by TAG in demonstrating compliance with their planning obligations). The ES predictions use a different version of the INM program, have used the results of a validation exercise based on actual aircraft measurements and have also taken account of local terrain. The effect of these changes is generally to reduce the size of the noise contours, compared with earlier predictions, as shown in Table 3. The inclusion of helicopters and the effect of the phase out of Chapter 3 aircraft has a relatively small impact on noise contour size. The 2000 Deed contours do not therefore represent current best practice in producing aircraft noise contours. It is therefore considered that the original 2000 Deed contours do not provide an appropriate baseline for consideration of any future increases in business aviation movements. The fact that the ANASE study indicates that people have generally become more annoyed by aircraft noise supports the contention that it is inappropriate to keep existing 2000 Deed contours as the baseline for assessing any future increases in aircraft movements. Therefore a more appropriate baseline should be adopted for consideration of future noise impacts.

8.6 Alternative methods of noise control for the airport have been considered. The main alternative currently in use is the Quota Count (QC) system. The system was originally developed for night flights from the main London airports, and has subsequently been used at a number of other passenger airports. Aircraft are given a Quota Count (QC) based on the EPNdB noise level band for take off and landing as shown in Table 7 below.

Table 7: Quota Count noise level bands

Noise Level Band EPNdB	Quota Count QC
<84	Exempt
84 – 86.9	0.25
97 – 89.9	0.5
90 – 92.9	1
93 – 95.9	2
96 – 98.9	4
99 – 101.9	8
>101.9	16

8.7 The QC system works by a given QC allocation being specified for a certain time period, usually a night or part of a night. If a QC value of 16 is allocated for a night, the airport operator can allow either one aircraft of QC/16, two aircraft of QC/8, four aircraft of QC/4, or any combination of aircraft that does not exceed the total QC allocation. The system is analogous to the L_{Aeq} noise index in that twice as many aircraft can be allowed if they are 3 EPNdB quieter.

8.8 The night time QC system currently operating at Heathrow, Gatwick and Stansted uses a QC based noise quota and a movement limit. Therefore, the QC system does not of itself obviate the need for a movements limit.

8.9 The other main problem in using a QC limit system at Farnborough is that many of the aircraft using the airport produce a lower noise level than the lowest QC value (QC 0.25). Therefore, these aircraft would be classed as exempt from the QC scheme and would not count towards any chosen QC quota.

8.10 It is considered therefore that the QC system would not be a viable overall method of noise control for Farnborough.

8.11 It is noted that Policy FA2.2(A) of the Rushmoor Local Plan Review (1996-2011) contains a restriction of

No flying by aircraft with an average EPNdB greater than 98.9 at maximum take off weight

8.12 It is not considered that the current restriction on EPNdB level adds to the overall noise controls proposed for the AAP. It is recommended that if an EPNdB limit is to be maintained, it should be reduced to 89.9, and should be contained within a supplementary legal agreement. This reduced limit would still accommodate the Boeing and Airbus Business Jets.

8.13 In relation to other noise controls that are in place such as hours of operation and aircraft weight limits, no additional systems of control have been identified as being necessary. It is considered that the current restrictions on aspects such as hours of opening, weight limits and ground operations are appropriate and provide adequate control.

9.0 RECOMMENDATIONS

9.1 It is strongly recommended that the acceptability of any future increases in movement numbers should not be assessed against a baseline using the full 2000 Deed noise contours.

9.2 It is recommended that in considering the noise aspects of the AAP, the baseline situation should be represented by noise contours smaller than those contained in the 2000 Deed. The noise contours should take account of current government policy to utilise existing airport runways more intensively but should also take in to account the latest calculation methodologies, the results of validation measurements and the proposed phase out of Chapter 3 aircraft.

9.3 It is recommended that the noise impact of any increase in movement numbers should be controlled by a similar control mechanism to that currently in place i.e. a limit on the size of noise contours as well as a limit on aircraft movement numbers.

9.4 In the recently submitted ES, TAG's noise advisors state that in their professional experience "a change of less than 2 L_{Aeq} units would not be discernible to most people, changes between 2 and 3 L_{Aeq} units might be discernible, but would not usually be significant".

9.5 It is recommended that the future noise contour limits should be based on the 2019 With Development scenario for 50,000 movements per annum including a tolerance of 0.5 dB(A). These contours represent noise levels approximately 2 dB L_{Aeq} above those that would be experienced in the 2019 Without Development scenario. The area of the contours is between 27 and 40% smaller than the full 2000 Deed contours, as shown in Table 8 below.

Table 8: Area of noise contours in sq km

Scenario	**55 dB $L_{Aeq, 16hr}$**	**60 dB $L_{Aeq, 16hr}$**
2000 Deed Contours	9.09	4.01
Proposed Future Limit	6.6	2.4

9.6 The Proposed Future Limit contour areas shown in Table 8 can be met by the 50,000 movement scenario. This level of movements is that which has been applied for by TAG for the period up to 2019. It is not possible at this stage to accurately predict what aircraft noise levels will be for a given level of movements for the remaining period of the proposed AAP beyond 2019. This is because there may be further progress with reducing aircraft noise. It is therefore recommended that the proposed future limit noise contour shown in Table 8 should be adopted for the AAP up to 2019 with a review to be carried out at that stage for the remainder of the AAP period.

9.7 Should the above approach be adopted, it is recommended that the following additional noise requirements are included within the AAP (the current effect of these items is included in the Proposed future Limit in Table 8):

- Contour predictions should include helicopter movements (this leads to an increase of approximately 2% in the size of the noise contours)

- The contour area predictions should be specified in relation to the version of INM used and the calculation options used. All future assessment work should use the new version of INM.

- A validation exercise should be carried out each year to assess the predicted noise levels against the actual measured noise levels for aircraft landing and taking off at the airport. The validation exercise should utilise not only the data from the two fixed noise monitors but also the portable monitor to provide data for areas not covered by the fixed monitors. The latest validation data shall be used in the annual noise contour report.

9.8 In addition to the above specific recommendations, consideration of additional measures to minimise the noise impact of the use of the airport are supported. These measures could include TAG investigating whether the CAA would grant an Airspace Change Proposal to provide TAG with additional control over aircraft movements in the vicinity of the airport. A

further item that could be considered is the introduction of a system of fines for aircraft that fly non-compliant arrival or departure tracks that are not authorised by Air Traffic Control.

9.9 Consideration should be given to imposing a certified noise limit of 89.9 EPNdB on take off or arrival for aircraft using the airport. This restriction would be more appropriately contained within a supplementary legal agreement rather than the AAP. The specified noise level relates to the certified noise level for the aircraft, but could be 'corrected' to take account of the location of the noise monitoring terminals at Farnborough.

10.0 SUMMARY AND CONCLUSIONS

10.1 Hepworth Acoustics was commissioned by Rushmoor Borough Council to carry out an assessment of noise impacts of business aviation at Farnborough Airport. The assessment has been commissioned in relation to the preparation by the Council of the Farnborough Airport Area Action Plan and the Core Strategy.

10.2 The study was required to consider the noise impact of options for increased annual business aviation movements to 35,000, 50,000 and 60,000+.

10.3 An overview has been provided of noise guidelines and criteria and the current noise controls at the airport have been detailed. The current noise impact of the airport operations has been discussed based on a detailed assessment of the noise prediction and measurement data.

10.4 The potential noise impact of the options for increased annual business aviation movements has been documented.

10.5 Consideration has been given to alternative noise control options for the airport. This has concluded that the main noise controls at the airport should continue to be a combination of a movements limit and noise contour areas not to be exceeded. However, it is strongly recommended that the AAP should restrict noise contours for the period up to 2019 to those levels shown as Proposed Future Limit in Table 8.

10.6 It is recommended that the AAP should allow up to 50,000 business aviation movements per annum (including up to 8,900 at weekends and bank holidays) subject to the new noise contour areas not being exceeded. It is considered that these contours can be met with 50,000 business aviation movements per annum by taking in to account the phasing out of Chapter 3 aircraft. A review is suggested of the noise contour areas and movement limits in 2019.

10.7 A number of other detailed recommendations have been made to provide a robust scheme of noise control, and one that can deal with future changes in noise prediction methodology.

Appendix I – Noise Units and Indices

a) Sound Pressure Level and the decibel (dB)

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

b) Frequency and hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kilohertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20,000 Hz. However, the upper frequency limit gradually reduces as a person gets older.

c) Glossary of Terms

When a noise level is constant and does not fluctuate over time, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the

level is continuously varying, a number of other indices, are used. The indices used in this report are described below.

L_{Aeq} This is the A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.

SEL Referred to as the Sound Exposure Level (dB) this is the total A-weighted sound energy produced by an event and is effectively the L_{Aeq} of an event normalised to a duration of 1 second in length. SEL's can be scaled according to the number of events and can be further manipulated to provide an average noise level $L_{Aeq,T}$.

EPNdB Referred to as the Effective Perceived Noise Level. This is a measure of the noise from an aircraft movement, weighted to reflect subjective responses to aircraft noisiness.