FARNBOROUGH AIRPORT

Sections 106 and 299A
Town and Country Planning Act 1990

Annual INM7 Noise Assessment 2022
Predictive Contours January to December 2022

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FIGURES

APPENDIX

1. INTRODUCTION

1.1 In compliance with the requirements of paragraph 2.5 b), c), d) and e) of the Section 106/299A Town and Country Planning Act 1990 agreement, between Rushmoor Borough Council (RBC) and Farnborough Airport Ltd (FAL), this report provides details of the outcome of the latest Integrated Noise Model (INM) study run for business aviation operations at Farnborough.

This report is for the calendar year 2022 and includes predictive contours for 2023, based on forecast growth in movement numbers and aircraft track data from the study year.

1.2 Paragraph 2.5 of the planning agreement states:

b) At the end of the 4th Quarter in each year the INM model will be used to produce noise contours based on the actual movements in the past year and a second set of theoretical contours for the year ahead

c) These sets of contours shall be supplied to the council no later than 6 weeks after the model has been used.

d) For paragraphs 2.5 a) and c) the INM model shall use a simplified departure track representation and such simplified departure track representations shall be made after inspection of the spread of actual aircraft tracks on site.

e) For paragraphs 2.5 a) and c) the INM model shall include terrain information and at the end of each year the results shall be compared between the individual INM predicted levels with the measured levels determined by the fixed and mobile monitoring points in and around the site.

This report is intended to address the requirements of paragraph 2.5, b), c), d) and e).

1.3 The intended use of the INM, to produce noise contours relating to business aircraft movements at Farnborough, is to assess the noise impact on the surrounding area under existing conditions and the potential impact of the predicted growth of the airport as permitted by the Planning Agreement.

1.4 Civil operations at FAL are restricted to ‘daytime’ hours only (as defined by PPG 24 “Planning and Noise”). The airport is open from 07:00 to 22:00 hours on weekdays and 08:00 to 20:00 hours at weekends and bank holidays. The modelling process uses representative tracks produced from study of real track data, to construct contours that represent the time averaged noise of operations.

1.5 For this report modelling was completed using Version 7.0d of the FAA’s Integrated INM. This version of INM includes aircraft types that better represent those in operation at Farnborough Airport together with revised aircraft substitutions.

1.6 As in previous reports, the contours displayed within this report reference the work commissioned by RBC from Acoustic Technology Ltd during the consideration of the original FAL planning application. The outcome of this work established contours referred to in paragraph 2.1a of the Agreement, annotated as the “control contours” within this document.

1.7 In accordance with clause 12.1 of the planning agreement, further reductions in area of the control contours apply. The reductions are as follows:

- a 72.5% reduction of the land area within the 55dB(A) $L_{Aeq,16h}$ contour
- a 60.0% reduction of the land area within the 60dB(A) $L_{Aeq,16h}$ contour

Table 1 displays the resultant effect on the land area within the control contours.

1.8 Aircraft operations during this study period consisted of 32,598 movements of movement types required by the Planning Agreement.

2. METHODOLOGY

2.1 The core stages of the contour methodology are as follows:

- The contours in this report have been produced using the Federal Aviation Administration (FAA) software, the Integrated Noise Model (INM), version 7.0d. This version of the software was released in 30th May 2013. INM has been replaced by the FAA with the Aviation Environmental Design Tool (AEDT) as of May 2015. When using the same settings, the two models give similar results.

- As the INM software is specifically mentioned in the S106 it is considered that this is appropriate software to use when producing contours to compare with contour area limits given in the S106 unless or until FAL and RBC agree otherwise.

- FAL have provided simplified departure and arrival tracks for use in the model, which have been produced following inspection of actual track data from the Aircraft Noise and Operations Management System (ANOMS). These simplified tracks include dispersion to reflect the variations in track observed in the ANOMS data.

- For each runway there is a single modelled arrival route and a single modelled departure route. These routes include a degree of dispersion to reflect the variations in actual tracks flown.

- Local terrain has been included in the model, as it was in the previous methodology and as required by the S106, paragraph 2.5 (e).

- FAL have provided Bickerdike Allen Partners (BAP) with a log of the aircraft movements which occurred in the calendar year of 2022. This section summarises the processing of this aircraft movement data. There were a total of 31,723 fixed wing movements and 875 helicopter movements at Farnborough Airport in the calendar year of 2022 that were included as part of the noise contour assessment.

- In order to produce the 2023 forecast, the 2022 movements were increased pro-rata by a factor of 3% based on forecast information provided by FAL.

- There are various categories of aircraft at Farnborough Airport. The majority of aircraft are included for the purposes of producing the noise contours, however some categories are excluded, for example those associated with the Airshow or emergencies. The aircraft category has been provided with the log of flights.

- The INM software includes noise information for many common aircraft types, but it does not include every aircraft type. Therefore, the aircraft type codes used in the log need to be mapped to aircraft types in the INM software. For some aircraft, substitutions are proposed by the INM software where a similar alternative aircraft type is used to model the actual type. For larger aircraft this generally does not involve a change but for some smaller aircraft, including a number of the types which commonly operate at Farnborough Airport, substitutions are required. Where INM has no guidance, an aircraft type has been assigned based on the aircraft size and engine details. A full list of the substitutions used by BAP for each aircraft type code used in the log is given in Appendix 1.

- All flights at Farnborough Airport occur during the daytime period, defined as 07:00 to 22:00 during weekdays and 08:00 to 20:00 during weekends and bank holidays.

- Each movement in the log is categorised as either an arrival or departure.

- The INM “STANDARD” profiles have been used for all aircraft departures. For arrivals, a user-defined 3.5 degree approach profile has been used for all aircraft to reflect the steeper approach in operation at Farnborough Airport.

- For the departure movements, the INM software offers a number of flight profiles for most aircraft types, particularly the larger aircraft types. These relate to different departure weights, which are greatly affected by the length of the flight and consequently the fuel load. In the INM software this is referred to as the stage length. As the stage length increases, the aircraft has to depart with greater fuel and so its flight profile is slightly lower than when a shorter stage length is flown.

- Stage lengths are defined in increments of 500 nmi up to 1,500 nmi and then in increments of 1000 nmi.

- For the contours in this report, destination airports were given with the aircraft movement data. Stage lengths have been assigned based on the distance of these airports from Farnborough Airport. Where the stage length determined using this method does not exist in the INM software database, the highest stage length available has been used.

- To provide a check of the methodology used in producing the noise contours for this report, a validation exercise has been conducted along similar lines to those done for previous contours for the airport. This has involved the comparison of predicted noise levels for individual operations by the 20 most common aircraft types with the measured noise levels obtained from the airport's permanent noise monitors located at Farnborough College and Tweseldown Racecourse.

- Modifications to the noise model are then made where appropriate to account for any residual differences between the predicted and measured noise levels. Further details of the validation exercise and the resulting modifications are given in Appendix 2.

3. RESULTS

3.1 Figure 1 displays a comparison between this INM contour assessment (2022) and the RBC 1997 Planning Contours. Figure 2 displays predicted contours for 2023 against the same 1997 contours. Both contours include helicopter movements following the same trend as fixed wing movements in terms of movement numbers. When examining the contours there are several important points to note:

- The planning agreement refers only to 55 and 60dB(A) $L_{Aeq,16h}$ however a third 65dB(A) $L_{Aeq,16h}$ contour has been added for information.

- The contour areas for this study period are within the planning permission control contour areas, as amended under clause 12.1a of the planning agreement.

- The predicted contour areas for the study period are also within the planning permission control contour areas, as amended under clause 12.1a of the planning agreement.

- The contours use assumptions and data inputs as described within this report.

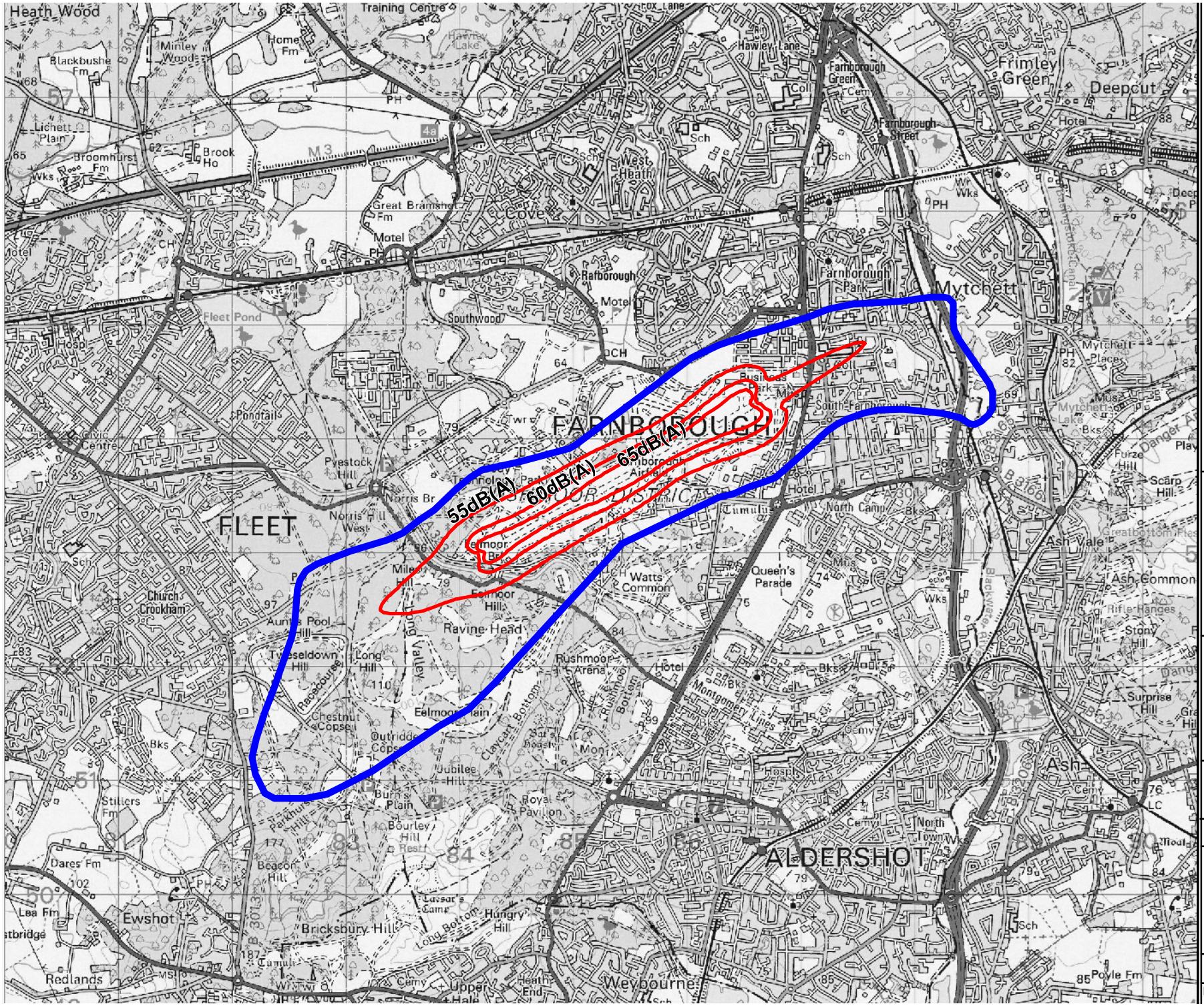
- The contours should be regarded as indicative only and represent time averaged noise levels expressed as dB(A) $L_{Aeq,16h}$. This measure represents the sound energy released as noise varies over time, expressed as an average for the relative period.

- Control Contours included as part of the planning agreement between RBC were theoretical and used conceptual aircraft movement routes. The contours attached to this document are generated using representative tracks created through inspection of actual flight track data.

- Helicopter movements are included in the modelling process.

- The steeper angle of approach used at FAL (3.5 as opposed to 3 degrees) has been allowed included in the model to correctly represent the height of arriving aircraft.

- Comparison of INM predicted noise levels for individual aircraft movements against measured noise levels at the NMTs validates the assessment. This shows, as with the



Key:

Airport Noise Contours dB(A) LAeq 16

Planning limit 55dB(A) LAeq 16 Noise Contour

Revisions

Farnborough Airport Ltd
Farnborough
Hampshire
GU14 6XA

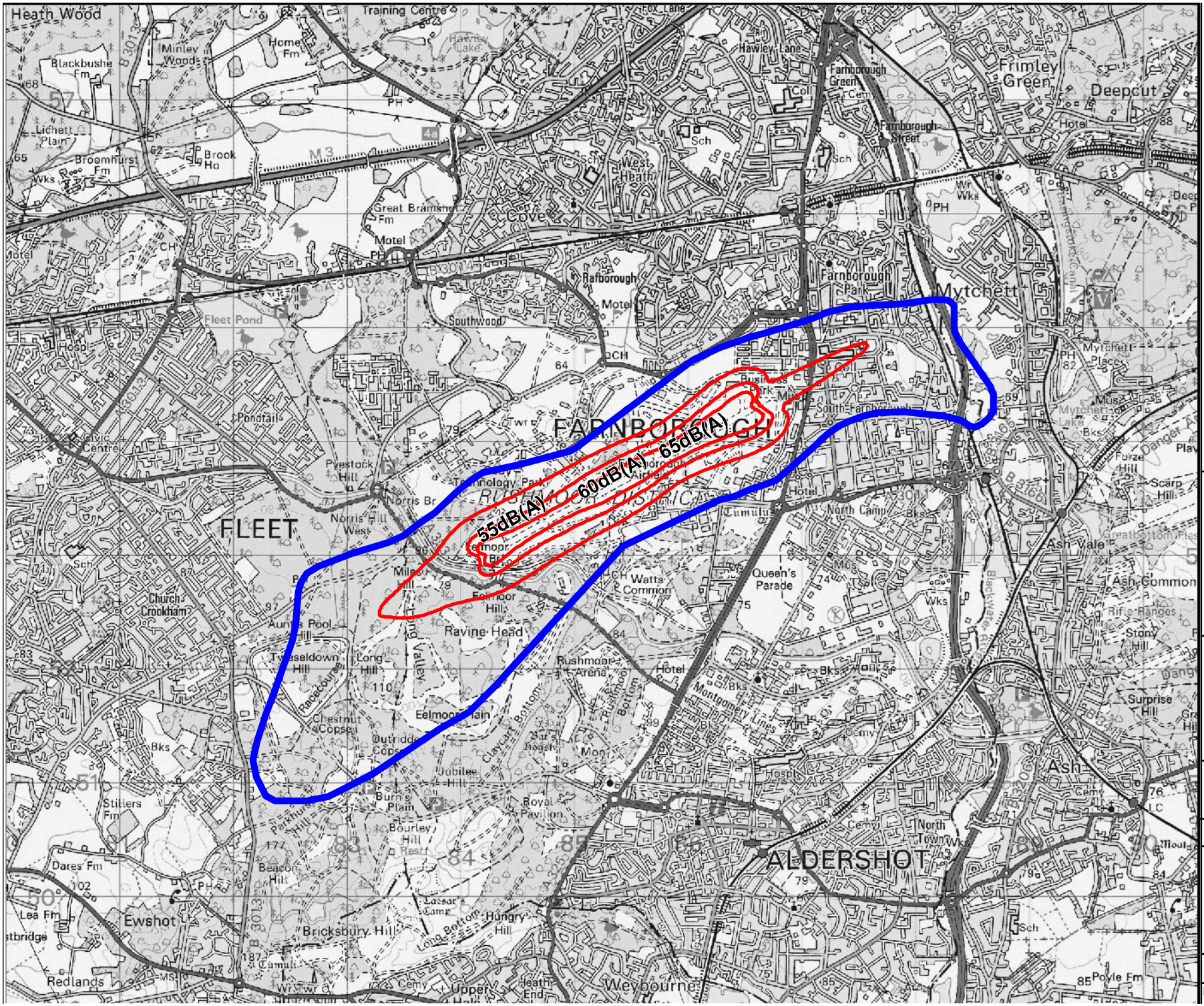
Scale@A4	Date	Drawn by
1:40 000	02/02/23	DB

Title

Figure 1:
Airport Noise Contours
All 2022

Drawing No.	Rev No.
GN TG A OP 3342	A

File



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Revisions

Farnborough Airport Ltd
Farnborough
Hampshire
GU14 6XA

Scale@A4	Date	Drawn by
1:40 000	02/02/22	DB

Title

Figure 2:
Airport Noise Contours
All Predictive 2023

Drawing No.	Rev No.
GN TG A OP 3343	A

File

exercise reported at the Public Inquiry in 2010, that some of the INM standard aircraft substitutions used older aircraft types that over-estimated the noise levels of the more modern types operating. The standard substitutions are revised annually, (refer to Appendix 1).

Comparison of total land area within each Noise Contour

3.2 Tables 1 and 2 compare the total land area within each contour for both the "control contours" and the most recently produced actual and predicted contours.

Table 1: Predicted noise contour areas, 20,000 movements at 1997 mix (Control Contours)

dB(A) $L_{Aeq,16h}$	Predicted 20,000 movements 1997 mix (km^2)	Amended Control Contour Areas as per clause 12.1a of the S106 (29/10/2010) (km^2)
55	9.07	6.58
60	4.03	2.42
65	1.70	n/a

Table 2: Contour areas: Actual 2022 and Predicted 2023

dB(A) $L_{Aeq,16h}$	Actual contour areas 2022 (km^2) (Based on 32,598 movements)	Predicted contour areas, 2023 (km^2) (Based on 3% increase on 2022 movements of fleet mix)
55	2.39	2.45
60	1.02	1.04
65	0.50	0.51

4. CONCLUSION

4.1 Contours produced for 2022 and the predicted contours for 2023 are within the planning permission area limits.

5.0 SUMMARY

Noise contours for Farnborough Airport have been produced for 2022 and 2023 using a similar methodology to that used to produce noise contours in previous years. These are within the planning permission area limits.

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Appendix 1

INM 7.0d Substitution List

Operational Aircraft Code	INM Aircraft Code	Operational Aircraft Code	INM Aircraft Code
A318	A319-131	C550	CNA500
A319	A319-131	C560	MU3001
A320	A320-211	C56X	C56X*
ASTR	IA1125	C650	CIT3
AT45	DO328	C670	CIT3
AT72	DO328	C680	CNA680
B190	1900D	C680A	C68A*
B250	BE20*	C68A	C68A*
B350	CNA441	C700	CNA680
B462B	BAE146	C750	CNA750
B733	737300	CL30	CL601
B734	737400	CL35	CL35*
B737	737700	CL60	CL60*
B738	737800	CL605	CL60*
BE20	BE20*	CL65	CL60*
BE30	CNA441	CL850	CRJ2*
BE40	MU3001	CRJ1	CL601
BE9L	CNA441	CRJ2	CRJ2*
C25A	C25A*	CRJ7	CRJ9-ER
C25B	C25B*	CRJ9	CRJ9-ER
C25C	CNA525C	CRJX	CRJ9-ER
C25M	CNA525C	D328	CL600
C501	CNA500	DA42	BEC58P
C510	CNA510	DA62	BEC58P
C525	C525*	E135	E35L*
C52A	C25A*	E135N	EMB145
C52B	C25B*	E145	EMB145

Operational Aircraft Code	INM Aircraft Code	Operational Aircraft Code	INM Aircraft Code
E190	EMB190	GA7C	GV
E295	EMB195	GA8C	GV
E314	BEC58P	GALX	CL600
E35L	E35L*	GL5T	GL5T*
E50P	CNA510	GL6T	GLEX*
E545	CNA55B	GL7T	GV
E550	E550*	GLEX	GLEX*
E55P	E55P*	GLF4	GIV
EA50	ECLIPSE500	GLF5	GLF5*
EMB550	E550*	GLF6	GLF6*
F2LX	F2TH*	H25B	LEAR35
F2TH	F2TH*	H25C	LEAR35
F900	F10062	H750	LEAR35
F9LX	F10062	HA-420	CNA510
FA10	LEAR35	HA4T	CL600
FA50	F10062	HDJT	CNA510
FA6X	GV	HS25	LEAR35
FA7X	FA7X*	J328	CL600
FA8X	F10062	JS41	SF340
G150	IA1125	LJ31	LEAR35
G200	CL600	LJ35	LEAR35
G280	CL601	LJ40	LEAR35
G450	GIV	LJ45	LEAR35
G550	GLF5*	LJ55	LEAR35
G650	GLF6*	LJ60	CNA55B
GA5C	GV	LJ75	LEAR35
GA6C	GV	M345	CNA500

Operational Aircraft Code	INM Aircraft Code	Operational Aircraft Code	INM Aircraft Code
M346	CNA500	A139	SA330J
P180	SD330	A169	S76
P28A	PA28	AS35	SA355F
P46T	GASEPV	AS55	SA355F
PA31	PA31	AW159	S76
PA46	GASEPV	AW169	S76
PAY4	PA42	B407	B407
PC121	PC12*	B429	B429
PC24	PC24*	EC12	SA341G
PRM1	LEAR35	EC15	SA365N
RJ100	BAE300	EC30	EC130
SB20	HS748A	EC35	EC130
SF34	SF340	EC45	B429
SF50	ECLIPSE500	EC55	SA365N
SW3	CNA441	EH10	S65
A109	A109	R66	R44
A109A	A109	SK76	S76
A119	A109		

Appendix 2

Validation Adjustments

For each validated aircraft type, the measured noise levels obtained from the airport's permanent noise monitors located at Farnborough College and Tweseldown Racecourse have been compared with the default modelled noise levels at the same locations.

For each aircraft type, an INM aircraft type has been selected along with a multiplier to the number of aircraft movements. This multiplier serves to modify the L_{Aeq} noise level, for example a multiplier of 2 will add approximately 3 dB to the noise level for that aircraft type. All the validated types have been modelled at stage length 1. The selections have been based on minimising the difference between the predicted and measured results at the noise monitors.

The table below shows, for each validated aircraft type, the resulting INM type and multiplier used.

Validated Aircraft Code	Arrivals		Departures	
	INM Aircraft Code	Multiplier	INM Aircraft Code	Multiplier
BE20	CNA441	2.35	CNA441	1.45
C25A	CNA525C	1.15	CNA55B	0.40
C25B	CNA525C	1.00	CNA55B	0.35
C525	CNA525C	1.45	CNA55B	0.75
C56X	CNA560XL	0.60	CNA560XL	0.35
C68A	CNA680	0.75	CNA750	0.30
CL35	CL601	0.75	CNA560XL	0.45
CL60	CL600	1.35	CNA560XL	0.45
CRJ2	CL601	1.70	CNA560XL	0.80
E35L	EMB145	0.85	F10062	0.35
E550	CNA55B	0.50	CNA55B	0.40
E55P	CNA510	1.45	CNA560XL	0.50
F2TH	CL600	0.90	F10065	0.15
FA7X	F10062	0.60	F10065	0.45
GL5T	GV	0.60	F10065	0.40
GLEX	GV	0.65	F10065	0.55
GLF5	GV	0.60	F10065	0.40
GLF6	GV	0.65	F10065	0.35
PC12	CNA208	0.85	CNA208	0.35
PC24	CNA55B	0.65	CNA55B	0.75