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Exploration of Aircraft Noise Model Validation with Noise Measurements

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ABSTRACT

Aircraft noise pollution continues to be a major part of adverse community reaction towards airports and air navigation service providers. With the ease of access to noise and flight operations data, community opposition to airport growth is increasing and is originating from areas further away from airports. Recent studies of airports in Hobart, Sunshine Coast and Brisbane have shown that adverse public reaction to aircraft noise can be high at distances of 30km to 50km along a flight path where predicted noise levels are low. This highlights the need for accurate noise modelling and the importance of noise modelling results to inform major community engagement activities. Noise modelling accuracy can be improved through validation with real world measured data. The key goal is to continually improve the practice of noise modelling to better predict noise levels in community areas both close to and far from airports so mitigation actions or noise improvements can be implemented.

1 INTRODUCTION

Aircraft noise modelling best-practice methods in Australia have generally gained acceptance by the aviation industry using tools such as the US Federal Aviation Administration's Aviation Environmental Design Tool (AEDT) and NoiseMap. These noise prediction tools are continually examined for their accuracy and when accuracy is taken for granted, serious noise impact issues and adverse community reaction can arise.

2 AIRCRAFT NOISE METRICS

The current noise metrics employed in Australia for aircraft are a mixture of cumulative exposure metrics such as the Australian Noise Exposure Forecast (ANEF) and 'Number-Above' metrics (number of events above a defined noise level). The ANEF is primarily used for land-use-planning applications, whereas Number-Above metrics are used to determine environmental impacts and are generally easier for the community to understand. Number-Above metrics are derived from the maximum noise level (LAmax) of individual aircraft events, therefore accurate noise model predictions are important.

3 VARIATION OF MEASURED RESULTS

Aircraft maximum noise levels experienced on the ground by the community can vary greatly due to several factors including, distance to the source, sound output of the aircraft, the type of aircraft and meteorological conditions among others. The individual performance characteristics of each aircraft can also vary along a defined flight path causing large variations in the measured noise level on the ground. The following example shows an arrival flight path into Hobart Airport using Performance Based Navigation (PBN) with Required Navigation Performance – Authorisation Required (RNP-AR) technology. The resulting flight path is highly concentrated with minimal lateral and vertical spread.

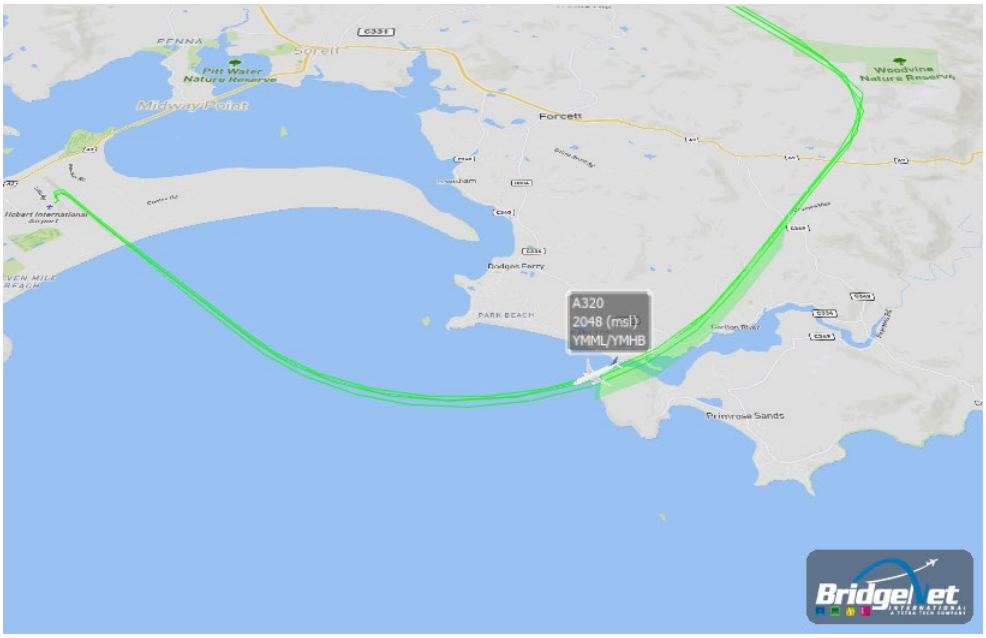

Figure 1: Arrival flight path to Hobart Airport Runway 30 viewed with Volans software.

Despite the concentrated flight path, the measured noise level on the ground varies greatly as shown in the histogram below, measured at a point on the coast at approximately 8 nmi to the runway threshold from Airservices Noise and Flight Path Monitoring System (NFPMS).

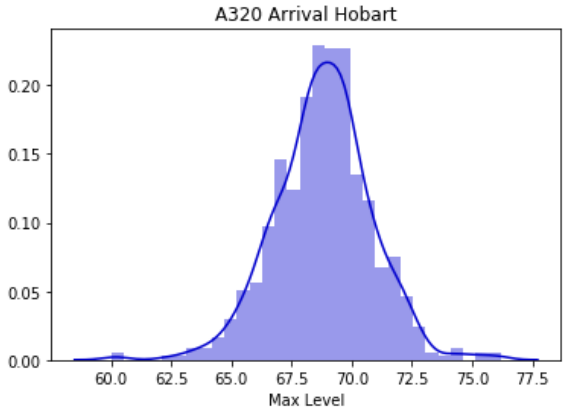

Figure 2: Single event maximum noise levels (LAmax dB) of an arriving Airbus A320 aircraft to Runway 30 at Hobart Airport measured at approximately 8 nmi to the runway threshold.

At this measurement point, maximum noise levels for the arrival Airbus A320 on the concentrated RNP flight path ranged by more than 10dB(A).

4 MODEL CALIBRATION DISCUSSION

Noise modelling tools used to predict single event maximum noise levels (LAmax) aim to provide an accurate average result and do not always reflect the large variation in aircraft noise events measured in the field. Often noise models can be under predictive and adjustments are required to ensure accurate results. Using current noise prediction software such as AEDT, options to adjust or calibrate the noise output includes:

- the increase of aircraft stage lengths,
- the development of user defined aircraft arrival and departure flight profiles,
- adjustments to the aircraft's individual Noise-Power-Distance (NPD) curves.

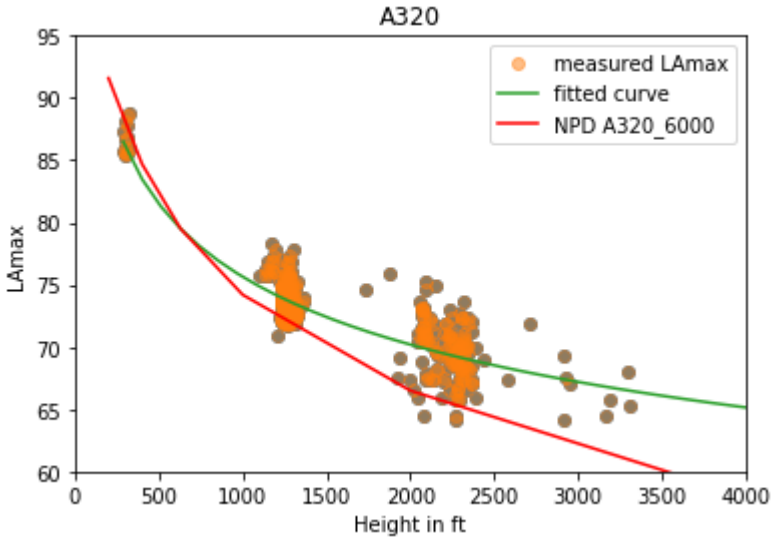

Figure 3: Sample of measured Airbus A320 aircraft maximum noise level (LAmax dB) vs height of aircraft (green line) overlaid with the AEDT's A320 Noise-Power-Distance curve (red line).

In the above example, measured noise levels are shown from Airservices' NFPMS at various locations across the country for an arriving Airbus A320 aircraft. Each point represents an individual aircraft noise event with the aircraft's height in feet. The green line represents a line of best fit for the data set. The available NPD curve in AEDT for an arrival Airbus A320 is represented by the red line. This shows the modelled noise is potentially under predictive. In this example adjustments to the aircraft NPD curve to match the red line with the green line may achieve a more accurate result when compared to measured noise levels on the ground.

5 SUMMARY

Number-Above noise metrics have become widely used for the assessment of environmental impacts from aircraft operations. Accurate noise modelling is required as these metrics use maximum aircraft noise levels. A large variation in measured maximum noise levels can exist, even when flight paths are highly concentrated. Where measured aircraft noise data is available, there are various options to adjust noise modelling programs to improve the accuracy of predicted noise levels. One such option includes the adjustment of Aircraft Noise-Power-Distance curves.

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