

## ***SUPPORTING DATA FOR SACF NOISE ABATEMENT DEPARTURE PROTOCOL [NADP] DISCUSSION***

***By P.S. Lingard, BSc., Ph.D., LLB. SACF Proxy for Mayor of Ashfield.***

[Revised: 30/3/2007 -3/4/2007; Ex. 22/8/2006]

### ***Introduction:***

The LTOP Reports (1996) and Proponent Statement Recommendation 19 require that :

***"Noise abatement climb procedures be standardised for all runways at [KSA] and that an assessment be made to determine whether the [ICAO] Procedure 'A' or Procedure 'B' be mandated for all jet operations."***

Recently reported Noise Data from Summer Hill<sup>#1</sup> , suggests there has been failure by Airservices Australia to implement this recommendation considering the current low-flying and distance of the location from the furthest runway end .

Noise abatement procedures were first considered by early meetings of the IMC (See eg. Meeting 6, 17 Nov. 1997). CASA advised that the procedures would be safe and would provide a measurable benefit.

The implementation of ICAO-A procedures was first endorsed by a resolution at the SACF Meeting No. 12 (28 Nov. 1997) . The Resolution read as follows:

***"The Sydney Airport Community Forum requests Airservices Australia to immediately commence all necessary procedures required to implement ICAO " A " departure procedure for all jets operating at Sydney Airport and to enable such procedures to become effective without delay.***

***SACF further requests the Implementation and Monitoring Committee to examine as a matter of urgency any necessary requirements for refining and optimising the procedure to achieve optimum noise minimisation; such further refinements being implemented as necessary after the standard ICAO "A" procedure is operating. [Proposed D. Lidbetter]***

In subsequent meetings both in SACF and the IMC, David Lidbetter persevered against protests from Qantas then representatives citing increased fuel use . By August 1998 the resolution was not actioned by Airservices . It was therefore reaffirmed at a Special Meeting of SACF held on 28 August 1998 (item 11) . On that date also an apparent Directive was issued by then Transport Minister Vaile to the effect that ICAO-A noise abatement departure procedures would be adopted by Airservices on all flight tracks taking off over residential areas (Ministerial Media release T159/98 - copy attached). Unfortunately there is no confirmation of Mr. Vaile's purported directive in the Ministerial Directives published by Airservices in appendices to their Annual Reports, for either 1998 -99 or later.

### ***Reason for Agenda Item:***

Since the SACF resolution of Nov. 1997 there has evidently been no substantive action . With Boeing 747s often taking off at inclinations to the horizontal over the inner northwest as low as 2.5° , the noise burden of sections of Dulwich Hill and Summer Hill has become both concentrated and intolerable in level . B747s are typically observed crossing Summer Hill (ca. 60% of Northwest movements<sup>#2</sup> ) at altitudes of around 1500 ft or less [AGL] . This at times produces noise at ground level exceeding 90 dB(A) . This is a long-settled prime residential area which includes several schools . These practices are completely unacceptable to the Ashfield Community and must be

---

<sup>1</sup> "Community Noise Report Summer Hill, Summer Hill, 2003-2005", Heinrich & Lingard , December 2005

<sup>2</sup> Now confirmed by Airservices Departure-time statistics for 2003 -5; showing a zone of flight path concentration .

stopped. Moreover, both the LTOP Proponent Statement and subsequent Directive of Minister Anderson 1999 [M37/99, 3 May 1999, para. (v)] required Airservices Australia to:

***"Develop and implement effective aircraft noise abatement procedures and monitor and report to the Secretary on compliance..."***

A list of Official LTOP Statements on the requirement and conditions for NADPs is provided in Table 2 at the end of this paper. A question legitimately asked is: ***"What noise abatement work has been carried out by Airservices Australia in the context of Sydney Airport since that directive?"***

### ***Noise Profile Computer Modelling using The "INM" <sup>#3</sup>:***

This paper considers the advantages for residents under departure tracks expected from ICAO-A-like<sup>#4</sup>, as well as potentially improved, noise abatement takeoff procedures. These are considered with the aid of the US Federal Aviation Administration's (FAA) "Integrated Noise Model" [or INM - herein Ver. 6.2].

"INM" is a computer program which uses mathematical algorithms based on well-established aviation standards and sound-level monitoring which enables the noise at ground level to be computed from the characteristics of the aircraft model and engine type. The INM enables the calculation of absolute ground level noise for given flight path assumptions as a function of distance from take-off roll. It also enables the "Australian Noise Exposure Forecast" (ANEI) equivalent noise-dose data to be predicted.

Figures 1 to 4 show noise curve examples obtained by the author using the "INM" for the most heavily-loaded B747s for a selection of both custom and standard profiles. The custom profiles model departures with initial climb angles of 2.5, 5, 10, 15 and 20 degrees, respectively which level out at from 4000 ft to 6500 ft to a 5 degree climb beyond. They are calculated for Straight Takeoffs over level ground. The custom profiles apply staged, engine thrust - reduction factors of 82% and 63% at ca. 1600 and 4000 ft, respectively, for initial slopes of 10 & 15 degrees, and 1600 and 6500 ft for 20 degrees. Beyond each initial, steepest climb, the attack angle reduces to 5 degrees. For initial climbs at 5 degrees or less the Engine Thrust reductions are applied at 1600 ft and 3000 ft, respectively. Due to the necessary simplifications made, the benefits predicted are indicative, only, not a guarantee of performance.

Figure 1 details the custom-selected fixed-point flight track profiles used together with the "INM"-standard and ICAO profiles for noise level and noise dose calculation [Maximum decibels (dB(A), max); and ANEI - the Australian Noise Exposure Index].

Figure 2 shows the maximum noise level (La, max) expected at various distances along the flight path centreline for overflying B747-400 aircraft of maximum loading (MTOW) 838000 lb. The results are compared to the ***FAA - "INM" "Standard -8"*** profile for B747 -400's as supplied with the software package [Asterisked points]. Standard -8 is roughly comparable to an "ICAO-B" -style procedure with initial climb to 1000 ft, without noise abatement features<sup>#5</sup>.

The figure shows that beyond 2 kilometres the predicted takeoff noise level declines dramatically with distance for each profile, and further reduces with increasing departure climb angle.

Thus at 10 km from takeoff-roll (roughly the distance to Summer Hill) an initial climb out angle of 15 degrees up to 4000 ft reduces the ground noise by 13 dB(A) from that for the ***FAA -INM "Standard -8"*** departure profile.

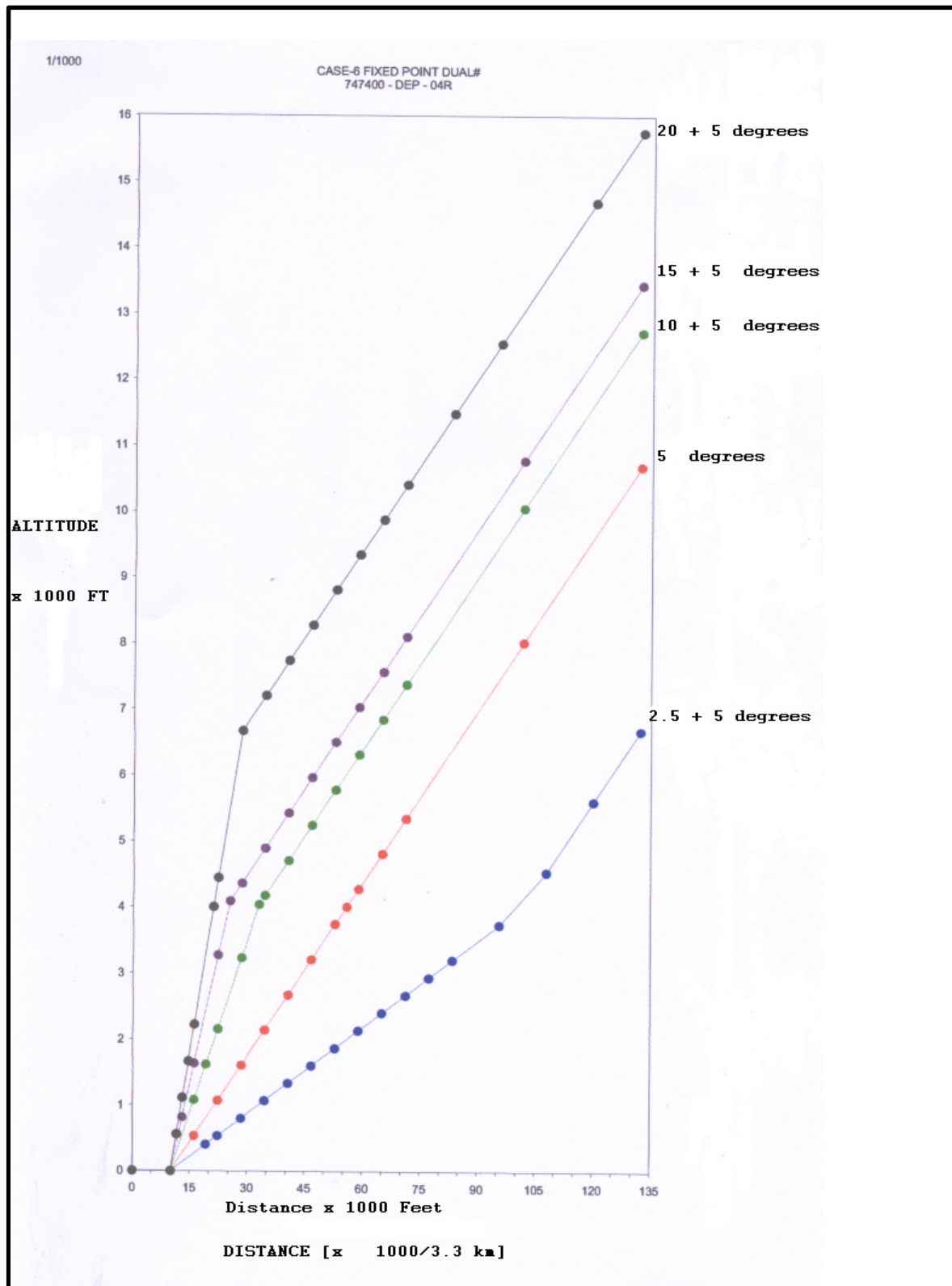
---

<sup>3</sup> FAA Integrated Noise Model [Version 6.2 herein used]

<sup>4</sup> The ICAO recommended protocols have since been changed by ICAO (Nov. 2001). The "A" protocol now being nominally of the same intent as ICAO-2; The "B" Protocol now being "1". But the procedures for ICAO-A are well documented and not illegal.

<sup>5</sup> INM 6.2 Software release Notes 19/5/2006, p. 4 - Commercial Aircraft Noise/Performance Database.

**FIGURE 1 ASSUMED CUSTOM FLIGHT PATH PROFILES:**



To have climbed only to 1500 ft by Summer Hill , as often observed with this aircraft type, corresponds to a climb-out angle of only ca. 2.6 degrees [ie.  $\tan^{-1}(1500/33000)$  ]. From Figure 2, at 10 km the maximum sound level difference between a climb out at 2.5 degrees and one at 15 degrees is 28 dB(A) for this aircraft!

FIGURE 2 MAXIMUM SOUND LEVEL (dB(A)) FOR B747-400 FLYOVERS ALONG FLIGHT PATH

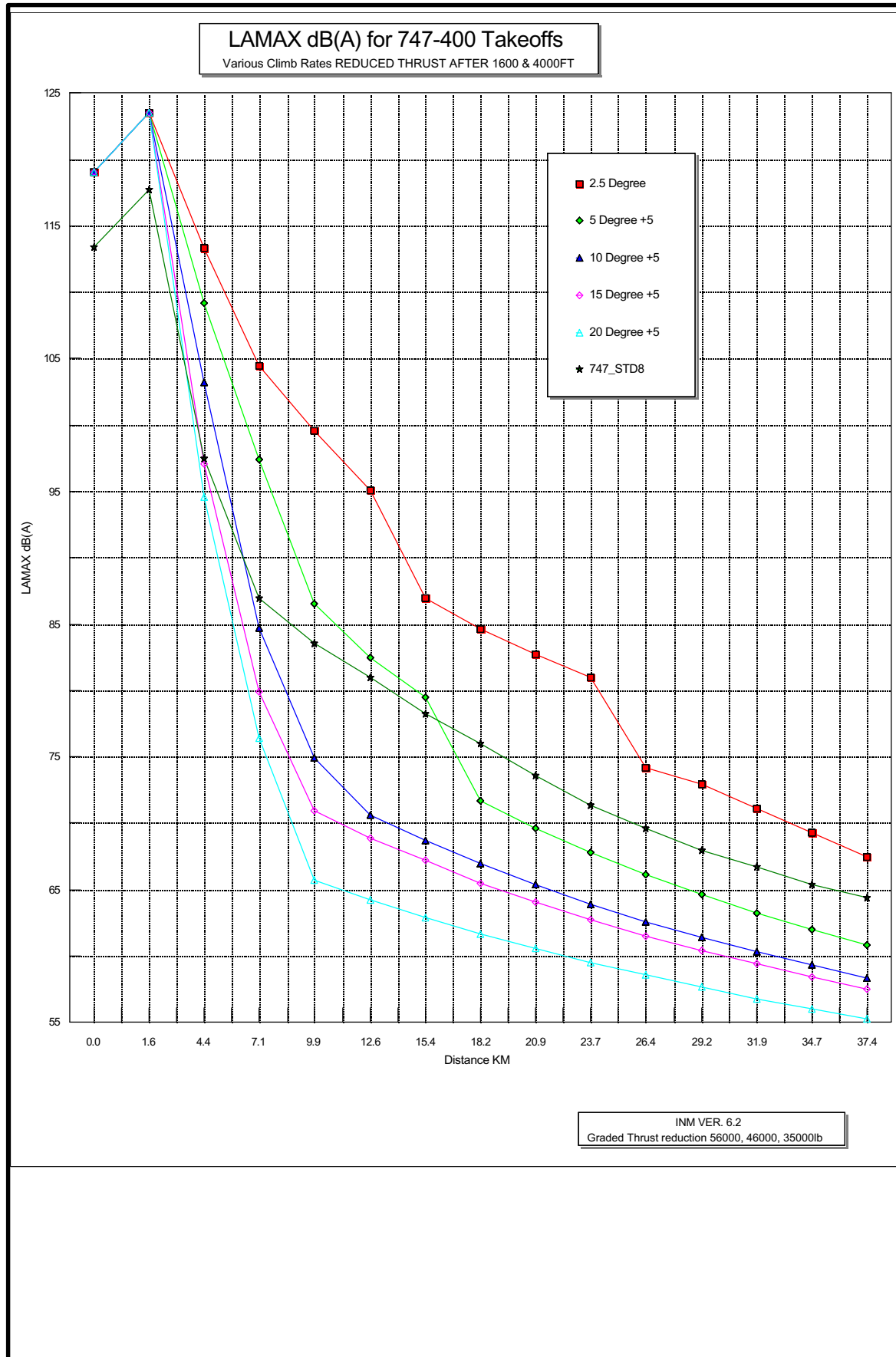
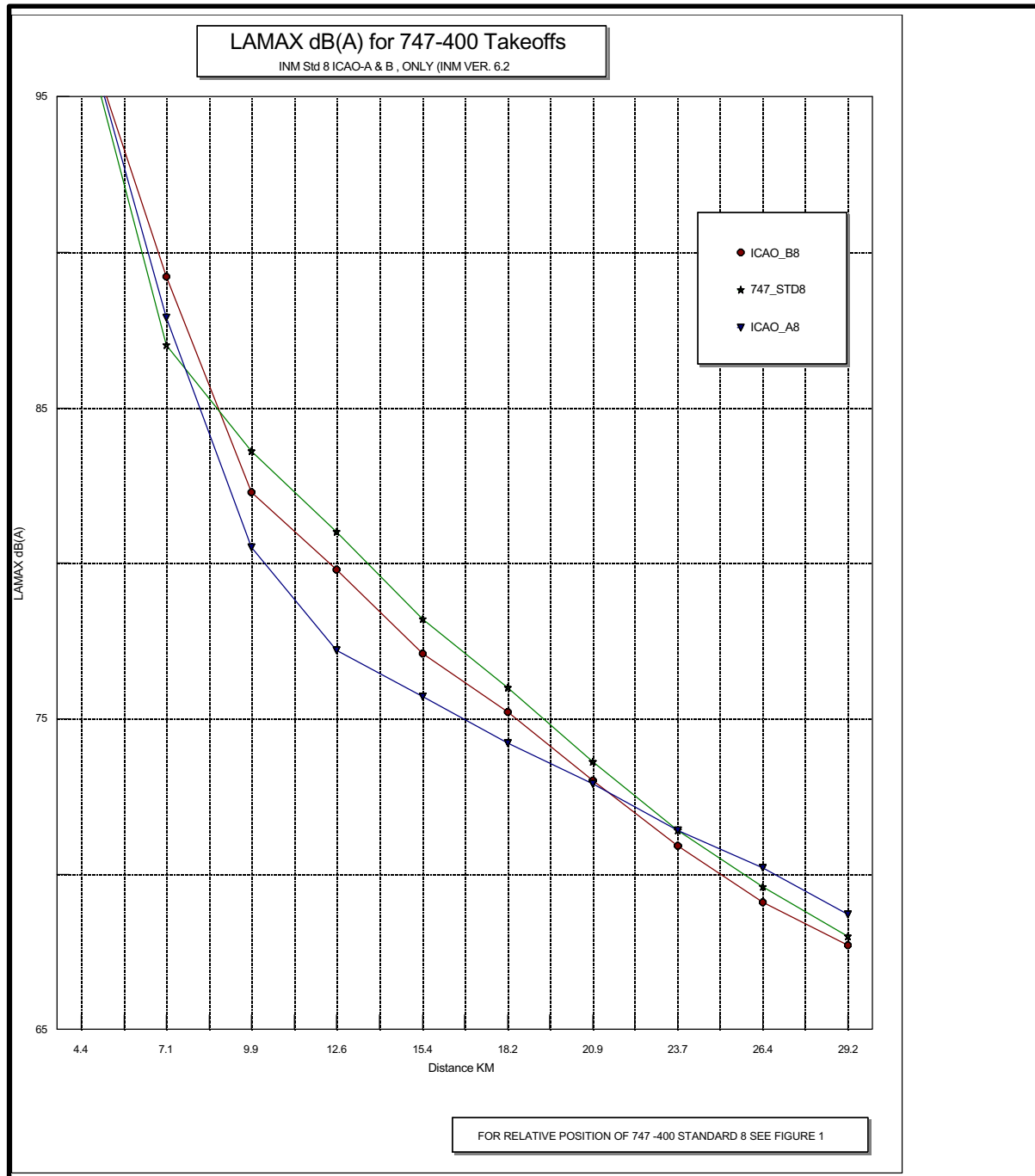


Figure 3 compares the noise results for **INM- Standard 8** for B747-400's with those produced with the INM-supplied profiles for ICAO-A & -B <sup>#6</sup> . It shows a benefit of ca. 4.5 dB(A) at 12 km of using the "ICAO-A" procedure in the INM compared to the "Standard" procedure & 1.5 dB(A) for ICAO-B. This contrasts the potential benefit of the ICAO-A [distant-benefit] versus the ICAO-B [close-in benefit] as compared to INM "Standard-8". While not as beneficial in terms of noise reduction as the hypothetical custom NADP profiles shown in Figures. 1 - 2 , ICAO -A appears better than both the "Standard" and also the ICAO-B profile for intermediate distances (7 - 21 KM) from takeoff roll.

**FIGURE 3 COMPARISON OF INM - ICAO-A , B & STANDARD -8 MAXIMUM SOUND LEVEL (dB(A) FOR B747-400 FLYOVERS**

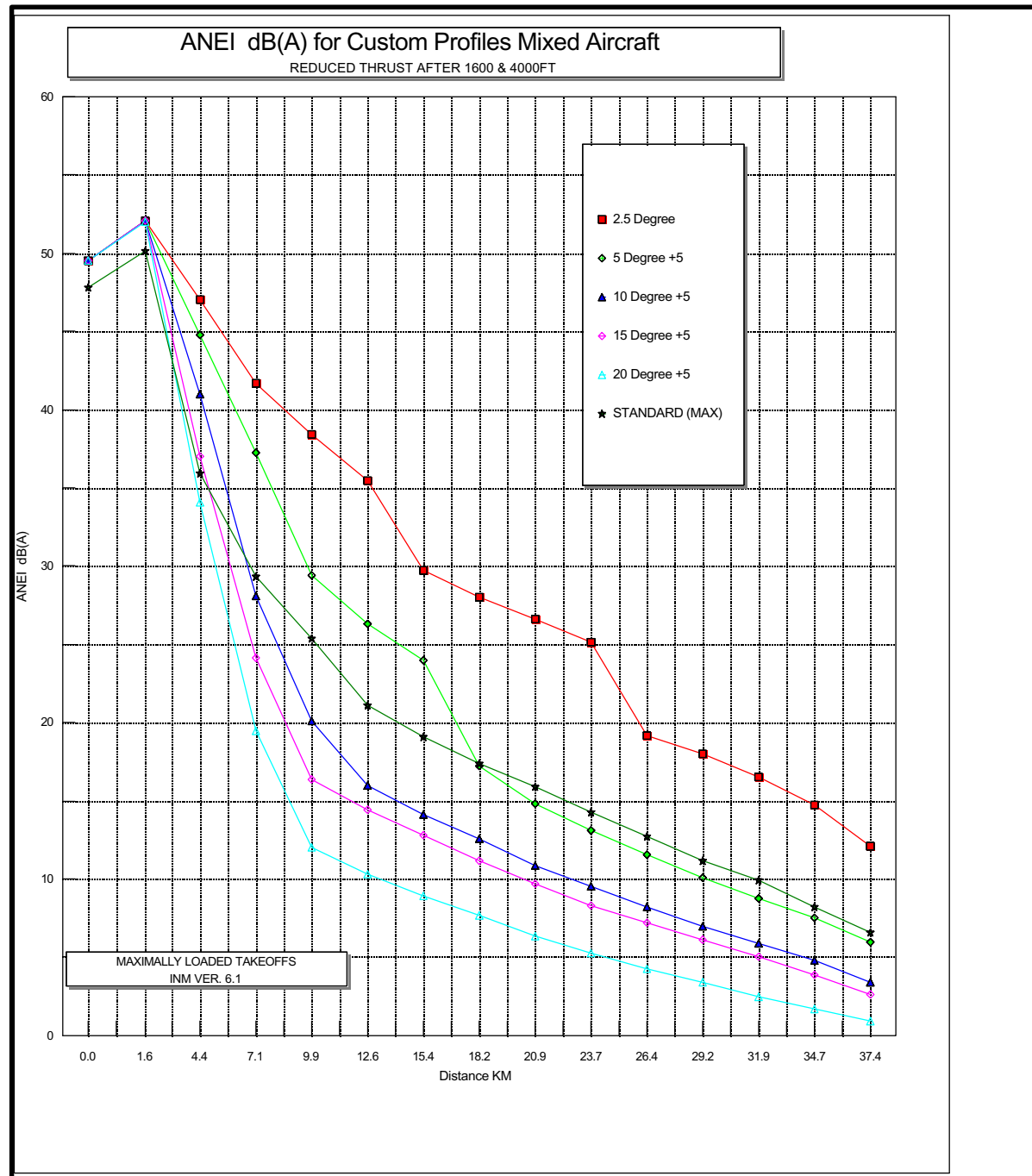


<sup>6</sup> ICAO PANS-OPS Doc. 8168 - Part V, Chapt. 3, S. 3.1.1 - 5/11/1998 & 11/11/1993 (No. 10).

However, Figure 2 has shown that the resulting benefit can be even greater than ICAO-A if the initial climb-out is more steep. This invites the question whether any such two-stage profile could be made to work for departures over the residential neighbours of KSA?

Figure 4 compares computed ANEI (*Australian Noise Exposure Index*<sup>#7</sup> -ie Noise Dosage) levels for a mixture of aircraft, including B747's, corresponding to the number of aircraft per day (ca. 60<sup>#8</sup>) logged travelling over the subject house. The mixture of aircraft used was modelled on Airservices -provided departing aircraft data for the noise monitoring terminal (NMT15) at Croydon, each assumed to be maximally loaded..

FIGURE 4 COMPUTED ANEI (dB(A)) FOR MIXTURE OF FLYOVERS ALONG FLIGHT PATH



<sup>7</sup> See Australian Standard AS 2021-2000 , "Acoustics- Aircraft Noise Intrusion - Building Siting and Construction".  
<sup>8</sup> See "Community Noise Report Summer Hill 2003-2005" (ibid)

Table 1 (Appendix ) shows the breakdown of flyovers per day by aircraft type which was used in the ANEI calculations of Figure 4.

Figure 4 shows that for the distance corresponding to the subject residence at Summer Hill (ca. 10 km from takeoff-roll) the noise dose, represented by the ANEI , is very sensitive to the climb-out angle of the aircraft. The calculations assume that all aircraft are maximally loaded, and completing climb out following the same flight profile (trajectory). This assumption is partly justified since Airservices- supplied departure times correspond with the machine-detected noise for ca. 60 % of takeoffs from 34L in the monitored period <sup>#9</sup> . However, it is acknowledged that there will be a spread of audible aircraft around the home, ANEI computed will therefore slightly over-estimate the true value. Similarly, there will be differences caused by the curvilinear flight paths employed at KSA and terrain effects, which is not modelled here.

The results show that from the 26 dB(A) ANEI level for the FAA **"Standard - Max"** noise curve , noise dosage (ANEI) reductions of 5 , 8 and 13 dB(A) are observed , respectively , for the 10 , 15 and 20 degree climb out profiles, with increases to 29.5 and 38 dB(A), for reduced climb-out angles of 5° and 2.5° respectively !

The results show that (ignoring turning effects and terrain ) , the ANEI for the subject residence at Summer Hill lie between 20 & 30 dB(A) if all of the aircraft were maximally loaded. This supports the estimates calculated by Lingard & Heinrich in December 2005 [Ref. #1], and suggests that the Airservices suggested ANEI for this corridor of 17 dB(A) is being exceeded.

By Australian Standard AS 2021 -2000 <sup>#10</sup> an ANEI of between 20 & 25 corresponds to an only **"conditionally acceptable"** location for a residential dwelling. ANEI above 25 dB(A) are considered **"unacceptable"** and Federal Government noise insulation grants commence at ANEI = 30 dB(A)!

**NADP 1 & 2 (ICAO Nov. 2001, cf. ICAO "A" &/or "B"):**

Some discussion at SACF and at the IMC has suggested that the new (Nov. 2001) NADPs - 1 & 2 replace and/or are equivalent to the old ICAO-A (2 for "A"; & "1" for "B") . ***This is not the case!***

NADP-1 (for "close-in" benefits) requires a minimum initial climbout to only 800 ft (cf. 1000ft for ICAO-A) . This will produce marginally greater noise. Similarly NADP-2 (for "distant" benefit ) also requires a minimum initial climb to only 800 ft ! Furthermore the current AIP permits puts the onus of developing NADPs on "the operator" (ie airline) to select which one to use. This operator-chosen NADP need not be equivalent to ICAO-A. The LTOP Proponent Statement states ***"the overriding intention of the Plan is to ameliorate the noise impacts of Sydney Airport"*** . It would therefore defeat the overriding noise reduction objective of LTOP to permit:

- (1) ***An inferior NADP to replace an existing superior one without discussion at SACF and ;***
- (2) ***The "fuel cost" argument from Qantas to override community hopes of noise reductions; or***
- (3) ***The "Trackmile" and /or "Greenhouse Gas" argument found in the Feb. 2003 TF2 report.***

Since 1998 the ICAO recommended protocols have been changed by ICAO (Nov. 2001) . The "A" protocol now being nominally of the same intent as NADP-2; The "B" Protocol now being "1". But the procedures for ICAO-A are well documented and not illegal. The 2001 changes water-down the benefits inherent in the ICAO-A procedure, though are not inconsistent with it.

---

<sup>9</sup> P. S. Lingard - Unpublished data.  
<sup>10</sup> AS 2021 -2000 ibid.

### CONCLUSIONS:

By far the worst contributor to aircraft noise annoyance in the Ashfield Municipal area are the B747's and doubtless things will worsen when the A380's begin to use KSA . The Rolls Royce Trent-900 engines they employ develop 57 % more thrust than the PW4056's used in B747s.

For the jet departure flyover mixture using the Croydon corridor (Table 1, See Appendix ), considerable impact reductions appear obtainable by increasing the steepness of the initial aircraft climbout angles from the current 2.5 - 5 ° range for B747's to between 10-20 ° up to above 4000 ft.

The ICAO-A requirement was for an initial climb to 1500 ft at maximum takeoff thrust and  $V_2 + (10-20)$  knots, followed by continued climb at reduced thrust and velocity not less than  $V_2 + (10-20)$  knots to 3000 ft, before smoothly accelerating to "en-route" climb . While the SACF-endorsed ICAO- A effect are not as good as the custom hypothetical profiles herein tentatively suggested, they might provide an initial benefit in the 8 - 20 km range where the present sound levels are worst.

The proffered preliminary custom-profiles involving steeper initial climbouts to up to (or beyond) 4000 ft, with two gradients and thrust reductions, suggest ways in which Airservices Australia might explore possible further benefits for residents under the northwest corridor, and thereby comply with the erstwhile August 1998 "directive" of Minister Vaile, and the May 1999 directive of Minister Anderson to "Develop and implement *effective* aircraft noise abatement procedures". Similar benefits might also be expected for east- and west-heading takeoffs from Runways 07, 34R (with extended climb to turn ) and 25.

In case of doubt , Boeing Manuals show that at least the fully-loaded B747-200B aircraft IS capable of up to 20 degree climbs , so that it appears that much better noise reduction performance is achievable than presently practiced by Airservices Australia . One Boeing - specified "**Noise Abatement Takeoff Procedure**" for 747 200B's refers to a 15 degree ( while maintaining comfort levels for passengers ) climb out pitch <sup>#11</sup> to 1000 ft , with ongoing climb to 3000 ft. The B747-200B represents a maximum take-off weight of 800,000 lb cf. 870,000 lb for a B747 -400 [FAA], therefore similar results should be possible for the latter.

In summary, it is shown that significantly reduced maximum ground noise can be achieved with the mixture of aircraft presently using the northwest corridor, and in particular with the heavy B747 -type aircraft which cause the most pain and suffering in those affected , by using a bimodal takeoff profile with an initial quick climb to 4000 ft or greater, followed by a levelling off to 5° and thrust reductions at 1600 and 4000 (or 6500 for the steepest climb) ft .

In August 1998 the then Minister implied by Media Release to have directed Airservices Australia to comply with ICAO-A jet climbout procedures over residential areas at Sydney Airport. This has not eventuated . If there was a formal direction, then the current Minister should remind Airservices Australia that they should comply with his directions. Airservices Australia should comply with the spirit of the LTOP and collaborate with CASA to produce more optimal NADPs for KSA. If the Minister did not so ordain ICAO-A -type takeoffs by official direction, then his 1998 Media Release was unfortunately 9 years premature and so far vain. Either way, the Proponent's intentions for LTOP and of SACF in its Nov. 1997 Resolution have been effectively subverted.

Table 2 in the Appendix (See p. 10) lists the various Authoritative Statements relevant to Noise Abatement Departure Protocols for Sydney Airport.

END

---

<sup>11</sup> Eg. "Boeing 747-100/SP/200B Procedures" (Compilation M. Zagoren)



**APPENDIX TO NADP DISCUSSION**

**MINISTER VAILE'S AUGUST 1998 MEDIA RELEASE ATTACHED**

**TABLE 1 : FLIGHT OPERATIONS ASSUMPTION**

(BASED ON ASA CROYDON MONITOR STATISTICS )

<b>AIRCRAFT</b>	<b>Day</b>	<b>Evening</b>	<b>Night</b>
<b>717-200</b>	2	0	0
<b>737-400</b>	6	3	2
<b>737-800</b>	6	3	2
<b>747-400</b>	1	1	7
<b>767-400</b>	6	2	1
<b>777-300</b>	4	0	0
<b>A320</b>	4	3	0
<b>A330</b>	3	2	0
<b>A340</b>	2	0	0
<b>TOTALS</b>	<b>34</b>	<b>14</b>	<b>12</b>
<b>TOTAL OPS</b>	<b>60</b>		

P.T.O - TABLE 2

**TABLE 2**  
**AUTHORITATIVE STATEMENTS AND DIRECTIONS ON NOISE ABATEMENT**

1	<b>LTOP:</b> "The Overriding intention of the Plan is to ameliorate the noise impacts of Sydney Airport." <i>Proponent Statement Ch. 3.2.4, p. 3-21.</i>
2	<b>LTOP:</b> "Noise abatement climb procedures be standardised for all runways at [KSA] and that an assessment be made to determine whether the [ICAO] Procedure 'A' or Procedure 'B' be mandated for all jet operations." - <i>Proponent Statement Rec. 19, Ch. 1.2, p. 1-12.</i>
3	<b>LTOP:</b> "Examination of enhanced noise abatement departure procedures" <i>Proponent Statement Ch. 3.4.2 page. 3-22, dotpoint 4.</i>
4	Re. ICAO _A: "The difference in decibels were sufficient to warrant implementation" - D. Toepfer, CASA : <i>Minutes IMC</i> Meeting 6 , 17 Nov. 1997 [Extraordinary Agenda Item] .
5	<b>SACF Resolution:</b> "The Sydney Airport Community Forum requests Airservices Australia to immediately commence all necessary procedures required to implement ICAO " A" departure procedure for all jets operating at Sydney Airport and to enable such procedures to become effective without delay.  "SACF further requests the Implementation and Monitoring Committee to examine as a matter of urgency any necessary requirements for refining and optimising the procedure to achieve optimum noise minimisation; such further refinements being implemented as necessary after the standard ICAO " A" procedure is operating. " - <i>Resolution of SACF; Meeting No. 12 (28/11/1997)</i>
6	Resolution of SACF [Item (5) , This Table ] - reaffirmed at a Special Meeting of SACF held on 28 August 1998 (Agenda Item 11) .
7	<i>"SACF recommended to me that the steeper climb procedures should become a permanent feature of take-offs over land." ..... "ICAO-A" procedures involve steeper climbs and a delayed reduction in power setting which ensures that the jets reach higher altitudes before over-flying home close to the airport"</i> : Transport Minister , Mark Vaile, 28 August 1998 - <i>Ministerial Media Release, T159/98</i>
8	<b>Activities to be performed by Airservices Australia under paragraph 8(1)(d) , and for the purposes of Subsection 9(2) [of the Act]:</b> "Develop and implement effective aircraft noise abatement procedures and monitor and report to the Secretary on compliance with those procedures at Australian airports.": Minister Anderson, Direction to Airservices Australia , <i>dotpoint (v) - Instrument Number M37/99, 3 May 1999.</i>
9	<b>ICAO-A/B -</b> "These aeroplane operating procedures for the take-off climb have been developed so as to ensure that the necessary safety of flight operations is maintained whilst minimizing exposure to noise on the ground. ....Procedure A results in noise relief during the latter part of the procedures, whereas Procedure B provides relief during that part of the procedure close to the airport. In unusual circumstances . .... a special procedure meeting the limitations of 3.1.2.3 may be developed.": ICAO PANS-OPS Doc. 8168 - Part V, Chapt. 3, S. 3.1.1 - 5/11/1998 & 11/11/1993 (No. 10).
10	<b>NADP 1/2 -</b> "The following two examples of operating procedures for the climb have been developed and are considered safe"..... "The first (NADP 1) is intended to provide noise reduction ... in close proximity to the departure end of the runway . The second (NADP 2) provides noise reduction to areas more distant from the runway end ": ICAO PANS-OPS Doc. 8168 - 1/11/2001 (No. 11) Appendix to Part V Chapt. 3 Paras 1.1 - 1.2.
11	AIP Section GEN 1.7 "Differences from ICAO STANDARDS , RECOMMENDED PRACTICES AND PROCEDURES" shows that Airservices does not always comply with ICAO Rules: <a href="http://www.airservices.com/publications/aip.asp">http://www.airservices.com/publications/aip.asp</a>
12	<b>NADPs Generally :</b> "The State in which the aerodrome is located is responsible for ensuring that noise abatement objectives are specified by aerodrome operators. The noise abatement objectives should enable the operators to develop safe procedures in accordance with this Chapter. The State of the Operator is responsible for the approval of safe flight procedures developed by the aircraft operators." : ICAO PANS-OPS Doc. 8168 - Part V Chapt. 3, S. 3.1.2, p. 5-3, 1/11/2001.
13	<b>NADPs Generally :</b> "There will be no more than two departure procedures to be used by one operator for an aeroplane type, one of which should be identified .... as the noise abatement departure procedure": ICAO PANS-OPS Doc. 8168 - Part V Chapt. 3, S. 3.2.3, p. 5-3, 1/11/2001.

**P.T.O. MINISTER VAILE'S AUGUST 1998 STATEMENT ATTACHED**

28 August 1998  
T159/98

## STEEPER CLIMBS OVER LAND

As a result of strong community support for steeper climbs by jet aircraft taking off to the north from the new parallel runway at Sydney airport, the Minister for Transport and Regional Development, Mark Vaile announced today that it has been decided that the procedure will be required of all airlines departing north from the parallel runways.

Additionally, the steeper climb procedures for take-offs from the east west runway will be explored.

Earlier this year the Sydney Airport Community Forum (SACF) and the airlines initiated a trial of "ICAO A" steeper jet climb procedures to the north to determine whether this would reduce the impacts of aircraft noise on residents.

"Following a review of the data from the noise and flight path monitoring system at the airport, and most importantly after hearing the views of the community on the benefits of the trial, SACF recommended to me that the steeper climb procedures should become a permanent feature of take-offs over land," Mr Vaile said.

"In view of the strong community support, for the steeper climb procedures, the Government will be moving to make this a requirement for all aircraft departing the airport to the north off the parallels.

"This is a victory for the Federal Member for Wentworth, the Hon Andrew Thomson MP, who has been a strong supporter of the steeper take-offs on behalf of his constituents.

"The use of steeper take-offs from the main runway will also be welcome news to the people in the electorate of Lowe. Robert Lee, the Liberal candidate for the seat of Lowe has made strong representations to me about community support for introducing this requirement for all aircraft."

"We will also be working with the industry and the community to the east and west of the airport to determine whether there would be benefits for them in introducing such procedures off the east-west runway," the Minister said.

"ICAO A" procedures involve steeper climbs and a delayed reduction in power setting which ensures that the jets reach higher altitudes before over-flying homes close to the airport.