

**OCCUPATIONAL AND ENVIRONMENTAL
MEDICINE WING**

NOISE AND VIBRATION DIVISION

Report: OEM/52/14

Dated October 2014

A REPORT ON AN ENVIRONMENTAL NOISE SURVEY
OF AIRCRAFT ACTIVITY AT RAF MARHAM

Approved for publication



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**OCCUPATIONAL AND ENVIRONMENTAL MEDICINE WING
NOISE AND VIBRATION DIVISION**

ROYAL AIR FORCE CENTRE OF AVIATION MEDICINE

Report No: OEM/52/14

**A REPORT ON AN ENVIRONMENTAL NOISE SURVEY OF AIRCRAFT ACTIVITY AT
RAF MARHAM**

EXECUTIVE SUMMARY

1. The Noise and Vibration Division was tasked by [REDACTED] to carry out a Noise Amelioration Scheme (Military) assessment of aircraft activity at RAF Marham.
2. RAF Marham is home to three Tornado GR4 squadrons as well as the Tactical Imagery-Intelligence Wing, the Tornado GR Force HQ, No.3 (RAF) Force Protection Wing HQ, No.93 Expeditionary Armament Squadron and No.2620 Sqn RAuxAF Regiment.
3. Average Daily Movement numbers were calculated from Air Traffic Control movement logs for the period Apr 11 to March 12.
4. Using the Federal Aviation Administration's Integrated Noise Model, 16-hour L_{Aeq} noise contours were produced. These contours were reviewed by the Defence Safety and Environment Authority and administrative adjustments made to extend the noise contour in specific areas.
5. It is recommended that the administrative adjusted 72, 66 and 63 dB $L_{Aeq,16hr}$ contours should be used as the basis for the Noise Amelioration Scheme (Military) at RAF Marham.

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Author: [REDACTED]

INTRODUCTION

1. The Noise and Vibration Division was tasked by [REDACTED] to carry out a Noise Amelioration Scheme (Military) (NAS(M)) assessment, in accordance with Reference A, of aircraft activity at RAF Marham.

BACKGROUND

2. RAF Marham is situated at Upper Marham in the English county of Norfolk with the town of Swaffham located approximately 8km to east of the station. There are also a number of villages that surround the station which included Marham to the north, Shouldham to the west, Fincham to the south-west and Barton Bendish to the south.

3. The station has two runways. The main runway designated 24/06 is 2783m long and 46m wide. The cross runway 01/19 is 1853m long and 43m wide.

4. Runway 01/19 is used in emergencies and occasionally for training; however runway 24/06 operated as the main runway for 100% of the time during the movement log period. The dominant aircraft movements take place on runway 24 with 72% of movements and 28% on runway 06.

5. The station is home to three Tornado GR4 squadrons as well as the Tactical Imagery-Intelligence Wing, the Tornado GR Force HQ, No.3 (RAF) Force Protection Wing HQ, No.93 Expeditionary Armament Squadron and No.2620 Sqn RAuxAF Regiment.

6. The Tornado GR4 is a two-seat, all weather, day/night attack and reconnaissance aircraft, with the ability to operate at low level and powered by two Rolls-Royce RB 199 Mk103 turbofan engines, each capable of producing 16,000lbs of thrust.

7. In addition to Tornado GR4 aircraft, RAF Marham also hosts a number of visiting aircraft including fast jets such as Typhoon and Hawk.

8. The last environmental noise survey of RAF Marham is detailed in Reference B.

RELEVANT LEGISLATION

9. The Secretary of State's policy statement on health, safety and environmental protection requires that adverse effects on the environment are minimised and where defence has exemptions derogations or disapplications from environmental protection legislation, departmental arrangements that produce outcomes that are so far as reasonably practicable, at least as good

as those required by UK legislation. Defence is bound by the majority of environmental protection legislation applicable to environmental noise including those covering protected species and habitats. However, defence does have an exemption from elements of statutory nuisance in the Environmental Protection Act (1990); that exemption includes “noise emitted from premises so as to be prejudicial to health or nuisance”. To meet Secretary of State’s policy commitments to take all reasonable steps to minimise adverse effects from environmental noise and put in place arrangements that produce outcomes that are, so far as is reasonably practicable, at least as good as those required by legislation to manage the environmental noise produced by defence activities.

10. Reference A was written to satisfy Planning Policy Guidance 24 (PPG24) at Reference C. PPG24 uses similar but not identical noise levels to the NAS(M). PPG 24 has now been withdrawn and Reference D has partially replaced it.

11. Reference A details MOD Environmental Policy. With regards to Environmental Noise, in particular aircraft operations, the MOD has a Noise Amelioration Scheme (Military) (NAS(M)) which is introduced on an airfield by airfield basis. Its aim is to compensate those people living in the immediate vicinity of military airfields in the United Kingdom and who are affected by noise from the activity. NAS(M) is based on the following criteria:

- a. Offer to purchase residential properties exposed to aircraft noise of 72 dB(A) $L_{Aeq,16hr}$ or more.
- b. Offer to install an acoustic insulation package:
 - i. For residential properties exposed to aircraft noise of 66 dB(A) $L_{Aeq,16hr}$
 - ii. For noise sensitive areas such as schools/colleges, hospitals and care homes exposed to aircraft noise of 63 dB(A) $L_{Aeq,16hr}$

FLIGHT DATA COLLECTION

12. Information regarding aircraft performance, flight paths and flight variables were obtained from RAF Marham Military Flight Information Publication document (MilFLIP) at Reference E and discussions with the relevant aircrew.

13. Circuits flown by fast jet aircraft are to the south of station at a height of 1000ft, with an option to fly at 500ft for low level circuits. Fast jet aircraft depart with a straight climb before turning to avoid overflying the local towns and villages (Reference F).

MOVEMENTS REVIEW

14. The average daily movement (ADM) numbers were calculated from Air Traffic Control (ATC) movement logs for the period Apr 11 to March 12. Table 1 below shows the calculated ADM numbers which are based on a flying year of 220 days. Helicopter movements are not included in this review. This is due to the number of helicopter movements recorded by RAF Marham being insignificant and therefore having little impact on the contour. Table 2 contains the ADM figures for the period May 02 to Apr 03 from Reference B converted to the same format to allow a direct comparison. Table 3 shows the percentage change for each identifiable type.

Table 1 – Calculated Average Daily Movements for 12 Month Period Apr 11 to March 12

	Departure/ Approach	Roller	Overshoot
Tornado	14.4	7.6	15.1
Visiting Fast Jets	0.9	0.1	0.7

Table 2 – Average Daily Movements for 12 Month Period May 02 to Apr 03

	Departure/ Approach	Roller	Overshoot
Tornado	15.7	8.5	7.4
Visiting Fast Jets	1.3	0.6	2.3

Table 3 – Percentage Change in Average Daily Movement Figures

	Departure/ Approach	Roller	Overshoot
Tornado	-8%	-11%	+104%
Visiting Fast Jets	-31%	-83%	-70%

15. When an aircraft is going to perform an overshoot or roller it approaches the airfield as if it is going to land. Overshoots are performed when an aircraft enters the landing pattern and continues straight down the line of the runway before climbing again into the circuit. A roller is similar however it involves the aircraft touching its wheels onto the ground and rolling down the runway before accelerating and climbing again into the circuit.

ANALYSIS

16. Noise contours for the station are produced using the Federal Aviation Administration's Integrated Noise Model (INM) which is an internationally recognised noise prediction package and is used extensively within the UK for civil/commercial aircraft operations. INM 7 is the latest version which allows a 3 dimensional geometric model to be constructed including the runway, flight tracks, ground heights and receiver. Aircraft noise models work by taking a core data set of aircraft Noise-Power-Distance (NPD) source noise levels and then predicting the noise impacts beneath the flight track using the flight profiles of the aircraft.

17. The Tornado aircraft was modelled from NPD source noise and flight variables built into INM.

18. Administrative adjustments are extensions of the noise contours intended to smooth regions of the contour where there are significant variations in noise levels in small areas. Where the noise contour passes through areas of housing or near to noise sensitive buildings (i.e. schools, nursing homes, hospitals etc.) then an administrative adjustment will be made to extend the noise contour to a natural break (such as a road, river or empty land etc.) An administrative adjustment always extends the area covered by the contour. Administrative adjustments are made by the Defence Safety and Environment Authority.

ASSUMPTIONS

19. All departing aircraft have been modelled as using standard instrument departures (SIDs) and as published in Reference D. All approaching aircraft are modelled as having taken either a Visual Flight Rules approach or an Instrument Flight Rules approach, with a split of 80-20% between the two.

20. All overshoots and rollers are recorded as rollers. This is due to rollers being more consistent to model, as an overshoot can be performed at a range of altitudes.

21. Observations of fast jet approaches have shown that fast jet aircraft perform an overshoot then climb back into a circuit before making a landing. Therefore an additional overshoot has been included for every recorded approach by fast jets.

22. Engine ground running of aircraft at RAF Marham has not been included in this assessment as the data was not available. This is due to the data not being collected by RAF Marham.

RESULTS

23. Annex A presents the 72, 66 and 63 dB $L_{Aeq,16hr}$ unadjusted noise contours as produced by INM. The contours consider noise from aircraft only; it may be that in any particular area there may be other noise sources such as busy roads, railway lines etc that dominate the noise environment.

24. Annex B presents the 72, 66 and 63 dB $L_{Aeq,16hr}$ administrative adjusted noise contours. The contours consider noise from aircraft only; it may be that in any particular area there may be other noise sources such as busy roads, railway lines etc that dominate the noise environment.

RECOMMENDATIONS

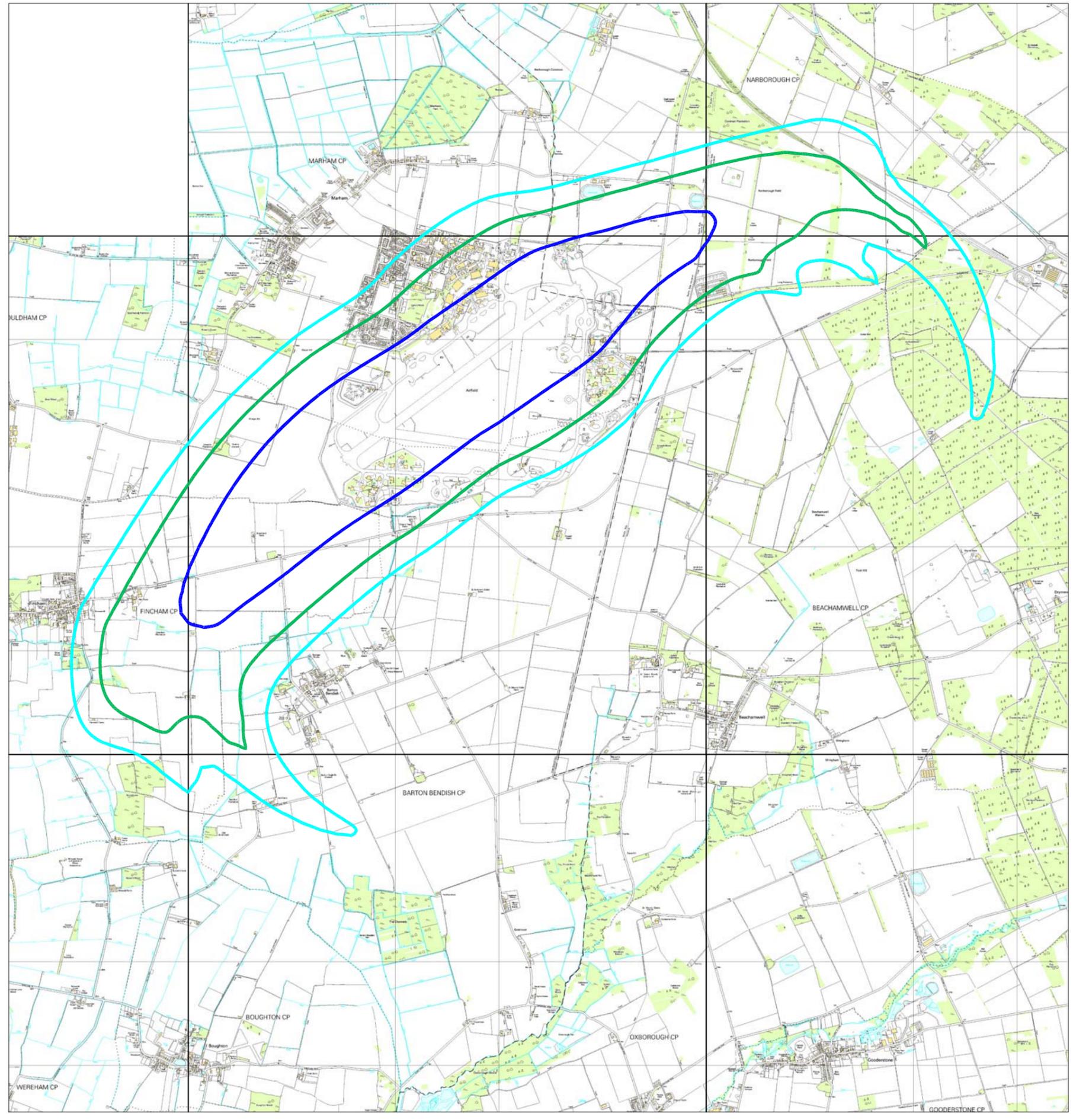
25. It is recommended that the 72, 66 and 63 dB $L_{Aeq,16hr}$ administrative adjusted noise contours detailed at Annex B, should be used as the basis for the NAS(M) at RAF Marham.

ACKNOWLEDGEMENTS

26. The Noise and Vibration Division would like to thank the personnel of RAF Marham who assisted with data collection that enabled the production of the contours.

REFERENCES

- A. JSP 418, Volume 2, Leaflet 04.1. Dated June 2010.
- B. RAF CAM Report No. OEM/122/05. Dated December 2005
- C. Planning Policy Guidance: Planning and Noise. PPG 24. Department of the Environment, dated Sep 94.
- D. Noise Policy Statement for England. Department of Environment, Food and Rural Affairs, dated 15 Mar 10.
- E. MilFLIP No AD 2- EGYM.
- F. RAF Marham Flying Order Book. 2012

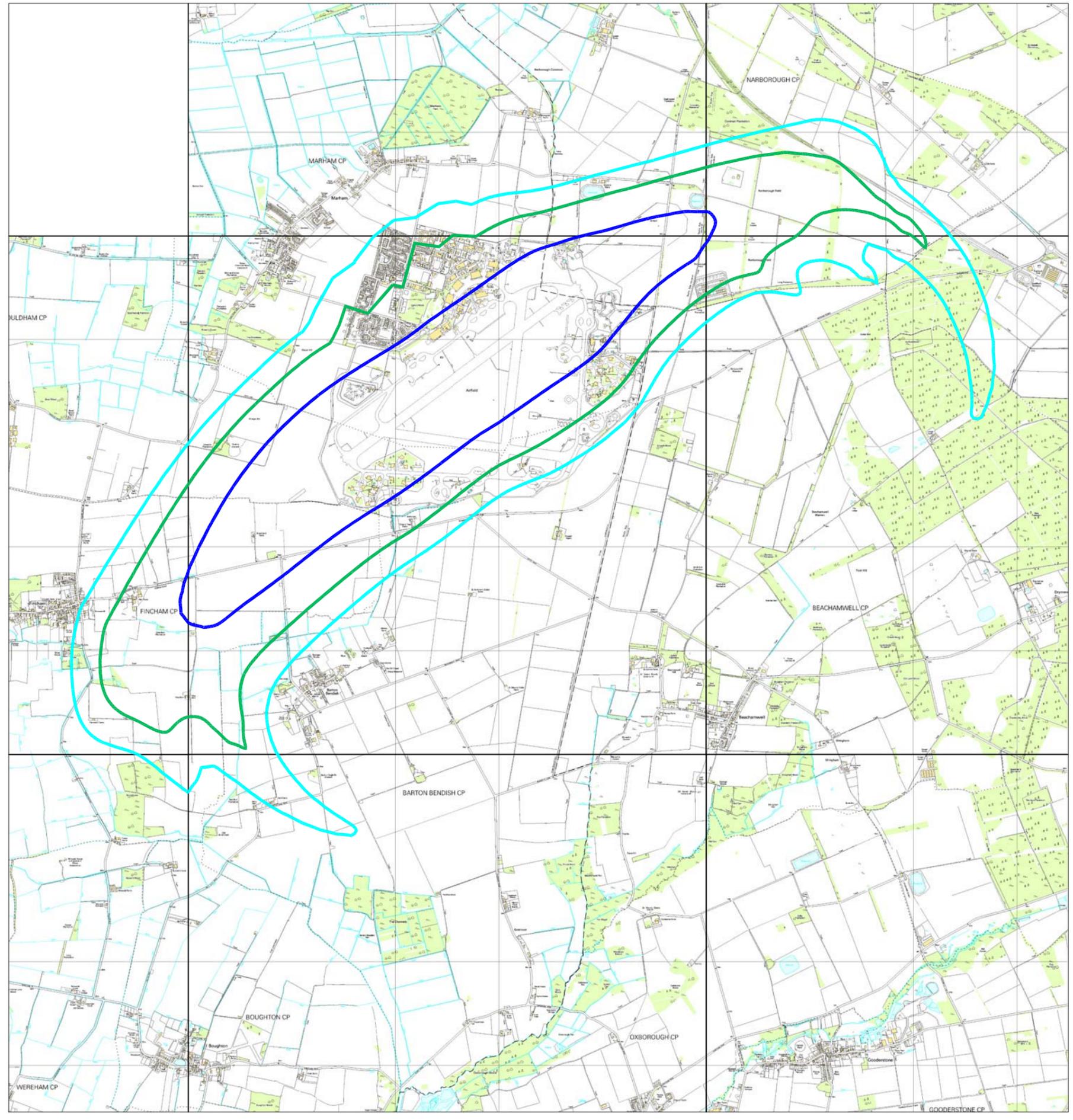


KEY

	-	72dB L _{Aeq,16h} Contour.
	-	66dB L _{Aeq,16h} Contour.
	-	63dB L _{Aeq,16h} Contour.



PROJECT RAF Marham	
TITLE LAeq,16 Hour Noise Contour - INM	
DRAWING NUMBER OO1	DRAWN BY 
DATE 01.08.2014	REVISION 1
CAD FILE Contour.dwg	
CAM FILE REFERENCE 0409100803	
CLASSIFICATION	



KEY

	-	72dB L _{Aeq,16h} Contour.
	-	66dB L _{Aeq,16h} Contour.
	-	63dB L _{Aeq,16h} Contour.



PROJECT RAF Marham	
TITLE LAeq,16 Hour Adjusted Noise Contour - INM	
DRAWING NUMBER OO1	DRAWN BY 
DATE 01.08.2014	REVISION 1
CAD FILE Contour.dwg	
CAM FILE REFERENCE 0409100803	
CLASSIFICATION	