



MARSHALL DAY  
Acoustics 

AIRPORTS & AIRCRAFT NOISE  
CAPABILITY BROCHURE





## WHO WE ARE

Sound is a key part of our environment, providing information about our surroundings and influencing our perception of amenity and environmental quality.

It can therefore be an important consideration in the planning, design and management of the modern environment.

Marshall Day Acoustics (MDA) specialise in assessing sound and vibration.

We are an international firm of engineers, designers, musicians and scientists, with over 30 years experience helping private and public sector clients reach informed decisions about acoustics.

We provide consultancy services for a wide range of applications spanning from building design and construction to environmental impact assessment for major utility and transport infrastructure projects.

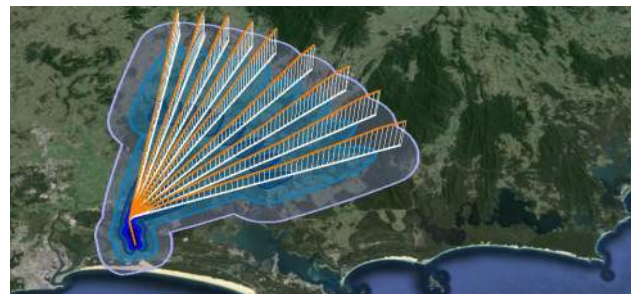
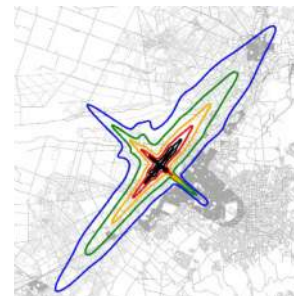
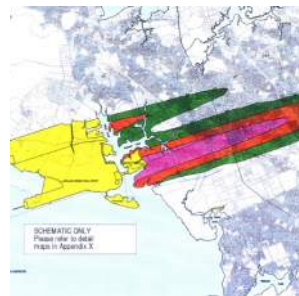
Our focus on acoustics provides our clients with the benefit of specialist skills and expertise, enhanced by the shared experience of our international offices.

**Testimonial:** *“Environmental noise was one of the most important considerations for the F-35A Joint Strike Fighter environmental impact assessment.*

*Marshall Day Acoustics provided a very high standard of service throughout the project at every stage, including modelling, community consultation and reporting. In particular, they delivered a highly technical and comprehensive assessment, but the factor that differentiated their service was the ability to clearly communicate technical subjects in a way that enabled Defence to make informed decisions about the project.*

*I would have no hesitation in recommending Marshall Day Acoustics.”*

**Group Captain Mick Brown, - Project Director in Service Support, Joint Strike Fighter Division, Department of Defence**



## EXPERTISE

Air traffic growth, urban development pressures and changing community expectations, means that environmental noise is a key challenge for regulators, airport operators and planning authorities tasked with balancing the wider benefits of aircraft operations with the impacts to neighbouring communities.

Conversely, new aircraft and monitoring technologies provide better opportunities to manage noise impacts.

MDA has more than 20 years experience in the assessment and management of aircraft noise in Australia and New Zealand.

Our experience is based on work carried out for major international airports, military bases and regional airports, including the majority of Australian military and New Zealand civilian airports. Our experience and consulting services in airports and aircraft noise include:

### Environmental

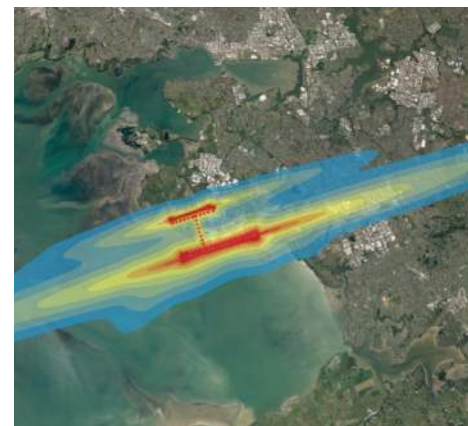
- Noise modelling to assess air traffic growth, runway modifications, varied operating scenarios and aircraft fleet substitutions
- Preparation of Australian Noise Exposure Forecast (ANEF) and New Zealand Noise Airport Noise Control Boundary contours
- Noise model validation and refinement studies
- Impact assessment using a variety of tools to evaluate noise changes and generate community noise exposure statistics
- Aircraft noise emission testing
- Stakeholder engagement, including community consultation
- Policy support for land use planning authorities

### Monitoring

- Short-term and permanent noise monitoring systems
- Advanced aircraft noise detection software
- Supply, installation and data management
- Cloud-based integration of flight track and noise data

### Building

- Facade design to control aircraft noise intrusion
- Room acoustics & PA design for enhanced amenity & speech intelligibility
- Services noise control
- Design for privacy & separation



## ENVIRONMENTAL - MILITARY

### RAAF Base East Sale, VIC

2016 - 2017

2035 Australian Noise Exposure Forecast

Client: Currie & Brown / Department of Defence

Development of the new 2035 ANEF contour, incorporating new Pilatus PC-21 and relocated training school operations.

### RAAF Base Williamtown, NSW (Newcastle Airport)

2011 - 2014

Joint Strike Fighter (F-35A) Environmental Impact Study

Client: Coffey Environments / Department of Defence

Analysis of flight paths, long term noise monitoring data and calculation of Australian Noise Exposure Index (ANEI) contours for existing F/A-18A/B Hornet operations. Prediction of Australian Noise Exposure Concept (ANEC) contours for alternative F-35A operating scenarios and runway scenarios. Generation of Number Above contours for existing and future operating scenarios, and analysis of land-use planning and community noise implications. Reporting to address Commonwealth Department of Environment EIS Guidelines.

### RAAF Base Tindal, NT

2011 - 2014

Joint Strike Fighter Environmental Impact Study

Client: Coffey Environments / Department of Defence

Prediction of ANEC contours for alternative F-35A operating scenarios, comparison of long-term and short-term noise exposure metrics for existing F/A-18A/B Hornet and future F-35A operations. Analysis of land-use planning and community noise implications. Reporting to address Commonwealth Department of Environment EIS Guidelines.

### RAAF Base Darwin, NT (Darwin International Airport)

2011 - 2014

Joint Strike Fighter Environmental Impact Study

Client: Coffey Environments / Department of Defence

Modelling of short term activity noise levels associated with existing F/A-18A/B Hornet and future F-35A training exercises. Reporting to address Commonwealth Department of Environment Guidelines.

### RAAF Base Townsville, QLD (Townsville International Airport)

2011 - 2014

Joint Strike Fighter Environmental Impact Study

Client: Coffey Environments / Department of Defence

Development of a new Australian Noise Exposure Concept (ANEC) contour for proposed F-35A operations. Modelling of short term activity noise levels associated with existing F/A-18A/B Hornet and future F-35A training exercises. Reporting to address Commonwealth Department of Environment EIS Guidelines.

### RAAF Base Point Cook, VIC

2011 - 2012

Client: Brookfield Multiplex / Department of Defence

Area-wide noise monitoring of general aviation circuit training activities at RAAF Base Point Cook, for reporting to the local community consultation forum.





## ENVIRONMENTAL - COMMERCIAL

### PROJECT EXPERIENCE AS PRIMARY CONSULTANT

#### Auckland International Airport, NZ

1993 - Ongoing

Clients: Auckland International Airport Company and Manukau City Council

Calculation of airport noise contours based on 30 year projections and 3 different options for a second parallel runway.

Measurement and investigation of the sound insulation of houses and schools under the flight paths and design acoustic treatment and ventilation for new and existing houses.

Reported to a Mediation Forum run by the city Mayor which achieved an agreement on a second runway and sound insulation programme.

Assessment of noise impacts for the implementation of Performance Based Navigation.

Preparation of new noise control boundaries and an accompanying report to be used in the revision to the Auckland Council planning review.

Ongoing noise management, compliance monitoring and noise forecasting services.

#### Christchurch International Airport, NZ

1992 - Ongoing

Client: Christchurch International Airport Ltd

Prediction of noise contours for various scenarios. Preparation of airport noise boundary locations for inclusion in District Plans in 2000 and 2007. Noise monitoring to confirm INM model.

Preparation of expert evidence on proposals to construct residential developments surrounding the airport.

Preparation and development of bespoke Engine Testing noise software.

Ongoing noise management and compliance monitoring services.

#### Wellington International Airport, NZ

2013 - Ongoing

Client: Wellington International Airport Company

Preparation of annual noise compliance contours. Acoustic advice relating to the Airport sound insulation programme, including wide ranging noise measurement surveys and development of treatment packages.

#### Moorabbin Airport, VIC

2013

Client: City of Kingston

Area-wide noise monitoring of general aviation and circuit training activities. Preparation and presentation of expert witness evidence concerning land zoning amendments around the airfield, including issues related to the guidance of the National Airports Safeguarding Framework.

#### Queenstown Airport, NZ

2010 - Ongoing

Client: Queenstown Airport Company Limited

Noise monitoring to verify the noise model. Preparation of various scenarios for revised airport noise boundaries for inclusion in a District Plan. Assessment of noise effects. Presentation of expert evidence. Preparation of acoustic advice relating to the Airport sound insulation programme, including wide ranging noise measurement surveys and development of treatment packages.

#### Wanaka Airport, NZ

2007 - 2011

Client: Queenstown Airport Company Limited

Preparation of various scenarios for revised airport noise boundaries including new runway configurations. Preparation of airport noise boundary location for inclusion in District Plan. Assessment of noise effects, and land use planning advice. Presentation of expert evidence.

#### Ardmore Airport, NZ

1996 - Ongoing

Client: Tramco Properties

Preparation of airport noise contours using the INM. Onsite noise monitoring to confirm GA noise levels and "Warbird" single event levels. Interaction with District Council and local resident action groups on long term planning for the airport. Measurement and development of sound insulation treatment packages for affected dwellings



### **Nelson Airport, NZ**

1996 & 2005

Client: Nelson Regional Airport Authority

Noise monitoring to confirm INM model. Prediction of noise contours for various scenarios. Preparation of airport noise boundary location for inclusion in the District Plan. Presentation of expert evidence. Preparation of software for ongoing noise monitoring. Review of noise boundaries in 2005.

### **Invercargill Airport, NZ**

1995

Client: Beca Carter Hollings & Ferner Ltd

Prediction of noise contours for various operational scenarios, to form the basis of the air noise boundary location to be included in the District Plan. Presentation of expert evidence.

### **Invercargill Airport, NZ**

2011

Client: Invercargill Airport Limited

Review of air noise boundary location with respect to new nearby residential subdivisions.

### **Hawke's Bay Airport, NZ**

1994 & 2007 - Ongoing

Client: Hawke's Bay Airport Limited

Prediction of noise contours, preparation of airport noise boundary location for inclusion in District Plan to be notified in 1994. Revised contours prepared in 2007, 2012 and associated assessment of noise effects. Medium term noise monitoring to validate INM noise model.

### **Gisborne Airport, NZ**

2011

Client: Gisborne Airport

Review of air noise boundary location with respect to new nearby residential subdivisions.

### **Dunedin Airport, NZ**

1995

Client: Beca Carter Hollings & Ferner Ltd

Prediction of noise contours for various operational scenarios. Preparation of airport noise boundary location for inclusion in District Plan. Presentation of expert evidence.

### **Subang International Airport, Kuala Lumpur**

Client: Marshall Day Bersekutu

Noise monitoring and INM predictions for a developer wishing to develop a residential complex adjacent to the Kuala Lumpur Airport.

### **Whangarei Airport, NZ**

2005 & 2008

Client: Whangarei Airport Limited

Noise monitoring to verify INM model. Prediction of noise contours for various scenarios. Preparation of airport noise boundary location for inclusion in District Plan. Presentation of expert evidence. Ongoing compliance monitoring services.

### **Orange Airport, NSW**

2006

Client: Orange Airport

Preparation of ANEF contours for Australian Air Services authorisation.



### Rotorua Airport, NZ

2005 & 2009

Client: Rotorua Regional Airport Ltd

Noise monitoring to verify INM model. Prediction of noise contours for various scenarios. Preparation of airport noise boundary location for inclusion in the District Plan. Assessment of noise effects. Presentation of expert evidence. Development of sound insulation treatment packages for dwellings.

### Kapiti Coast Airport, NZ

2006 & 2010

Client: Paraparaumu Airport Holdings Ltd

Noise monitoring to verify INM model. Prediction of noise contours for various scenarios, preparation of airport noise boundary location for inclusion in District Plan. Assessment of noise effects. Presentation of expert evidence. Ongoing monitoring services.

### Whakatane Airport, NZ

2006 & 2011

Client: Whakatane District Council

Preparation of airport noise contours for inclusion in the Airport Master Plan.

Preparation of revised airport noise boundaries, land use planning advice and assessment of noise effects for inclusion in District Plan review process.

### Palmerston North Airport, NZ

1995

Client: Mount Cook Group & Air Nelson

Review of proposed noise contours and engine testing provisions.

### Queenstown Airport, NZ

2010 - Ongoing

Client: Queenstown Airport Company Limited

Noise monitoring to verify noise model. Preparation of various scenarios for revised airport noise boundaries. Preparation of airport noise boundary location for inclusion in District Plan. Assessment of noise effects. Presentation of expert evidence.

### Timaru Airport, NZ

1996 & 2006

Client: Timaru District Council

Prediction of noise contours for various scenarios, preparation of airport noise boundary location for inclusion in District Plan. Revision of noise contours for updating in District Plan.

### Masterton Airport, NZ

2002, 2005 & 2009

Clients: Beca Carter Hollings & Ferner Ltd, Masterton District Council

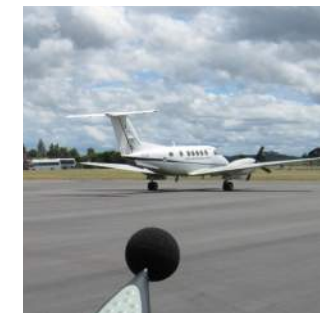
Noise monitoring to verify INM model. Prediction of noise contours for various scenarios. Revision of contours for inclusion in combined District Plan. Re-revision of contours for combined District Plan.

### Hamilton International Airport, NZ

1994

Client: Hamilton International Airport

Review of revised noise contours prepared for Waikato Regional Airport Ltd.





## PROJECT EXPERIENCE IN A REVIEWING CAPACITY

### Western Sydney Airport Peer Review (Badgerys Creek), NSW

2015

Client: Parsons Brinckerhoff / Western Sydney Regional Organisation of Councils

Peer review of the aircraft noise assessment presented in the Environmental Impact Statement (EIS).

### Melbourne Airport Runway Development Programme, VIC

2015

Client: Melbourne Airport

Peer review of the noise impact assessment report, including the assessment methodology, modelling parameters, the modelling procedures and the method of calibrating the Integrated Noise Model (INM) to better represent measured noise levels.

### Sydney Airport, NSW

2009 & 2012

Client: Wilkinson Murray

Peer review of the INM inputs for ANEF contours presented in the 2009 and 2013 Sydney Airport Master Plans.

### New Zealand Standard 6805:1992

Client: Air New Zealand

Review of Proposed New Zealand Standard for Airport Noise at draft stage.

### Southern Lakes International Airport, NZ

1994

Client: Hunter Ralfe - Residents Group

Review noise contours and noise impact of proposed international airport near Lumsden. Presentation of evidence at Planning Tribunal hearing.





## BUILDING ACOUSTICS

The Buildings in the vicinity of airports can be exposed to high levels of noise. Considering the impact of aircraft noise as well as other acoustic requirements at an early stage in the design of a building can save significant costs in the long term and secure an optimum outcome for the development.

The control of aircraft noise intrusion, sound and vibration transmission between different spaces, reverberation control within circulation spaces, building services noise & vibration and PA/paging system infrastructure design, are key considerations.

Our services include:

- Acoustic design and assessment for every type of building, whether it's commercial, residential, hospitality or retail
- Development of acoustic criteria through coordination with the client and design team

*"We have no hesitation in recommending Marshall Day Acoustics for their extensive services in both acoustic and vibration consulting."*

David Waldren  
GROCON

- Design and specification of PA and paging system components and infrastructure (including integration with site-wide communication networks and BMS)
- Innovative and economic solutions for building services noise and vibration control
- Assessment of existing buildings and provision of advice for retrofit acoustic treatment
- Commissioning test programmes to demonstrate compliance with regulatory requirements (e.g. intelligibility of PA systems)
- Development of proprietary software, sold in more than 20 countries worldwide, for predicting sound insulation and acoustic performance of building elements

## PA SYSTEMS

PA systems have a diverse range of requirements, from providing essential paging messages to forming part of life safety evacuation systems. It is generally desirable that PA system components complement and integrate with the architectural design whilst maintaining good clarity and intelligibility.

Achieving such clarity and transparency is the result of careful design and extensive experience; understanding the properties of sound, reverberation and the various technological options available.

Our theatre & AV design team, Marshall Day Entertech, incorporates cutting-edge audio technology to achieve optimal intelligibility in acoustically complex spaces.



## SELECT PROJECTS

### NOVOTEL AUCKLAND AIRPORT HOTEL, NZ

Architect: Warren & Mahoney, Auckland  
Budget: NZD \$65 m

Novotel Auckland Airport Hotel is a 263 room 12 level hotel, built just some 50 metres from airport terminal. The top nine levels are hotel suites with reception, bar, dining, meeting and conference rooms on lower levels. The hotel was designed to meet very stringent noise level guidelines (30 dBA Leq). The client wanted a high-quality, quiet environment for guests, who would likely include flight crews needing to sleep.

With the hotel being so close to the runway, noise was potentially a huge problem. Before work started Marshall Day installed a noise logger on the roof of the airport terminal for a week to determine the exact noise levels that would be incident on the building. Marshall Day's acoustic solution involved a double-glazed façade with an extra-large 600 mm air cavity and thick laminated glass panels. The design was able to meet the strict internal criteria without compromising the views and the natural light. The hotel has been designed to provide a high level of sound insulation between rooms (> FSTC 55) and noise levels from air-conditioning inside rooms controlled to PNC 25 - 30.

### WELLINGTON AIRPORT HOTEL, NZ

Client: Wellington International Airport Limited (WIAL)

Marshall Day Acoustics has been engaged to undertake the acoustic design of the proposed Wellington Airport Hotel and Carpark Project. The Hotel is a 4 star 122 bed Hotel directly adjacent to the existing international terminal.

The scope for the acoustic design includes external and internal sound insulation, building services noise control and advice on internal surface treatments.

Due to the close proximity of the hotel to the runway, the facade design was of primary importance. MDA used 3D environmental modelling of the noise sources and the screening that the building would be afforded. The model was calibrated using on site measurements at the airport. Internal criteria was set using international best-practice comparisons along with auralisation of aircraft flyovers to assist with client decision making.

*“And it’s quiet. Novotel is an oasis of peace in the 24-hour mayhem of a busy airport”* - NZ Herald  
Review of Novotel, by Linda Thompson





### **Auckland International Airport Terminal, Redevelopment and extension, NZ**

2011

Client: Auckland Airport

New terminal development, coinciding with the 2011 IRB Rugby World Cup.

### **Christchurch International Airport Terminal Redevelopment & Lounge, NZ**

Client: Christchurch Airport

Design of acoustics and public address system for the international satellite terminal.

### **Kuala Lumpur International Airport Satellite Building, Malaysia**

Client: UPH Consortium

Design of acoustics and public address system for the Satellite A international terminal building.

### **Melbourne Airport Multi-User Domestic Terminal, VIC**

Client: Fletcher Construction

Terminal extension at Melbourne Airport for use by multiple airlines.

### **Perth Airport Terminal Building, WA**

2013

Client: Aurecon Australia

\$65 m new fitout of Perth Airport, Terminal 1.

### **Orange Airport Terminal Building, NSW**

2012

Client: Geolyse Pty Ltd

Regional airport in country New South Wales.



## Qantas Airways Ltd, VIC

Client: Qantas Airways

Mechanical Services noise assessment for the QANTAS club lounge at Melbourne Airport.

## RAAF Base Edinburgh, SA

2012

Stage 2 Redevelopment

Client: Grocon

Commissioning of new facilities and provision of workable, buildable, and cost effective design solutions to meet the required security and Defence project criteria for noise control from jet aircraft operations

## RAAF Base Townsville, and Army Aviation Centre Oakey, QLD

2010 - 2014

MRH-90 Simulator Design

Client: KBR

Detailed design and commissioning for new helicopter simulators, to reduce noise ingress to critical spaces from existing base aircraft and helicopter activities.

## RAAF Base Woomera, SA

2015 - ongoing

Range Command Centre and Maintenance Storage facilities

Client: KBR

Design and documentation for new Range Command Centre and Maintenance Storage facilities to support the system solution by the Capability Development Group Project AIR3024-Phase 1. Include treatment to reduce noise ingress to critical spaces from fast jet aircraft operations

## Virgin Australia Fitout, Perth Airport Terminal Building, WA

2013

Client: Woods Bagot

Fitout of new Virgin back of house engineering and administration offices including meeting rooms, operations rooms, briefing rooms and training spaces.

## Wellington International Airport Terminal, NZ

Client: Wellington Airport

Design of acoustics and public address system for the terminal of New Zealand's capital city international airport.







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