Australian Government
Department of Defence

RAAF BASE WILLIAMTOWN & SALT ASH AIR WEAPONS RANGE

2025 ANEF

AUGUST 2011

SUMMARY REPORT

Australian Government
Department of Defence

RAAF BASE WILLIAMTOWN & SALT ASH AIR WEAPONS RANGE

2025 ANEF

SUMMARY REPORT

CLIENTS | PEOPLE | PERFORMANCE

GHD Pty Ltd

Level 7, 16 Marcus Clarke Street

Canberra ACT 2601

ABN **39 008 488 373**

RAAF Base Williamtown & Salt Ash Air Weapons Range

2025 ANEF — SUMMARY REPORT

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INM INPUT DATA REPORT

CONFIRMATION

The aircraft operation data are confirmed as accurate transcription of the information provided by Director Operational Requirements – New Air Combat Capability Project and Deputy Director Air Combat Capability – Air Force Headquarters to GHD Pty Ltd for the preparation of the 2025 Australian Noise Exposure Forecast map for RAAF Base Williamtown and Salt Ash Air Weapons Range.

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Signature Title Date

.... WGCDR DDACC - AF 8 AUG 11

Signature Title Date

APPROVAL

The Integrated Noise Model (INM) Input Data Report compiled for RAAF Base Williamtown and Salt Ash Air Weapons Range is endorsed for use in the production of the 2025 Australian Noise Exposure Forecast map.

.... D.D.O.R. NACC. IPT 8 AUG 11

Signature Title Date

ABBREVIATIONS

2OCU	No. 2 Operational Conversion Unit
2SQN	No. 2 Squadron
3SQN	No. 3 Squadron
4SQN	No. 4 Squadron
44WG	No. 44 Wing
76SQN	No. 76 Squadron
77SQN	No. 77 Squadron
A320	Airbus 320
A330	Airbus 330
ACG	Air Combat Group
ADF	Australian Defence Force
AEW&C	Airborne Early Warning & Control
AGL	Above Ground Level
AMSL	Above Mean Sea Level
ANEC	Australian Noise Exposure Concept
ANEF	Australian Noise Exposure Forecast
ARP	Aerodrome Reference Point
ARR	Arrival
AS	Australian Standards
ATC	Air Traffic Control
B737	Boeing 737
BDR	Embraer Bandeirante (also see EMB)
CAGRS	Certified Air Ground Radio Service
CL601	Bombardier Challenger 601
CNA441	Cessna 441 Conquest II
CTAF	Common Traffic Advisory Frequency
Dash8	Bombardier (de Havilland Canada) Dash 8
DEP	Departure
DoD	Department of Defence
EMB	Embraer Bandeirante (also see BDR)
ERSA	En-Route Supplement Australia
F-35A	Lockheed Martin F-35A Lightning II Joint Strike Fighter
F/A-18A/B	McDonnell Douglas (Boeing) F/A-18A/B Hornet
F/A-18F	Boeing F/A-18F Super Hornet
FAA	Federal Aviation Administration (USA)
GHD	GHD Pty Ltd
I&P	Initial & Pitch
IFR	Instrument Flight Rules
ILS	Instrument Landing System
INM	Integrated Noise Model
J32	Jetstream 32
JSF	Joint Strike Fighter
KCAS	Knots Calibrated Airspeed
LIF	Lead-In Fighter
MBZ	Mandatory Broadcast Zone
Metro	Swearingen Metroliner

MGA 94	Map Grid of Australia 94
NACC	New Air Combat Capability
NDB	Non Directional Beacon
nm	Nautical mile
NOTAM	Notice To Airmen
OVF	Overflight
P-3C	Lockheed P-3 Orion
PC9	Pilatus PC-9
RAAF	Royal Australian Air Force
RPT	Regular Public Transport
RWY	Runway
SATCO	Senior Air Traffic Control Officer
SAAWR	Salt Ash Air Weapons Range
SRG	Surveillance and Response Group
TACAN	Tactical Air Navigation Beacon
TAG	The Acoustic Group
TGO	Touch&Go
VHF	Very High Frequency
VOR	VHF Omni-directional Range

DEFINITIONS

Airfield	An Australian Defence establishment where aircraft operations are undertaken.
Australian Noise Exposure Concept (ANEC)	This is a noise contour map that may be produced during considerations of options for aerodrome development. It is based on a hypothetical set of aircraft movement numbers and operating times, aircraft types, destinations, flight paths and a given use of runways at the aerodrome.
Australian Noise Exposure Forecast (ANEF)	A contour map showing the forecast of noise exposure levels that will exist in a future year. It is based on a firm forecast of aircraft movement numbers and operating times, aircraft types, destinations, flight paths and a given use of runways at the aerodrome.
Day	Defined (in the ANEF system) as being the hours between 7.00 am and 7.00 pm.
Flight Path	A corridor within which an aircraft is to move defined by a flight track and a flight profile. It is typically described by a centre line (backbone) and a set of subtracks.
Flight Track	A line depicting aircraft movement in three dimensions through the atmosphere.
Initial & Pitch Approach	An "Initial&Pitch" approach involves an aircraft joining the circuit, usually via a point at 5nm downwind of the runway in use ("initial"), displaced to the dead side, and track inbound at speeds up to 450 knots. When abeam of either the upwind or downwind thresholds, the aircraft turns ("pitches") to join downwind to configure for landing. When conducting this procedure, the height for fast jets is normally 1500 ft AGL and 1000 ft AGL for other aircraft (Standard Initial&Pitch). Aircraft on tactical missions can conduct the Initial&Pitch at 500 ft AGL and this is referred to as a Low Initial&Pitch (or Tactical Initial&Pitch). Generally pilots conducting this manoeuvre will broadcast their position at the initial point, on the pitch, and on the base turn.
Instrument Approach	An approach using a navigation aid such as VOR, TACAN, NDB or ILS to provide guidance to the airfield or align the aircraft onto the runway.
Instrument Flight Rules	Procedures where aircraft fly by reference to instruments in the flight deck, and navigation is accomplished by reference to electronic signals.
Integrated Noise Model (INM)	A computer modelling tool used to model the impact of aircraft noise developed by the US FAA.
Movement	Either a take-off or a landing by an aircraft.
Nautical mile	A length of 1,852 metres.
Night	Defined (in the ANEF system) as being the hours between 7.00 pm and 7.00 am.

1. EXECUTIVE SUMMARY

1.1 RAAF Base Williamtown & Salt Ash Air Weapons Range 2025 ANEF

1.1.1 On 23 October 2009, Defence promulgated an ANEF which forecast the proposed flying operations for the introduction into service of the F-35 Joint Strike Fighter (JSF) aircraft at WLM & SAAWR at the year 2025.

1.1.2 Defence has also prepared and released to the public an ANEC (the 2025 ANEC – 17 May 2010) which modelled a reduction of the JSF's proposed use of SAAWR by 50% in conjunction with lower engine thrust settings, thereby reducing the forecast level of noise exposure around Salt Ash, Oyster Cove and East Medowie.

1.1.3 In September 2010, a comprehensive review of meteorological data for Williamtown showed that a number of instrument approaches planned for JSF arrivals on Runway 12 could be reapportioned to visual approaches or moved to Runway 30. This had the effect of further reducing the forecast level of noise exposure to areas northwest of the base around Raymond Terrace. Another ANEC was released to the public known as "2025 ANEC – 1 September 2010" incorporating the re-apportionment and well as the earlier refinements made in the ANEC of 17 May 2010

1.1.4 In May 2011 new optimised departure and arrival flight profiles were developed with the aim of reducing the impact of JSF noise. This development showed that the JSF can be operated safely at significantly reduced thrust settings during departures and arrivals at WLM and for the use of SAAWR.

1.1.5 The validation of flight profiles that allow the safe and efficient operation of the JSF at reduced thrust settings represents a significant change to the planned aircraft operations at WLM and SAAWR as forecast in the 2025 ANEF of October 2009. The development of JSF Noise Abatement Procedures, together with the other reductions in the abovementioned ANECs, has prompted Defence to issue a revised forecast.

1.1.6 This report summarises the data used for the INM and includes the resultant noise exposure contours for the 2025 ANEF for RAAF Base Williamtown and SAAWR.

1.1.7 The RAAF Base Williamtown and SAAWR 2025 ANEF (10 August 11) is illustrated in Appendix F, Figure 1. Appendix F, Figure 2 show a comparison with the RAAF Base Williamtown 2012 ANEF and the SAAWR 2012 ANEF. Appendix F, Figure 3 show a comparison with the RAAF Base Williamtown and SAAWR 2025 ANEF (23 October 2009). Appendix F, Figure 4 show a comparison with the RAAF Base Williamtown and SAAWR 2025 ANEC (1 September 2010).

2. INTRODUCTION

2.1 RAAF Base Williamtown

2.1.1 RAAF Base Williamtown is located approximately 15 km north of the city centre of Newcastle in central NSW, and is part of the Local Government Area of the Port Stephens Council. The Base property encompass an area of approximately 800 ha with a perimeter of approximately 15 km, and is bounded by Nelson Bay Road to the south-east, Medowie Road to the east and Hunter Water Corporation land to the north and west.

2.2 Salt Ash Air Weapons Range

2.2.1 Associated with RAAF Base Williamtown is the SAAWR which is used for air-surface gunnery and bombing practice. SAAWR is located approximately 6 km to the north-east of the Base and contains various target and support facilities.

2.2.2 SAAWR is located approximately 20 km north of Newcastle on the central coast of NSW and is within the Port Stephens local government area. SAAWR covers an area of 2,800 ha with a perimeter of approximately 32 km and is bounded by Moffats Road, Old Swan Bay Road, Boundary Road and the Medowie State Forest.

2.2.3 SAAWR supports operations from RAAF Base Williamtown. Flying operations at SAAWR are directly linked to the basing of military fast jet aircraft at RAAF Base Williamtown. The proximity of SAAWR to RAAF Base Williamtown makes it ideal for air-to-ground attack training of pilots.

2.3 Summary of the Assessment of Aircraft Noise

2.3.1 In order to provide an authoritative basis for suitable land use planning in the vicinity of the Australian Defence Force (ADF) establishments, the Department of Defence (Defence) produces noise exposure contour maps covering the operations at Defence airfields and some air weapons or bombing ranges. Noise contour maps for Defence are produced in consideration of Australian Standard *AS2021-2000 Acoustics—Aircraft noise intrusion—Building siting and construction*. The ANEFs are generally reviewed every five years or when there is a change in the operating aircraft or when there is a significant change in the number of movements or operational characteristics.

2.3.2 Defence can also produce ANEC maps prior to an ANEF map being endorsed and promulgated for public information. There can be several ANEC maps for the same year which may represent different operational scenarios.

2.3.3 The ANEF and ANEC contours are produced by the Integrated Noise Model (INM), a sophisticated computer modelling tool developed by the FAA. Preparation of the input data for the INM requires detailed information regarding aircraft flight tracks, aircraft operational profiles, aircraft noise signatures, aircraft movement numbers on specific flight tracks and time of day of the operations.

2.3.4 A more detailed discussion on the ANEF system for the assessment of aircraft noise is included in Appendix A – The ANEF System and INM..

2.4 ANEF for RAAF Base Williamtown

2.4.1 On 23 October 2009, Defence promulgated an ANEF which forecast the proposed flying operations for the introduction into service of the F-35 Joint Strike Fighter (JSF) aircraft at WLM & SAAWR at the year 2025.

2.4.2 Defence has also prepared and released to the public an ANEC (the 2025 ANEC – 17 May 2010) which modelled a reduction of the JSF's proposed use of SAAWR by 50% in conjunction with lower engine thrust settings, thereby reducing the forecast level of noise exposure around Salt Ash, Oyster Cove and East Medowie.

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2.4.4 In May 2011 new optimised departure and arrival flight profiles were developed with the aim of reducing the impact of JSF noise. This development showed that the JSF can be operated safely at significantly reduced thrust settings during departures and arrivals at WLM and for the use of SAAWR.

2.4.5 The validation of flight profiles that allow the safe and efficient operation of the JSF at reduced thrust settings represents a significant change to the planned aircraft operations at WLM and SAAWR as forecast in the 2025 ANEF of 23 October 2009. The development of JSF Noise Abatement Procedures, together with the other reductions in the abovementioned ANECs, has prompted Defence to issue a revised forecast.

2.4.6 This report summarises the data used for the INM and includes the resultant noise exposure contours for the 2025 ANEF for RAAF Base Williamtown and SAAWR.

2.5 Data Collection, Compilations and Validation

2.5.1 The process adapted for collection of data, compiling and validation of the military operations at RAAF Base Williamtown and SAAWR is as follows:

a. Preparation of Data Proformas by GHD personnel;

b. Completion of Data Proformas during a consultation visit to the Base by GHD personnel;

c. Compilation of a draft INM Input Data Report by GHD personnel;

d. Review of the draft INM Input Data Report by Defence personnel;

e. Amendment of the draft INM Input Data Report by GHD personnel;

f. Endorsement of the final INM Input Data Report by Defence; and

g. Production of the ANEF and preparation of a Summary Report.

h. Production of a Transparent Noise Information Package for the RAAF Base Williamtown and SAAWR 2025 ANEF.

2.5.2 Over the period 2007-2011 a number of visits to RAAF Base Williamtown were undertaken to collect the input data for the Integrated Noise Model (INM) model. Discussions were held with representatives of the following stakeholders:

a. Chief of Staff (COS) Air Combat Group

b. Combat Support Unit (CSU) Williamtown

c. No. 44 Wing Detachment Williamtown (ATC)

d. Regional Environmental Officer (REO) Williamtown; and

e. Newcastle Airport Limited (NAL).

2.5.3 The New Air Combat Capability (NACC) Project Office provided information on the proposed F-35A JSF operations at RAAF Base Williamtown. This information was provided through a number of interviews with operation staff in the NACC Project Office and was confirmed through the F-35 Operational Profile Version 1.1.01 document provided by NACC Directorate of Operational Requirements.

2.5.4 Defence sent a team to the USA to fly the F-35A flight simulator and to further develop noise abatement flight profiles and flight tracks for use in Australia and specifically at RAAF Base Williamtown. This data was provided to GHD by Air Force Headquarters (AFHQ) and the NACC Project Office in the form of flight track and flight profile data and refined in the INM computer model through a series of meetings and interviews and iterative improvements to the computer model.

2.5.5 This report presents the endorsed 2025 ANEF contour maps for RAAF Base Williamtown and SAAWR. Additionally this report summarises the input data used for the preparation of the 2025 ANEF.

3. SUMMARY OF INPUT DATA

3.1 General

3.1.1 Data on the existing military aircraft movements to be included in the draft 2025 ANEF for RAAF Base Williamtown and SAAWR was provided by the NACC Project Office, Defence personnel from the Air Combat Group (ACG), 44WG (Air Traffic Control) and NAL. The data collected included details of the flight tracks flown, operational characteristics of the aircraft and the existing number of aircraft movements.

3.1.2 A forecast of the annual aircraft movements was prepared based on the existing aircraft movements and extrapolated to include future operations by aircraft such as the F-35A and AEW&C.

3.1.3 The data was collated into the format required for input into the INM and includes the number of aircraft movements, the proportion of day and night movements, the flight tracks used by aircraft and the typical profiles of aircraft.

3.1.4 The following sections provide summary information on the aircraft movements used in the modelling exercise as well as major assumptions influencing construction of the model.

3.2 Datum for the Integrated Noise Model

3.2.1 The INM requires an origin point for the coordination of the flight tracks and noise contours. This is normally the Aerodrome Reference Point (ARP) of the airfield with each runway end referenced to the ARP. The latitude and longitude of the ARP at RAAF Base Williamtown was provided by the Department of Defence in the WGS 84 coordinate system. These coordinates and the converted INM coordinates are shown in Table 3.1.

Table 3.1
INM Datum

Aerodrome Reference Point	WGS 84	INM
Latitude	S 32°47′41″	-32.794,928°
Longitude	E 151°50′04″	151.834,473°

3.2.2 The coordinates of the runways at RAAF Base Williamtown were provided by the Department of Defence in MGA 94 format as shown in Table 3-2. These co-ordinates take into account a proposed runway extension which would increase the runway length by 610 metres to a total of 3,048 metres.

Table 3-2
MGA 94 Coordinates of the extended Runway 12/30

Location	Eastings (m)	Northings (m)
Runway 12 (extended)	389,752.0934	6,371,518.9180
Runway 30 (extended)	392,098.6434	6,369,745.3262

3.2.3 The coordinates of the runways, after converting them to coordinates in the INM with reference to the ARP as the origin (0,0), are shown in Table 3-3.

Table 3-3
INM Datum Coordinates

Runway Ends	Easting (km)	Northing (km)
Runway 12 (extended)	-1.1149	0.8454
Runway 30 (extended)	1.2316	-1.1005

3.3 Aircraft Flight Tracks

3.3.1 The military and civil aircraft flight tracks to and from RAAF Base Williamtown are illustrated in Figures 1 to 33 of Appendix C – *Flight Track Plans*.

3.3.2 The majority of departures to the north-east are used by military jet aircraft flying to SAAWR or training areas outside 25 nautical miles from the Base. The remaining tracks are used by RAAF PC9s, RAAF transport aircraft and civilian aircraft.

3.3.3 There are three main categories of arrival tracks to the Base: initial and pitch approaches, standard visual approaches and instrument approaches.

3.3.4 Military aircraft based at RAAF Base Williamtown (F-35A, Hawk, and PC9) normally perform an initial and pitch manoeuvre whereby they approach the airfield singly or in formation and pitch into the circuit pattern at regular intervals.

3.3.5 Military transport aircraft and civilian aircraft normally perform standard visual approaches to the airfield where the aircraft manoeuvre to a point approximately three nautical miles from the end of the runway and land.

3.3.6 All aircraft performing instrument approaches will commence their approaches to the runway from a distance approximately 15 nautical miles using navigation aids such as the Instrument Landing System (ILS), Tactical Air Navigation System (TACAN) or the Non-Directional Beacon (NDB) to provide guidance on the position of the aircraft relative to the runway end. These approaches are flown in poor visibility conditions and additionally are flown in good visibility conditions for training purposes.

3.3.7 The majority of flight tracks to and from RAAF Base Williamtown modelled in INM incorporate a central backbone track and associated subtracks as shown in Appendix C – *Flight Track Plans*. Subtracks have been used to represent normal variation in the alignment of the tracks flown caused by meteorological conditions such as wind strength and direction, formation flying and pilot technique.

3.3.8 The aircraft movements are concentrated along the backbone track with the number of subtracks varying depending on the aircraft type and operation. The extent of the dispersal of the subtracks and the distribution of aircraft movements onto the tracks was determined in consultation with ATC and the aircraft operators at RAAF Base Williamtown.

3.3.9 Right hand circuits are flown for operations on Runway 12 and left hand circuits are flown for operations on Runway 30 as illustrated in C – *Flight Track Plans*. This results in all the circuit tracks being orientated to the southern side of the airfield.

3.3.10 The track name convention used in this study is outlined in Table 3.4.

Table 3.4
Track naming convention

					Description
12C	D	09	F	1	Runway 12C, Departure, track 09, Fighter, Variation 1
30C	A	01	F	L	Runway 30C, Arrival, track 01, Fighter, Long
12C	T	05	X		Runway 12C, Touch&Go, track 05, common
12C	A		Q	1	Runway 12C, Arrival, Noise Abatement, Initial&Pitch 1
SA	S	01	L		Overflight, strafing, track 01, Lead-in Fighter

Additional information (optional)
L=long, M=medium, S=short.
I=Initial&Pitch.
1=variation 1, 2= variation 2 , 3= variation 3

Aircraft designator
B=Large aircraft, F=fighter (F-35A or Hawk), Q=noise abatement, L=Lead-in Fighter (Hawk), P=JPATS (PC9), X=common track (more than 1 aircraft type),

Consecutive number of a track

Type of operation
A = Arrival, D = Departure, T = Touch&Go, B=Bombing, P=Pop attack, S=Strafing

Runway name
C stands for centre runway (default), SA for SAAWR flights (overflights, no runway)

3.4 Aircraft Movement Numbers

3.4.1 The forecast annual aircraft movement numbers in Table 3.5 are used in Williamtown and SAAWR 2025 ANEF. The F-35A forecast annual aircraft movement numbers models the planned number of aircraft movements from two operational squadrons and one training squadron of F-35A (approximately 70 F-35A aircraft) that will replace the current Squadrons of F/A-18 Hornet aircraft.

Table 3.5
Forecast Annual Aircraft Movements

Aircraft	Arrivals	Departures	Circuit Movements	SAAWR Movements	Total
F-35A (JSF)	6,964	6,964	3,118	1,200	18,246
HAWK LIF	1,971	1,971	2,728	10,716	17,386
JPATS (PC-9)	1,188	1,188	1,640	708	4,724
Military Transport	190	190	0	0	380
KC-30A (MRTT)	95	95	0	0	190
AEW&C	384	384	192	0	960
Civil Heavy Jet (A330)	260	260	0	0	520
Civil Medium Jet (737400)	5,460	5,460	0	0	10,920
Civil Commuter (DHC8)	5,512	5,512	500	0	11,524
Civil Light (CNA441)	2,002	2,002	540	0	4,544
Business Jet (CL601)	2,002	2,002	100	0	4,104
Helicopter (IROQA)	374	374	164	0	912
TOTAL	26,402	26,402	8,982	12,624	74,410

3.4.2 The proposed annual movements for the AEW&C aircraft is in accordance with details of the proposed operations provided by 42WG. Additional movements by the Military Transport and KC-30A aircraft to support the additional capability were also incorporated into the forecasts.

3.4.3 The forecast civilian movements were based on forecasts prepared by Newcastle Airport Limited (NAL) in the Newcastle Airport Master Plan, and related to the maximum number of movements permitted under the lease agreement with the Department of Defence. The forecast civilian aircraft movements were confirmed by NAL based on the planned future services to/from Newcastle Airport.

3.4.4 The INM requires input of the average daily aircraft movements for the forecast year. The annual aircraft movements, therefore, need to be converted from annual movements to average daily movements for the INM. As there is generally no military flying on the weekends and reduced activity over the Christmas period, the number of military flying days per year at the Base has been calculated on the basis of operations on 5 days a week, 48 weeks a year, i.e. 240 days a year. Civilian operations have been assumed to occur on 365 days a year. One of the environmental conditions of consent for the introduction into service of the Hawk LIF was that the average annual use of the Range will not increase and will continue to be minimised as far as practical. The maximum 10-year rolling average for aircraft usage at the Range will be 115 days for all Hornet and Hawk operations. Therefore, it has been assumed that there will be 115 flying days at SAAWR for the purposes of this forecast.

3.4.5 Accordingly, to determine the noise impact for the actual flying days, the annual military aircraft movement figures were divided by 240 whilst annual civilian movement figures were divided by 365 and the results added to obtain the average daily aircraft movements at the Base. At SAAWR, the annual military aircraft movement figures were divided by 115.

3.5 Runway Usage

3.5.1 The runway usage by individual aircraft type varies between aircraft and the type of operation as shown in Table 3.6.

Table 3.6
Runway Distribution

	Arrival movements		Departure movements		Circuit movements	
	12	30	12	30	12	30
F-35A	48%	52%	45%	55%	45%	55%
HAWK	51%	49%	45%	55%	45%	55%
PC-9	51%	49%	45%	55%	45%	55%
Military Transport	53%	47%	45%	55%	n/a	n/a
KC-30A	58%	42%	45%	55%	n/a	n/a
AEW&C	51%	49%	45%	55%	64%	36%
Civil Heavy Jet	45%	55%	45%	55%	45%	55%
Civil Medium Jet	51%	49%	45%	55%	45%	55%
Civil Commuter	47%	53%	45%	55%	45%	55%
Civil Light	51%	49%	45%	55%	48%	52%
Business Jet	50%	50%	45%	55%	45%	55%
Helicopter	45%	55%	45%	55%	45%	55%

4. INM DATA

4.1 Overview

4.1.1 The Integrated Noise Model software used to model the impact of aircraft noise was developed by the US Federal Aviation Administration in response to an increasing requirement to be able to scientifically measure and forecast noise impacts around airports. The first version of the model was released in 1978. Version 6.2a, was endorsed by Airservices Australia for the preparation of ANEF contours. INM version 6.2a was used for the preparation of the ANEF contours for RAAF Base Williamtown and SAAWR.

4.1.2 The specific US based noise exposure system parameters are varied within the model to reflect the Australian parameters for the Australian Noise Exposure Forecast System as endorsed by the House of Representatives Standing Committee on Aircraft Noise.

4.2 Aircraft Substitutions

4.2.1 The INM software includes noise profile data for a number of different aircraft types. The Department of Defence also maintains noise profile data for RAAF aircraft. Where information on specific aircraft types was not available in the model or from the Department of Defence, equivalent aircraft from the INM suite were used. A summary of the INM aircraft used and the source of the data is shown in Table 4.1.

Table 4.1
INM Aircraft Data

Aircraft Category	Aircraft Type	Actual Aircraft	INM Aircraft	Data Source
Military	F-35A	F-35A	F35AA1	DoD
	HAWK	Hawk 127	HAWK*	INM
	PC-9	PC-9	JPATS	INM
	Military Transport	C-130	C130	INM
	KC-30A	A330-301	A330	INM
	AEW&C	B737	737400	INM
Civilian	Civil Heavy Jet	A330-300	A330	INM
	Civil Medium Jet	B737	737800	INM
	Civil Commuter	Dash 8	DHC8	INM
	Civil Light	CNA441	CNA441	INM
	Business Jet	Canadair	CL601	INM
	Helicopter	IROQ	IROQA	DoD

* The noise signature of standard Hawk with an ADOUR engine was modified by increasing the noise produced at each thrust level by 3dB.

4.2.2 Standard operational profiles and noise signatures within the INM were used for the civil aircraft.

4.2.3 The flight profiles for the F-35A have been updated for this ANEF to reflect the latest information available to Australia from the aircraft manufacturer, Lockheed Martin. The flight profiles reflect a significant change to the previously used profiles, as a consequence of aircraft performance validation through flight modelling and simulator optimisation.

4.2.4 The noise profile of the Hawk LIF was based upon standard data for the Hawk 100 aircraft, powered by a Rolls Royce ADOUR Mk 151 engine, included in the INM. The RAAF operates a variant to the standard Hawk which has been modified by installing the ADOUR Mk 871-05 instead of the ADOUR Mk 151 engine.

4.2.5 Consultation with the Environment Services Branch of Airservices Australia indicated that the noise signature of the modified Hawk with the ADOUR Mk 871-05 engine is increased by 3dB at all altitudes and power settings compared to the standard Hawk with a Mk 151 engine. This assumption was later confirmed as being a close approximation to the actual noise signature of the Hawk 127 by the measurements undertaken during the Environmental Impact Statement (EIS) for the introduction of the Hawk.

4.3 INM Parameter Settings

4.3.1 The ANEF input files have been prepared using INM Version 6.2a. The ANEF noise metric setup parameters used are described in Table 4.2 and the noise contours produced in accordance with the specified requirements of *AS 2021-2000*.

Table 4.2
INM Parameter Settings

Parameter	Setting
Day Multiplier	1
Night Multiplier	4
10 log (Time)	88
Refinement	10
Tolerance	0.1

4.4 Williamtown Environmental Conditions

4.4.1 Temperature, relative humidity data for RAAF Base Williamtown was sourced from the Bureau of Meteorology website:
http://www.bom.gov.au/climate/averages/tables/cw_061078.shtml
This data was accessed on 20 July 2011 and are summarised on Table 4.5. The mean temperature and mean relative humidity values have been used in the INM computer model. The mean atmospheric pressure was not available from the Bureau of Meteorology website, therefore the default INM value has been used.

Table 4.3
Williamtown Environmental Parameters

Parameter	Value
Mean maximum temperature (°C)	23.0
Mean minimum temperature (°C)	12.4
Mean temperature (°C)	*17.7*

4.5 Terrain

4.5.1 A terrain file was prepared for the Williamtown region and imported into the INM computer model.

5. 2025 ANEF CONTOURS

5.1.1 The RAAF Base Williamtown and SAAWR draft 2025 ANEF is illustrated in Appendix F, Figure 1. Appendix F, Figure 2 show a comparison with the RAAF Base Williamtown and SAAWR 2012 ANEF. Appendix F, Figure 3 show a comparison with the RAAF Base Williamtown and SAAWR 2025 ANEF (23 October 2009). Appendix F, Figure 4 show a comparison with the RAAF Base Williamtown and SAAWR 2025 ANEC (1 September 2010).

Appendix A

The ANEF System & INM

Assessment of Aircraft Noise

The Australian Noise Exposure Forecast System

In 1980, the Department of Defence and the then Department of Transport commissioned the Australian National Acoustics Laboratories (NAL) to undertake a major socio-acoustic investigation to assess the impact of aircraft noise on residential communities in Australia. The NAL confirmed that the 'equal energy' indices such as the NEF were more highly correlated to the community reaction than any other indices.

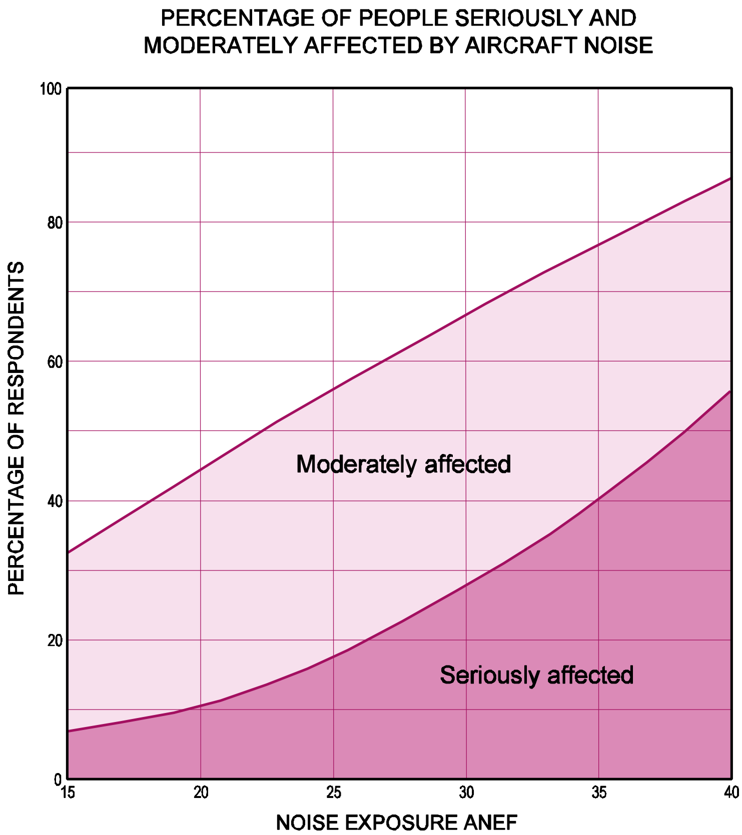
The NAL investigations also found that the standard weightings given in the US-based NEF system were not applicable to the Australian environment. As a result of the NAL's findings, the NEF technique was refined for application in Australian conditions. The amended parameters in the NEF system were defined as the Australian Noise Exposure Forecast (ANEF) system and later endorsed by the Australian Federal Government as the technique to be used for the determination and evaluation of the impact of aircraft noise on communities in the vicinity of Australian airports.

The resulting ANEF system defines a means of determining a scientific measure of the noise exposure levels around Australian airports taking into account the following factors:

- The intensity, duration, tonal content and spectrum of audible frequencies of the noise of aircraft take-offs, approaches to land, overflights and reverse thrust after landing;
- The forecast frequency of aircraft types and movements on various flight paths, and
- The average daily distribution of aircraft take-off and landing movements in day time and night time.

The NAL report also investigated the percentage of residents living around airfields who were seriously affected, moderately affected or not affected by aircraft noise. This information was presented in a 'dose/response' relationship as illustrated in the diagram below. This information was used in the formulation of the recommendations on compatible land use around Australian airports.

Dose/Response Relationship Diagram



Source: AS 2021-2000.

The dose/response relationship diagram shows that the noise impact does not stop at the 20 ANEF contour. At the 15 ANEF, approximately 8% of the population considered themselves seriously affected, and 33% of the population considered themselves moderately affected by aircraft noise. At the other end of the scale, 33% of the population considered themselves not affected by aircraft noise at the 30 ANEF contour. This figure reduces to 23% at the 35 ANEF contour and to 15% at the 40 ANEF contour.

ANEF

The resulting ANEF system defines a means of determining a scientific measure of the noise exposure levels around Australian airfields. The details of the ANEF system are defined in the *Australian Standard AS2021–2000 Acoustics–Aircraft Noise Intrusion–Building Siting and Construction*. The objective of this Standard is to provide guidance on the siting and construction of new buildings against aircraft noise intrusion.

The impact of aircraft noise is illustrated by ANEF contours drawn on maps of the airport environment which define land areas around the airport affected by increasing aircraft noise (increasing ANEF values). ANEF contours provide a means of planning effective noise abatement measures and determining land use compatibility.

The resulting land use compatibility with various ANEF levels is given in Table A.1.

Table A.1.

Building site acceptability based on ANEF zones

Building Type	ANEF zone of site		
	Acceptable	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

Notes:

1. The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variations in aircraft flight paths.

2. Within the 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate.

3. There will be cases where a building of a particular type will contain spaces used for activities which would generally be found in a different type of building (e.g. an office in an industrial building). In these cases Table A.1 should be used to determine site acceptability, but internal design noise levels within the specific spaces should be determined by reference to the Australian Standard.

4. The Australian Standard does not recommend development in unacceptable areas. However, where the relevant planning authority determines that any development may be necessary within existing built-up areas designated as unacceptable, it is recommended that such development should achieve the required Aircraft Noise Reduction (ANR) determined in accordance with the Standard. For residences, schools, etc., the effect of aircraft noise on outdoor areas associated with the buildings should be considered.

5. In no case should new development take place in greenfield sites deemed unacceptable because such development may impact on airport operations.

Source: AS 2021–2000

In the areas outside the 20 ANEF noise contour, the standard assumes that noise exposure is not of significant concern. However, as detailed in the NAL report, noise does not drop off at this contour. The actual location of the 20 ANEF contour is difficult to define accurately, because of variations in aircraft flight paths, pilot operating techniques and the effect of meteorological and terrain conditions on noise propagation. For that reason, the 20 ANEF contour is shown as a broken line on ANEF plans.

Within the area from the 20 ANEF to the 25 ANEF noise contour, aircraft noise exposure starts to emerge as an environmental problem, while above the 25 ANEF noise contour the noise exposure becomes progressively more severe.

Land-use planning for new developments should be in accordance with the above Table A.1, to minimise the noise intrusion for developments in the vicinity of airports.

The ANEF computation is based on forecasts of traffic movements on an average day for a nominated year in the future, normally ten years ahead. Allocations of the forecast movements to runways and flight paths are on an average basis, and take into account the existing, and forecast, air traffic control procedures at the airport which nominates preferred runways and preferred flight paths for noise abatement purposes. When developing the ANEF, aircraft movements are grouped according to the following categories:

- Type of aircraft;
- Take-off, landing, overflight or Touch&Go route;
- Runway used (including displaced thresholds);
- Flight path; and
- Night or day.

Integrated Noise Model (INM)

The Integrated Noise Model (INM) is a sophisticated computer modelling tool used to assess the impact of aircraft noise in the vicinity of airports. The INM was first developed by the US Federal Aviation Administration (FAA) in 1978 in response to an increasing requirement to scientifically measure and forecast noise impacts around airports. The latest version is the culmination of 20 years of development of acoustic modelling capabilities and a graphical representation of results.

INM is designed to estimate the impacts of aircraft noise using average annual input conditions. An average annual day is a user-defined best representation of the typical operations for the airport. These conditions include the number and type of operations, routing structure, runway configuration, aircraft weight, air temperature, and wind.

The INM requires detailed data of aircraft flight tracks, aircraft profiles (thrust settings, altitude, air speed), noise signature for each aircraft, movement numbers for each flight track and time of day of the movements. Using the above data, the program compiles output for various noise metrics. The ANEF noise metric based on the parameters established by the NAL is included in the model. The outputs (noise contours) of the INM can be exported in a number of formats for inclusion in various electronic documents for publishing or analysis.

Appendix B

Regional Location Plan and Runway Layout Plan

Appendix C

Flight Track Plans

Appendix D

Summary of Aircraft Movements

This appendix details the annual aircraft movements for each aircraft type that is included in the INM computer model. The annual civil aircraft movements have been averaged over 365 days while the annual military aircraft movements have been averaged over 240 days being the number of operational days at RAAF Base Williamtown and 115 days for Salt Ash Air Weapons Range. As these movements have been averaged, minor discrepancies may occur between totals and the sums of the component items.

Appendix E

2025 ANEF Map

DEPARTMENT OF DEFENCE

RAAF Base Williamtown & Salt Ash Air Weapons Range 2025 ANEF Summary Report

Document Control Sheet

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