

40.4883.R1:ZDS

31st August, 2010

The Principal Solicitor
Communities NSW (Sport and Recreation)
Locked Bag 1422
SILVERWATER NSW 2128

Attention: Mr P. Brady

SOUTHERN HIGHLANDS REGIONAL SHOOTING COMPLEX
WATTLE RIDGE ROAD, HILL TOP

The purpose of this report is to present the results and findings of a review of documentation prepared in relation to noise emission from the Southern Highlands Regional Shooting Complex at Hill Top.

For my review I have been provided the following documents:

- A Noise Assessment prepared by GHD P/L dated January 2008 (was contained in Volume 2 of an Environmental Assessment Report)
- A Noise Impact Assessment report prepared by Norman Disney Young (July 2008)
- An Independent Expert Panel report into the Part 3A Project Application (July 2008)
- An Approval from the Minister for Planning dated 1 March 2010

The issue at hand relates to noise limits contained in Condition of Approval A9 that is based upon the original acoustic assessment that under certain firing scenarios is exceeded.

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THE ACOUSTIC GROUP

In light of compliance testing recording noise emission levels greater than the permitted levels and greater than the noise levels predicted in the two assessments and considered in the Independent Panel's deliberations, Communities NSW (Sport and Recreation) have requested this review.

In conducting this review it is necessary to identify that I have qualifications and experience to conduct the acoustic review (see Annexure A).

Furthermore my acoustical experience includes the measurement of firearm noise. I have conducted assessments and compliance testing at more than 30 ranges over 30 years, including civilian and military rifle ranges (see Annexure B).

The Site

I am instructed that an 800 metre big bore range that is part of the subject complex has been in existence since 1982 in the land that was identified as part of a state forest.

The forest has been incorporated into a larger parcel of land under the control of the National Parks and Wildlife Service, and that the shooting complex is now identified as a separate parcel of land which is no longer under the control or jurisdiction of the National Parks and Wildlife Service.

The GHD assessment (January 2008) identified that the existing Hilltop rifle range was to become the Southern Highland Regional Shooting Complex by the addition of a 500 m rifle range, a 200 m rifle/pistol shooting range, a 50 m pistol range, a shotgun range, and an indoor air range.

In the context of noise emission the smaller ranges (when compared to the existing 800 m range) would be expected to generate lower levels of noise for residential receivers to the South East and similar or slightly higher noise levels for residential receivers to the North West.

However in any event the additional ranges to be provided on the complex would be additional to the existing range and noise limits would be governed by the existing noise criteria that would apply to the 800 m range.



Measurement of Rifle Noise

In dealing with the assessment of noise from rifle ranges and pistol ranges that are located in an outdoor environment with the acoustic descriptor used for such assessments in New South Wales has been for more than 20 years based upon an energy average un-weighted (Linear) peak hold level.

This acoustic measurement is different to the general assessment procedure for noise matters that utilises the A-weighted FAST response level.

The technical basis for using an un-weighted measurement procedure is due to the very short time period associated with the pressure wave generated by the projectile being less than the rise times associated with the electronic filter that is used for A-weighted measurements. This means that passing a rifle shot noise event through an A-weighted FAST response filter will be inaccurate.

The National Acoustic Laboratories Report No. 84, February 1981 ISBN 642 06060 6, "Community reaction to noise from Hornsby Rifle Range" reviewed the measurement of rifle noise and proposed use of the un-weighted peak sound pressure level (LPEAK) or the A-weighted sound exposure level (ASEL) to be technically correct.

The use of 'A' frequency weighted maximum levels is not normally encountered in overseas criteria for impulsive type noise. On the contrary, use of 'C' frequency - weighted or Linear (un-weighted) peak hold levels or sound exposure levels has been the usual practice

The peak hold level measured for a rifle shot event is significantly greater than the A-weighted level (recorded for the same event) and therefore persons not aware of the differences, and used to general noise measurements expressed as a dB(A) level, may be concerned with noise levels quoted for the measurement of rifle and pistol noise.



Because one is measuring a pressure response, when an assessment location is removed from a rifle range the ambient noise levels may be similar to the noise being assessed. If there are any wind gusts the resultant un-weighted peak hold level can be higher than that generated by the rifles.

Where one has a mixture of disciplines utilising a shooting complex there will be a different range of noise levels experienced at receiver locations dependent upon the type of firearm being discharged and the location of the firing position with respect to the receiver location.

For rifle ranges the targets are at a set location but the firing position can be at different distances from the targets. For an 800 m range shooting can occur at firing positions from 100 m out to 800 m, generally on 100 m increments.

It is necessary to note that noise levels associated with rifle and pistol firearms have a highly directional component. For a monitoring position that is perpendicular to the midpoint of the range the average noise level of one type of firearm will vary dependent upon the position from which the firearm is discharged. Therefore in conducting an assessment of a big bore rifle range it is necessary to conduct measurements at the various firing positions that may be used by that discipline.

For smaller ranges the firing position may be a permanent position in which case it is not uncommon to have a structure over the firing position.

Noise Guidelines

The various acoustic assessments prepared in relation to the Southern Highlands Regional Shooting Complex refer to shooting noise guidelines (“the guidelines”) issued by the (then) State Pollution Control Commission (“SPCC”) in the mid 1980s.



On reviewing the acoustic documentation it would appear the authors of the reports are not fully conversant with the noise guidelines and how they are applied to rifle ranges. Therefore it is necessary to provide information as to the development and application of those guidelines as it may very well be the situation that none of the authors of the acoustic reports were practising as acoustic consultants when the guidelines were developed or first issued.

The guidelines were published as Chapter 164 in the SPCC's *Environmental Noise Control Manual* and provide a sliding scale of noise levels depending on the number of operating days/nights per week. One set of noise targets are for existing ranges and a lower set of noise targets for future ranges.

I am familiar with the guidelines as I developed the original version of the guidelines in my capacity as a member of the State Shooters' Liaison Committee which was chaired by the SPCC and included representatives from the various shooting disciplines. I was appointed by the Sporting Shooters' Association of Australia to be their technical representative on the committee.

The first version of the guidelines was based on actual measurements of various rifle ranges (Seaham, Hornsby and Silverdale) and a noise assessment report for military use of Hornsby Rifle Range prepared for the Department of Defence by the National Acoustics Laboratories (identified above).

My draft guidelines were amended by the SPCC by lowering the recommended noise limits by 5dB. Other than that adjustment the technical content of the guidelines are as I originally prepared for the committee.

After the guidelines were published, further assessments of rifle ranges came before the State Shooters' Liaison Committee in relation to ranges operated by the Shooting Supporters Association of Australia. Those assessments provided working examples of the guidelines resulting in the SPCC adopting the use of the energy average of the individual maximum levels (for each shooting discipline) to be then compared against the target guideline.



For indoor ranges the linear peak level was not used as in general indoor ranges had a significantly smaller separation distance to residential receivers and as such ranges were sought to be operated at night the noise target was assessed in terms of the A-weighted level and a desired goal of inaudibility.

The SPCC has evolved over the years into the Environment Protection Authority (“EPA”), then the Department of Conservation (“DEC”), then the Department of Conservation and Climate (“DECC”) and currently the Department of Conservation, Climate and Water (“DECCW”).

When the guidelines were published rifle ranges were Scheduled Premises under the Noise Control Act and as such were under the jurisdiction of the SPCC.

With the formation of the EPA and gazettal of the Protection of the Environment Operations Act (“POEOA”) rifle ranges were no longer scheduled premises and therefore fell under the control of Councils. Rifle range applications since 1992 have in New South Wales generally been assessed in accordance with the SPCC guidelines.

The principal intent of the SPCC/EPA *Environmental Noise Control Manual* was to address industrial noise, or activities that were Scheduled under the Act. Subsequently the EPA discontinued use of the *Environmental Noise Control Manual* when they issued their *Environmental Criteria for Road Traffic Noise* document and the *Industrial Noise Policy* document.

The GHD Assessment

The assessment nominates the aforementioned noise guidelines as being Chapter 164 of the DECC Environmental Noise Control Manual.

In a technical sense this is incorrect as the first version of the ENCM was issued by the SPCC and a later version was identified as an EPA ENCM. There has never been a DECC ENCM.



In Section 3.1 the report identifies that monitoring of the existing environment was conducted using unattended environmental noise loggers which are of no assistance in terms of evaluating the acoustic environment the area with respect to rifle noise. The environmental noise loggers record the A-weighted noise level and therefore in terms of describing the existing acoustic environment for comparison with firearms that material is no assistance.

Section 3.2 of the report refers to attended noise monitoring where the Peak Hold Linear levels were recorded that were purported to be representative of the proposed new ranges. On page 15 of the report the authors identify that in their opinion the testing simulated a worst-case configuration because:

- *Firing was undertaken at the end of the firing range nearest to the rear target earth embankment. Firing would normally occur at a further set back distance from the target than that tested, providing further distance loss attenuation of sound at the nearest receivers; and*
- *The firing during testing was considered more elevated and exposed than the rest of the range, with less trees intervening between source and the receiver locations.*

The first opinion is incorrect and indicates the authors had no understanding of the directional characteristic of firearms and that if one looked at a polar plot of noise one would find an expansion of noise contours to the side of the line of fire as one moved from the firing position towards the target. Therefore the greater the distance between the firing bench and the target the wider the noise contours and therefore there was a fundamental error in the assumption as to predicted noise levels from the proposed ranges.

With respect to the second basis of the opinion I can accept the elevated position can give rise to higher noise levels than a position shielded by topography, but do not accept the concept that the trees may result in a substantial attenuation, particularly if one is considering shotguns where the firearm is not discharged in a horizontal plane but is normally angled up between 20° and 60° above the horizontal.



Section 3.2.2 refers to measurements conducted for military weapons that utilised the existing 800 m range with firing positions between 100 m and 400 m. One would expect by reference to locations B3 and B4 to have negligible noise due to the directional component of such firing, but I would have expected the results for locations B1 & B2 to be expressed in terms of the different firing positions.

Table 3-6 identifies peak noise levels measured at 8 m to the side of the sniper rifles with identification that the different firearms provided consistent results of 144- 145 dB. The narrow range of noise levels would not appear to agree with measurements that I have conducted at greater distances from those weapons which caused me to look at the instrumentation that has been used for assessment purposes.

Section 3.2 nominates to sound level meters used for attended measurements and claims that both meters are Type 1 accuracy.

The specification sheet for the Svan 943 SLM indicates it is a Type 2 meter with a maximum range of 133dB_{ARMS} that can determine a peak level but does not include a peak detector as part of the averaging of the meter.

The SVAN 912 SLM in fact has a number of models (A & AE) which are both Type 1 meters but would appear to have a maximum peak detector level of 140 dB.

When one is seeking to record such high pressure levels to ensure the meter does not overload one either uses (for Bruel & Kjaer instrumentation) a passive attenuator between the microphone and the meter, or a microphone with a lower voltage output so as to not overload the sound level meter. For sound pressure levels in excess of 130dB normally one then chooses to use a smaller diameter microphone (¼ inch or 1/8 inch) that can record such levels without overloading the microphone or the measurement system.



From the GHD interpretation of the measurement results they have identified that the new ranges are to be assessed under the future range category and that on the basis of a maximum level of 71 dB the new rifle and shotgun ranges should be restricted to 5 days per week and one night per week. For the pistol range that generates lower noise emission levels the recommendation is to 7 days per week and a maximum night-time usage of three nights per week.

The report does not identify the permitted usage for the existing 800 m range, which by reference to Table 3-5 for shooting out to 400 m would be permitted to have seven days per week and two nights per week.

However, as identified above because the authors of the GHD report did not understand propagation of noise from rifle ranges the predicted noise levels for other firing positions have not been obtained and they have underestimated that noise impact.

The NDY Assessment

In the first instance this assessment relies upon the GHD report that is then supplemented by noise testing at Hilltop in June 2008 and testing at Holsworthy in July 2008.

The first survey was conducted 20 m from the firing position and at a 90° angle from the firing direction that related to firearms to be used that has been described as “domestic firearms”. The meter used for measurements is a Type 1 meter but the text does not indicate a 20dB capacitive attenuator was inserted between the microphone and the meter.

If no attenuator was provided, the specifications for the meter indicate the maximum peak level that could be recorded is 133dB.

Therefore, are the measurements provided in Table 2 of the report accurate?



Furthermore if one was to assume the levels are correct then the NDY measurements at 20 metres raise doubts about the GHD measurements of military weapons at 8 metres.

The report correctly identifies there is a directivity pattern nominated for a firearm but does not explore how the noise contours propagate in the far field for such firearms.

The second survey conducted measurements with firearms located approximately 50 m from the target and in all cases the monitoring location is behind the firing position which therefore by way of the directivity pattern in Figure 2 would automatically experience a significantly lower noise level than if the measurements had been conducted at similar distances to the side of the firing range. As such the measurements do not assist in ascertaining the noise levels that would be received at residential locations for different shooting positions.

The third survey provides measurement results that from my experience at both civilian and military ranges represent an unsafe monitoring procedure for locations 13 to 17 inclusive. I have never been allowed to conduct measurements in front of the firing position and if the measurements so indicated for Holsworthy occurred on a military base there were very serious breaches of the occupational and safety requirements implemented by Department of Defence for their ranges.

The text following Table 4 raises the issue of overload for the GHD measurements but does not identify the capabilities of the instrumentation used by NDT for their measurements.

The provision of the directivity pattern for position only 10 m from a weapon being fired would appear to be an invalid methodology take into account the non-linear propagation of the projectile and the upper limit of the sound level meter.



Section 5.3.1 seeks to provide attenuation without comprehending the non-linear propagation associated with projectiles. The methodology confirms that the propagation of noise is not an omni-directional spherical propagation with distance and the results shown in figures 6 and 7 cannot be extrapolated to the residential receivers from the data because the different distances are related to different angles from the direction of firing.

The text indicates that there are different rates of propagation for different firearms and based upon those rates the nearfield directivity has been allocated in computer modelling to determine noise levels at receiver locations used by GHD. The tables suggest that under various weather conditions the noise levels are similar to or slightly higher than that nominated by GHD.

It would appear that NDY had never previously conducted a compliance test for a rifle range and therefore was unfamiliar with what was required for the purpose of testing or the ramifications of directivity associated with rifle ranges.

It would seem that the most simplest method of evaluating the noise impact at residential receivers for the (then) proposed range was if (as identified by NDY) they had an understanding of directivity would be to conduct measurements at the GHD assessment locations for firearms operating on the existing range but at similar positions with respect to the Wattle Ridge Road to that that would be proposed. On this basis with respect to locations A1 to A3 the noise levels obtained by using the existing range would be marginally higher than that for the proposed ranges.

Independent Expert Panel Report

The Executive Summary of the report indicates that the panel included a noise specialist.

The report indicates that whilst measurements recorded in proximity to the firearms by GHD were likely to be inaccurate, the assessment utilised a maximum noise level of 75 dB (Linear) Peak Hold determined in the NDY report.



The report indicates public submissions raised the matter that the original assessment had not considered the impact currently experienced by residents, which if such an assessment had been undertaken might very well have highlighted the errors in the GHD assessment report.

The report does not identify whether the noise specialist on the panel was aware of the directivity patterns associated with an operational rifle range and the significant variations that may occur for different firing positions.

The report identifies submissions on behalf the residents raised concerns as to the adequacy of the Chapter 164 guidelines and whilst those guidelines were used as the basis of assessment the panel was not advised as to the history of the guidelines or the practical modification of the guidelines that had been implemented since those guidelines were first published.

It may very well be the case that the DECC comment did not have the benefit of this knowledge.

The report does not address the matter of urban encroachment upon an existing range and the need to protect the current operations. It appears that as a result of the public submissions and the fact that there is an inadequate buffer to protect the previous operations of the range that the consequence of inappropriate planning to locate residential premises in proximity to an active range has resulted in a restriction in such range operations.

Because the applicant and acoustic specialist on the Panel did not raise the matter of different noise levels for different firing positions the likelihood of noise levels are greater than 75 dB (Lin) peak hold can result in a breach of the Minister's consent.



The Current Situation

From the above material is obvious that none of the acoustically trained persons involved in the assessment of the subject shooting complex had the appropriate experience and knowledge (with respect to rifle ranges) to conduct such an exercise.

The matter of assessing, evaluating and predicting noise emission from rifle ranges is not the same as what would normally occur for a residential air-conditioner or even a large-scale industrial plant. The lack of appropriate knowledge as to the propagation of noise from a rifle range is evident in the acoustic assessments prepared for the applicant.

What should have been done, and correctly pointed out in the public submissions, was to conduct measurements in the residential area utilising the existing big bore range but conducting measurements at various distances that are currently used and placing the firing positions for the new firearm classifications at the same setback distance from the access road to that that would occur for the new range.

This measurement methodology would confirm the nature of the current noise impact for residential properties to the east and south-east of the main firing range, and place in the correct context the change that would occur as result of the additional ranges/disciplines.

With respect to the residential location north west of the current range the testing could have included a reference location closer to the testing position (than the existing residence) that would simulate the same distance as what would occur with the new ranges.

Such testing if carried out now would reveal the errors in the predicted levels nominated by GHD and NDY.



The reality of having an 800 m big bore rifle range operating over its entire length will result in noise levels greater than 75 dB (Linear) Peak Hold at residential receivers to the east and south-east when shooting from a firing position greater than 400 m.

What has not been presented in the material concerning the shooting complex is that the Chapter 164 guidelines were in practice modified to consider an energy average of the individual shots attributed to the different classifications of firearms.

Based on previous EPA assessment/approvals for existing rifle range complexes that had been expanded by the provision additional ranges/disciplines, one considers the existing operations as an existing category under the guidelines with the additional ranges/disciplines considered in terms of the future range classification.

That procedure has not been adopted in this case with the approach being to reduce the entire complex to future range criteria. Normally the restriction is in terms of number of days usage, whereas the another critical issue for this shooting complex is a condition of consent that limits the maximum noise level without even correctly identifying that level is an energy average.

In resolving the acoustic issues it will be necessary to undertake testing to ascertain the range of noise levels that will occur from the previous and permitted use of the 800 m range, separately from the noise levels generated from the new ranges.

With these results the obvious error in the application and the approval process will be evident.

What consequences the technical errors by both GHD and NDY, as to the reaction of the community is a matter that needs to be resolved.

Because the complex is determined by the Minister then the complex may be considered of state significance.



How that matter is resolved will require some delicate and intense consultation. The consequence of generating noise levels higher than that in the current approval can still be addressed by way of the guidelines but could, from the resident's perspective, result in a further reduction in the number of days the range may be used each week.

At the present time the big bore range should not be permitted to utilise any firing positions greater than 400 m so as to maintain compliance with the conditions of consent.

Yours faithfully,

THE ACOUSTIC GROUP PTY LTD


STEVEN E COOPER



ANNEXURE A: CURRICULUM VITAE

STEVEN E. COOPER - DIRECTOR



DATE OF BIRTH: 15 June 1952

QUALIFICATIONS: Bachelor of Science Engineering
(Electrical) 1978, University of NSW

Master of Science (Architecture) 1990,
University of Sydney

MEMBERSHIPS: Member, Australian Acoustical Society

Fellow, Institution of Engineers, Australia
Chartered Professional Engineer

Member, Institute of Noise Control Engineering

Member of Standards Association of Australia
Committee AV/10 – Whole Body Vibration (1986 to
present), Committee EV/11 – Aircraft & Helicopter
Noise (1986 to present), AV/4 – Architectural
Acoustics (1996 – 2000), and Committee EV/10/4 –
Railway Noise (1998 to October 2007)

NSW Division, Australian Acoustical Society
Membership Committee since 1978 to 1997

EXPERIENCE: The Acoustic Group Pty Ltd
Incorporated in 2003

Steven Cooper Acoustics Pty Ltd
Incorporated in 1995

James Madden Cooper Atkins Pty Ltd
Incorporated in 1981

James A. Madden Associates Pty Ltd
Appointed Associate Director 1980
Appointed Associate 1979
Appointed Engineer 1978

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THE ACOUSTIC GROUP

The Acoustic Group was formed to provide specialised services and research in Acoustics and Vibration and draws on the considerable experience of Mr. Cooper from his position from 1982-1995 as Principal and Partner of James Madden Cooper Atkins and from 1995-2004 as Principal of Steven Cooper Acoustics. His particular areas of acoustical expertise include machine and vibration monitoring, acoustical design of auditoria, studios and entertainment venues, traffic and helicopter noise, laboratory instrumentation, precision analysis system, legal assignments and expert witness.

He has considerable experience in vibration measurement and assessment in industry for both Machinery Operating Condition and Occupational Exposure Levels.

His experience in the measurement and assessment of noise emission from industry and licensed premises is extensive having produced numerous assessment reports and noise control designs for clients, statutory bodies and courts. He has been an invited Guest Lecturer on Noise Assessment to NSW Policy Academy for their Noise Familiarisation Course run by the State Pollution Control Commission, a guest lecturer for the Faculty of Architecture at the University of NSW, and a lecturer on noise issues for seminars/workshops run by the Australian Industries Group and the Australian Environment Network.

He is the acknowledged leader in the measurement, assessment and design of helipad/heliport operations, aircraft noise assessments, and is a major contributor to various Australian Standards. Mr. Cooper is the recipient of an Engineering Excellence Award in the Environment Category from the Institution of Engineers in 1997 for the TRW No. 2 Forge Project.

Projects in which he has been involved include the ICI Botany Complex (Noise and Vibration), APM Matraville Paper Mill (Site noise control), Manildra Flour Mill, Sydney CBD, Granville & Gosford Heliports, ANEF Validation and NPD testing for F111, FA-18 aircraft, Iroquois, Squirrel, Sea King, Sea Hawk, Blackhawk, Super Seasprite and Tiger helicopters, acoustical assessments for Licensed Premises, Studios, Auditorias etc.

PAPERS & PUBLICATIONS

“Design for Noise Reduction – Dual Occupancies” 5th Annual Conference, Local Government Planners Association of NSW, November 1979

“Is Exposure to High Levels of ‘Rock’ Music a Major Health Hazard to Patrons and Staff” 10th International Congress on Acoustics – Sydney, July, 1980

“Hornsby Shire’s General Sound Insulation Code for Residential Flat Buildings” 10th International Congress on Acoustics – Sydney, July, 1980

“Archiving Reproducing Piano Rolls” 10th International Congress on Acoustics – Sydney, July, 1980



“Road Traffic Noise and Local Government Controls”, Graduate School of the Built Environment, University of NSW, February, 1981

“Noise Levels of Rock Music and Possible Effects on Young People’s Hearing” Scientific Meeting NSW Division, Australian Acoustical Society, April, 1981

“Noise Assessment of Licensed Premises” NSW Police Noise Familiarisation Course, Policy Academy Sydney, July, 1981

“Noise Effects on Staff in Entertainment Venues” Australian Live Theatre Council, May, 1983

“Noise Pollution” Shout – August 1987, Journal of the Registered Clubs Association of NSW

“The Roles and Needs of Expert Witnesses”, Development, Local Government and Environmental Seminar for Sly & Russell, Sydney, November, 1987

“Noise Limits for Helicopters”, “Helicopters Noise and the Community”, “Flight Techniques to Reduce Noise”, Helicopter Noise Seminar – NSW Branch of the Helicopter Association of Australia, April, 1988

“Intensity Measurements of the Ampico/Duo Arts Parts 1 & 2” The AMICA News Bulletin (USA), Vol 25 No. 4, July, 1988

“Community Perceptions, Case Studies and Control of Noise” – Australian Conservation Foundation – Sydney Branch, September, 1988

“Helicopter Noise Assessment”, Australian Acoustical Society Conference, Victor Harbour, South Australia, November, 1988

“Noise Considerations for the Establishment of Helipads/Heliports”, Rotortech ‘89, Sydney, October, 1989

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“Noise Control – Decibels per dollars. A Practical Approach”, The Stock Feed Manufacturers’, Association of Australia Conference, Canberra, March, 1990

“Community Response to Aircraft & Helicopter Noise – Proposed PhD Research”, Technical Meeting of the Australian Acoustical Society, NSW Division being a Review of Acoustics Research at Sydney University, May, 1991

“A Practical Method for the Assessment of Noise Controls for Aircraft Noise Intrusion”, Second Sydney Airport Coalition Public Meeting, Petersham Town Hall, Sydney, September, 1991



“Are Regulatory Noise Limits in Australia Exterminating the Helicopter Industry?”, Inter-Noise 91, Sydney, December, 1991

“Consideration of Alternative Acoustic Criteria for Assessment of Aircraft Noise in Wilderness & National Park Areas”, Progress Report of Noise Criteria Working Group, Blue Mountains Fly Neighbourly Advice, July, 1994

“Are Regulatory Noise Limits in Australia Exterminating the Helicopter Industry?”, Second Pacific International Conference on Aerospace Science & Technology, Melbourne, March, 1995

“Sound Proofing of a Forge”, Acoustics Australia, Vol 26 (1998), No 2

“AS2021 – What Does it Mean Now?”, Australian Mayoral Aviation Council Conference 1998

“Upgraded Plants and Retrospective Application of Modified Noise Criteria – Case Studies”, Australian Industry Group, January, 1999

“Revision of Australian Standard AS2021”, Airport Operators Conference, Melbourne, May, 1999

“Living with Your Neighbour’s Noise”, Neighbourhood Disputes Seminar, LAAMS, Sydney, May, 2000

“What Triggers the New EPA Noise Policies – Tips & Traps”, Australian Environment Business Network Noise Pollution Seminar, June, 2001

“Practical Environment Management – Noise Issues”, Australian Environment Business Network Environment Management Practitioners Workshop, August 2002, November 2002, February 2003, May 2003, August 2003

“Environmental Issues Management – Noise”, Australian Industries Group Practical Methods and Technologies Seminar, October, 2002

“The INM Program is a much better program than HNM for helicopter modelling, but”, SAE A-21 Helicopter Noise Working Group Meeting, Las Vegas, March, 2004

“Noise Certification, is the Helicopter Industry selling itself short?”, HeliExpo 2004, Las Vegas, March, 2004

“Derivation & Use of NPD Curves for the INM”, Helicopter Noise Workshop, American Helicopter Society Conference, June, 2005

“Problems with the INM: Part 1 – Lateral Attenuation”, Noise of Progress Acoustics Conference 2006, New Zealand

“Problems with the INM: Part 2 – Atmospheric Attenuation”, Noise of Progress Acoustics Conference 2006, New Zealand



“Problems with the INM: Part 3 – Derivation of NPD Curves”, Noise of Progress Acoustics Conference 2006, New Zealand

“Problems with the INM: Part 4 – INM Inaccuracies”, Noise of Progress Acoustics Conference, 2006, New Zealand

“Reviewing the Role of the Expert in Land & Environment Court Cases”, NEERG Seminars, Sydney, August 2007

“JSF Aircraft Noise Issues for Australia”, F35 ESOH Working Group Meeting, Washington, September 2007

“Acoustic Experts - Noise Under Pressure?” Getting it Together in the Land & Environment Court: Compiling Joint Expert Reports, NEERG Seminars, Sydney, October 2007

“What can go wrong acoustically”, NEERG Seminar Dealing with DAs in 2009, Sydney, May 2009

“Community Response to Impulse Noise & Vibration”, Training Area Noise & Vibration Workshop, Department of Defence, Canberra, June 2009

“Acoustics & Noise”. Regulations & Implementation of DAs & SEPP65, NEERG Seminars, Sydney, March 2010

“INM Getting it to work Acoustically”, 20th International Congress on Acoustics, Sydney 2010.

“Military Aircraft Noise in the Community”, 20th International Congress on Acoustics, Sydney 2010.

“Sound Therapy Restores hearing – Fact or fiction? A personal experience of an acoustician”, 20th International Congress on Acoustics, Sydney 2010.

“Alternative Aircraft Metrics – Useful or like moving the deck chairs on the Titanic”, 20th International Congress on Acoustics, Sydney 2010.

SPONSORED TECHNICAL REPORTS (Brief Selection only):

Noise Radiation and Reduction on a Fibreglass Minesweeper – HMAS Rushcutter for Carrington Slipways P/L, JMCA Report 16.1650.R1

Occupational Vibration Exposure Levels on Euclid Dump Trucks and Coal Haulers at Utah Blackall Mine Queensland, JMCA Report 16.1648.R1-R3



Thermal Expansion and Misalignment on a Gas Turbine Alternator at Shell Clyde Refinery, JMCA Report 17.1716.R1-R3

Acoustic Appraisal and Control – ABC Perth TV & Radio Studio Complex, JMCA Report 17.1607.R3

Southern Arterial Route – Pyrmont to St. Peters for NSW Department of Main Roads, JMCA Report 16.1647.R1

Building Structure Vibration Department of Social Security, East Point Centre Computer Installation, JMCA Report 15.1542.R2

Blower House Acoustic Controls (Building and Silencer Designs) St. Marys, Quakers Hill, Glenfield, Macquarie Fields and Hornsby Heights Pollution Control Plants, JMCA Reports 10.1014 & 14.1416

The Application and Use of ANEF Contours for Aircraft Noise Control, SCA Report 25.3127.R3 for Submission to the Senate Inquiry into Aircraft Noise at KSA

An Acoustical & Vibration Investigation into Freight Rail Operations in the Hunter Valley, SCA Report 26.3387.R1-R41

TRW No 2 Forge Noise Minimisation Study, SCA Reports 26.3314.R12-R19

Acoustical Assessment, Proposed Extension of Dock Hours, Westfield Shoppingtown, Parramatta SCA Reports 28.3766.R8-R12

Noise Impact Assessment, Proposed Service Centre, Cnr Cowpasture Road & Hoxton Park Road, Hoxton Park, SCA Report 30.3934.R1

Acoustical Assessment, Proposed Extension of Operating Hours, Westfield Shoppingtown Hornsby, SCA Report 30.3928.R3

Acoustical Assessment Aircraft Operations, RAAF Williamtown and Salt Ash Weapons Range, SCA Report 32.4190.R6

Acoustical Assessment Pollution Reduction Program No. 7, Shoalhaven Starches Plant, Bombaderry, SCA Report 32.3849.R17

HMAS ALBATROSS 2013 ANEF, Derivation of NPD Curves, SCA Report 33.4185.R11

Acoustical Assessment, Proposed Residential Development, Glenning Valley, Wyong, SCA Report 33.4303.R1

Acoustic Assessment, Proposed Groundwater Cleanup Project, Botany Industrial Park, TAG Report 34.4372.R3



Acoustic Design Report, Stage 1 Development Application for Bathurst Hospital, TAG Report 35.4477.R2

Acoustic Assessment, SCT Freight Complex - Stage 1, Brolgan Road, Parkes, TAG Report 36.4523.R1

Noise Disturbance in Residential Apartments as a Result of Building Expansion/Contraction, Bluewater Point Apartment Complex, Minyma, Queensland, TAG Report 36.4578.R1

Acoustic Design Report, Westfield Centrepoint Refurbishment, TAG Report 37.4472.R5

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Proposed Shao Lin Temple Development Site Near HMAS Albatross: Noise Assessment Report, TAG Report 37.4586.R1

TIGER ARH NPD Curves, TAG Report 37.4510.R15

Acoustical Assessment, Point Piper Marina, 38.4705.R9

Rail Traffic Noise Impacts, Residential Sub-division, Isedale Road, Braemar, 40.4865.R1

Acoustic Compliance Testing, New Buildings, RMAF BASE Butterworth, TAG Report 40.4386.R3



ANNEXURE B: S. Cooper Experience in relation to Shooting Ranges

Measurement & Assessment		Assessment Only	
Condell Park Indoor Pistol Range	Roden Security Services	Tamworth Rifle Range	Sporting Shooters Association
Cecil Park Full Bore Range	Blacktown & District Clay Target Club	Canungra Rifle Range (QLD)	Sporting Shooters Association
Penrith Indoor Range	Shooters Paradise	Collinsvale Gun Club (TAS)	Collinsvale Gun Club
Silverdale Rifle Range	Sporting Shooters Association	Scotts Head Rifle Range	
JW Bruce Rifle Range, Seaham	Sporting Shooters Association	Purga Rifle Range (QLD)	Department of Defence
Goulburn Rifle Range	Sporting Shooters Association	Review of Shooting Guidelines (VIC)	Shooting Sports council of Victoria
ANZAC Rifle Range	Sporting Shooters Association		
Wagga Wagga Rifle Range	Sporting Shooters Association		
Batemans Bay Rifle Range	Sporting Shooters Association		
Brisbane Valley, Biana (QLD)	Sporting Shooters Association		
Fassifern Shooting Complex (QLD)	Sporting Shooters Association		
Eastern Creek Rifle Range	Blacktown & Districts Rifle Club		
Hornsby Rifle Range	Northern Districts Rifle Club		
Olympic Shooting Centre	Sydney Olympics 2000		
Kingswood Small Arms Range	Mr L Satara		
Kiama Albion Park Rifle Range	Kiama Albion Park Rifle Club		



Measurement & Assessment		Assessment Only	
Liverpool Rifle Range	Liverpool Rifle Club		
Tuncaster Small Bore Range	Lismore Pistol Club & Small Bore Rifle Club		
Coburn Rifle Range (VIC)	Sporting Shooters Association		
Nowra Rifle Range	Nowra Rifle Club		
Blue Mountains Rifle Range	Blue Mountains Gun Club		
St Marys Indoor Range	Sporting Shooters Association		
Lismore Pistol Range	Lismore Pistol Club		
Cecil Park Rifle Range	Hawkesbury Gun Club		
Hastings River Shooting Complex – 4 ranges	HRSC		
Majura Small Arms Range (ACT) – 7 ranges	Department of Defence		
Singleton Training Area	Department of Defence		

