Christchurch International Airport
Airport Noise Management Plan
May 2019, V.D

CHRISTCHURCH AIRPORT
bringing the world South

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Revision Schedule					
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A	July 2017	Draft for ANLC comment	NR, KM, RB and SP	ANLC	ANLC
B	May 2018	Minor updates to approved version for issue to CCC	FB	MB, SP and RB	ANLC
C	October 2018	Amendments following CCC review	FB and JR		
D	May 2019	Updates following CCC Review	FJB		
E	February 2022	Update for ANLC comment	LC	FH	

F	October 2022	Updates following ANCL Review	JS	FH	

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1 LIST OF DEFINITIONS AND ACRYONMS

1.1 DEFINITIONS

Aircraft Operations	Also referred to as 'Operational Noise' (refer Section 6.1) a) the landing and take-off of aircraft; and b) aircraft flying along any flight path associated with a landing or take-off. For the purposes of Rule 6.1.6 Activity specific noise rules, it excludes: a) aircraft operating in an emergency for medical or national/civil defence reasons; b) air shows; c) military operations; d) Antarctic operations; e) helicopter operations; f) aircraft using the airport as an alternative to a scheduled airport elsewhere; g) aircraft taxiing; and h) aircraft engine testing.
ANB	A composite line formed by the outer extremity of the 65 dB L_{dn} noise contour and the 95 dB L_{AE} noise contour. The Air Noise Boundary defines an area in which the future daily aircraft noise exposure from aircraft operations is sufficiently high as to require land use planning controls
Decibel (dB)	The unit of sound level. Expressed as a logarithmic ratio of sound pressure relative to a reference pressure
L_{AE}	The Sound Exposure Level. The sound level of one second duration which has the same amount of energy as the actual noise event measured. Usually used to measure the sound energy of a particular event, such as an aircraft flyover
L_{Aeq}	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.
L_{dn}	The day night noise level which is calculated from the 24-hour L_{Aeq} with a 10dB penalty applied to the night-time (2200-0700 hours) L_{Aeq}
L_{AFmax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
Noise Calculations	Noise levels calculated using computer modelling software, typically to predict current and future noise levels. Noise measurements are used to verify accuracy of calculated noise levels.
Noise Measurements	In-situ noise measurements of actual noise levels using either semi-permanent noise monitoring terminals or hand-held equipment (sound level meters).
Noise Monitoring	Monitoring of noise levels (generally with respect to assessing compliance with the District Plan), using both noise measurements and calculated noise levels.
On-Aircraft Engine Testing	The testing of engines on aircraft.

1.2 ACROYNMS

AANC	Annual Aircraft Noise Contour
ANB	Air Noise Boundary
ANLC	Airport Noise Liaison Committee
CPD	Christchurch District Plan
CIAL	Christchurch International Airport Limited
ETMS	Engine Testing Management Software
INM	Integrated Noise Model
NMP	Noise Management Plan
NMR	Annual Noise Monitoring Report
NMT	Noise Monitoring Terminals
NZS 6805	New Zealand Standard NZS 6805:1992 "Airport Noise Management and Land Use Planning"
USAP	United States Antarctic Programme

2 INTRODUCTION

Aircraft noise is often the most significant source of contention between communities and airports worldwide. Long term exposure to high levels of noise from airport operations can cause negative health effects and have adverse effects on amenity values. Aircraft noise can also cause disruption to residents and other noise sensitive activities. Effective management of noise resulting in reduced noise exposure enables airports across the world to continue to operate and grow.

Christchurch International Airport Limited (CIAL) must manage noise to reduce adverse effects on the local community, and in turn protect airport operations from reverse sensitivity effects. Christchurch Airport is located close to Christchurch City and operates 24 hrs per day. Consequently, the airport offers significant benefits to businesses and people in the region, including fast and efficient overnight delivery of mail and freight, lower airline fares and frequent trans-Tasman services. However, noise from airport operations, particularly at night, can adversely affect residents and other noise sensitive activities where these are close to the airport.

The extent to which the community is affected by noise is determined by a wide range of factors, including the number of aircraft movements, timing of airport operations, aircraft type, air space management, the proximity of noise sensitive activities, and weather conditions. Aircraft take offs and landings, and on-aircraft engine testing are the most significant noise sources at Christchurch Airport. Noise can also occur because of other activities including use of Aircraft Auxiliary Power Units, Ground Power Units and other ground support activities such as baggage unloading and re-positioning of aircraft, airfield maintenance and site development activities.

In accordance with the District Plan requirements, this management plan has been prepared by suitably qualified and experienced persons, and in consultation with the Airport Noise Liaison Committee (ANLC).

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ANLC	Airport Noise Liaison Committee

3 STATUTORY REQUIREMENTS

The Christchurch District Plan (CDP) contains rules relating to the control of noise emissions from Christchurch Airport. The approach adopted is to set noise limits which the airport cannot exceed. These limits have been determined through assessing the noise effects and with reference to relevant standards and guidelines. Methods of reporting on this are also stipulated.

For operational noise, the noise limits have been determined with reference to NZS 6805; the New Zealand airport noise standard.

For on-aircraft engine testing noise, the noise limits have been set through a specific noise assessment addressing the most appropriate methods to control on-aircraft engine testing noise, referencing on-aircraft engine testing noise control rules around New Zealand.

Rule 6.1.6.2.7.1 in the CDP and associated Appendix 6.11.14 (see appendix 1) requires aircraft operations and on-aircraft engine testing at Christchurch Airport to be managed in accordance with an Airport Noise Management Plan.

In addition to the District Plan requirements, there is also a general duty placed on the airport by Section 16 of the Resource Management Act to avoid unreasonable noise.

The Noise Management Plan (NMP) must be reviewed, and updated if required, at least once every two years.

The plan must contain the following information:

- Outline the methods used to demonstrate how aircraft operations and on-aircraft engine testing at the airport will comply with the District Plan noise limits;
- Consider alternative methods of noise management and mitigation to reduce noise effects from aircraft operations and on-aircraft engine testing;
- Engine maintenance ground run procedures for on-aircraft engine testing, to be implemented in conjunction with all aircraft operators and their agents;
- Details of a noise monitoring programme for the noise monitoring and reporting required by the District Plan;
- A complaints procedure for responding transparently and expediently to any complaints about noise from aircraft operations or on-aircraft engine testing;
- A disputes resolution procedure;
- A procedure for presenting the following reports transparently and expediently in a publicly accessible forum:
    - The Airport Noise Management Plan
    - Annual Aircraft Operations Noise Monitoring Report,
    - Annual On-Aircraft Engine Testing Noise Monitoring Report
    - Quarterly On-Aircraft Engine Testing Report

- Seven day rolling report of noise from on-aircraft engine testing against the District Plan noise limits at 8 specific monitoring positions
- Daily L_{AFmax} report of noise from on-aircraft engine testing noise at the edge of the residential zone
- A summary of complaints received annually, and a description of actions taken to address complaints.

- Schedules of the acoustic treatment implemented over the previous calendar year, acoustic treatment offered where conditions of the offer required by Section b of Appendix 6.11.15 have not been met.

4 NOISE LIMITS

This NMP demonstrates how aircraft operations and on-aircraft engine testing are managed to ensure that the airport complies with the District Plan noise limits. Those noise limits are described in this section.

4.1 NOISE LIMITS FOR AIRCRAFT OPERATIONS

The noise limits for aircraft operations are detailed in Rule 6.1.6.2.5 of the District Plan (refer to appendix 2 of this plan). The rule states that noise from aircraft operations shall not exceed 65 dB L_{dn} outside of the 65 dB L_{dn} noise contour shown in Figure 1 below:

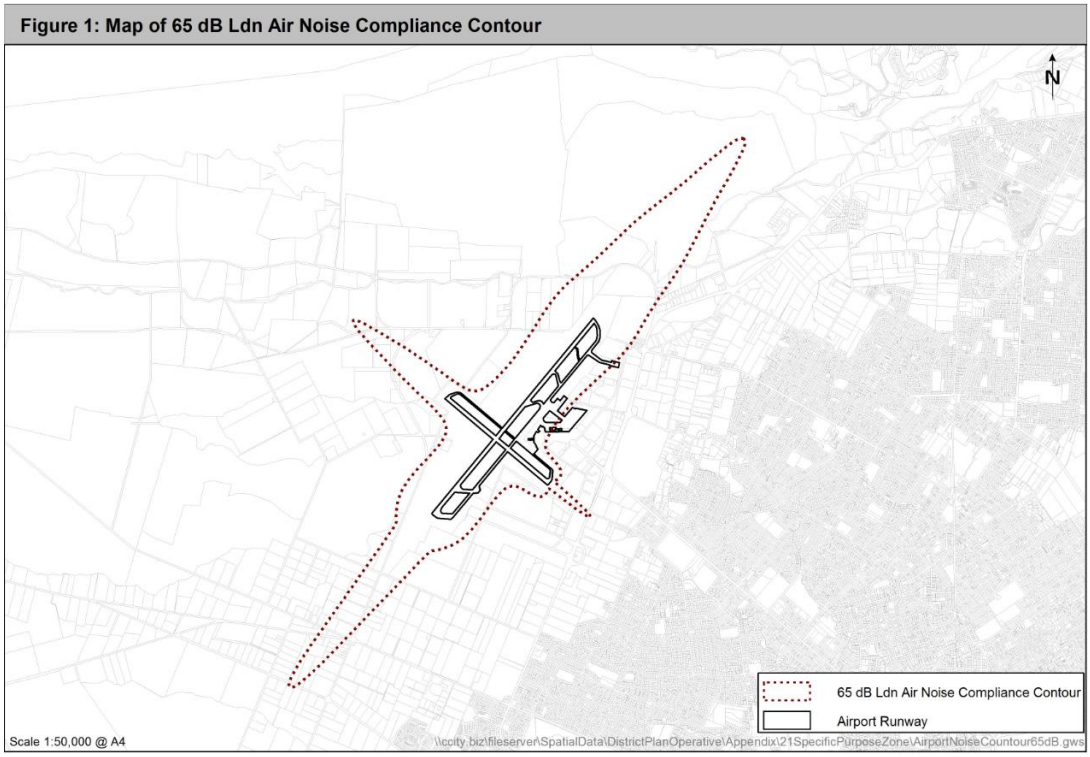


Figure 1: District Plan 65 dB L_{dn} air noise compliance contour

Some exceptions to this rule are permitted. Noise may exceed the limit by up to 2dB if the exceedance is due to atypical weather, national flight disruption, natural disaster or other unplanned circumstances. Noise exceedances resulting from the circumstances listed above are reported in the annual noise monitoring report.

4.2 RULES AND NOISE LIMITS FOR ON-AIRCRAFT ENGINE TESTING

The rules and maximum noise limits for on-aircraft engine testing are detailed in rule 6.1.6.2.6 of the District Plan (refer to appendix 3 of this plan). The rule states that on-aircraft engine tests must comply with the following standards:

Noise from on-aircraft engine testing shall not exceed the limits shown in Table 1 below when measured at the specified on-aircraft engine testing compliance monitoring positions shown on the contour maps in Figure 2 below.

Table 1: District Plan on-aircraft engine testing noise limits

Noise Limit	On-aircraft engine testing compliance monitoring positions (ETCMP) - refer Figure 2
65 dB L_{dn}, 7 day	8 points
55 dB L_{dn}, 7 day	8 points
75 dB L_{Amax} 2200 to 0700 only	Edge of residential zone – 3 points

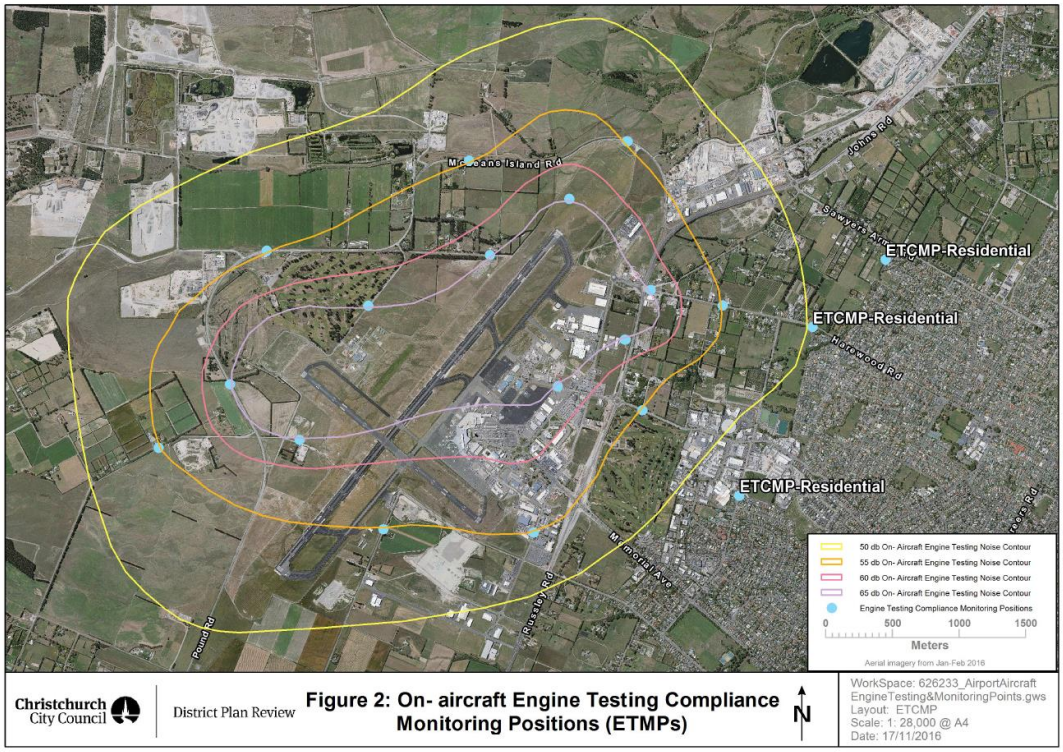


Figure 2: District Plan on-aircraft engine testing noise contours and monitoring positions

In addition,

- Within any three-month period, a maximum of five unplanned high-power jet engines tests may be carried out between the hours of 2200h and 0700h. There shall be no more than 12 unplanned high-power tests per year carried out between 2200 and 0700h hours.

- All other high-power jet engine tests must be carried out between 0700h and 2200h.

- Any on-aircraft engine tests for turbo prop engine aircraft between the hours of 22:00 and 07:00h, with a total duration of testing at high power for 5 minutes or more per aircraft shall be conducted near the threshold of Runway 11. This is the northwest end of the crosswind runway.

4.2.1 EXCEPTIONS

The on-aircraft engine testing rules do not apply to the following activities:

- Engine testing for aircraft used for Antarctic operations;

- Engine testing necessary to satisfy an airworthiness directive or other safety requirement issued by the Minister of Transport, the Director of Civil Aviation or the Civil Aviation Authority;

- Any other unplanned testing arising from an aircraft operator identifying a safety issue relating to an aircraft fleet, or required because of a natural disaster including volcanic eruption;

- Turbo prop engine testing is exempt from the requirement to use the threshold of Runway 11 between the hours of 22:00 and 07:00h, during times that Runway 11/29 is in use.

5 NOISE MANAGEMENT

CIAL implements a range of measures to ensure that operational noise from aircraft and noise from on-aircraft engine testing complies with the District Plan noise limits. This section details how airport operations are managed to ensure that on-aircraft engine testing and aircraft operations comply with the maximum permitted noise limits described in Section 4.

5.1 MANAGEMENT OF AIRCRAFT OPERATIONS AND ON-AIRCRAFT ENGINE TESTING

CIAL provides and maintains airport infrastructure such as runways, terminals, airport parking and other infrastructure to facilitate an operational airport. It does not directly manage aircraft movements or conduct on-aircraft engine testing. Christchurch Airport(?) is responsible for ensuring all operators conduct airport operations and on-aircraft engine testing in a manner that does not breach noise limits specified in the District Plan.

Airways New Zealand is responsible for managing air navigation and air traffic management across New Zealand, including managing the take-off, landing and taxiing of aircraft at Christchurch International Airport. Airways follow Civil Aviation Authority (CAA) standards and communication procedures, as legally required, when controlling air traffic movement.

On-aircraft engine tests are carried out by airline operators or repair companies who operate on the airport campus. These airline operators or repair companies manage on-aircraft engine testing, including where, when and how these are conducted.

To achieve compliance of operational aircraft noise, CIAL influences aircraft noise through the approval of departure and arrival tracks and the use of noise abatement departure procedures. This can be achieved through working with Airways and the Civil Aviation Authority (CAA) to implement 'good neighbour behaviour'. Good neighbour practices are generally considered to be actions that accommodate community concerns and interests.

To manage noise generated from on-aircraft engine testing, CIAL uses two primary tools; these are the Engine Testing Management Software (ETMS) and the Ground Running Procedures Policy document.

5.1.1 OPERATIONAL NOISE

CIAL manages operational noise using several methods. The approach is firstly to understand and quantify how noise is generated from airport operations, thus enabling operators within the airport and stakeholders to make informed decisions as to how airport operations are to be managed. The primary goal is to ensure the operation of Christchurch Airport complies with the 65 dB L_{dn} noise contour.

CIAL uses noise monitoring to understand and quantify airport operational noise levels. Noise monitoring includes computer noise modelling and field noise measurements.

Each year computer noise modelling is used to generate Annual Aircraft Noise Contours (AANCs). These predictions are then verified with field noise measurements to ensure their accuracy.

This approach is used as it is impractical (and cost-prohibitive) to measure noise levels at every relevant location. However, the general proviso to this is that these calculations need to be checked for their accuracy, which is done by using targeted noise measurements at several key locations.

The noise monitoring can then be used as a tool itself, in that the results inform discussions held between CIAL and various stakeholders regarding noise management.

One such example would be that CIAL works with Airways encouraging airline operators to implement 'good neighbour behaviour'. This includes making changes to minimal operational heights around densely populated areas, altering take-off and landing procedures and the taxiing of aircraft. These changes are influenced by the extent of current noise emissions, as shown in the yearly AANC.

In addition to encouraging airlines to manage operations in such a way to reduce noise, certain types of aircraft are banned from using Christchurch Airport. These include chapter 2 aircraft as defined by ICAO Annex 16.

CIAL has worked with the Canterbury Aero Club to implement good neighbour behaviour with regards to night flight training. Night flying is an essential part of the NZ CAA's requirements for professional pilot licences, and the Canterbury Aero Club offers the opportunity to carry out this training as part of their pilot training programme. Night flying involves flying at relatively low altitude over both rural and urban areas. In response to community concerns about light aircraft noise around Christchurch City, CIAL have worked with the Canterbury Aero Club to improve practices and restrict late night flying to no later than 22:00 in winter and 23:00 in summer to reduce noise experienced by residences. This has resulted in a significant reduction in the number of noise complaints received by CIAL associated with light aircraft manoeuvres.

CIAL recognises that there is increased sensitivity to aircraft noise at night. Night-time aircraft noise events and associated impacts are managed using the L_{dn} noise metric which includes the imposition of a 10-decibel penalty for night-time noise. CIAL also considers noise impacts when scheduling additional aircraft movements at night.

CIAL also uses noise monitoring to establish how changes in operations may impact noise levels generated from operations.

Noise monitoring compliments work CIAL does in the management of noise when changes to airport operational characteristics occur or are planned. When a change occurs, or is scheduled to occur, an assessment is carried out to see what effect it would have on the airport's compliance, and whether anything additional can be done to reduce possible resultant noise impacts.

Recent examples are given below:

15/15 Departures

The commercial aviation flight sector is moving towards planned and predictable procedures that allow Flight Management System support and the most recent procedure update is Divergent Go-Around and Missed Approach (GOMA) (informally referred to as 15/15 departures at Christchurch Airport).

GOMA is a flight path enhancement implemented by Airways NZ and expected to be rolled out at major aerodromes across the country. It is designed to reduce likelihood of confliction between departing and inbound flights in the event of a missed approach.

Site-specific GOMA procedures are developed; local topography, location of urban populations and climb profiles are all inputs in the design of the procedure.

In very simple terms GOMA results in departing aircraft making a 15-degree divergence off the centreline from departure, and in the event of a missed approach, the inbound aircraft makes a 15-degree divergence off centreline in the opposite direction. GOMA provides an increase in safety and predictability in the event of a missed approach and provides for increased capacity and more efficient use of airport infrastructure.

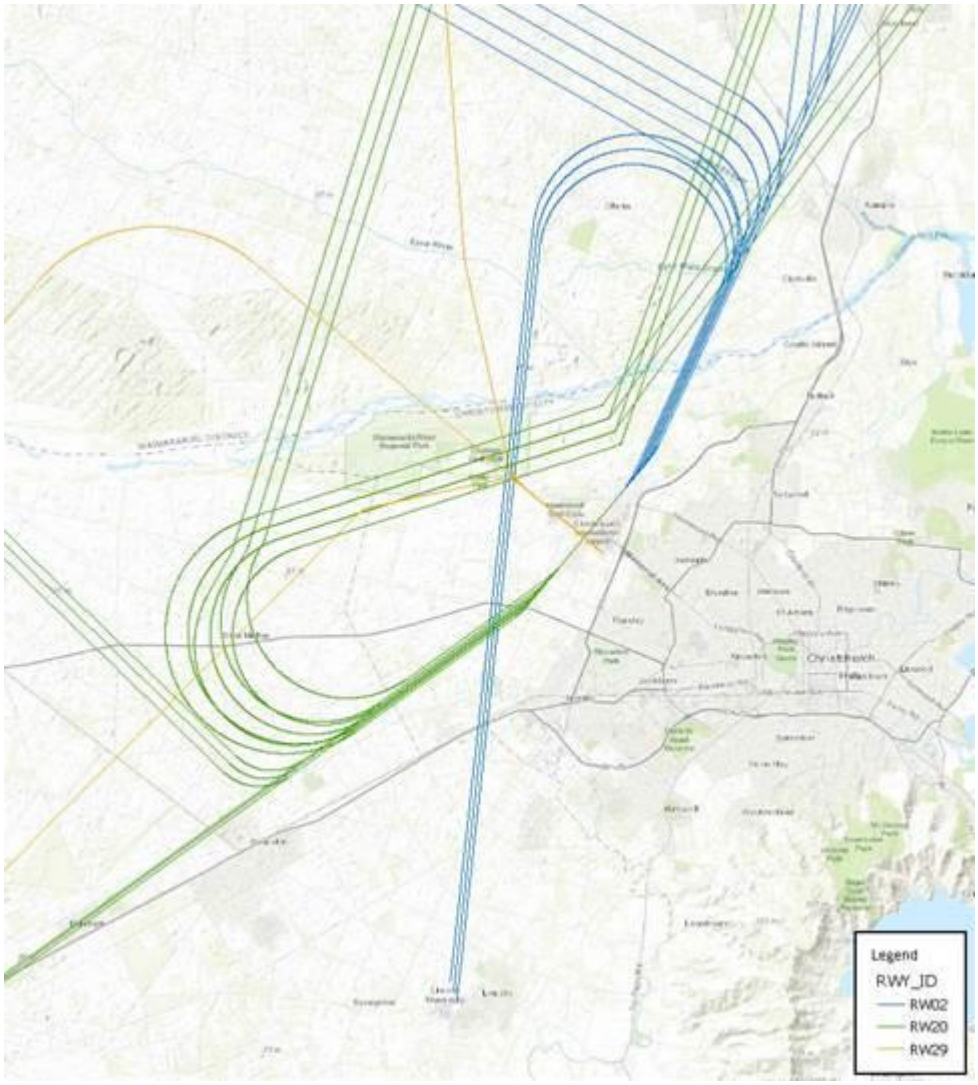


Figure 3: GOMA flight tracks for RW02, RW20 and RW29 departures

Prior to the flight path change and as part of the approval process CIAL, Airways NZ and Marshall Day Acoustics investigated the impact of GOMA on the annual compliance contour and on-going compliance. Investigations included updating flight paths in the AANC to include GOMA, calculating the "2025" AANC based on 2.1% per annum growth of the busiest three months of 2018. Investigations identified that compliance with the 65 dBA Ldn would be achieved.

RNP/PBN Trial

Airways NZ began developing a new set of arrival procedures known as RNP (Required Navigation Performance)/ PBN (Performance Based Navigation) in 2016 with the aim to improve aircraft efficiency.

These procedures were trialled at Christchurch Airport over a 12-month period in 2017-2018 in a study referred to as the 'Christchurch PBN Flight Paths Trial'. The results show that significant benefits were achieved in distance saved, flight time reduction, fuel savings, CO_2 emissions avoided and passengers receiving benefits of increased safety and flight time reduction. The trial also concluded that RNP/PBN changed the overall noise level (Ldn) by up to 2dB which is within the margin of variation and is regarded as being indiscernible.

Due to the range of benefits achieved, the RNP/PBN flight paths became operational at Christchurch Airport at the end of 2018.

Runway Overlay (Project Takatu)

A noise assessment was completed by CIAL prior to the commencement of the runway overlay project. The runway overlay project resulted with increased use of the cross-wind runway, particularly at night. The airport completed a noise assessment to establish if increased use of the cross-wind runway would breach the compliance noise contours. The noise assessment identified that a cap on the number of movements on the cross-wind runway was required to manage compliance within the noise contours.

Garden City Helicopter Relocation

Garden City Helicopters relocated from the corner of Memorial Avenue and Ron Guthrey Road to a new facility on Grays Road in late 2017. For the purposes of the District Plan, helicopter operations are not considered Aircraft Operations and as such noise associated with helicopter movement is not included in compliance calculations. However, the CIAL wanted to understand noise impacts associated with the relocation and a noise assessment was carried out to establish if relocation of Garden City Helicopters would materially impact the compliance contour.

In summary, the noise effects were assessed to be reasonable, based on the existing noise environment, the current noise exposure that is occurring in the area, and the proposed number of helicopter flights that would occur. The assessment also concluded that noise levels would be below noise levels recommended in the helicopter noise standard and on that basis no further action was deemed necessary.

5.1.2 ON-AIRCRAFT ENGINE TESTING

On-aircraft engine testing is defined in the CDP as the testing of engines on-aircraft. On-aircraft engine testing is generally required as part of pre-flight testing following engine repairs and maintenance and occurs outdoors. As a result, on-aircraft engine testing is more likely to affect residents as it must occur outdoors.

Off-wing testing involves detaching engines from aircraft and testing occurs inside a dedicated test cell in a purpose built in door facility. It is generally required after major maintenance and repairs.

The District Plan requires CIAL manage on-aircraft engine testing and for operators to ensure compliance with testing restrictions and noise limits at the locations referred to in Section 3.2. To manage on-aircraft engine testing, CIAL uses two primary tools:

- Engine testing management software (ETMS) and
- Ground running Procedures Policy document.

5.1.3 ENGINE TESTING MANAGEMENT SOFTWARE

Engine Testing Management Software (ETMS) is a web-based application developed by Marshall Day Acoustics as the primary tool to manage on-aircraft engine testing noise. The ETMS predicts on-aircraft engine testing noise calculating whether a scheduled test complies with on-aircraft engine testing noise limits. Details of the ETMS are provided in Appendix 3.

Software predictions are based on noise data from engine tests for different aircraft at different power levels. The software predictions are verified against noise measurement data collected from noise monitoring terminals (NMT) placed around the periphery of the airport. Noise monitors were installed during the first six months of the development of the ETMS and will be redeployed biannually for reverification.

Prior to conducting an engine test, the operator enters test details into the ETMS. The system then indicates if the test can occur, based on whether the proposed test would exceed the allowable noise 'budget'. If the test is approved, a portion of the total noise budget is then reserved for the operator until the test is completed. Once the engine test is completed the operator must update the test details to ensure any variations are captured. The system will not approve any test that will result in an exceedance of the allowed noise budget.

The ETMS includes a reporting function that produces daily, quarterly and annual reports. The software sends automatic emails to CIAL staff and senior operator staff should a breach occur; the noise levels are close to breach limits; a malfunction has occurred; or when scheduled tests have not been completed where noise budget has been reserved. In the instances of a breach, steps will be taken to inform the Council and the ANLC and formulate future steps.

Additionally, this process allows the airport to proactively manage on-aircraft engine testing noise. If a new operator intends to establish a testing facility or whenever a change in the airport on-aircraft engine testing regime occurs, a requirement to check noise compliance is triggered. The airport can use the ETMS to assess the noise impact of such a change.

5.1.4 GROUND RUNNING PROCEDURES

CIAL have developed a ground running procedure, to help all operators (including Antarctic operations) who conduct on-aircraft engine testing implement the ETMS. This procedure outlines how and when to use the ETMS, ETMS restrictions to be adhered to and the responsibilities of all parties. The document also outlines penalties to be imparted upon operators who breach the Plan restrictions. A copy of this document is attached in Appendix 4 of this Plan

The United States Antarctic Programme (USAP) has signed the Ground Running Procedures Policy document, however, in accordance with Rule 6.1.6.2.6 (a) (iv) (A) they are not bound by the restrictions in the District Plan. For the USAP, a clause has been added to their document that requests that all engine tests are undertaken between the hours of 0700 and 1900 where possible.

5.2 CONSIDERATION OF ALTERNATIVES

Alternative methods for managing and mitigating noise to achieve the reduction of noise effects from all aspects of aircraft operations, including on aircraft engine testing, was considered during the District Plan Review Process.

The use of ground run-up enclosures (GRE) were considered. The use of such a facility was balanced against the imposition of on-aircraft engine testing contours and on-aircraft engine testing restrictions in relation to whether it would achieve suitable reductions in noise levels. The cost of developing such a facility was also considered in the context of predicted reduction in noise levels. The use of a GRE was not considered to be a suitable alternative to the use of noise contours and on-aircraft engine testing restrictions as a more effective means to manage aircraft on-aircraft engine testing noise.

CIAL have considered and implemented alternative methods to power aircraft while they "parked" on the Apron during boarding, unloading and turnaround time between flights. Traditionally aircraft would use engines to provide power to the aircraft or alternatively plug into ground power unit (GPU's). Christchurch Airport provides ground power services allowing aircraft to "plug-in" removing the need to run engines or run GPU's and noise associated with running engines or GPU's. Apron noise resulting from operations not associated with aircraft movement is not covered by the definition of aircraft operations in the District Plan, however, this alternative does reduce noise generated on the campus.

CIAL will revisit alternatives when they are put forward. The ANLC is the main forum for consideration of alternatives.

6 NOISE MONITORING PROGRAMME

The CDP requires CIAL to monitor noise levels and produce monitoring reports.

As mentioned in Section 5, the main purpose of noise monitoring is to determine whether noise levels comply with the maximum noise limits set out in the CDP and to allow noise management procedures to be instigated where exceedances occur. There are separate noise monitoring and reporting requirements for aircraft operational noise and on-aircraft engine testing noise.

The monitoring and reporting requirements are outlined in Rules 6.1.6.2.5 and 6.1.6.2.6 in the CDP.

6.1 MONITORING OPERATIONAL NOISE

Noise from aircraft operations is monitored using both calculations from an operational aircraft noise model and records of actual aircraft movements. Noise is also monitored using real time noise measurements which are then used to verify the accuracy of the operational aircraft noise model.

6.1.1 THE ANNUAL AIRCRAFT NOISE CONTOUR

The primary method for monitoring operational noise is by calculating 'compliance contours'. These use the total number of aircraft movements occurring in a given year to produce the Annual Aircraft Noise Contour (AANC). As referenced in NZS6805: 1992 the noise model used to develop the AANC is the United States Federal Aviation Authority Integrated Noise Model (INM). The INM is the same model used to prepare the CDP noise contours. Noise calculations are performed by a person with appropriate qualifications and experience in airport noise modelling and acoustics assessment.

The AANC map is based on total aircraft movements from the busiest three-month period of the previous year. The calculations take account of aircraft type, time of day, runway used, timing and published flight paths. INM does not provide for actual flight paths flown, however, published flight paths are used. Airways and the Acoustic Engineer go through a visual process reviewing flight path information ensuring the published flight paths used in the INM are still a reasonable approximation of actual flight paths flown. Any new published flight path procedures are also incorporated into the INM. In the future CIAL hopes to use updated modelling software which provides for the use of actual flight paths flown when calculating the AANC. CIAL has produced aircraft noise contour maps annually since 2006. The contour produced is then assessed against the 65 dB $_{Ldn}$ air noise compliance contour in the CDP to determine compliance.

Where the AANC is calculated to be within 2 decibels of the CDP compliance contour, CIAL will conduct an initial summary review as to the extent and cause of this margin. The Environment and Planning Manager and Acoustic Engineer will be responsible for making the decision to conduct the initial summary review and any further analysis that may be required.

Where the AANC are calculated to be within 1 decibel of the CDP compliance contour, CIAL will undertake more detailed analysis including noise measurements to verify the AANC. The Environment and Planning Manager and Acoustic Engineer will be responsible for making the decision to undertake a more detailed analysis. Noise measurement results and analysis would be contained in the Annual Noise Monitoring Report and the methods for further investigation communicated to the ANCL.

6.1.2 VERIFICATION OF THE AANC

Verification of the AANC is to be completed no less than every 3 years. If the AANC is within 1dB of the compliance contour in the CDP, CIAL will increase the verification frequency to yearly. The Environment and Planning Manager and Acoustic Engineer will be responsible for making the decision to undertake verification measurements. Verification is to be completed using NMT placed within the vicinity of Christchurch Airport and the process to identify the exact locations of the NMT is to be determined with consultation with the ANLC. Details of the noise verification, including information such as the noise measurement programme and noise analysis, are to be included in the noise monitoring report. It is expected that noise measurements would primarily be used to verify the AANCs, but on occasion can be used to assess specific noise issues.

6.2 MONITORING ON-AIRCRAFT ENGINES TESTING NOISE

Noise levels from on-aircraft engine testing is monitored using noise calculation software (ETMS) and real-time noise verification measurements.

6.2.1 CALCULATING ON-AIRCRAFT ENGINES TESTING NOISE USING THE ETMS

Noise levels from on-aircraft engine testing is monitored using noise calculation software which uses data supplied from actual on-aircraft engine testing events. The noise level is calculated as a 7-day rolling average, that is the average level of noise resulting from on-aircraft engine testing over the previous 7-day period. This is calculated automatically each day for the preceding 7-day period by the ETMS. The ETMS also calculates daily maximum noise level in relation to the daily 75 dB L_{Amax} noise limit at the edge of the residential zone that must also be complied with. The ETMS is verified using noise measurements to be conducted in accordance with Rule 6.1.6.2.6v.B.

6.2.2 MEASURING ON-AIRCRAFT ENGINE TESTING NOISE

Noise from on-aircraft engine testing must also be measured to verify that the calculated noise levels are accurate. Measurements must be taken from the on-aircraft engine testing Compliance Monitoring Positions. There are 8 monitoring positions located on each of the 65 dB L_{dn} dB and 55 dB L_{dn} on-aircraft engine testing contours, and a further 3 positions along the boundary of the residential zone. The monitoring positions are shown in figure 2 in Section 3.2 of this plan.

CIAL completed the first-round of on-aircraft engine testing noise verification measurements in the last quarter of 2017. Subsequent verification measurements have occurred in 2019 and 2021. In accordance with the CDP, CIAL will undertake on-aircraft engine testing noise verification measurements biannually, with the results and analysis of verification measurements to be included in the Annual Noise Monitoring report. CIAL will also on occasion undertake specific on-aircraft engine testing noise measurements when it is deemed necessary to do so.

6.3 NOISE REPORTING

In accordance with Rule 6.1.6.2.5 and 6.1.6.2.6 of the District Plan, CIALis required to produce annual noise monitoring reports for both aircraft operational noise and on-aircraft engine testing. The Annual Noise Monitoring Report is submitted to Christchurch City Council and is made publicly available on the Christchurch Airport website. The report is produced for the calendar year (1 January – 31 December). In addition to

reporting requirements as outlined in the CDP the annual report will also include any other acoustical considerations during the previous calendar year.

6.3.1 REPORTING AIRCRAFT OPERATIONS NOISE:

Information in the annual noise monitoring report on aircraft operations noise includes:

- The AANC;
- The results of any verification measurements undertaken;
- Analysis of whether the noise from aircraft operations complied with the noise limit at the 65 dB L_{dn} noise compliance contour;
- Any instances where noise levels exceeded the permitted limit at the compliance contour, and the reasons for the exceedances;
- A summary of the complaints received over the previous year in relation to noise from aircraft operations, and the actions taken in response.

6.3.2 REPORTING ON-AIRCRAFT ENGINE TESTING NOISE:

Information in the annual noise monitoring report on On-aircraft Engine testing includes:

- The results of verification measurements taken;
- Analysis of whether the noise from on-aircraft engine testing has complied with the applicable noise limits;
- A summary of complaints received over the previous year in relation to noise from on-aircraft engine testing, and any actions taken in response.

The ETMS includes a reporting function capturing data required to compile the annual, quarterly and daily reporting requirements. CIAL makes these reports publicly available and submits reports to Christchurch City Council for compliance purposes.

6.3.3 QUARTERLY ON-AIRCRAFT ENGINE TESTING REPORTING:

The CDP also requires CIAL to provide a Quarterly On-aircraft Engine Testing Report to Christchurch City Council. The report must include:

- a summary of all on-aircraft engine testing activities undertaken during the quarter;
- All tests undertaken that complied with the applicable noise limits;
- All tests undertaken that are exempt from the noise limits, (e.g. tests on Antarctic aircraft) the reasons the tests were exempt, and any measures taken to manage noise effects during those tests.

Information required to compile quarterly reports is captured and reported via the ETMS. CIAL makes these reports publicly available and submits reports to CCC for compliance purposes. Quarterly reporting periods are January-March, April-June, July-September, October-December. The report will be published no later than the 30th of the month following the completion of the reporting period.

6.4 SOFTWARE REVIEW

Noise monitoring for both aircraft operational noise and on-aircraft engine testing noise use acoustic software packages to generate predicted noise levels. Noise calculations for aircraft operational noise uses the Version 7 of the INM. Compliance contours in the CDP were developed using v7 of INM. To ensure consistency of calculated noise levels CIAL uses the same software.

CIAL will review software packages used to calculate aircraft operational noise levels as new versions of the software are developed. At a minimum CIAL will review software used every five years.

The ETMS is a software packaged developed by acoustic engineers, taking account of noise level data sourced from aircraft manufacturers and noise measurements of aircraft on the ground at Christchurch Airport. Engines testing noise verification measurements (detailed in Section 5.2.1) are used to update the software package to ensure calculated noise levels are an accurate representation of actual noise levels generated.

7 COMPLAINTS

In accordance with Rule 6.1.6.7.1 in the CDP, CIAL must provide a procedure for transparently and expediently in responding to any complaints received in relation to noise from aircraft operations or on-aircraft engine testing. CIAL has an on-line system in place to, register, investigate, respond and report on all noise complaints.

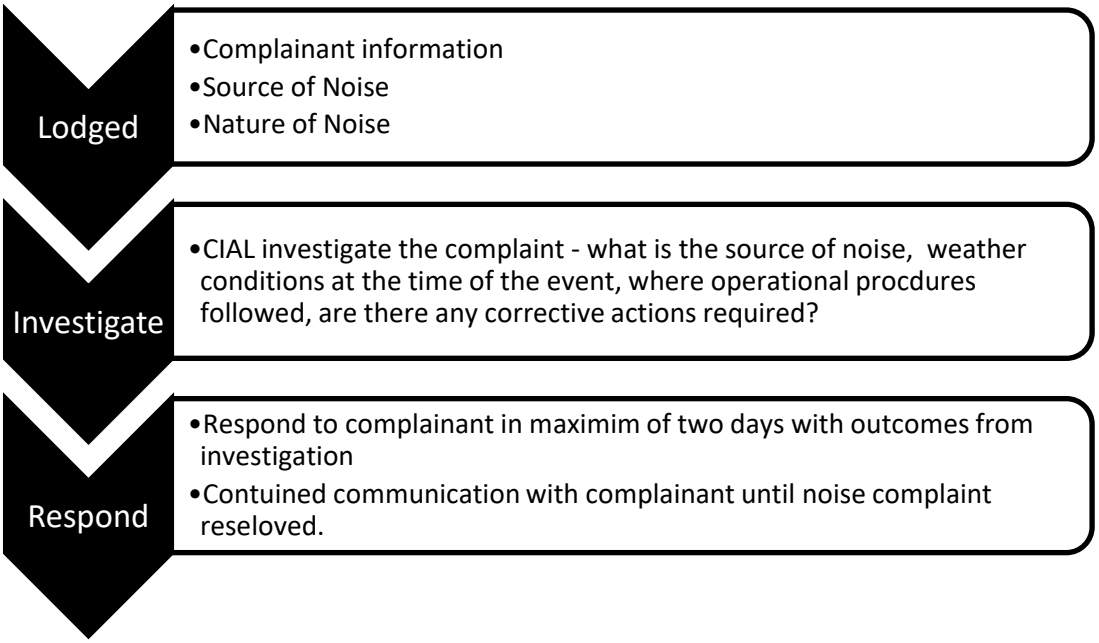
7.1 COMPLAINT PROCESS:

Members of the public register a compliant either via the Christchurch Airport website (noise complaint feedback form here), the post or by contact via the phone. CIAL records details of the complaint and the complainant using the on-line tool. Information recorded in the online tool includes:

- Complainant details and preferred method of communication;
- Source and nature of noise;
- Outcomes of CIAL's investigation into the noise source;
- Communication with the complainant;
- CIAL's response timeframes.

CIAL then investigates the complaint looking specifically into what caused the noise, where operational procedures followed, what were the weather conditions at the time and are there any corrective actions. CIAL then communicates findings of the investigation with the complainant initially within a maximum of 2 days and will continue to update the complainant on the investigation until the complaint is resolved.

Complaint's process:



7.2 COMPLAINT REGISTER

The online tool used to manage the noise complaints is also the noise complaints register used to produce noise complaint reporting information.

The online tool is used to provide a summary of complaints received annually and a description of steps taken to address complaints. A summary of complaints received annually will be found on the Christchurch Airport website in the annual noise monitoring report. Copies of individual complaints are not published to protect the privacy of individuals in accordance with the requirements of the Privacy Act 1993. The summary of complaints will provide information about the types of complaints received, and a description of the actions CIAL has taken to address the complaints. CIAL also updates the ANLC on all noise complaints and actions taken. The ANLC may make recommendations to CIAL in relation to complaints that CIAL endeavours to give effect to where possible.

8 DISPUTE RESOLUTION PROCEDURE

CIAL acknowledges that in some instances the noise complaint procedure outlined in Section 7 may not completely resolve noise issues reported. In this instance, the disputes resolution process detailed below is to be implemented.

1. CIAL accepts it is the prerogative of the chairperson of the Airport Noise Liaison Committee (ANLC) to determine that a point of difference exists and that the chair may endeavour to resolve the issue acting as a mediator.

2. If the chairperson determines the issue is of significance or the point of difference is within the ANLC the chairperson may appoint an independent mediator at the cost of CIAL.

3. To facilitate meditation CIAL will provide the chair at its cost with whatever information and advice the chair considers is reasonably necessary including if a legal opinion on the issue or aspects of it, on the basis that the information and advice will be made available to the members and CIAL.

4. The ANLC will formally provide and recommend to the appropriate body the reason for that recommendation and any supporting material. The ANLC will also advise as to whether the recommendation relates to aviation safety and operations.

5. If despite best efforts (including independent mediation if the Chairperson so chooses) a consensus cannot be reached within the ANLC, the appropriate body making the decision will consider any recommendation on the issue in dispute that the chairperson may make and will formally advise the chairperson within 10 working days of its decision in respect of any such recommendation and the reasons for its decision.

9 NOISE MANAGEMENT WEBSITE

9.1 AIRPORT NOISE MANAGEMENT PLAN

Previous and the current Airport Noise Management Plan can be viewed at:

Airport Noise Management Plan

9.2 AIRCRAFT OPERATIONS

The Aircraft Operations Noise Monitoring Report will be published annually and can be viewed at:

Annual Noise Monitoring report (both Aircraft Operations and On-Aircraft Engine Testing)

9.3 ON-AIRCRAFT ENGINE TESTING

Noise from on-aircraft engine testing is continuously monitored by CIAL. A 7-day rolling report will be published daily on the Christchurch Airport website by 12pm the following day, which will include the L_{dn} 7-day noise levels and the L_{Amax} for the previous day. This information can be viewed at:

On-Aircraft Engine Testing 7 day rolling report and the L_{dn} 7-day noise levels and the LA_{max} for the previous day

The annual On-aircraft Engine Testing Noise Monitoring Report can be viewed at:

Annual Noise Monitoring report (both Aircraft Operations and On-Aircraft Engine Testing)

9.4 SUMMARY OF NOISE COMPLAINTS

A summary of noise complaints received annually (calendar year) and a description of actions taken to address complaints can be viewed at:

Annual summary of noise complaints and a description of actions taken to address complaints

10 SCHEDULE OF ACOUSTIC TREATMENT

In accordance with Rule 6.1.6.2.7.2 b (i) CIAL will make offers for acoustic treatment or advice to eligible property owners within 24 months of 6 March 2017. The initial offers of acoustic treatment and advice were sent to the applicable dwelling owners on 5 March 2019.

Each year after 6 March 2019, within 12 months from the date, CIAL will formally offer acoustic mitigation (either as acoustic treatment or mechanical ventilation) to dwelling owners as specified in the CDP to any additional residential units that meet the requirements at that time. In 2020, six properties were located within the 65dB L_{dn} Annual Aircraft Noise Contour, and 11 properties within the 60-65dB L_{dn} Engine Testing Contour. The owners were contacted and offered acoustic mitigation or advice.

One property owner has accepted an offer, and works have commenced to their property. The ANLC is also working with two other owners of properties that are entitled to full acoustic treatment, and four other owners of properties that are entitled to mechanical ventilation.

No additional properties were within the 2021 AANC and therefore no further mitigation offers will be made.

11 REVIEW

11.1 REVIEW OF AIRPORT NOISE MANAGEMENT PLAN

This document is required to be reviewed at least once every two years. The next review of this document will commence before 3/10/2024.

11.2 REVIEW OF NOISE MANAGEMENT SOFTWARE

The software used to monitor and manage aircraft operations and on-aircraft engine testing at Christchurch Airport is required to be reviewed at least once every five years.

The next review of this software will commence on or before 01/06/2022.

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APPENDIX 1: DISTRICT PLAN RULE 6.1.6.2.7.1 AND APPENDIX 6.11.14

6.1.6.2.7.1 Airport Noise Management Plan

a. Within 12 months of 6 March 2017, noise from aircraft operations and on-aircraft engine testing at Christchurch International Airport shall be managed in accordance with an Airport Noise Management Plan prepared by a suitably qualified and experienced person on behalf of the airport operator and in consultation with the Airport Noise Liaison Committee, in accordance with the requirements set out in Appendix 6.11.14. The Airport Noise Management Plan shall be reviewed, and updated if required, at least once every two years.

b. The Airport Noise Management Plan shall:

   i. demonstrate how compliance with the following noise limits will be achieved:

      A. for aircraft operations - Rule 6.1.6.2.5; and

      B. for on-aircraft engine testing - Rule 6.1.6.2.6.

   ii. provide the details of the noise monitoring programme;

   iii. incorporate a procedure for transparently and expediently responding to any complaints received in relation to noise from aircraft operations and on-aircraft engine testing; and

   iv. incorporate a procedure for transparently and expediently presenting, in a publicly accessible forum, the following:

      A. the Aircraft Operations Noise Monitoring Report, On-aircraft Engine Testing Report, and On-aircraft Engine Testing Noise Monitoring Report required by Rules 6.1.6.2.5 and 6.1.6.2.6;

      B. a 7-day rolling report of noise from on-aircraft engine testing against the requirements of Rule 6.1.6.2.6 a.; and

      C. a daily L_{Amax} report of noise from on-aircraft engine testing against the requirements of Rule 6.1.6.2.6 a. at the edge of the residential zone.

c. Link to: Christchurch District Plan Rule 6.1.6.2.7.1

Appendix 6.11.14 Airport Noise Management Plan

a. The Airport Noise Management Plan required by Rule 6.1.6.2.7.1 shall:

   i. document noise management actions including ongoing investigations, methods, processes and resources to provide for:

      A. the management of aircraft operations and on-aircraft engine testing to ensure compliance with Rules 6.1.6.2.5 a.i. and ii. and 6.1.6.2.6 a.i.-iv.; and

      B. consideration of alternative methods of noise management and mitigation to achieve the reduction of noise effects from all aspects of aircraft operations including on-aircraft engine testing; and

C. engine maintenance ground run procedures to be implemented in conjunction with all aircraft operators or their agents, including:
    I. compliance with Rule 6.1.6.2.6 a.i.-iv., including documentation required by Rule 6.1.6.2.6 a.v.-vii.; and
    II. procedures which will encourage Antarctic and NZDF engine testing on the wing to occur between the hours of 07:00 to 19:00.

ii. provide the details of a noise monitoring programme to maintain compliance with Rules 6.1.6.2.5 a.iii.-iv. and 6.1.6.2.6 a.v.-vii. and, in particular, the following:
    A. the monitoring, recording, verification and calculation of aircraft operation and on-aircraft engine testing noise levels;
    B. the preparation of the annual Aircraft Operations and On-aircraft Engine Testing Noise Monitoring Reports and quarterly On-aircraft Engine Testing Report;
    C. the preparation of the AANC maps, showing actual noise contours in 1 dB increments from 55 dB L_{dn} to 70 dB L_{dn}; and
    D. the review of the software used for predicting aircraft operation noise and the software used for predicting engine testing noise, at least once every five years to determine whether the models and/or software require updating.

iii. establish dispute resolution procedures.

iv. establish a procedure for transparently and expediently responding to any complaints received in relation to noise from aircraft operations and on-aircraft engine testing.

v. require the maintenance of a website that provides for the transparent and accessible display of:
    A. the current version of the Airport Noise Management Plan as required by Rule 6.1.6.2.7.1;
    B. the Aircraft Operations Noise Monitoring Report, On-aircraft Engine Testing Report, and On-aircraft Engine Testing Noise Monitoring Report for the previous year, required by Rules 6.1.6.2.5 and 6.1.6.2.6, including a summary of noise monitoring conducted, and the AANC;
    C. a 7-day rolling report of noise from on-aircraft engine testing over the previous seven days updated daily and identifying all tests undertaken both within the L_{dn} limits and those exempted, including reasons for the tests exempted;
    D. a summary of complaints received annually and a description of actions taken to address complaints.

vi. document schedules of:
    A. acoustic treatment implemented over the last calendar year as required by Rule 6.1.6.2.7.2; and

B. acoustic treatment offered, where the conditions of the offer required by section b. of Appendix 6.11.15 have not yet been met.

Link to: Christchurch District Plan Appendix 6.11.14

APPENDIX 2: DISTRICT PLAN RULE 6.1.6.2.5

6.1.6.2.5 Aircraft operations at Christchurch International Airport

1. Aircraft operations at Christchurch International Airport shall meet the following activity standards:

1. Noise from aircraft operations shall not exceed 65 dB L_{dn} outside the 65 dB L_{dn} Air Noise Compliance Contour shown in Figure 1, other than as provided for in Rule 6.1.6.2.5 a.ii..

2. Noise from aircraft operations may exceed the aircraft noise limit in Rule 6.1.6.2.5 a.i. by not more than 2 dB, provided that such exceedance is due to atypical weather, national flight disruption, natural disaster or other unplanned circumstance.

3. Monitoring and determining compliance with activity standards i. and ii. above shall be as follows:

1. Noise monitoring of aircraft operations shall be based on calculations from an operational aircraft noise model, and records of actual aircraft operations at Christchurch International Airport over the previous year's aircraft operations.

2. Noise from aircraft operations shall be calculated as the Annual Aircraft Noise Contour (AANC), over the busiest three month period of the previous year.

3. The calculations shall be performed by a person with appropriate qualifications and experience in airport noise modelling and acoustics assessments.

4. The calculated results shall be verified by noise measurements carried out in accordance with the Airport Noise Management Plan required under Rule 6.1.6.2.7.1.

5. The measurement of aircraft sound exposure levels and the derivation of the 65 dB Ldn contour shall be in accordance with NZS 6805:1992.

4. An Aircraft Operations Noise Monitoring Report shall be provided annually by the airport operator to the Council, with the first required by the 6 March 2018. The report shall include:

1. the calculated AANC;

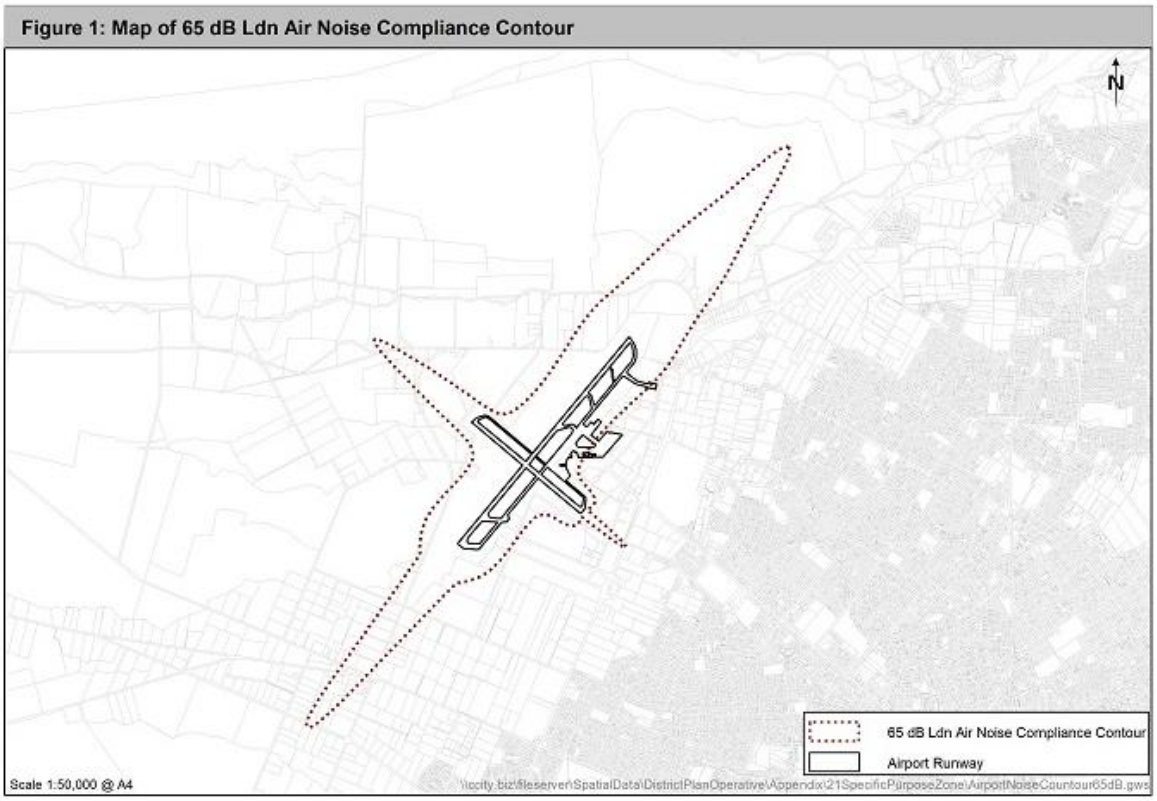
2. the results of the verification measurements;

3. analysis of compliance with reference to Rule 6.1.6.2.5 a.i. and ii.(including the number of exceedances and the reasons for them); and

4. a summary of complaints received over the previous year in relation to noise from aircraft operations, and any actions taken in response.

5. The additional activity standards in Rule 6.1.6.2.7 for aircraft operations at Christchurch International Airport shall be met.

Figure 1: 65 dB L_{dn} Air Noise Compliance Contour



Link to: [Christchurch District Plan Rule: 6.1.6.2.5]

APPENDIX 3: DISTRICT PLAN RULE 6.1.6.2.6

6.1.6.2.6 On-aircraft engine testing at Christchurch International Airport

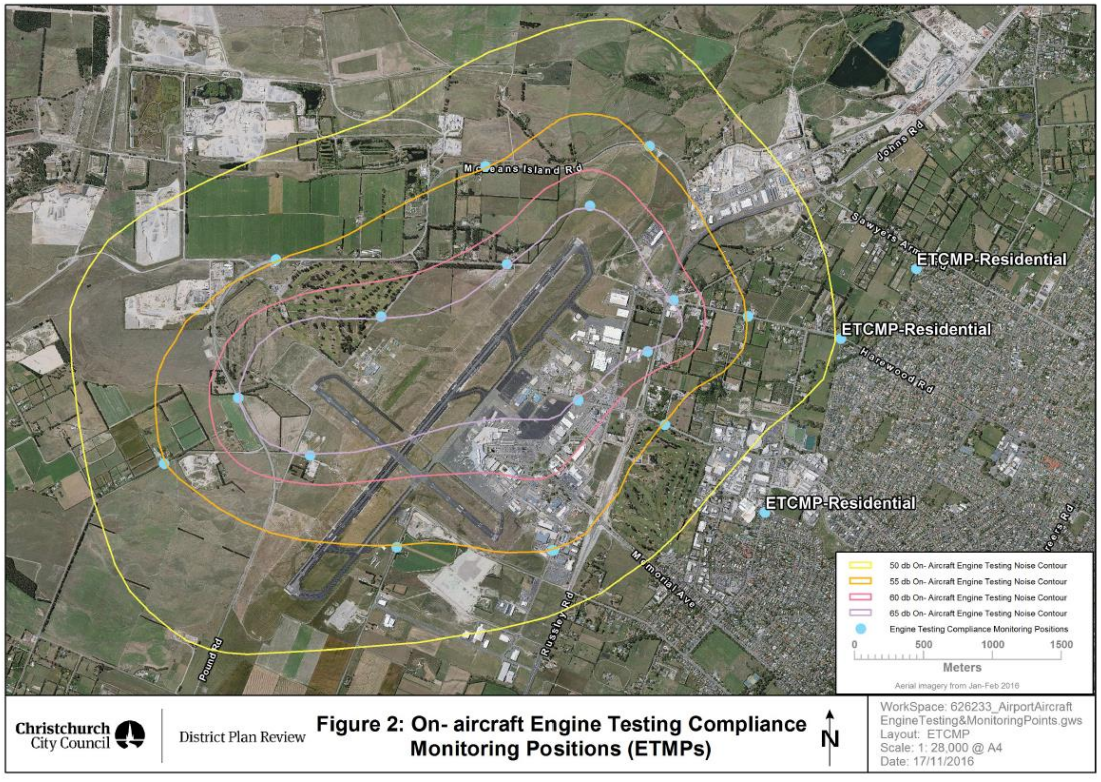
a. The testing of engines on aircraft at Christchurch International Airport shall meet the following activity standards:

   i. Noise from the testing of engines on aircraft shall not exceed the noise limits shown in Table 5 below at the engine testing compliance monitoring positions (ETCMPs) shown in Figure 2.

Table 5: On-aircraft engine testing noise limits

Noise Limit	**Engine testing compliance monitoring positions (ETCMP) - refer Figure 2**
65 dB L_{dn}, 7 day	8 points
55 dB L_{dn}, 7 day	8 points
75 dB L_{Amax} 22:00 to 07:00 only	Edge of residential zone – 3 points

Figure 2: On-aircraft engine testing compliance monitoring positions (ETCMPs)



ii. All high power testing of jet engines on an aircraft shall occur between the hours of 07:00h and 22:00h, except that a maximum of 5 unplanned engine testing events within any three month period, up to a maximum of 12 unplanned engine testing events per annum, may occur between the hours of 22:00h and 07:00h.

iii. Testing of turbo prop engines on an aircraft between the hours of 22:00h and 07:00h, when the total duration of testing at high power is five minutes or more per aircraft, shall be conducted in the vicinity of the threshold of Runway 11 (ie. the north-western end of the cross-runway).

iv. The following exclusions apply:

A. The testing of engines on an aircraft used for Antarctic operations, is excluded from activity standards i.-iii..

B. The testing of engines on any aircraft is excluded from activity standards i.–iii., where such work is necessary to satisfy an airworthiness directive or other like safety requirement issued by the Minister of Transport, the Director of Civil Aviation or the Civil Aviation Authority, as is any other unplanned engine testing arising from an aircraft operator's identification of a safety issue relating to an aircraft fleet, or required as a result of a natural disaster including volcanic eruption.

C. The testing of turbo prop engines on an aircraft is exempted from activity standard iii. when Runway 11/29 is in use.

v. Monitoring and determining compliance with activity standard a.i. above shall be as follows:

A. Compliance or otherwise with activity standard a.i. shall be demonstrated by calculations of on-aircraft engine testing noise emissions based on the actual on-aircraft engine testing events and calculations of noise emissions for the engine testing events and configurations in question. The noise level ($L_{dn,\ 7day}$) shall be calculated as a 7 day rolling average.

B. The calculations in activity standard a.v.A. shall be verified by measurements undertaken with reference to at least four ETCMPs for a sample of at least two different on-aircraft engine test configurations. Verification measurements shall be carried out for an initial period of 6 months from 6 March 2017 and subsequently be undertaken at least once every two years.

vi. An On-aircraft Engine Testing Report shall be provided quarterly by the airport operator to the Council, with the first covering the period ending the 30 June 2017 and provided to the Council by the 15 July 2017. The report shall include:

A. a summary of all on-aircraft engine testing activities undertaken in the quarter; and

B. identification of all tests undertaken both in accordance with activity standard a.i. and those excluded by activity standard a.iv., including

reasons for the tests excluded and any measures taken to manage noise effects during those excluded tests.

vii. An On-aircraft Engine Testing Noise Monitoring Report shall be provided annually by the airport operator to the Council by 6 March 2018, and annually thereafter. The report shall include:

A. the results of verification measurements in accordance with activity standard v.B.; and

B. analysis of compliance with reference to Rule 6.1.6.2.6 a.i.; and

C. a summary of complaints received over the previous year in relation to noise from on-aircraft engine testing, and any actions taken in response.

viii. The additional activity standards in Rule 6.1.6.2.7 for on-aircraft engine testing at Christchurch International Airport shall be met.

Link to: Christchurch District Plan Rule: 6.1.6.2.6

APPENDIX 4: ENGINE TESTING MANAGEMENT SYSTEM SOFTWARE

The Engine Testing Noise Management Software (ETMS), was developed so that CIAL could quantify and manage on-aircraft engine testing noise emissions around the airport. The software could calculate noise emissions at multiple receiver locations, based on actual records of on-aircraft engine testing that had occurred.

Several sources of input data were required to develop the ETMS, as discussed below.

On-aircraft engine testing Activity Data

Maintenance staff record in the ETMS a detailed set of information including the type of on-aircraft engine testing activity, aircraft model, date and time, wind direction, and speed, duration of each engine 'on' time, power setting and aircraft orientation, as well as the location of the test. These records are then used by the ETMS to calculate community noise exposure at the different locations specified in the District Plan

Noise Source Data

An essential component of the ETMS calculation procedure is a detailed knowledge of the noise emission levels of each aircraft type. This information includes noise level and directivity patterns and a variety of engine settings for each aircraft. This data has been collected via noise measurements at Christchurch Airport and elsewhere, in conjunction with noise emission data sourced from aircraft manufacturers.

Manufacturers Noise Emission Data

For each type of aircraft on which on-aircraft engine testing occurs at Christchurch Airport, noise level emissions data has been sourced through a literature review and discussions with the manufacturers, with some exceptions. Data for some aircraft types were not available at the time of the ETMS development. For these aircraft, reference has been made to measured aircraft flyby noise levels, and emissions data found within the INM noise model to determine appropriate equivalent aircraft on-aircraft engine testing noise levels where data is available.

However, because of the limited number of tests that occur, noise emissions from these are not expected to significantly affect the overall community noise levels, and overall airport on-aircraft engine testing compliance.

Noise emission data comprises noise level measurements in polar plot form, for various engine types and under various thrust settings. This enables a fully comprehensive set of noise emissions data to be used. All manufacturer noise emission data is based on-site noise measurements of aircraft, with measurements occurring under reference meteorological conditions and at reference microphone positions.

As well as this, noise measurements near various aircraft engine test events at Christchurch Airport have been undertaken and these have been complimented by measurements at locations in the community. These noise level measurements have been used to ensure that the manufacturers data is accurate and represents actual on-aircraft engine testing noise levels in practice. The noise measurements ensure that noise emissions data used in the calculations is accurate.

Computer Noise Modelling

Computer noise modelling was then employed to calculate community noise exposure levels for a number of different operating scenarios. The noise levels calculated for the final version of the ETMS was sound pressure levels at the 19 ETCMP receiver locations stipulated in the Christchurch District Plan.

The verified noise emissions data was used in noise modelling software to calculate noise levels for each possible on-aircraft engine testing scenario at each receiver location. The purpose of this is develop a database of noise levels received at each location for each scenario so that differing noise exposure levels in the community can then be calculated, in accordance with the District Plan noise controls.

Each scenario is based on a specific:

- Aircraft type
- Power setting
- Orientation
- Location

Based on these parameters there are more than 1500 operating scenarios which have been calculated.

Computer noise modelling was carried out using SoundPLAN, an internationally recognised computer noise modelling software package.

In summary, a digital topographical model of the area of interest was entered into SoundPLAN together with locations of the noise sources (noise levels have been predicted in accordance with the algorithm detailed in ISO9613-2: 1996- Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO9613) as implemented in SoundPLAN.

ISO9613 considers a range of frequency dependent attenuation factors, including spherical divergence, atmospheric absorption, ground effect, acoustic screening and directivity effects. It assumes meteorological conditions favourable to propagation from sources (downwind at wind speeds 1 -5 m/s in all directions), and as such, calculates slightly conservative sound levels.

The directivity effects that have been included are taken from the manufacturers' noise emission data.

Engine Testing Noise Management Software (ETMS)

The calculated sound pressure levels for each one of the above operating scenarios are then compiled into a database in the ETMS. It is the ETMS that is then used to calculate community noise exposure based on this noise level database and the historic records of time/duration of each operation activity.

The Engine Testing Management Software (ETMS) has since been further developed by Marshall Day Acoustics and Translate Digital for CIAL. It is similar in concept to the software used to show compliance with the general aircraft noise emissions (INM) in that it is based on the records of the actual on-aircraft engine testing that has been carried out.

The ETMS is now a predictive tool that can be used to proactively manage on-aircraft engine testing noise. The software does not allow tests to be scheduled that would breach the relevant controls. Instead, a maintenance engineer could look at scheduling the test during the day, or at a different location or orientation.

This ability to review possible on-aircraft engine testing scenarios allows the CIAL and the maintenance staff to manage how the testing is conducted, and therefore how to manage the on-aircraft engine testing noise emissions.

APPENDIX 5: ENGINE GROUND RUNNING PROCEDURE

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