NOISE/NEWS INTERNATIONAL

Volume 14, Number 1
2006 March

A quarterly news magazine with an Internet supplement published by I-INCE and INCE/USA

- **ACTIVE 2006**
  Travel Planning
- Sustainable Development in an Urbanizing World—The Noise Issue
- Minneapolis Workshop on United States Noise Policy
- **MEMBER SOCIETY PROFILE**
  The Italian Acoustical Association

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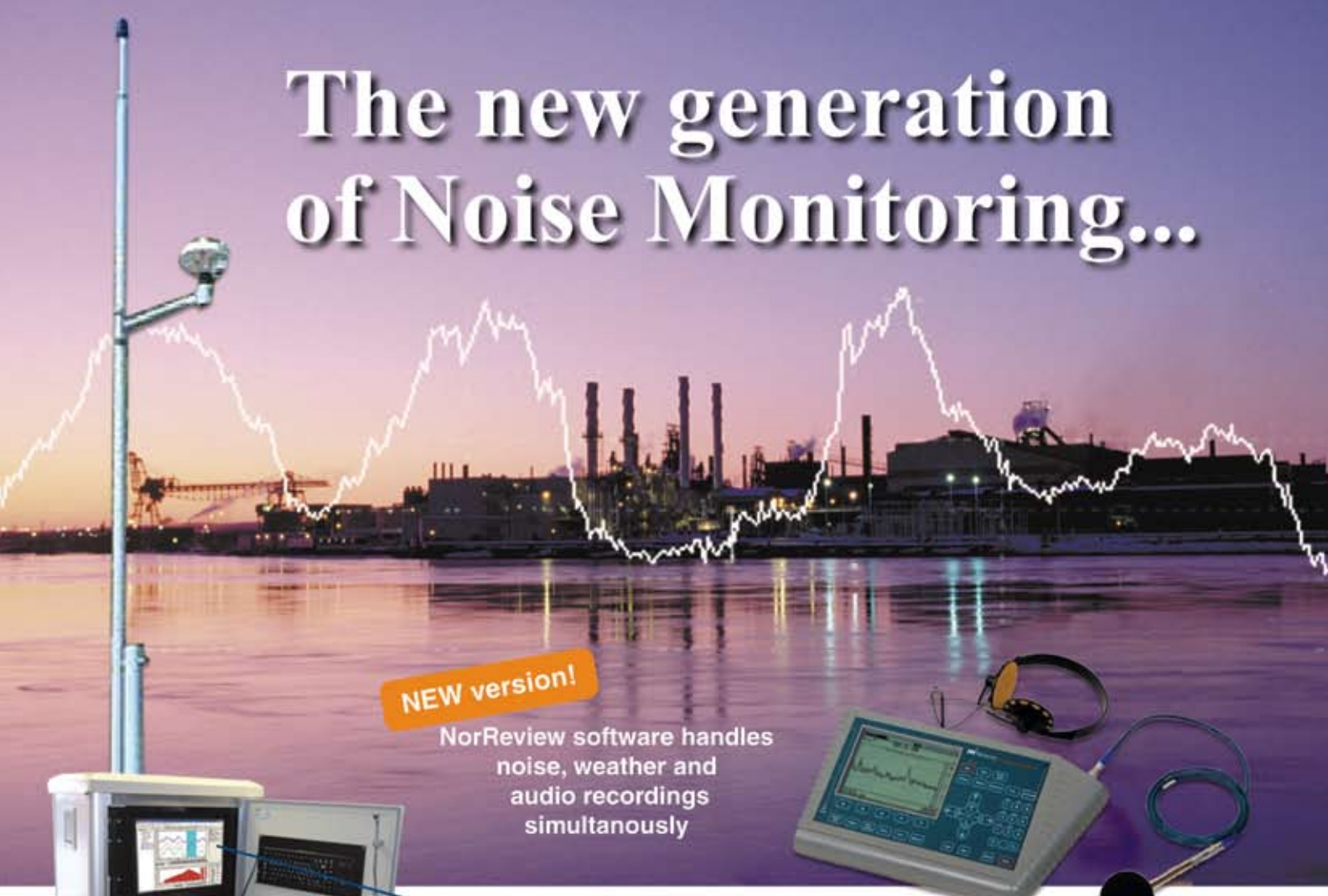

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Norsonic

www.norsonic.com

NOISE/NEWS INTERNATIONAL

Volume 14, Number 1 **2006 March**

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A quarterly news magazine with an Internet supplement published by I-INCE and INCE/USA

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NOISE/NEWS INTERNATIONAL

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I-INCE

The International Institute of Noise Control Engineering (I-INCE) is a worldwide consortium of societies concerned with noise control and acoustics. I-INCE, chartered in Zürich, Switzerland, is the sponsor of the INTER-NOISE Series of International Congresses on Noise Control Engineering, and, with the Institute of Noise Control Engineering of the USA, publishes this quarterly magazine and its Internet supplement. I-INCE has an active program of technical initiatives, which are described in the Internet supplement to NNI. I-INCE currently has 46 Member Societies in 39 countries.

INCE/USA

The Institute of Noise Control Engineering of the USA (INCE/USA) is a non-profit professional organization incorporated in Washington, D.C., USA. The primary purpose of the Institute is to promote engineering solutions to environmental noise problems. INCE/USA publishes the technical journal, *Noise Control Engineering Journal*, and, with I-INCE publishes this quarterly magazine and its Internet supplement. INCE/USA sponsors the NOISE-CON series of national conferences on noise control engineering and the INTER-NOISE Congress when it is held in North America. INCE/USA Members are professionals in the field of noise control engineering, and many offer consulting services in noise control. Any persons interested in noise control may become an Associate of INCE/USA and receive both this magazine and *Noise Control Engineering Journal.*

NNI Internet Supplement

www.noisenewsinternational.net

- Links to the home pages of I-INCE and INCE/USA
- Abstracts of feature articles in the printed version
- Directory of the Member Societies of I-INCE with links, where available, to the Member Society Profiles and home pages
- Links to I-INCE Technical Initiatives
- Calendar of meetings related to noise—worldwide
- Links, where available, to NNI advertisers
- Links to news related to the development of standards
- Link to an article "Surf the 'Net for News on Noise," which contains links to noise-related sites—worldwide

Sharing of Responsibility for Traffic Noise Mitigation

Traffic noise is a general environmental problem in almost all countries. For this problem, noise regulations/guidelines are established, and various measures for noise source emissions and the noise propagation process must be available. To mitigate the problem effectively, however, not only these respective technical developments but also a comprehensive investigation of the total system is needed. Among traffic noise problems, road traffic noise is discussed, because it is the most common environmental issue everywhere.

Regarding the relevant noise sources, phased noise emission regulations for road vehicles have been established in many countries, and automobile manufacturers have been making a significant effort to reduce the noise emissions of road vehicles. As a result, engine and exhaust noises have been much reduced. For automobile tires, various investigations have been made to reduce tire/road noise by examination of tire structure, materials and tread patterns, but epoch-making reductions have not been realized up to now because of the conflicting relationship with safety performance. On the other hand, "quiet pavement" technology has been much developed recently. It has been found that the drainage asphalt concrete pavement, first developed for running safety, is very effective for the reduction of tire/road noise, and this type of pavement is now being widely adopted in many countries. In Japan, almost all newly constructed highways are paved with drainage asphalt concrete.

However, it is a problem that this type of pavement has aged deterioration caused by clogging and it is urgently necessary to establish a technology to recover the noise reduction efficiency.

Regarding abatement measures related to noise propagation, various types of noise barriers are being developed. In Japan, noise barriers with a Y-figure section are being applied for highways as a standard type. Recently, an "active noise barrier" has actually been installed as a trial. In the case where highways run through quiet residential areas, semi-underground and canal-type roads are sometimes constructed as "quiet roads."

Along with these abatement measures, sound insulation treatment for roadside buildings should be considered. In urban areas, it is inevitable that many structures are built to close to busy roads.

In such a situation, the buildings must be designed to have sufficient sound insulation performance. In the Japanese "Environmental standards for noise," standard levels for indoor noise transmitted from the outside (45 dB or less for daytime and 40 dB or less for nighttime) are specified for areas close to artery roads. However, a legislative system to secure these standard values has not yet been established.
As mentioned above, for the mitigation of road traffic noise problem, the responsibility should be shared by respective processes (noise emission, noise propagation and noise reception) and model scenarios should be drawn by considering effectiveness, technical feasibility and cost of each element. In the past INTER-NOISE congresses, for example, many papers have been presented covering these research fields but it has been rare that such technical developments are compared and evaluated from a synthesis viewpoint. To examine these points, an informal conference has been organized in Japan under the sponsorship of the Japanese Automobile Research Institute (JARI), in which people in the automobile, tire, and pavement industries, highway corporations, construction industries, and administrative organizations are participating voluntarily. Discussions are being held and exchanges of technical information are taking place. This conference is very meaningful for a mutual understanding between different viewpoints in industries and administrations.

Hideki Tachibana

President, International INCE

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Flexibility and Community Noise

The increasing use of cars and trucks for transportation leads to increasing traffic volumes and consequently increasing noise from road traffic in all countries. As Paul Donovan discussed in his Editorial in the last issue of NNI, the methods for the control of road traffic noise are well established and the main stumbling block is the actual implementation of these measures.

There are other forms of community noise for which the noise control solutions are not so clear. This is particularly the case for noisy activities which are part of the cultural, social and recreational activities enjoyed by part of the community. In the Asia Pacific region, there is a diversity of cultures and many have sound output as an essential component. For example; the bells of churches and temples, the music for street processions and celebrations, and fireworks for major festivals.

In the appropriate context, each of these are part of the life of the area and accepted as part of the local soundscape. Changes in the surrounding community can lead to action and these sounds being considered as excessive noise. For example, when the city extends to take over the villages or towns and the new residents have different expectations, or when new developments make major changes in an area which has historically provided a different social focus. When groups from a different cultural and social background move into a community, their cultural activities may bring a richness to the society but there may well be some who are annoyed by the accompanying noise.

Living together in a community requires some acceptance and tolerance from all. Annoyance with noise is a subjective reaction, and, if there is no flexibility in the legislation, a vocal group in the community—which perhaps may be a minority—can demand strict enforcement of the noise criteria. Compliance with these criteria may require expensive noise control for buildings etc., or even the cessation of the activity.

The inclusion in community noise legislation of a concept of "reasonable and feasible" or of an option for a negotiated agreement can go some way to overcome this dilemma. All those involved are then forced to meet and discuss so that the different sides have a better understanding of the issues of concern and of the importance of the activity to part of the community. They can also discuss the various management strategies that can be used to minimise the annoyance. The ideal solution is if the two sides can come to a mutually agreed solution. If this is not the case, there needs to be an arbiter who, when presented with the views from both sides, can make a final decision on what is reasonable.

There are many strategies that can be used to reduce the annoyance, such as limiting the number and timing of the noisy activities or providing some control on the noise output. There is also the possibility that the traditional use of a particular area justifies the establishment of a higher noise criteria and new people in the area need to accept this.

Objective criteria are important for equity purposes and certainly assist to make enforcement and planning consistent across a community. However, for those countries embarking on the challenge of introducing environmental noise legislation, consideration of the benefits of some flexibility may well assist to cater for the needs of the various groups which comprise a community.

Marion Burgess

Asia-Pacific Editor

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[2] Transducer Electronic Data Sheet

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The Italian Acoustical Association

The 35th anniversary of the founding of the Italian Acoustical Association (AIA) will be celebrated in 2007. The organization was formed in 1972 to promote education and disseminate research on all aspects of acoustics. The exchange of information among members was (and remains) an important goal, as well.

The 16 founders of the association have grown their ranks to include several hundred members. Five membership grades are offered: Honorary Fellows, Fellows, Individual Members, Collective Members (institutions, companies, etc.), and Students.

Management of the association is in the hands of an 11-member board consisting of the president, past president, secretary, treasurer, and seven Fellows elected by their peers. Each board member serves a four-year term. The Society's web address is www.associazioneitalianaacustica.it. The site contains information on the history of the organization, membership opportunities, and conferences. The information is presented primarily in Italian, although there is a link to a summary document about the association written in English. The e-mail address for AIA is segreteria.aia@imamoter.cnr.it.

AIA focuses its activities in three specialty areas: environmental acoustics, music acoustics, and speech. The Speech Group was formed in 1988, the Environmental Acoustics Group (now the largest of the three areas) in 1990, and the Musical Acoustics Group in 1992. A Coordinator elected by the Fellows and Members of the group directs the group's activities assisted by a Committee.

The Association annually hosts a three-day meeting that covers all aspects of acoustics. About 150 members participate. The published proceedings of the meeting generally consist of 100 papers, resulting in a book that is 600 pages in length. A highlight of the meeting is the presentation of the Giacomini Prize for the best degree thesis on acoustics from prior year. The prize is named for the association's first president.

In addition to the annual meeting, members of the specialist groups present seminars and workshops throughout the year. These proceedings, covering various topical subjects, are also published by AIA. The association is also a regular host of international conferences. The group spearheaded the 4th FASE Symposium on Acoustics and Speech, Venice, 1981; the Conference on Acoustics and Recovery of Spaces for Music, Ferrara, 1993; the 18th AICB (Association Against Noise) Congress, Bologna, 1995; the 17th International Congress on Acoustics (ICA), Rome, 2001; and the 5th EuroNoise Conference, Naples, 2003.

The association launched a quarterly journal in 1977. Titled *Revista Italiana di Acustica*, the publication is the official magazine of the association. Each issue features research papers, technical notes, news from AIA, and a calendar of events. Papers are usually presented in Italian with a summary in English, although the papers of some authors have been presented in French, English, and other languages. Each issue is about 50 pages in length; nearly 1000 copies are distributed.

AIA maintains close ties with the Italian Audiology Society and other national associations related to acoustics. It was among the founders of the Federation of Acoustical Societies of Europe (1972) and the European Acoustics Association (1992). AIA has been affiliated with I-INCE since 1983.

This is the 53rd in a series of articles on the Member Societies of International INCE.

2006 International Symposium on Active Control of Sound and Vibration

Adelaide, Australia

18-20 September 2006

Travel Planning

ACTIVE 2006, The 2006 International Symposium on Active Control of Sound and Vibration, will be held in Adelaide, South Australia, Australia on 2006 September 18-20. This, the sixth in a series of international symposia on active control of sound and vibration, is sponsored by INCE/USA and supported by the Australian Acoustical Society and the University of Adelaide. The meeting is being organized by the University of Adelaide. ACTIVE 2006 is an International INCE Symposium. The symposium co-chairs are Carl Howard and Mike Kidner.

The deadline for submission of abstracts and papers has passed, and more than 100 papers on various aspects of active control will be presented. This article covers travel planning for the symposium, papers to be presented, registration, and the social program.

Photo courtesy of Marketing & Strategic Communications Office, The University of Adelaide

Keynote Speakers

The following Keynote addresses will be presented:

- **Digital Signal Processing algorithms and implementations on active noise control systems.**
  Professor Sen Kuo, Northern Illinois University, USA
- **The choice of sensors and actuators for smart panels implementing active structural acoustic control.**
  Dr. Paolo Gardonio, ISVR, University of Southampton, UK
- **Global energy-based active noise control and the use of energy density sensing methods.**
  Professor Scott Sommerfeldt, Brigham Young University, USA
- **Active vibration and motion control of ocean vehicles.**
  Professor Jie Pan, University of Western Australia, Australia
- **How big is your head? A discussion of system complexity, inverse problems and acoustic arrays**
  Dr. Marty Johnson, Virginia Polytechnic Institute and State University, USA

Photo courtesy of Andrew Riha

Location of the Conference

The conference will be held in the Lower Napier building at the University of Adelaide (www.adelaide.edu.au/campuses/maps2006/northtce.jpg, grid reference J-11) Delegates who register for the conference will be sent a map of the venue in the post. The conference opening ceremony and registration desk will be at the Art Gallery of South Australia (grid reference K-7), which is next to the University, and a 2 minute walk from the conference venue.

Registration

A registration form for ACTIVE 2006 is available as a link from the Symposium home page on the Internet. One can download the form in either MS Word format or in Portable Document Format. In the first case, the form can be filled in using Word; in the second case, all fields should be completed using legible handwriting and block letters. The forms are designed for A4 paper, but can be converted to letter size.

The registration form and its second page giving authorization by the credit card holder to charge for the registration fee should be faxed to: ***FAX: +61 8 8303 4367***

ACTIVE 2006 Conference Registration
School of Mechanical Engineering
The University of Adelaide S.A. 5005
Australia

At least one author of each paper must register for the symposium. If you have any difficulties with the registration process, please contact:
Phone: +61 8 8303 5460
Email: registration@active2006.com

The registration fees for the symposium are as follows:

Regular Registration	***Student Registration (fax a copy of your student ID):***
Before 2006 June 23: 600 AUD	Before 2006 June 23: 300 AUD
After 2006 June 23: 700 AUD	After 2006 June 23: 350 AUD

Accompanying Person
150 AUD

All prices are in Australian dollars (AUD) and include G.S.T.
Refunds—less a 50 AUD administration fee—will be granted to delegates unable to attend, provided written notice is received by AAS by 23 June 2006. No refunds will be granted for cancellations received after 23 June 2006. Reimbursements will be made after the congress.

Scientific Committee

The scientific committee comprises many distinguished international members including:

- Anthony Zander, Australia, Chair
- Emil Ardelean, USA
- Arthur Berkhoff, Netherlands
- Alain Berry, Canada
- Ingo Borchers, Germany
- Mike Brennan, UK
- Randolph Cabell, USA
- Ben Cazzolato, Australia
- Geoff Chase, NZ
- Lei Chen, Australia
- Jin Chen Ji, Australia
- Ingvar Claesson, Sweden
- Robert Clark, USA
- Duc Do, Australia
- Niek Doelman, Netherlands
- Stephen Elliott, UK
- Ken Frampton, USA
- Francesco Franco, Italy
- Emmanuel Friot, France
- Christopher Fuller, USA
- Paolo Gardonio, UK
- Gary Gibbs, USA
- Lars Håkansson, Sweden
- Dunant Halim, Australia
- Roger Halkyard, NZ
- Chris Hann, NZ
- Colin Hansen, Australia
- Fangpo He, Australia
- Carl Howard, Australia
- Shiro Ise, Japan
- Hiroyuki Iwamoto, Japan
- Sven Johansson, Sweden
- Marty Johnson, USA
- Richard Jones, NZ
- Yuvi Kahana, Israel
- Jonathan Kemp, USA
- Nicole Kessissoglou, Australia
- Mike Kidner, Australia
- Kozue Kobayashi, Japan
- Janusz Kowal, Poland
- Damien Leclercq, Australia
- Xinye Li, China
- Brian Mace, UK
- Patrice Masson, Canada
- Gopal Mathur, USA
- Philippe Micheau, Canada
- Cam Ng, USA
- Jie Pan, Australia
- Christopher Park, USA
- Roshun Paurobally, Australia
- Marek Pawelczyk, Poland
- Benoit Petitjean, France
- Stan Pietrzko, Switzerland
- André Preumont, Belgium
- Xiaojun Qiu , China
- Boaz Rafaely, Israel
- Alain Roure, France
- Karl Sammut, Australia
- Hisashi Sano, Japan
- Bogdan Sapiñski, Poland
- Toshihiko Shiraishi, Japan
- Richard Silcox, USA
- Scott Sommerfeldt, USA
- Nobuo Tanaka, Japan
- Jing Tian, China
- Osman Tokhi, UK
- Mathias Winberg, Sweden
- Jun Yang, Singapore

ACTIVE

Accommodations

Accommodations for conference delegates are at hotels located in the city of Adelaide, a short walk from the conference venue. Delegates should book their accommodation with the hotels directly. ***Be sure to mention "Active Noise and Vibration Control Symposium" to receive special discount room rates.*** There is a map on the ACTIVE 2006 home page that shows the proximity of the hotels to the conference venue.

The list of hotels and links directly to the hotel home pages may be found from the ACTIVE 2006 home page. Special room rates for the conference have been obtained at the following hotels.

Pacific International Hotel

Room rates per night range from 120 AUD to 150 AUD.

Pacific International
Apartments on Frome
88 Frome Street
Adelaide, South Australia 5000
Australia
Phone: +61 8 8223 9000
Fax: +61 8 8223 9014
Web: http://www.
pacificinthotels.com/

Majestic Roof Garden Hotel

Room rates per night range from 135 AUD to 165 AUD.

Majestic Roof Garden Hotel
55 Frome Street
Adelaide, South Australia, 5000
Australia
Phone: +61 8 8100 4400
Fax: +61 8 8100 4488
Web: http://www.
majestichotels.com.au

Hotel Richmond

Room rates per night range from 130 AUD to 230 AUD (deluxe suite)

Hotel Richmond Adelaide
128 Rundle Mall
Adelaide, South Australia, 5000
Australia
Phone: +61 8 8223 4044
Fax: +61 8 8232 2290
Web: http://www.
hotelrichmond.com.au

Mercure Grosvenor Hotel

Room rates per night range from 99 AUD to 155 AUD.

Mercure Grosvenor Hotel
125 North Terrace, Adelaide,
South Australia, 5000 Australia
Phone: +61 8 8407 8888
Fax: +61 8 8407 8855
Web: http://www.
mercuregrosvenorhotel.com.au

Best Flights to Adelaide

Adelaide International Airport (ADL) has direct international flights from Hong Kong, Singapore, and Kuala Lumpur that arrive on Sunday morning of 17th September 2006. Alternatively, delegates can get domestic transfer flights from Melbourne (1hr 15min flight) or Sydney (2hr flight).

Transport from the Airport to Hotels

Adelaide International Airport is about 10 minutes drive from the city. The easiest way to get to the city and hotels is by taxi, which cost about 20 AUD. Alternatively there is an airport shuttle bus (www.skylinkadelaide.com/) that costs 7.5 AUD, and will stop at all the conference hotels. The least expensive way to get to the city is by public transport bus (www.adelaidemetro.com.au/guides/airport.html), which will cost 3.5 AUD, however you are likely to have a 15 minute walk to your hotel.

Banking Facilities

Foreign exchange banking facilities are available at the airport and all banks within Rundle Mall (3 minute walk from the conference venue). Equivalent currency values as of 20 March 2006 are listed below. Major credit cards are accepted at all recommended hotels and at most restaurants.

Currency	1 AUD =
China Yuan Renminbi	5.83 CNY
Euro	0.59 EUR
Hong Kong Dollars	5.63 HKD
India Rupees	32.09 INR
Japan Yen	84.28 JPY
Singapore Dollars	1.17 SGD
Taiwan New Dollars	23.54 TWD
United Kingdom Pounds	0.41 GBP
United States Dollars	0.72 USD

2006

Social Program

The social program is as follows:

Sunday Evening, 17 September
Reception at the State Art Gallery, Adelaide

Monday Evening, 18 September
Banquet at The Stamford Grand, Glenelg

Tuesday Evening, 19 September
Adelaide Zoo, Adelaide

Wednesday Afternoon, 20 September
Close of symposium - drinks and BBQ at the conference venue.

The Art Gallery of South Australia holds one of Australia's finest art collections housed in one of Adelaide's most beautiful historic buildings. It is centrally located on leafy North Terrace between the South Australian Museum and the University of Adelaide and has been an important cultural focus since its establishment in 1881, only 45 years after the first European settlers arrived. The official conference opening will be held at the Art Gallery on Sunday evening. Drinks and nibbles will be served and delegates will be able to wander through the gallery.

The Stamford Grand Adelaide is located right on the beachfront in Glenelg and only 20 minutes from the city and 10 minutes from the airport. Surrounded by a myriad of leisure activities, this resort style hotel is the perfect environment in which to relax. The conference banquet will be held at the Stamford Grand Australia and delegates will be taken to the hotel on historic Adelaide trams.

Adelaide Zoo is home to over 3,400 animals and almost 300 species of exotic and native mammals, birds, reptiles and fish exhibited in magnificent botanic surroundings now expanded to eight hectares. Adelaide Zoo has the largest display of Australian animals in South Australia and the second largest in Australia. The Zoo is the second oldest zoo in the nation and represents a significant and important part of South Australia's heritage and social history. It is unique among Australian zoos as it has retained many original and significant architectural features giving it a style and character all its own. Cocktails and canapes will be served at the Zoo on Tuesday evening and delegates will be able to have guided-tours of the zoo.

About Adelaide

In Adelaide's compact city centre, all facilities, from the convention centre and hotels to cafés and nightclubs, are conveniently clustered within walking distance of each other. With its pivotal location on the continent, and an international airport only 10 minutes from the CBD, Adelaide makes an ideal launchpad for flights north, south, east and west, to any other Australian city, or to regional South Australia. Another great advantage is the city's proximity to a host of special tour destinations—from the Barossa Valley, Adelaide Hills and Fleurieu Peninsula to Kangaroo Island. The region around Adelaide provides plenty of opportunity for sightseeing, from the local vineyards to the rugged coastline of Victor Harbor and Kangaroo Island.

Weather for the Conference

The mean daily maximum temperature for September in Adelaide is 18.8 °C, and the mean number of rain day for the month is 13. For more climate information see www.bom.gov.au.

For more details on ACTIVE 2006, go to www.active2006.com

List of Accepted Abstract Titles

TOPIC: ***Active sound control***

- Active acoustical matching of vibrating body surface with incident waves
- Design of active noise control using grazing estimation method
- Adaptive wave field synthesis with independent radiation mode control for active sound field
- The mechanisms of feedback control active ear defenders
- The selected digital systems of active sound control
- Feedback control of broadband axial fan noise for global attenuation
- Using energy-based control to achieve global attenuation (keynote paper)
- Development of hartley domain filtered-s lms algorithm for active noise control system
- Limits on active noise control performance at virtual microphones
- Decentralized feedback control for active absorption in flow ducts

TOPIC: ***Active control of outdoor sound***

- Behavior of the films adaptive algorithm
- Feasibility study on active noise control of moving source in view using directional microphones and directional speakers

TOPIC: ***Active control in ducts***

- An analysis of active noise control in ducts with feedforward, feedback and hybrid control structure
- Active noise control of a duct for a thermoacoustic air-conditioner
- An analysis of the active silencer with and without side-branch resonator
- Performances prediction of the anc system
- Nonlinear active noise control (anc) with feedback consideration for square duct

TOPIC: ***Active control of sound in vehicles***

- Acoustic field reproduction for psychoacoustic experimentations : application to aircraft interior noise
- Active noise control for large exhaust pipe
- Sound profiling active noise control system
- An investigation into active synchrophasing for cabin noise reduction in propeller aircraft
- Application of feedback control to low-frequency noise in a vehicle
- Active noise control of low frequency noise in a station wagon

TOPIC: ***Active control of sound transmission***

- Active control of sound transmission into an acoustic cavity surrounded by multiple flexible structural boundaries
- Hybrid piezo-poroelastic sound package concept: numerical/experimental validations

TOPIC: ***Active control of interior noise***

- Interior active noise control in turbofan aircraft: characterisation of the test-article and numerical simulation for optimal actuator positioning by genetic algorithms
- Energy-based attenuation of diesel generator noise
- Active control for the noise reduction in a helicopter cabin

TOPIC: ***Active control of aeroelastic systems***

- Design of active twist rotor blades incorporating single crystal piezoelectric fiber composite actuators

TOPIC: ***Active jet noise control***

- Variable geometry chevron flight test
- On a fundamental problem in the derivation of Ffowcs Williams and Hawkings equation of aeroacoustics
- Development of a soma hybrid composite jet engine chevron concept

TOPIC: ***Hardware for active control***

- Implementing active noise control with parametric array loudspeaker as system controller
- Development of a semi-active electromagnetic vibration absorber system
- A self-powered circuit for noise and vibration control

TOPIC: ***Active structural acoustic control***

- Active trim panels for noise reduction in aircraft cockpits
- Smart panel with decentralised inertial actuator active dampers
- An active structural acoustic control strategy for coupled multiple-panel systems
- Active control of vibro-acoustic transmission paths in an automotive suspension assembly
- Smart panel with triangularly shaped piezoelectric actuators for asac control
- Performance and stability properties of a smart double panel with decentralized active dampers
- Active noise and vibration suppression of honeycomb panels using decentralized autonomous controllers
- Simultaneous noise and vibration control using active structural acoustic control inside an enclosed stiffened cylinder with floor structure
- Lpv control of acoustic power modes for a panel structure

TOPIC: ***Smart materials and structures***

- Flexural vibration of a smart laminated fgm plate with initial imperfections
- Development of a controllable damping engine mount using mr fluid for reduction of impact force during automobile collision

2006

TOPIC: ***Feedforward control***

- Acoustic feasibility of feedforward control in call centers
- A fast system structure for multichannel active control
- A comparison of convergence and tracking in ed and sp based fxlms algorithms
- Phase corrected algorithm and its application to the active control of ship interior noise

TOPIC: ***Feedback control***

- Optimal truncated model for flexible structure system within a frequency band
- Singular analysis of response of Duffing-Van der Pol oscillators

TOPIC: ***Non-linear control***

- On the nonlinear control of the carbon nanotubes bending

TOPIC: ***Signal processing and algorithms***

- Development of new adaptive control laws for time-periodic systems
- Frequency-domain broadband active sound quality control algorithms
- The implementation of delayless sub-band active noise control algorithms
- About the application of the mint theorem in active noise control
- Fast adaptive filter algorithms for active noise control with application to active noise reduction headsets
- A modified filtered-error algorithm with fast convergence in systems with delay

TOPIC: ***Active vibration control***

- Material-adapted vibro-acoustic simulation concepts for actively damped lightweight structures
- A geometric approach to the design of remotely located vibration control systems
- Instantaneous harmonic vibration control of a flexible rotor
- Optimal vibration control for overhung rotor system using actively flexible pedestal
- Distributed magnetorheological fluid damper for active structural vibration control
- Model identification and optimal h2 vibration control of an aeronautical panel
- Experiments in active control of panel vibrations with spatially weighted objectives using multiple accelerometers
- Comparison of different controllers in the active control of tool vibration; including abrupt changes in the engagement of metal cutting
- Distributed control using multiple velocity feedback loops with inertial actuators
- Power analysis in active control of space truss structures
- Control of nonlinear vibrations using a small attachment
- Active damping of a vibrating string
- Experimental verifications of active constrained layer damping treated beam for different boundary conditions
- Active tuning of a resonance changer to minimise the vibration transmission in a submarine
- Usage of active balancing devices for passing through flexible rotor modes in active magnetic bearings
- Mutually converging adaptive feedback active control with on-line secondary-path modeling
- Energy recovering in an active vibration isolation system – results of experimental research

TOPIC: ***Active vibration isolation***

- Zero-stiffness magnetic supports for active vibration control
- Earthquake isolation self-centering system with side rigid link-rods

TOPIC: ***Semi-active (adaptive) control***

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- Use of programmable logical controllers for implementation of the damper control systems
- Tonal noise attenuation in ducts by optimising adaptive Helmholtz resonators
- Experimental evaluation of mr controllable friction damper

TOPIC: ***Transducers for active control***

- Design and fabrication of a micro velocity sensor for direct velocity feedback control systems
- Nonlinear models of electro pneumatic transducers for use in feedforward active noise control schemes

TOPIC: ***Virtual reality in acoustics***

- The equivalent source method for virtual acoustics
- 3d reproduction of low-frequency sound fields using the boundary pressure control method

TOPIC: ***Underwater applications***

- Longitudinal stability in a supercavitating vehicle
- Monitoring propeller cavitation through hull vibrations

TOPIC: ***Array processing and imaging***

- Acoustic reflectometry for determination of waveguide geometry
- Noise source tracking using multiple diffracting arrays
- Fusion of acoustic and inertial data for mapping of building geometries

TOPIC: ***New directions in active control***

- Noise masking using psychoacoustics
- Control of low-frequency wall reflections in an anechoic room

Sustainable Development in an Urbanizing World – the Noise Issue*

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Introduction

Rio de Janeiro was the venue for the World Summit on Sustainable Development in 1992. This important conference, UNCED (UN Conference on Environment and Development), had as a background the Brundtland Commisson Report, *Our Common Future*. It resulted in the Rio Declaration and Agenda 21. Considering the theme of INTER-NOISE 2005, *Environmental Noise Control*, and the venue, Rio de Janeiro, a natural choice for a keynote at the opening of the this INTER-NOISE Congress is *Sustainable Development in an Urbanizing World - the Noise Issue*. This paper is restricted to road traffic noise.

In discussions and plans regarding the environment and sustainable development, the noise issue is often neglected; the documents from the UNCED conference are no exception. This is very remarkable, because noise is considered by the World Health Organization (WHO) to be the 3rd most hazardous pollution (air, water, noise) in large cities. Also, it is stated in several European Union (EU) documents: "Noise is one of the environmental pressures that is closest to the citizens. In public surveys, problems with noise are rated at the highest level together with global warming."

Road vehicles, rail vehicles, and airplanes are simply much too noisy—even when complying with international standards—so when used in today's mass transport the total noise emission gets much too high to comply with a sustainable development. This is a major problem for all cities in developed regions; it is still worse in less developed regions.

	Population (in billions)				
Major area	**1950**	**1975**	**2000**	**2003**	**2030**
Total population					
World	2.52	4.07	6.07	6.30	8.13
More developed regions	0.81	1.05	1.19	1.20	1.24
Less developed regions	1.71	3.02	4.88	5.10	6.89
Urban population					
World	0.73	1.52	2.86	3.04	4.94
More developed regions	0.43	0.70	0.88	0.90	1.01
Less developed regions	0.31	0.81	1.97	2.15	3.93
Rural population					
World	1.79	2.55	3.21	3.26	3.19
More developed regions	0.39	0.34	0.31	0.31	0.23
Less developed regions	1.40	2.21	2.90	2.95	2.96

Table 1. Distribution of global population. Source: United Nations Population Division. World Urbanization Prospects, The 2003 Revision.

The Urbanizing World

Table 1 shows some statistics concerning the global population. Approximately one-half of the population now lives in urban areas, and the fraction is increasing. There are also huge differences between the more developed regions and the less developed. Table 2 shows examples of population densities in different urban areas, with Los Angeles and Dharavi, Mumbai as the extremes.

Comments on Terminology

When dealing with environmental issues, especially noise, we have to distinguish very clearly between two concepts—*emission* and *immission*. (Cf. emigration and immigration)

Emission describes the noise output from the source. *Immission* (originally a concept from Roman law on real estate property rights) describes how much noise that reaches the neighborhood. The immission is a function of the emission (in our case determined by the amount and speed of the traffic, the characteristics of the vehicles, the road surfaces), the city structure (the road network, building sizes and positions), the type of ground between traffic routes and buildings, the plans of the dwellings, and—for indoor noise—the sound insulation of the building façades (when windows are closed!). It is the immission that determines the adverse effects of noise.

Many environmental problems have been solved, or can be solved, entirely by

** This is an edited version of the keynote paper presented by the author at the opening session of INTER-NOISE 2005 in Rio de Janeiro, Brazil on 2005 August 08.*

Table 2. Examples of urban population densities.
(based on Satterthwaite 2004 & USK/Stockholm 2004, Nnaggenda-Musana 2004)

Urban area	Urban population density
Dharavi, Mumbai (Bombay)	2,400 p/ha (0.5 m inhabitants in 2.1 sqkm)
Beijing "Core City"	342 p/ha (5.4 m inh in 158 sqkm)
Mexico City, central area	140 p/ha (1.9 m inh in 139 sqkm)
Mexico City Metropolitan Area	32 p/ha (15 m inh in 4,636 sqkm)
Tokyo central city	137 p/ha (8.2 m inh in 598 sqkm)
Tokyo prefecture	55 p/ha (11.8 m inh in 2,162 sqkm)
Dar es Salaam	45-130 p/ha (in the period 1891-2001)
Kampala	75-94 p/ha (1.6-2 m inh in 21,300 ha)
Greater London	40 p/ha (6.4 m inh in 1,579 sqkm)
Stockholm	40 p/ha (0.76 m inh in 187 sqkm, lakes excluded)
Stockholm modernist housing areas of 1950s & 1960s (FAR 0.5-0.7)	30-60 p/ha
Stockholm inner city 'stone town' (FAR 1.5-2.4)	260-290 p/ha
Los Angeles Consolidated Metropolitan Statistical Area	1.7 p/ha (14.5 m inh in 88,000 sqkm)

emission reductions. This is not the case for most noise problems. There are no end-of-the-pipe solutions other than in special cases. To reduce noise emissions from different sources is a difficult and time-consuming engineering task. This is why noise problems have to be tackled through measures both on the emission and the immission side.

On the immission side, environmental noise is mostly characterized by an A-weighted equivalent level, L_{Aeq}. The time period for the averaging is mostly 24h or 8h. An additional descriptor sometimes used, is L_{Amax}. L_{Aeq}, with a day/evening/night weighting of +5 dB for the evening and +10 dB for the night, called L_{den}, is used in the EU. In the United States, L_{dn} is widely used. L_{dn} has a +10 dB weighting for the night. Relations for typical traffic distributions over the 24 hours:

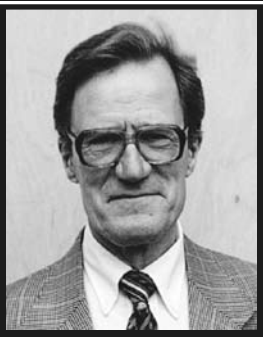
$$L_{den} \approx L_{dn} + 1\text{dB} \approx L_{eq,24h} + (3 \text{ to } 5)\text{ dB}$$

The actual immission levels also depend upon reflections from building façades close to the receiver. Therefore, in many noise regulations, limit or guideline values are given as free field levels, i.e., the levels as if there were no close-by buildings, with the approximate relation that the level at some distance from a façade (>2m) is 3 dB higher than the free field level.

When dealing with environmental noise regulations, measurements, predictions or mapping, it is important to distinguish very clearly between these concepts. Unfortunately, this is not always the case, resulting in some uncertainty and confusion in comparisons between data from different publications.

Adverse Effects of Urban Noise—Acoustic Demands Upon a Sustainable Development

Environmental noise has several adverse effects. The following specific health effects have been identified (Berglund/WHO 2000): interference with communication, annoyance responses, and effects on sleep, psycho-physiological symptoms, performance, productivity, and social behavior. Newer findings also show, that typical environmental noise levels in cities is a risk factor for cardiovascular disease[1]. Noise is especially a problem for the economically weak portions of the populations.



Tor Kihlman received his Master in Electrical Engineering from Chalmers University of Technology, Gothenburg, Sweden, and his Doctorate with a thesis on sound propagation in buildings from the Technical University of Lund, Sweden (1967). He began his professional career in acoustics at Chalmers University of Technology, moved for a few years to Lund University of Technology, and then returned to Chalmers in 1969 as professor in building acoustics. Since 1999 he has been an emeritus professor. His research interest has been in airborne and structureborne sound in buildings and occupational and environmental noise. He has been a member of Swedish Parliamentary investigations and a one-man investigator for the Swedish Action Plan against Noise (1993)

He is a fellow of ASA and a member of the Royal Swedish Academy of Engineering Sciences as well as member of several other professional societies. He has been vice president of his university. He has also been Chairman of the International Commission on Acoustics and President of I-INCE.

Table 3. WHO guidelines for community noise.

Specific environment	Critical health effect(s)	L_{Aeq} (dB)	Time base (hours)	L_{Amax}, fast (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Outside bedrooms	Sleep disturbance window open (outdoor values)	45	8	60

Sustainable development demands that these adverse effects are reduced to a minimum. The studies of the effects show very clearly, that to be negligible, it requires that L_{eq} be below 45-50 dB. This is reflected in the WHO guidelines (See Table 3). These are the demands that should be requirements for sustainable development.

Actual guidelines are less ambitious. As an example, the Swedish guidelines are given in Table 4. Similar values can be found also in the regulations of many other countries. The Swedish guideline values were set more than 30 years ago as a long-term goal. From the beginning, the goal was regarded as a technical/economic compromise, and not as a goal guaranteeing a good environment, but an acceptable one. It was believed that these levels could and would be reached within a foreseeable future. Today, this long-term goal seems more remote than it did when first formulated. The inertia of the manufacturers, the values promoted on the car market, and the strength of the industries' lobby organizations were totally underestimated.

Table 4. Swedish guideline values for new dwellings. Free field values.

	$L_{Aeq,24h}$ (dB)	L_{Amax} (dB)
Outdoor	55	70
Indoor, closed windows	30	
Indoor, closed windows, Night		45

$L_{Aeq,24h}$ dB corresponds approximately to 57 dB daytime and 48 dB nighttime.

The Noise Situation

Typical levels are substantially higher than those demanded for a sustainable development. Levels around 65 dB are not rare, a level at which the adverse effects of all the above mentioned kinds are severe. In many cities, still much higher levels are common. The situation is definitely not in harmony with a sustainable development. Below is a view of the environmental noise situation in some cities.

Some Theoretical Calculations

At the ICA congress in Seattle in 1998, together with Wolfgang Kropp, I gave a paper based on statistical traffic data for 31 major cities around the world.[2] Our surprising observation was that all these cities, according to our calculations, had approximately the same average traffic work per unit urban area, $2.7*10^7$ vehicle-km/km^2 and year, see Fig. 1. This follows from the well-known observation that all streets and motorways in urban areas get filled with traffic - a consequence of common human behavior. This also implies that the noise power emitted per unit urban area is approximately the same in all these cities if the road surfaces have similar acoustic properties and the speeds are similar.

So, for the traffic noise situation, sprawling the city does not help! The sprawled city is not— on average—quieter than a compact city. The method commonly used to decrease noise levels—increased distance between the source and the receiver, the equivalent to tall chimneys to decrease air pollution—is not very effective when used extensively. In fact, it is counter-productive. It leads to urban structures that are not desirable for a sustainable development for several reasons—land use, fuel consumption, etc. So, there is often not a conflict between different environmental interests. The task is to identify win/win solutions that lead to less noise, better traffic safety, less CO_2 emissions, etc.

The average calculated noise exposure of buildings facing the streets—based on the traffic and traffic network data and a simplified flat city model with a regular street pattern—was $L_{Aeq,24h}$ = 60 - 65 dB (free field).[2] In the calculations, it was assumed that vehicles and road surfaces were in good condition. The calculated levels are also in accordance with many measurements and detailed surveys in European cities. Only at some distance

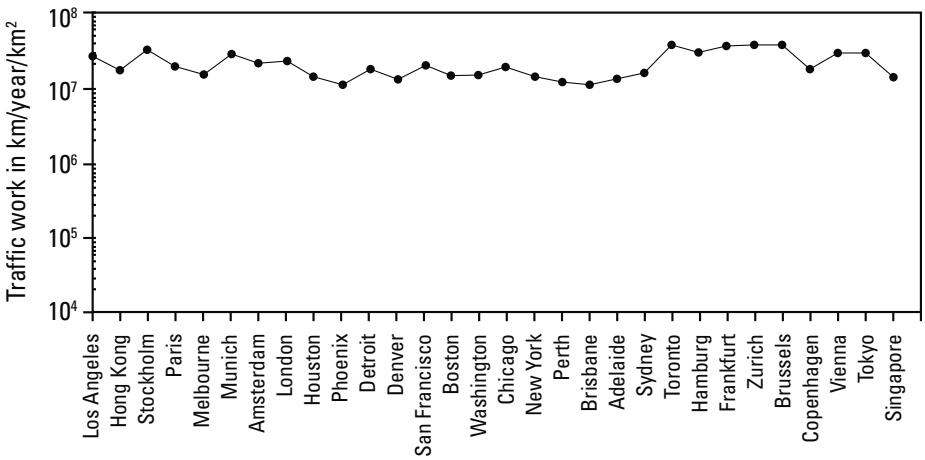


Figure 1. Total traffic work in private car equivalents.[2]

from a street, behind shielding buildings, the levels may be below 50 or 55 dB.

Traffic Noise Data for Gothenburg

As an example, Table 3 shows data for Gothenburg, Sweden, a city with 0.5 million inhabitants. The levels are calculated, free field values. Calculated levels show a good agreement with measurements in a number of control points.

Comparing these data with the Swedish long term goal in Table 2, we see a gap of approximately 10 dB. However, in all new planning and new dwelling buildings, efforts are made to fulfill the guidelines, which certainly is difficult. It is also a problem for political credibility to argue for these guidelines to be applied to new dwellings, referring to health reasons, and not being able to do much about the existing noisy situations. And still, there is a gap of at least another 5 dB between the guidelines and levels representing a good environment.

Table 3. Distribution of calculated traffic noise levels for 1636 sites in Gothenburg, Sweden.

$L_{Aeq,24h}$ (dB)	Number of sites	Percentage %
<50	80	5
50-55	224	14
55-60	560	34
60-65	495	30
65-70	228	14
70-75	44	3
75-80	5	0.3

If we apply well-known dose-response relations and consider typical urban plans and building designs, it can be estimated that in these cities we get approximately one or two annoyed persons per each 100 vehicle-km/day, differences depending upon differences in city structure and traffic network. Those, who both live in and drive in the city suffer from the noise that they cause when driving. The sleep disturbance is considerable. Today's traffic noise is much too high to fulfill demands on a sustainable development.

It must be noted, that this noisy situation, described above, concerns major cities in Europe, North America, Australia and Japan, parts of the world with a similar economic situation. The car fleet as well as the roads are, in general, in good condition. Nevertheless, the situation is such that it is, in practice, often impossible to build new dwellings fulfilling demands on reasonable, good acoustic environment in these urban areas. Exceptions from guidelines/ recommendations are therefore common. One conclusion is that there is a severe inbalance between emission requirements for new vehicles and reasonable demands on noise immission.

It is often said, not least by politicians, that measures at the source are the most cost-effective way to solve noise problems. However, every attempt to strengthen the requirements on cars, tires, and road surfaces is usually met with enormous resistance. The lobbying from the emitting side—the vehicle and tire manufacturers' organizations—is very effective and the result is that no political decisions are taken to decrease the emissions .

However, the immision situation in many other cities is still worse, not least in less developed regions. I will give two examples, Curitiba in Brazil and Cairo in Egypt.

Some Noise Data for Curitiba

Curitiba is located south of Rio de Janeiro. It is a city, which has undergone a remarkable growth and simultaneous development to improve the conditions for its citizens to give them a good environmental quality. Curitiba now has 1.5 million inhabitants. It has, for several years, stood as an international model for excellent city planning and governance. This is, to a high degree, due to the architect/planner and—through many years—mayor of the city, Jaime Lerner, later governor of the state of Parana. But in Curitiba, the noise environment is not very good. The data in Table 4 have been published by Zannin et al.[3]

Table 4. Distribution of measured $L_{eq,2h}$ values (daytime) for 1000 sites in Curitiba.[3]

$L_{Aeq,2h}$ (dB)	Number of sites	Percentage
<50	7	0.7
50-55	30	3
55-60	15	1.5
60-65	15	1.5
65-70	127	13
70-75	403	40
75-80	321	32
80-85	82	8

These data are 2-hour measurements and, with such a sampling of measurement points, comparisons with the data from Gothenburg cannot be done directly. However, corrected for the method differences, it seems that Curitiba is almost 10 dB noisier than Gothenburg.

It is noteworthy, that the noise limits set by the city authorities in Curitiba are as ambitious as those in Sweden, as illustrated in Table 5. The gap between goals and reality is still wider in Curitiba than in Sweden.

Table 5 Noise limits in Curitiba, dBA. Law 8583-1995 (There is a later revision).[3]

Zone	Day, 0700-1900	Evening, 1900-2200	Night, 2200-0700
Residential	55	50	45
Mixed	60	55	55
Services	65	60	55
Downtown	70	60	60
Industrial	70	60	60

The noisy situation in Curitiba as well as in other large cities in Brazil is explained by the following factors.[4]

1) The bad conditions, in general, of the urban streets;
2) The poor maintenance of the circulating vehicles: cars, buses, motorcycles. It

is not rare to find circulating vehicles with a damaged exhaust system or even without any exhaust system.

3) Generally the circulating vehicles are old. The average age of Brazilian vehicles is 14 years.
4) The bad habits, in general, of the Brazilian drivers:

a) Using the horn for any purpose, with or without apparent reason to do so.
b) Accelerating the vehicle during traffic jams or while waiting for green light.
c) High speed driving inside urban regions. It is not rare to find people driving over 80 km/h.

Some Noise Data for Cairo

Road traffic noise measurements and social surveys to determine the annoyance reactions have been performed by Ali *et al*. in Cairo.[5] Measurements were made at 21 sites covering different types of roads with different width, number of vehicles/hour, and speed. The results are shown in Table 6.

A social survey was carried out simultaneously with the noise measurements and at the same sites. The results are given in Fig. 2.

The results indicate, that the noise levels in Cairo are still higher than those in Curitiba. Nevertheless, Egyptian noise standards (Egyptian Environmental Number 4 Law from 1994) on the maximum permissible limits, given as Leq-values for day, evening and night and for different land use areas are even more ambitious than those in Sweden.6 So, the gap between goals and reality is still wider. The explanations for the bad situation are similar to those in Brazil.[6]

The results from the social survey in Cairo are in good agreement with other surveys. See Fig 2. Obviously, the fraction of people annoyed by the traffic noise in Cairo must be very high.

Discussion and Conclusions

Detailed comparisons between the noise situation in the different cities discussed here cannot be made based on available data. Such comparisons need very detailed knowledge of the immission situation especially in the residential areas, and it is not known to the author of this paper how representative the measured levels are in this respect. In the data for all the three cities exemplified above, high level locations are probably over-represented. Accurate noise mapping including quiet areas is therefore an important part of the work initiated by the EU-directive on environmental noise.[7] With these mappings, it will be possible to make more accurate comparisons between the environmental noise immission in European cities. For strong and firm global noise policies, representative data are also needed from other countries.

But it is quite clear that the gap between actual noise levels and the goals for a sustainable development is very wide, both in developed and less developed regions. This often leads to problems for political credibility—political goals differ too much from what is done to improve the acoustic environment where it is bad.

A long-term devoted effort is needed to make things substantially better. Actions are required on different levels. One obvious task is to change the traffic culture: ban horn use and loud music in cars, strict enforcement of speed limits, etc. Another task is maintenance of vehicles. A reasonable demand is mufflers in good condition under all circumstances. More modern cars and better road maintenance depend on the private and public economy and upon the priority given to the condition of the traffic system. Many of the required improvements here are also essential for better traffic safety. Good governance is a prerequisite.

But even with excellent town planning and the traffic system in good condition, technically as well as culturally, the immission levels cannot be brought down to fullfil the requirements of sustainable development because the noise emissions from today's vehicles are much too high. A lot has to be done to get a more reasonable balance between emission and immission requirements. Road vehicles in good condition need to be 10 dB quieter when used in ordinary traffic to give reasonable preconditions for the planning

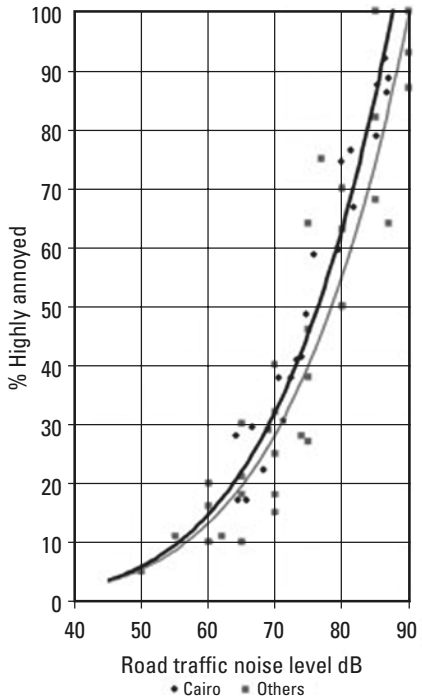


Figure 2. Results of a social survey in Cairo. The results are also compared to other results from the literature (Schultz and others) From reference 5.

Table 6. Road traffic noise levels in L_{dn} (dB) in 21 sites in Greater Cairo.[5]

Area	Road No. 1 L_{dn} (dB)	Road No. 2 L_{dn} (dB)	Road no 3 L_{dn} (dB)	Road No. 4 L_{dn} (dB)
Center of the city	-	85.3	75.8	70.6
Naser City	87	86.4	74.6	68.2
El-Ahram	86.8	81.4	72.4	66.6
Hulwan	85.2	79.5	71.2	65.7
Garden City	-	79.9	73.2	64.2
Old Cairo	-	81.8	73.9	64.5

and development of sustainable cities and well-being of citizens. During the past 3 decades, the emission levels for the individual vehicles have gone down by only 1-3 dB.[8] A special problem is the two-wheelers, which emit more noise than the cars for the same transportation work.

The lobby organizations on the emission side have to be counteracted by equally strong lobbying from the immission side to get relevant test methods and limit values for tires, road surfaces, and vehicles. Also, better traffic control systems are needed. A 10 dB reduction should then be achievable within some decades. It requires skilled engineering but does not require any fundamental technical breakthrough; it requires technology-forcing requirements. The fundamental prerequisite is a political leadership we have not seen in the past from those who act on national or international levels. And decisions on emission limits for ordinary vehicles can only be taken in broad international consensus.

Even so, the situation cannot be solved within a foreseeable future if good practice is not applied in town planning, traffic system planning, building design, and construction. It is important to have wide meshes for the main traffic routes. Public transportation systems need to be attractive and quiet. Strict noise emission requirements should consequently be set when cities buy new vehicles. Attractive routes for pedestrians and bicyclists with good traffic safety are further essential measures.

Further, it makes a great difference if the substantial variations in the noise levels we find in the built up city structure are exploited to the benefit of the citizens. In a Swedish research program,[9] it has been shown, that by exploiting these variations systematically and orienting bedrooms towards quiet sides of buildings much can be gained in terms of decreased annoyance and sleep disturbance. Good governance is needed to make effective use of town and building planning for better acoustic environments.

It is much easier and less expensive to get a reasonable acoustic environment with early, good planning than to improve a bad situation by measures afterwards. City structures are long-lived and they determine the noise situation in a wide sense for a very long time. This must be kept in mind not least for the rapidly growing megacities. Again, good and well informed governance is the key.

Acknowledgements

I am obliged to Prof. Paulo H. T. Zannin and Dr. Sayed Abas Ali for information.

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Workshop on Noise Policy Developments

George Maling and William Lang, Co-chairs

Three sessions on noise policy developments were held during a one-day workshop at NOISE-CON 05, the 2005 National Conference on Noise Control Engineering. The sessions were held on 2005 October 18 in Minneapolis, Minnesota, USA. The purpose of the workshop was to present a summary of the discussions during the workshop, "*Technology for a Quieter America*," sponsored by the National Academy of Engineering (NAE) and held in Washington, DC, on 2005 September 13-15. That event was a "project scoping workshop" in preparation for a consensus study on noise to be sponsored by the NAE.

Opening Remarks

George Maling opened the first session by introducing himself and co-chair, Bill Lang. He then made the following opening remarks:

When we were developing this workshop, we decided that it would be a good idea to discuss some elements of the program that was started last February (2005) by the National Academy of Engineering (NAE).

Last February I received a phone call from the Academy expressing interest in my participation in a program which would likely lead to a consensus study on noise in the United States. Our first task was to appoint a Steering Committee; our second was to appoint advisors to that Steering Committee. Then the NAE asked us to plan a scoping workshop to be attended by stakeholders in the noise business—persons who represented organizations. We spent a lot of time looking at stakeholders in the noise arena and identified 23 government agencies and more than 60 non-governmental organizations. The Academy sent out letters to these groups inviting them to participate in the workshop. The organizations themselves were to decide who would attend the workshop. We held the workshop September 13 through 15 in 2005 and are now in the process of producing a prospectus for the National Academy on what we would like to do as part of a consensus study in the next 30 months. (A prospectus was approved by the NAE in 2006 January.—Ed.) From this work there will be a report with many recommendations. Then the question is "Who are the customers for those recommendations and how do we get some traction in implementing what we think, what we've done?"

Report on Technology for a Quieter America

We selected the Steering Committee and the advisors; in April we had a Steering Committee meeting to plan the September workshop. The NAE requires balanced committees with different viewpoints represented. I was asked to be the chair of the Steering Committee. Elliott Berger, Robert Bernhard, Beth Cooper, Patricia Davies, Ken Eldred, Carl Hansen, Mardi Hastings, Gerald Lauchle, and Richard Lyon comprised the Steering Committee. We had three advisors—Leo Beranek, Steve Crandall, and Bill Lang. The Washington workshop was titled "Technology for a Quieter America." Each morning we had five presentations. In the afternoons we had four separate panel discussions, and the chairs reported back at a plenary session at the end of each day. About 70 persons attended the workshop.

After some welcoming remarks on the morning of the first day, the first technical paper on cost-benefit analysis, "Overview of the Aviation Portfolio Management Tool," was given by Kate Harback from MITRE. Second, Russell Hutchinson, Association of Equipment Manufacturers, spoke on product noise and manufacturing, mostly from the construction equipment industry viewpoint. Then Mark Stephenson and Bill Murphy spoke on the program of the National Institute for Occupational Safety and Health (NIOSH); and, finally, John Seiler gave us an overview of regulations both for the Mine Safety and Health Administration and the Department of Labor.

The second day Arlene Mulder, Village President (mayor) of Arlington Heights, Illinois, talked about noise problems around O'Hare Airport. Karl Dreher of CalTrans then spoke about highway noise problems. The next speaker, Arline Bronzaft, Mayor Bloomberg's right-hand person on noise in New York City, reviewed the City's revision of its ordinances on noise. Bob Rossman came from the National Park Service to talk about issues in the National Parks and Bob Bernhard talked about noise control programs in higher education.

The third day Carl Burleson, FAA, gave a talk on aviation and the environment. Richard Wlezien from NASA then gave a talk about

NASA's programs in aircraft noise reduction. Arnold Konheim from the Department of Transportation and Mark Swanlund from the Federal Highway Administration spoke on surface transportation noise reduction, and Eric Wood from RH Lyon/Acentech addressed the issue of noise from industrial plants.

There were 12 afternoon panels. The panel titles and panel chairs were:

1. Issues with respect to manufacturing competitiveness. Both export and import issues. Panel co-chairs: Bennett Brooks (Brooks Acoustics Corp.) and Robert Hellweg (Hewlett-Packard)
2. Occupational noise exposure, hearing protection devices, impact on: productivity, communications, safety, quality of life. Panel chair: Lee Hager (Sonomax Hearing Healthcare, Inc.)
3. Metrics for a cost/benefit analysis of noise reduction. Panel chair: Kate Harbach, (MITRE Corporation.)
4. Potentially hazardous noise for users of consumer products: personal music devices, children's toys, recreational vehicles. Panel chair: William Martin (Oregon Health Sciences University)
5. The nature and extent of complaints about noise (suburban, urban, rural) and public demand for quiet environments and products. Panel chair: Les Blomberg (Noise Pollution Clearinghouse)
6. Technical issues with respect to metrics/descriptors for community noise (annoyance, activity interference, noticeability). Panel chair: Nicholas Miller (Harris, Miller, Miller and Hanson)
7. Noise insulation (from aircraft and highway, etc.) in homes to control noise exposure and improve quality of life. Panel chair: Eric Wood (Acentech, Inc.)
8. Noise control engineering education and workforce development. Panel chair: David Wormley (The Pennsylvania State University)
9. Annoyance from noise as a quality of life issue, and its relationship to other sources of annoyance. Panel chair: Larry Finegold (Finegold & So, Consultants)
10. Future directions in the design of noise barriers, quiet vehicles and quiet pavements. Panel chair: Gregg Fleming (John A. Volpe National Transportation Systems Center)
11. Noise standards and design issues for rooms (schools, hospitals, offices, etc). Panel chair: Richard Peppin (Scantek, Inc.)
12. Technology for the design of products with lower noise and better sound-quality. Panel chairs: Gordon Ebbitt (Carcoustics) and Richard Topping (TIAX LLC)

Twelve Afternoon Panels at the Washington Workshop

The summaries of presentations below are not intended to cover all aspects of the workshop in Washington, but are impressions of what the twelve speakers in this session took away from the workshop. Most of them were either panel chairs or speakers in Washington.

Minneapolis Session 1

The four speakers in the morning session attended the NAE Washington workshop. Stephen Roth from Roth Acoustical Associates represented the Acoustical Society of America, Lawrence Finegold from Finegold and So Consultants ran one of the panel sessions, Les Blomberg from the Noise Pollution Clearinghouse was also a panel session chair, and Mardi Hastings, a member of the Steering Committee, was from the Office of Naval Research.

Stephen Roth: A Consultant's Perspective on Community Noise

The first speaker in the session was Stephen Roth. He said that the subject of community noise would be well covered by Larry Finegold and Eric Wood, and he gave a consultant's perspective on community noise. Out of fourteen of his projects in the past year on community noise, he said, ten had A-weighted requirements. The other four, all with the same municipality, had both A-weighted and octave band requirements.

Steve then gave an overview of four of the projects. The first was a school addition. There was a noise level ordinance in place—45dB A-weighted, no octave band requirements whatsoever. Large condensing units were to be placed on the roof of the addition. There was an apartment complex about 30 meters away, and some windows were on the same elevation as the condensing units. He said that he ran the numbers, and the noise levels were not going to be acceptable. At that point, he said, the equipment had already been ordered, and project management decided to wait and see what the outcome would be. Basically, they would look at the situation and resolve it

after the fact—even though a solution that might involve barriers and other changes to the equipment would be very difficult. This, he said, happens frequently. There is a noise ordinance in place, there is information on the equipment, but the decision makers don't take the noise information seriously.

The second example was an emergency generator put into place in a switch-gear operation and only run during the day, once every two weeks, to determine if it was running properly or not. But the owners said that they wanted to make sure that, in case it had to run at night because of power failure, it would meet the nighttime requirement. The nighttime requirement was 50 dB(A) at the property line of a complainant. In this case, he said, there was a silencer—perhaps not the best one—specified, so insertion loss data was available. It was predicted that the ordinance would be met; but, after installation, it was not. Eventually it was agreed that the insertion loss data were correct so the unit did not meet the expected levels based on that data. The situation was resolved by installing a second silencer—something that probably would not have happened if there were no ordinance. Unfortunately, he said, there are some cost issues still to be resolved.

A third interesting example was a large exhaust fan creating community noise about 1.6 km away—complaints coming from one person in one house. An ordinance level of 55 dB(A) was easily met, but the complaints arose from a strong 720 Hz tone generated by the fan. The tone was barely audible, but the owner of the industrial facility wanted to be a good neighbor and installed a silencer. This, he said, is a case where there was a complaint even though the ordinance was met by some 20 dB.

The last example he offered was a scrap yard with a "car shredder" used to flatten automobiles and almost anything else. The machine was in a valley, and there were complaints from 1.6 km away. Measurements were made both close-in and at a complainant's location. In this case, there was no ordinance in place; no objective noise level to design appropriate controls to. It will be very difficult to meet a subjective annoyance "criterion" for its neighbors.

He concluded by saying that about 50 percent of his practice is community noise, and about one-third of these projects have no noise ordinance at all. When you're dealing with no noise ordinance, he said, it is very difficult to develop an appropriate solution. A national noise program would be very valuable.

Panel Session Nine and Community Noise

Larry Finegold: Effects of Community Noise

The charge for his panel session, he said, was twofold. First, to discuss and describe the current state of knowledge in each of the panelists' particular areas of expertise, and then to develop a set of "testable hypotheses" which would provide inputs to the follow-on NAE consensus study to determine, when we have a much broader audience, how different agencies and groups feel. He said that, since the panel session addressed the effects of noise on people, there is a considerable amount that we already know. It is not a new topic, but there is a lot of controversy still remaining on community response issues. The panel spent about the first third of its time talking about what we know today about community responses to noise.

He said that Europe is clearly ahead of the United States both in terms of research conducted on the effects of noise and in developing adequate noise policies to minimize these effects. That is a situation we here in the U.S. must correct. In the past we did really good work on environmental noise research and related noise policies; we need to do this again.

He discussed the original 1978 "Schultz Curve" for assessment of community annoyance and said that more recent studies in the U.S. with a database three times the size of Schultz's resulted in a curve very similar to the original one. He pointed out that in Europe a set of three curves is being adopted—one for aircraft, one for road traffic, and one for railway noise. He questioned the need for three curves for public policy purposes because, in the range of levels important for public policy, there is no clear difference between the curves.

He said that the U.S. must be aware of and respond to possible European restrictions on night flights because we need to fly our aircraft, both passenger and cargo, into Europe. With the time differences, landing restrictions are going to be very severe and have an economic impact on the United States. So, he said, there is a strong a relationship between noise effects research and the decisions made by policy makers, particularly for aircraft noise.

There has not been a major epidemiologic cardiovascular health effects study on noise in the United States, he said; but a lot of work has been done on possible health effects in Europe. We in the United States need to come up with the funding necessary to do similar research.

He said that we don't know what the current levels of noise exposure are in the United States. Europe has carried out excellent studies so far and has a major noise mapping program underway to describe community noise exposure in the major cities in Europe. We haven't done that here. Chronic exposure to community noise is linked to a probability of increased risk of physiological damage other than to just the auditory system, including such effects as heart attacks, strokes, etc. This is a hypothesis that needs to be examined. Sleep disturbance is also a major problem; here we're stating the obvious. But we are taking it as a hypothesis in order to formally collect data to either confirm or deny this hypothesis.

Sonic booms will also be a community problem if small-sized supersonic aircraft are permitted to fly over land. There is a major program now underway to develop a small-sized supersonic business jet with efforts to minimize the effects of sonic booms. This is a controversial area, but the issue, he said, urgently needs to be discussed here in the United States.

In conclusion, he said that we have a wide ranging set of hypotheses that we can talk about concerning the potential negative effects of community noise on people. We pretty well know where the EU and the World Health Organization, which is a UN body, stand on these issues. Now we need to consider what the U.S. position should be on these various community response issues because our community and broader environmental noise policies are considerably out of date in many areas. The U.S. government needs to be convinced that noise effects are a serious problem, and the government needs to live up to its responsibility to adequately protect the U.S. population from these effects. In order to move forward, however, we need more data on the extent of noise exposure and the extent of the negative effects of this exposure. Also, more coordination with the international community is needed to make sure that we are in conformance with the viewpoints of other major countries, including both those in Europe and Asia. The U.S. used to be a world leader on noise effects research and environmental noise policies. This preeminence sorely needs to be reestablished, both because of the economic implications and to adequately protect the public health and welfare.

Les Blomberg: Key Concepts for Community Noise

Les Blomberg chaired a panel session in Washington and said that we may not be going about the development of national noise policy correctly. He doubted that the Congress will pass a noise bill; the "earmark" approach may be best because the Noise Control Act of 1972 still exists. He said that he helped to write the Quiet Communities Act, which has been introduced in the House several times but has gone nowhere (*Introduced into the 109th Congress as the Quiet Communities Act of 2005, H.R. 2895.—Ed.*). Bottom line, he said, we need to rethink how we can make progress on the noise issue.

Blomberg:

Sovereignty

Civility

Reciprocity

Community

He said that, although his panel session in Washington was on noise complaints, the group quickly expanded it to noise complaints and noise problems. The group didn't think that complaints alone are a very good description of what is happening in the community vis-à-vis noise issues.

Les believes that the four most important concepts in the realm of community noise are *sovereignty, civility, reciprocity*, and *community*. He explained these four concepts:

- *Sovereignty* is an issue of: Who has the right to do what? Who has the right to pollute? Who doesn't? It is this conflict of rights that he calls *sovereignty*.
- *Civility* is a concept of how you treat your neighbor. For the general public noise is not a technological issue; noise is an ethical issue. It's an issue of sovereignty and rights. It's an issue of civility. How do you treat your neighbor? It's an ethical issue—not technological.
- Noise problems happen when there isn't *reciprocity*. As an example, if you mow your lawn and I mow my lawn, we make accommodations; it works. If I see you outside with your family having a picnic, I'm not going to mow that side of the yard. I'll do the other side or do it another day. Problems occur when reciprocity isn't present, when the noise tends to travel in one direction.
- The final one, *community*, is similar to reciprocity. Most noise problems can occur in situations where you don't have a good sense of community. My neighbor is a musician who loves to have loud parties. He lives right across the street from me. He knows what I do for a living. We're good friends, so what does he do? He says "Les, I'm having a party, you're invited." Or he says "If it gets too loud, just give me a call and I'll turn it down." It is difficult to noise pollute a friend, or to wake up at 2 am someone who is taking your children to school at 7 am, or having you over for dinner that night. Most noise polluters either do so anonymously, or take a more bullying attitude that they do not care about others' reactions.

You can understand noise problems best, he said, by understanding those four concepts, and they have nothing to do with technology; they have nothing to do with sound level meters; they have nothing to do with metrics. Technology may be able to reduce noise impacts, but at its core, a noise problem is an ethical problem.

Mardi Hastings: Science-base, Education and Training, Ship Quieting, Legislation

Mardi said that there were four key points that she got from the NAE workshop. The first is that policy needs a scientific basis. She said that we need to be more concrete than speaking about complaints and annoyance, and that noise is generally a very small part of an environmental budget. As a result, science is a key factor; and it is necessary to keep science focused on policy.

A second key point is the need for public education. She said that there is a general lack of awareness of the effects of noise on hearing, and that parents often have no idea of the volume of the sound in the headsets going directly into the ears of their children. She said that if we do not

educate the public in an outreach fashion, we are not going to have the community support needed to go ahead with some kind of policy. She emphasized that very early education can make a large difference in the public's perception of a problem, and is also essential for public health because of the cumulative effects of noise on hearing over many years.

The third key point is that we do not have sufficient training and education of future scientists, engineers, and designers. It's not just education at a high level, because most of the acoustic and vibration programs we know are graduate programs. But it is also at a practical level. You can have a very quiet product, but if it's not properly installed, it's not going to be quiet. So education needs to be at all levels. A lot of the technology exists, but there is little technology transfer from one discipline to another discipline. A good example is that the U.S. Navy during the cold war spent millions and millions of dollars on ship quieting. Now ship noise is a huge issue with the commercial shipments that we depend on for our way of life. None of that Navy technology seems to have been transferred to commercial shipping. The technology exists; it's just not now in the right hands.

The fourth and last point, she said, is that effective legislation at local, state, and national levels could be very valuable. But ordinances are not very valuable unless they are enforced.

Mardi recalled living in a small suburb of Columbus, Ohio, where they had an ordinance against boom boxes and cars which was enforced.

> *Ordinances like that are effective if they are enforced. Unfortunately, as Les pointed out, a lot of these statutes are not only not enforced, but not always clearly understood. If the statutes are not clear and the name of the game is a lawsuit, litigation may be a way to get noise policy back on the forefront; but that's a very time-consuming, money-wasting step. I hope we don't have to go that way.*

Minneapolis Session 2

Bill Lang opened Session 2 by reminding new attendees that this workshop was a report on the "*Technology for a Quieter America*" workshop held in Washington, DC, in 2005 September. The panel for the second session of the workshop was Eric Wood from Acentech, Nick Miller from Harris Miller Miller & Hanson, and Bennett Brooks from Brooks Acoustics Corporation. Each played a role in the Washington workshop.

Eric Wood: New Industrial Plants, Residential Sound Insulation Programs, Submarines

Eric began by saying that the Washington workshop in September at the National Academy of Engineering was probably the best workshop he had attended during his professional career. "They did a wonderful job; it was a fascinating, very productive workshop."

He said that we face many noise-control engineering and noise-policy challenges in need of attention that could be addressed with cooperative efforts of industry and government agencies. He said one of the most important issues for industrial developers in the United States who are trying to get a license to build a new facility is the uncertainty caused by the lack of good, clear, well-defined standards. The lack of noise standards is just one problem , but it is an important one. The only federal agency that has any standard at all related to community noise from industrial plants in the United States is the Federal Energy Regulatory Commission. They limit community noise from new and upgraded gas compressor stations. Many states have no noise regulations, and in those that do, many of the regulations are out of date or badly written. Many local communities face the same problem.

He gave two examples. The first a project where they were trying to get a new facility licensed. Every month that the project was delayed cost an extra million USD, and it was experiencing significant delays. One of the reasons for the delays was the lack of good, well-defined standards. At another more recent project, 50 million USD was spent during the application portion of the project before even learning whether permission would be granted to build the facility. He said that industry and the regulatory agencies need better tools, guidelines, and standards for industrial plants to operate here in the United States as good acoustical neighbors.

> *Hastings: We do not Have Sufficient training and Education of Future Scientists, Engineers, and Designers*

He said that community noise design guides are needed.

> *We developed several community noise design guides for the electric power industry 20 to 30 years ago. They are dated, and they need to be improved. We need cooperation between the federal government, the state governments, and industry.*

He said that his favorite example is the submarine.

> *We have the quietest submarines in the world due to successful and intensive noise control programs. Our large ballistic-missile-carrying submarines operate quietly throughout the world's oceans. When operating in a stealth or quiet mode, they produce less noise in the water than my 20-foot fishing boat. Lots of this technology has not yet made it to the industrial sector, but it could.*

He then addressed the subject of residential sound insulation around airports in the

United States. Residential sound insulation projects have been ongoing for many years at major airports in Europe and the United States. He said that the Nation has spent over one billion USD insulating homes and schools near airports.

The purpose of residential sound insulation projects near airports is to address a barrier to the growth of our air transportation industry by reducing the noise that intrudes into people's homes and schools. Industry and government agencies also continue working together to develop quieter commercial aircraft.

Residential Sound Insulation Programs are Popular With the Public

He believes that the sound insulation programs in homes and schools in the United States are effective and well received by the home owners and the teachers in the schools.

Of the homeowners and teachers we've spoken to, 75 to 80 percent believe the programs are effective. The few complaints that we do receive are generally related to scheduling when the contractor came or perhaps the contractor didn't clean up quite enough, but the homeowners are happy with the reduction of noise within their homes.

He said it is important to have technologically effective and economically feasible codes, guidelines and standards that are not only written but are enforced, for the design and construction of homes and schools being built near an airport. And there's another metric needed. The FAA uses the day-night sound level, but a better metric is needed. We should supplement the day-night sound level with a metric that quantifies how loud a noise gets at the homes that are near airports.

Eric also believes we need to do a better job of modeling low-frequency noise and vibration from aircraft and rail lines. Insulation methods must be improved to address the intrusion of low-frequency noise into people's homes. In the sound insulation program for Boston's Logan Airport the homeowner is given the option of selecting one room in the house, often the bedroom or TV room, in which to install a double-wall construction. It does use up a bit of the real estate inside the room, but double-wall construction is one way to reduce the intrusion of low-frequency noise.

Also, he said that further development of higher-bypass ratio engines in the future will result in less noise in people's homes and schools around airports. A threshold of 65 dB day-night sound level is now used by the FAA. Because of the technology that's been developed over the past 30 years many believe that this threshold should be reduced to 60 or 55 dB.

He believes that the application of our new standards for schoolrooms will improve the learning environment for our children and grandchildren including those attending schools near airports. It's not only important for the average student, it's important for students where English is not their first language and for students who have a hearing handicap. He closed by saying that sound insulation programs increase the energy efficiency of homes and schools, which is an increasingly important goal of the United States—energy efficiency.

Nicholas Miller: Metrics for Community Noise

The next speaker was Nicholas Miller who chaired an afternoon panel session in Washington on metrics. After a great deal of discussion about current metrics, it was concluded that there is a plethora of types available and that their current usage is variable and inconsistent with inconsistent documentation. He took as one example the origin of the day-night sound level (DNL): If we want to find out how DNL 65 was chosen, for example, he believes we may not be able to do that. We can get close, but you can't find any documentation as to why that was chosen. The closest I've come to it is some of the work that Ted Schultz did for HUD way back when and some of the early EPA work that was EPA sponsored in 1973 or so. But to get the 65, I'm not sure it's possible.

He said that currently-used metrics oversimplify or understate the effects of community noise—non-auditory health effects, sleep loss, quality of life, etc.

One of his thoughts is that what we're doing now in most of the above areas, especially transportation noise where the federal agencies have processes and procedures, is based on assumptions and ideas and some research from the 1970s. They've been frozen into the process, he said, without asking the questions in an organized way "Were they right?" "Should we change them?" "What better could we do?" and "What have we learned?"

The inability to enjoy "natural quiet" in America's parks and wilderness areas degrades the quality of life for many Americans. He said that he and his company have worked for about 15 years for the National Park Service on just this issue. That one concept alone, he said, could use enormous research to quantify what enjoying natural quiet means.

Nick said that the appropriate metrics of sound depend upon the desired applications and not "one size fits all." Metrics must be related directly to the response or effects or concerns. We're certainly finding that DNL doesn't correlate to sleep interference. It does include the night time "weighting" but that appears inadequate to correlate well with sleep disturbance. Perhaps sleep disturbance is too complicated to characterize with simply one all night measure. The appropriate emission and immission metrics can be

identified or developed and harmonized to provide the basis for setting guidelines, standards and/or regulations for a quieter America. That's the biggest hypothesis of all—that it is possible to identify metrics to control noise. I don't think we've convinced ourselves that it's possible yet.

However, he said that metrics and associated limits can be identified or developed for specific applications for all land use categories, including but not limited to residential, rural, urban, commercial, and public lands; and, if implemented and enforced, will result in a quieter America.

Bennett Brooks: Indoor Noise

The next speaker was Bennett Brooks who did not discuss the manufacturing competitiveness panel session that he chaired with Robert Hellweg. He said that the panel chaired by Richard Peppin was the only one that discussed noise indoors as an issue, and that he wanted to make some comments on that panel. The current conditions, he said, are that we have:

Some performance criteria for classrooms that were recently developed for ANSI Standard S12.60.

Room noise criteria basically as guidelines—there's nothing mandatory about them—in ANSI S12.2, which is currently under revision and should be out soon. But there really is not a developed procedure for measuring these quantities in that standard.

Measurements for building isolation; we have ratings.

Guidelines from textbooks—the others here can attest to that—and from ASHRAE as well.

Some hospital association criteria that are developed, usually for the same type of sources. Some of the states have relevant regulations.

One of the things, he said, that came out of the discussion was that the existing criteria, such as for sleep disturbance and speech interference, really do not account for all populations. Generally, they are focused on the average hearing adult. But do they really focus on youngsters, infants, the elderly, people who have a disability? They don't. Those are the current conditions; we need to provide greater awareness.

Brooks: The Poor Acoustical Environment of Schools is Responsible for Significant Educational Failure and Delay

He said that the panel felt it was very important to harmonize the quantities for the description of noise immissions (the received noise) and the emissions. Their use in prescribing uniform limits is important to the preservation of hearing in occupational situations. The panel asked if we should be studying lower limit levels than exist today for hearing conservation—as are in place in the European Union.

With regard to classroom acoustics, he said that a testable hypothesis was that high noise levels and reverberation in U.S. classrooms are an impediment to learning. Probably most of us in this room would say "Why do we need to test that?" Again that's one of the hypotheses which many of us feel is absolutely true, but where are the data? We need to have more data; we need longitudinal studies on educational settings to show, categorically, what the cause and effect—the dose response effect—is on learning.

A corollary to that is that the poor acoustical environment of schools is responsible for significant educational failure and delay. Bennett believes that is a "hot-button" issue and something that we all would benefit from by studying.

He said that another topic of interest to the panel was indoor noise in hospitals and health facilities. High noise levels in retirement, nursing, and assisted-living homes can significantly degrade the quality of life and communication comfort, leading to increased isolation. That hypothesis highlights an area that's gaining a lot of attention. A related issue is speech privacy in health care facilities. The federal HIPPA act mandates privacy but offers no criteria or design guidelines.

He said that the group felt room-noise criteria will be difficult to implement without standardization and advances in measurement technology. So the hypothesis is: Do room noise criteria, including level and quality, really measure comfort, communication, and functionality? The group believes that perhaps this could be improved; we should test that hypothesis and see if it's true.

Minneapolis Session 3

Richard Lyon: A New Noise Control Research and Development Program (NC R&D)

The first speaker in the third session was Richard H. Lyon who spoke on noise reduction in product design and manufacturing competitiveness. He said that new technology is needed for product design, and that education is of key importance and closely linked to research. He suggested an R&D program for new technology modeled generally on the government's SBIR/STTR program. The SBIR (Small Business Innovative Research) supports R&D in small businesses and the STTR (Small Business Technology Transfer) program is for cooperative research between small businesses and certain categories of research institutions.

Every government agency that supports research has to set aside 2½ percent of

its research funds in the SBIR program and 1½ percent in the STTR program to support small businesses and research organizations (mostly universities) in the development of new technology. This new NC R&D program would encourage technology to be developed through the research of private R&D organizations, research institutes, universities, and government laboratories. That's like the way that the SBIR works except that it would not be limited to small business. Cooperative programs between these institutions in terms of program projects would be encouraged.

Another aspect of the SBIR program to be copied in the NC R&D program is that the people doing the research keep the proprietary rights. If there is intellectual property developed which has financial value, the small companies and the organizations that developed the research would retain that value. Then the licensing of this technology to industry would be encouraged and facilitated.

He said the first goal would be to produce design engineers who can include noise issues into products. The second goal would be technical demonstration projects that show how structures, components, and assemblies can be designed for better sound. As an example, there are several universities that have "capstone" senior year design courses. Typically, a team of students receives a charge to define or to find a technological solution to a stated problem. NC R&D funding could go to support these demonstration projects.

R&D funding to universities, private companies, and government laboratories would be provided for noise reduction studies. The technology generated in the program would be available to industry through licensing and other agreements; it would not be locked in to a particular industry, or a particular company. Licensing fees could then be a supplement to the research funding from the program.

There are three components to this "imagine" program. One of them is the research agency. The job of the research agency would be first of all to define the research agenda based on the needs identified by the support group. It would issue calls for proposals and topic lists based on inputs from research groups and from the industry agenda. It would work with the support groups to handle funds and facilitate technology transfer and would receive and evaluate proposals from the research groups. It would award contracts and administer reporting and legal arrangements and support commercialization through better, quieter components, and better designs. One of the desired aspects of the SBIR program is to promote commercialization which means connecting the small R&D group or the university group with a company that can help carry it forward as a product. That would also be a goal of this program.

Lyon: A New Model for Noise Control Research and Development is Needed

The second component is the supporting group, that is the people who are providing the money: government agencies, industry trade associations, private individuals, and foundations concerned with the economic strength of the U.S., the environment, health, and welfare.

The third component is the R&D community. That would include university researchers, engineering projects and capstone design courses. Many engineering departments are instituting team project courses that have as their goal a design in a device or system to solve a problem; that would be a natural input to this activity. Government laboratories and major R&D organizations would be another component. An R&D group with General Motors could be a part of this program as long as the work that came out of it was available to all on a license basis. These are all groups that would be candidates to carry out the research. This is different from the SBIR because, in that program, only companies that have fewer than 500 employees are eligible for the SBIR program

As noted, the intellectual property (IP) that comes out of the work would be available to all on licensing arrangements. Of course that's different than if a group within a company develops a product - they can either hide it or they can use it exclusively on their own. If they are supported by this program, the technology has to be available through various licensing arrangements to all subscribers.

He closed by saying that such a program would be a way to support R&D in universities, produce more noise control engineers, and provide a much needed new technology base for quieter and better sounding products.

Robert Hellweg: Hypotheses on Manufacturing Competitiveness

The next speaker was Robert Hellweg who spoke on the hypotheses that were discussed in the panel on manufacturing competitiveness which he chaired with Bennett Brooks. His presentation covered the six hypotheses recommended by the panel with his own observations and personal opinions.

He presented the following hypotheses that need further consideration. The first is:

1) Noise requirements from abroad are increasingly placed on products, machinery, and equipment, especially by the European Union. The application of current noise control technology can assist American industry to meet requirements on noise emissions with a minimum of expense and thereby

improve international competitiveness while increasing customer satisfaction in domestic markets. In many cases the development of new technology or the new application of existing technology will be needed to achieve competitiveness.

What sort of requirements do we have on product noise? There are several types of requirements in Europe and worldwide that we do not have in the United States. The products that we sell in other regions or countries have to meet their criteria.

He reviewed some of the European requirements on product noise, and noted the Community Outdoor Equipment Directive. The Machinery Safety Directive, which puts criteria not only on the full emissions from the product but also labeling requirements, is based on hearing-loss protection.

There are also indirect laws and regulations and criteria on products, he said. One example is the European Physical Agents Directive on noise (2003/10/EC) which establishes maximum sound pressure levels that workers may be exposed to in the work place, analogous to U.S. OSHA criteria, but with more stringent requirements on sound levels. Manufacturers of equipment going into machine shops and industry must produce products that will allow the employer to comply with the Directive. This Physical Agents Directive, he said, also has lower sound pressure levels at which actions need to be started by the employer. The action levels, he said, are 7 dB lower than the criteria levels, and the criteria levels are lower than U.S. OSHA limits.

There is a third type of criteria, he said, that has become popular around the world but not yet in the United States. Those are the criteria for environmental eco-labels for products. Parts of their criteria are for noise emission levels, and those noise criteria have to be met before a product can be labeled as environmentally friendly. For example, there are eco-label noise criteria on appliances, computers, and consumer products.

Another hypothesis from the panel was:

2) Low noise and high sound quality improve the competitiveness of American products both in the United States and abroad.

This needs to be addressed with respect to the United States market. He said that low noise levels may not be as important in the United States as they are in Europe and Japan, but they are a driver. He said that the trend in a globalized manufacturing economy is to produce products with the same noise emissions for all markets. In many cases economies of scale make it less expensive to implement the most stringent noise emission requirements in all products rather than have different designs.

Hellweg: The Trend. . . is to Products With the Same Noise Emissions for all Markets

Bob said that the third hypothesis:

3) The United States should participate more actively in the development of noise policies (i.e., requirements, standards, laws) that are international in scope.

In the United States, with its voluntary standards system, it is difficult to participate fully in international standards work, whereas most other countries provide government funding for participation in standards work.

He commented on two additional hypotheses that should be considered:

4) A greater awareness and understanding of product noise and the ability to design quieter products will lead to the demand for and design of quieter machines and equipment.
5) Consumers and purchasers are willing to pay more for quieter products.

We can see that there is extensive research on sound quality in automobiles to improve the interior noise. Clearly there must be a market for that; otherwise the automobile companies would not be investing resources for producing quieter automobiles.

The last hypothesis that the panel recommended had to do with the nature of the control and market forces and regulations.

6) Regulations might be appropriate for product noise that affects the public or non-user or has hearing-loss issues for the users. However, market forces are appropriate for product noise that affects only the users.

He concluded by saying that the panel had much discussion on this last hypothesis. For example consider air conditioners. The noise inside the house should be decided by the person purchasing that air conditioner. But what about the neighbor who is 3 meters away and exposed to the air conditioner noise from another dwelling? That neighbor needs to have some protection which is not obtained by market forces. Automobile noise is another good example. Market forces are driving interior noise reduction but are not helping to improve exterior or environmental noise. So we think this last hypothesis should be studied in detail.

Patricia Davies: Sound Quality and Product Design

Workshop Session 12 on sound quality was chaired by Gordon Ebbitt and Richard Topping, but Patricia Davies gave a summary of what came out of the session

In this panel, she said, we decided to summarize current conditions, key industries which are interested in sound quality—automotive, appliances, power garden equipment, office equipment, industrial products, medical, and aircraft.

We also made a note that, even though we were focusing on products and manufacturing in terms of quantification of sound and the perception of sound, there are parallel needs in quantification of community noise.

Sound quality is about sound, and there is more to sound than just levels. However, level (loudness) is a very important attribute of sound. We do see that some industries and some product manufacturers clearly are aware of these other sound attributes. Somebody pointed out that we know lots of things, but better practices are not always followed.

Two hypotheses are:

- It is more economical and effective if noise control is designed into a product from the earliest stages of design, and not as an afterthought.
- Noise control should be integrated into product design curricula.

She said that most of us who work in engineering departments note that the design classes do not often, or ever, include anything to do with acoustics. We have acoustics classes and noise control classes, but product design and acoustics are taught as two separate items. For noise to be taken seriously, all engineers, not just those interested in acoustics, should be aware of noise issues in product design and also that there is a need for more product design tools. A comment was made that current software used in product design is insufficient for predicting product noise. So engineers are somewhat hampered because there aren't the design tools to help them do this. There are measures that exist to quantify perception of product sound characteristics, and we could incorporate these objective measures into the design of the desirable machinery sound.

She continued with some personal comments:

> *Our perception of product sound and how noise affects people in a community are to do with how humans process sounds. Context plays an important role in our ultimate assessment of that noise., but there are a lot of commonalities between community noise perception and product noise perception. It worries me at conferences that I don't see many "community noise people" attending sound quality sessions nor "product sound quality people" attending community noise sessions. I think we need to talk to each other a lot more.*

At the workshop, somebody made a comment that we knew all this 30 years ago. In the last 30 years there's been a huge increase in our understanding of how humans process sound and sound perception. And yet we don't actually use that information in most of our metrics. Thirty years ago they used what they knew about people's response to sound in the metrics they developed, but we've moved on and now know a lot more. However, it seems to me that we are reluctant to change and incorporate this more recent knowledge.

When I talk to people about sound quality, I find that they're often using metrics that I think are wholly inadequate, in that they do not incorporate current understanding of how we (people) process sound. When this is pointed out, very soon in the discussion, instead of focusing on moving forward in improving metrics step by step by incorporating what we know and thus making progress, these discussions often focus on "You can't have a perfect model because of this, this, and this." I think that attitude, of wanting to go from the 'familiar and inadequate' to 'perfect' in one step (an impossibility), hampers us from making progress in this field.

Davies: There is More to Sound Than Just Levels

While a lot of the discussion is focused on metrics and metrics certainly are useful, we should remember that they are not the whole story; you shouldn't be bound by them and end up doing a bad job.

There are a lot of connections made between context and sound. Sound is desirable in some cases because it conveys information about the product. But people are hearing the sound and processing it, and it is possible to develop metrics that quantify that, though it may be difficult to do. Because these product-specific attributes are important, doesn't mean that attributes like loudness and other sound attributes are not important; they all contribute to our perception of the product sound, and thus the product quality.

Gerald Lauchle: Noise Control Engineering Education Today

Gerald Lauchle was part of the team that assisted Penn State Dean of Engineering David Wormley in his presentation at the September workshop. Dean Wormley, he said, is a key educator in the United States and also very influential in the Engineering Deans Council of the American Society for Engineering Education, of which he is a director.

This group summarized what they felt were the current conditions in education in noise control engineering, and then formulated a set of hypotheses that should be tested in order to decide if more or less education is needed. But certainly the field needs formal education, not only in noise control engineering as a technology itself—we have mechanical engineering, aerospace engineering, and those types of subjects—but also we need to have substantial education opportunities in the fields of audiology, conservation of hearing, and industrial hygiene. Acoustics has often been incorporated into these programs, but there are many institutions that do not include acoustics to the extent they should.

He said that every engineering curriculum in the United States should have some description of acoustics or noise control problems the students—freshmen—are going to experience in whatever discipline they are likely to undertake during their careers as students. Noise control and acoustics are not taught in introductory general engineering courses, he said, and that situation ought to be improved.

He discussed the supply and demand situation and one of the "testable hypotheses" brought up at the September workshop related to the level of education that is expected of a noise control engineer. He asked "…is a specialty degree all that is necessary; some kind of certification that may be obtained from a continuing education short course that may last six months or only a couple of weeks? Is that adequate? Or are we requiring as much as a full-blown graduate with a masters or PhD?"

With regard to the requirement for a graduate degree, he said there's probably not enough formal degree granting institutions that offer those degrees. So, therefore, the community at large depends on these certification programs that we see coming up in the various private sectors and industries. The quality of these non-credit, post-graduate degree programs needs to be questioned. Again going back to, "Who's going to teach? How well qualified are the teachers? Do they have an adequate reservoir of instrumentation, laboratory space, and things like that so people can get hands-on training where they can actually work with sound level meters and microphones? Will they know how to work with pass-by noise from highways, that sort of thing?" These require a fairly substantial physical infrastructure with whatever organization is doing the instruction. Not many universities have this resource.

Jerry expressed concern about the lack of a degree in noise control engineering. There appears not to be any engineering discipline that's called noise control engineering that you can go to University XYZ to obtain. You can get a degree in mechanical engineering with perhaps a small emphasis on noise control as part of a minor in mechanical engineering. But there is no sheepskin that actually says: "I'm a noise control engineer at the baccalaureate level." So this is a question that needs to be addressed for our future.

He said that professionalism in noise control engineering has been a very active topic within the Institute of Noise Control Engineering, and there has been a great deal of discussion about the equivalency of the INCE Professional Examination and a State license to practice engineering. He concluded that if we are going to be competitive in product design, we must have the engineers to do it.

Bernhard: There are Three Different Languages in Noise Control

Robert Bernhard: Future Needs in Noise Control Engineering Education

The final speaker in the workshop was Robert J. Bernhard who gave an overview of his presentation on noise control engineering education from the NAE workshop.

He spoke of three aspects to the problem. The first was the need for noise control specialists, the second related to current capacity, and the third was how universities operate when they consider increasing the amount of funding for noise control engineering education.

He said that he couldn't find any comprehensive surveys of how many noise control technologists are practicing in the United States today, but indications from a number of sources indicate that there is a need for at least 200 to 300 noise control engineers per year in the United States—not a very high number, and perhaps conservative considering the IT industry, the automotive industry, the airframe industry, consultants, etc. He said that the need could be two to three times that number, and that a very competitive situation exists in the automotive industry. He commented that many persons practicing noise reduction were hired as professionals in related fields such as aerodynamics and structural mechanics.

Bob described the following three 'languages' of noise control.

- People who are educated in acoustics who think in terms of waves and how things propagate to infinity.
- People who are educated, usually in vibrations, who think about finite systems; and, therefore, think in terms of modes.
- People who practice engineering controls who tend to work with absorption and transmission loss; these people have the language of dB'ese.

Very few of the practitioners that Bob interacts with are trilingual. His test for somebody with a graduate degree, at least from Purdue University, is whether they are able to talk in any of these three languages as needed for the application.

He said that there are only about twelve universities in the United States that have programs in noise control engineering, and that the total number of M.S. and Ph.D. graduates is close to about 30. The supply of individuals with an undergraduate degree who have had an elective course in engineering or architecture that covers noise control, decibels, etc. is probably in the range 100-200, so the demand clearly exceeds the supply.

To compensate for this, he said, companies often bring noise control specialists into corporate laboratories—which can be counterproductive if the objective is to get noise control into the design of products. If

specialists in corporate laboratories become involved in noise control late in the design process, he said, the solutions often involve "band-aid" treatments, and the specialists may become discouraged with progress in noise control.

A second strategy often employed, he said, is continuing education, but short courses have their limits because the depth of understanding is not always sufficient.

Bob believes that the challenge is to get universities to respond to the situation. He said that lack of a noise control engineering accreditation program is a problem since universities often build their offerings around such programs. Secondly, he said, it is necessary to convince universities that noise control is a national priority and a global challenge. He also said that in hiring young faculty members, universities are concerned about long-term funding potential, and he discussed what external funding is required to sustain the research program of a faculty member – perhaps 400,000 USD per year. Currently, he said, there is little funding and a lack of advocacy for noise control engineering in universities, partly because it is not a mainstream environmental issue and, being an interdisciplinary subject, crosses department boundaries.

Editor's Note: A prospectus was prepared for approval by NAE management following the Washington workshop, and approval was obtained in 2006 January. A new Steering Committee for the consensus study has been appointed, and work will begin in 2006 April. The study is expected to be complete and a report with recommendations will be issued 30 months from the inception of the study.

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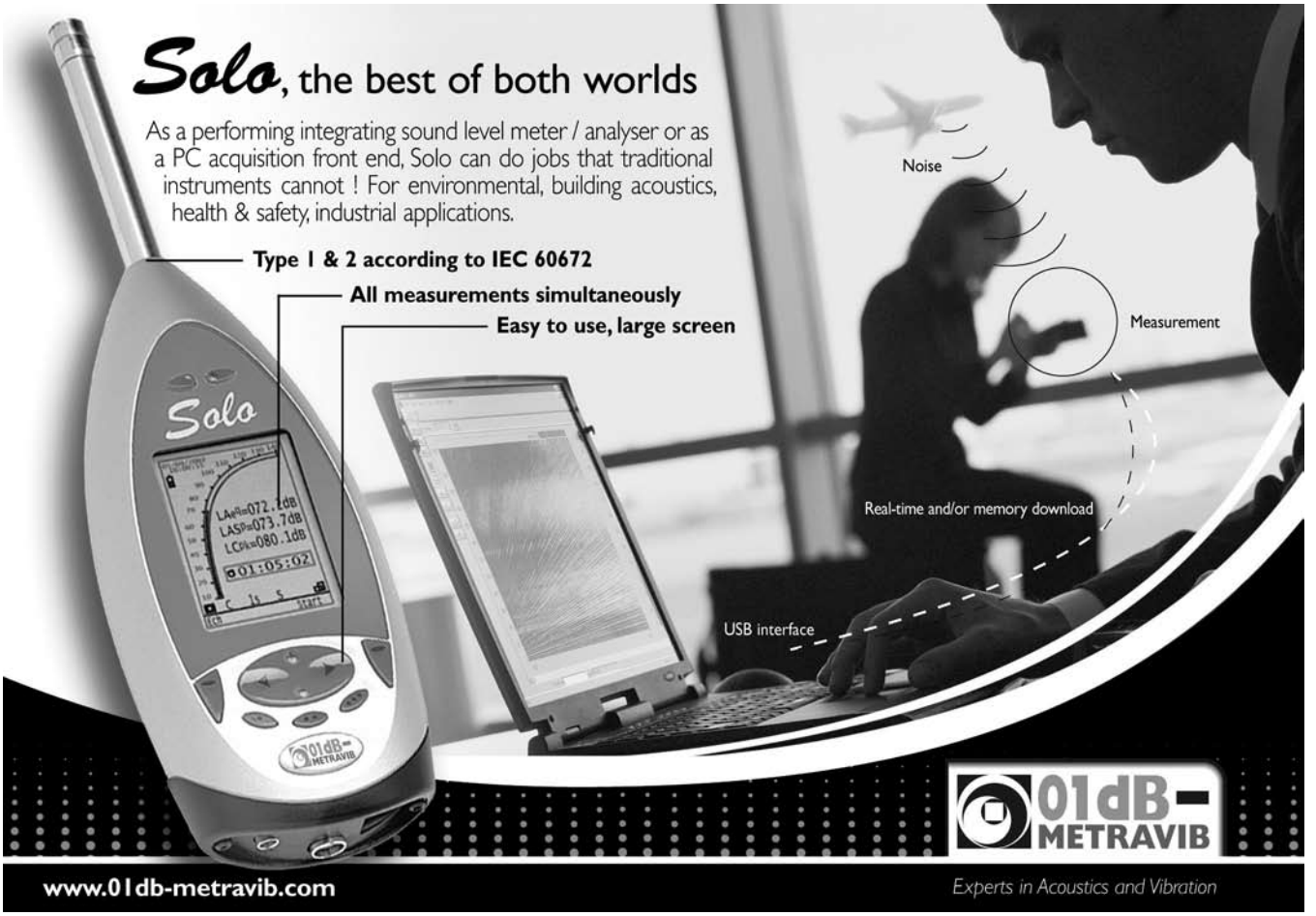

Asia-Pacific News

Marion Burgess, Asia-Pacific Editor

ASIA PACIFIC REGION

Asia Pacific Vice President Change

It was with regret that at the 2005 meeting of the I-INCE General; Assembly, the resignation of Masaru Koyasu as the I-INCE Vice President for the Asia Pacific region was accepted. His contributions to the Board and its various activities was acknowledged. Prof Koyasu has been a leader for acoustics in the region for many decades. In particular he had the important role as Chair for the most successful INTER-NOISEe 94 congress. From January 2006, his role as Asia Pacific Vice President is to be taken on by Marion Burgess from Australia

AUSTRALIA

ACTIVE 06

ACTIVE 06, The 2006 International Symposium on Active Control of Sound and Vibration, is being organized by the South Australian Division of the Australian Acoustical Society. The Symposium will be held on 2006 September 18-20 at the University of Adelaide. This is conveniently located on North Terrace, a short walk from the Adelaide Central Business District. The University of Adelaide is easily accessible by walking from all the recommended hotels. The Symposium is a continuation of the series of ACTIVE symposia which have been held in various countries since 1995. Internet: www.active2006.com. *(See the travel planning article beginning on page 8 of this issue.—Ed.)*

CitySounds - Acoustic Design Resource

The City of Melbourne and RMIT University's Spatial Information Architecture Laboratory have developed the CitySounds2 Acoustic Design Resource to provide information to assist architects, builders, developers and residents to minimize noise when designing, renovating or solving noise problems in city apartments. Using web design and audio software to create a virtual CBD living space, the program lets users hear real sounds of Melbourne and learn ways to reduce noise levels entering homes. A series of fact sheets have also been developed to provide comprehensive and accessible information on acoustic design considerations.
Internet: www.melbourne.vic.gov.au/noise

JAPAN

Time Interval for Assessing Construction Noise

Construction noise is one of the serious problems in city areas. It is reported by the Ministry of Environment that the complaint of this noise accounts for 28 percent of all complaints for outdoor noises such as industrial noise, traffic noise, commercial activity noise and neighbor's noise. Noise regulations and limits do exist for individual construction work, but it is a kind of noise emission regulation. There is no guideline from a viewpoint of immission management.

A discussion is arising for assessing construction noise in a technical committee in INCE/Japan. The bottleneck is the time interval for determination of L_{Aeq}. Since the construction noise occurs on and off, and sometimes very high and very low. Considering the compliance with social response to this noise, the reference time interval to be counted is the key. The discussion is still continuing.
—News from Japan contributed by Kohei Yamamoto

KOREA

WESPAC IX 2006

The 9th Western Pacific Acoustics Conference will be held June 26-28, 2006 in Seoul, Korea, the Land of Morning Calm. The program will include papers on a wide range of acoustics topics along with a technical exhibition and a full social program. This conference is a wonderful opportunity to find out about the latest advances in all areas of acoustics as well as meeting with colleagues from our region of the globe. Those who attended the excellent Wespac conference in Melbourne will know the benefits that can be gained from attending Wespac conferences. Information from http://www.wespac9.org

THAILAND

WWW Resource

Michel Rosmolen, an acoustical engineer from Holland, based in Thailand since 2002 has set himself the challenge of setting up a worldwide

continued on page 40

Thanks to Professor Masaru Koyasu for his Service to International INCE

5,000 Additional Homes to be Insulated Before the O'Hare Modernization Program is Completed

CANADA

CAA Annual Conference to be held in Halifax, Nova Scotia

The 2006 annual conference of the Canadian Acoustical Association will be held in Halifax, 2006 October11-13. There will be two and a half days of parallel sessions of papers on all areas of acoustics and auditory perception, as well as an interesting array of exhibits detailing acoustical products. There will be an exhibition of acoustical products and the opportunity for interaction between various industry partners. Student members who make presentations can apply for travel support and can apply to win one of a number of student presentation awards. The conference will be held at the Citadel Halifax Hotel located in downtown Halifax. The deadline for submission abstracts is 16 June 2006. For information see the CAA website.

CHILE

IberoAmerican Congress on Acoustics to be held in Santiago, Chile

On 2006 October 25-28, the 5th IberoAmerican Congress on Acoustics will be held in Santiago, Chile. This meeting combines the Chilean Meeting on Acoustics 2006, the 2006 Congress on Engineering Acoustics (INGEACUS 2006) and the Seminar of Acoustics 2006 (SEMACUS 2006) together with the IberoAmerican congress. The program will include invited lectures, technical sessions, poster sessions, round table discussions, and new technical products and services. General topics will include Environmental Acoustics, Buildings Acoustics, Effects of Noise, Instrumentation and Measurement, Psychoacoustics, Architectural Acoustics, Vibro-Acoustics, and Vibration Isolation and Damping. Abstracts are due by March 31, 2006, and full papers are due by June 30, 2006. For more information see www.fia2006.cl.

USA

ONCC Officially Accepts Role in O'Hare Modernization Program

The O'Hare Noise Compatibility Commission (ONCC) adopted a resolution on 2006 February 10 formally accepting the Commission's aircraft noise mitigation role in the O'Hare Modernization Program (OMP) as directed in the FAA's Record of Decision for the OMP. The Record of Decision was issued on September 30, 2005. The FAA designated the ONCC to continue overseeing the residential sound insulation program with a directive that approximately 5,000 additional homes be insulated before the OMP is completed.

In addition, the FAA charged the ONCC with continued oversight of the O'Hare School Sound Insulation Program and the Fly Quiet Program, as well as responsibilities for evaluating changes to the Airport Noise Monitoring System and other aircraft-related noise issues related to the reconfiguration of the airport.

The O'Hare Noise Compatibility Commission began working in 1996 to bring together the parties that are most able to reduce aircraft noise with representatives of communities affected by aircraft noise in a partnership to address jet noise at its impact and sources.

The Commission's current membership includes the villages of Arlington Heights, Bartlett, Bellwood, Elmwood Park, Franklin Park, Hoffman Estates, Maywood, Melrose Park, Mount Prospect, Niles, Norridge, Palatine, River Grove, River Forest, Rosemont, Schaumburg and Stone Park and; the cities of Des Plaines, Northlake, Oak Park, Park Ridge, Rolling Meadows and Chicago; Cook County; and school districts 59 (Elk Grove Village, Des Plaines, Arlington Heights, Mount Prospect), 63 (Des Plaines, Niles, Morton Grove and Glenview), 80 (Norridge), 81 (Schiller Park), 84 (Franklin Park), 84½ (River Grove), 85½ (River Grove), 86 (Harwood Heights), 87 (Berkeley, Northlake, Bellwood), 88 (Bellwood, Melrose Park, Stone Park) 89 (Maywood, Melrose Park and Broadview), 214 (Elk Grove Village, Des Plaines, Arlington Heights, Mount Prospect, Rolling Meadows, Prospect Heights, Wheeling, Buffalo Grove), 234 (Norridge, Harwood Heights), 299 (Chicago Public Schools) and 401 (Elmwood Park).

More information about the Commission, including its meeting schedule, can be found at www.oharenoise.org.

Vibration Institute Announces Symposium

The Vibration Institute announces its 2006 Technical Symposium and Annual Meeting to be held in Louisville, Kentucky on 2006 June 19–22 at the Galt House Hotel & Suites. The Symposium will include technical papers in various vibration analysis disciplines, including, rolling element bearings, precision spindles, journal bearings, gearboxes, modal analysis/ODS, alarm setting and others.

Several short courses will also be offered for: Dynamic Balancing, Shaft Alignment, and Vibration Analysis. Additionally, ISO Certification Tests will be given for various Vibration Analysts categories and the new Vibration Institute Basic Balancing Certification.

For more information on the Symposium or to register, contact the Vibration Institute at +1 630 654 2254 or visit the website at http://www.vibinst.org.

ANSI Announces Newly Revised Standard on Long-term Community Response to Noise

The American National Standards Institute has announced the availability of a newly revised standard, ANSI S12.9-1996/Part 4, entitled "Quantities and Procedures for Description and Measurement of Environmental Sound – Part 4: Noise Assessment and Prediction of Long-term Community Response". This standard specifies methods to assess environmental sounds and to predict the annoyance response of communities to long-term noise from any and all types of environmental sounds produced by one or more distinct or distributed sound sources. The sound sources may be separate or in various combinations. Application of the method of the standard is limited to areas where people reside and related long-term land uses. This Standard does not address the effects of intrusive sound on people in areas of short-term use such as parks and wilderness areas, nor does it address other effects of noise such as sleep disturbance or health effects. This standard does not provide a method to predict the community response to short-term, infrequent, non-repetitive sources of sound. Electronic copies of this standard are available for purchase through the Acoustical Society of America's home page at http://asa.aip.org with hard copies also available by contacting ASA directly. The price of the standard is 100 USD.

FHWA Releases New Roadway Construction Noise Model

The Federal Highway Administration has just released the first version of their new Roadway Construction Noise Model (RCNM) complete with User's Guide. The model is available free of charge by simply downloading it from the FHWA website, www.RCNM.us. The RCNM model's approach, equipment noise database, and default noise criteria limits are based on those used at the Central Artery / Tunnel Project in Boston (The Big Dig). The user can also modify or add to the equipment list and set up project-specific noise limits if desired. RCNM was developed under contract with the Volpe Center in Cambridge, Massachusetts. Volpe has also set up an email address (Support@RCNM.us) to provide assistance for RCNM users.

LMS appoints Guy Buyst as Executive Vice President Sales and Customer Services

LMS International has announced the appointment of Guy Buyst in the position of Executive Vice President Sales and Customer Services. Guy Buyst joins LMS from Base where he held the position of Chief Commercial Officer. Guy Buyst holds more than 25 years of experience in sales and marketing, sales management and general management at companies like Anixter Bros, Digital Equipment Corporation (DEC), Cabletron, Philips and Base.

New Roadway Construction Noise Model is Available

NCEJ to be Published on CD-ROM in Mid-2006

INCE/USA

2005 State-of-the-Institute—INCE/USA

As my year as President of INCE/USA draws to a close it is comforting for me to report that the Institute continues to have many on-going noise control activities and initiatives. There is good stability within the organization; student membership has grown slightly; *Noise Control Engineering Journal* (*NCEJ*) is seeing an increase in papers; INCE/USA members are becoming more active in USA noise policy issues; and there were two very successful noise conferences held in 2005. INTER-NOISE 2005 took place in Rio de Janeiro during August, and NOISE-CON 2005 was concurrent with the 150th Meeting of the Acoustical Society of America (ASA) held in Minneapolis, MN during October. There were nearly 200 papers presented and published in the NOISE-CON Proceedings. The strong collaboration with ASA is very evident in that many of these papers came from special noise sessions jointly organized by the ASA Technical Committees on Noise, Architectural Acoustics, and Structural Acoustics. The remaining sessions were organized by the INCE/USA Technical Activities Board, which is chaired by Patricia Davies, Vice President – Technical Activities. Patricia also served as co-Technical Chair (with Stuart Bolton) of NOISE-CON 2005; the General Chairs of the conference were Daniel Kato and Robert Bernhard. The Technical Chairs teamed with George Maling to produce one of the most comprehensive Proceedings CD-ROMS ever! It contains the NOISE-CON Proceedings for 2005, 2004, 2003, 2001, 2000, 1998, 1997, and 1996. Also included are the Proceedings of the Sound Quality Symposiums of 1998 and 2002, and a select set of papers that deal with both national and international noise policy.

The Board of Directors of INCE/USA has accepted the offer from the Australian Acoustical Society to hold Active 2006 at the University of Adelaide in September; INCE/USA will co-host with INCE/Japan INTER-NOISE 2006 in Honolulu in December; NOISE-CON 2007 is tentatively planned for Santa Clara, CA in early fall; NOISE-CON 2008 will be in the Ann Arbor, MI area; and a formal proposal to I-INCE to hold INTER-NOISE 2009 in Ottawa under the sponsorship of INCE/USA is presently under review.

After an international search was completed under the leadership of James Thompson, Vice President – Publications, the Institute has named Courtney Burroughs as the new Editor-in-Chief of *NCEJ*; his appointment became effective 1 July 2005. The plan to publish *NCEJ* electronically, along with the traditional paper copy for libraries only, has been approved by the Board of Directors in October 2005. The American Institute of Physics will handle the electronic publishing of the journal, which will eventually include all past issues. Members and libraries can expect to begin receiving CD-ROMs of *NCEJ* in July 2006. Efforts by many to minimize the delays in the publication of *NCEJ* have continued; the journal is presently behind schedule by two issues. The January/February 2006 issue of *NCEJ* will be a special issue devoted to fan noise. It will contain seven expanded papers from the I-INCE 2003 Fan Noise Symposium, which took place in Senlis, France under the organization of Alain Guedel and Jean Tourret. It has been my pleasure to serve as the Editor of this Special Issue of *NCEJ*.

Total membership in the Institute remains relatively constant. As of October 2005 there were 100 new members, 22 of them students. Many of the first-year members who signed up as part of the NOISE-CON 2004 membership promotion have elected not to re-new their membership in 2005; thus, there has been an overall decrease in membership by some 60 individuals. A Fellow grade of membership has been approved in 2005, and an initial slate of nominees is being prepared by the Vice President – Membership, Gregory Tocci. He has also negotiated a Memorandum of Understanding with Acentech to assist INCE/USA with up-dating the Fundamentals of Acoustics Exam. Acentech would also offer preparatory on-line courses to individuals planning to take the exam.

Rick Kolano, Vice President – Board Certification conducted a member survey and detailed analysis of the certification and re-certification processes.

Various improvements and upgrades are being implemented because of this effort. There is a move within INCE/USA to have Board Certification be made equivalent to an Engineering State License in the discipline of noise control engineering. Basically, the INCE/USA Board Certification Exam will have to be accepted as equivalent to the Professional Engineering Exam. David Swanson has been appointed Chair of an ad hoc committee to investigate and bring this action to closure.

The technology and policies of noise control engineering in the USA is the subject of a study being conducted by the National Academy of Engineering (NAE). I would like to take this opportunity to recognize and thank founding INCE/USA members George Maling, Bill Lang, and Leo Beranek for their continuous effort – since 1972 – in bringing the issues of noise and noise policy to the attention of the Academy and others in the Federal government. Through their direction of a steering committee (chaired by George Maling) consisting of practicing noise control specialists, the NAE held a very successful workshop in September 2005. Many INCE/USA members gave keynote addresses at this workshop, in addition to participating in working groups to define appropriate courses of action in the areas of noise control engineering cost-benefit analysis, demand, and education; new technologies; improved occupational noise controls and community noise metrics; public awareness; and government coordination and assistance. The study is expected to continue for at least two more years. The goals are to summarize the current state-of-the-art of noise control engineering, to recommend policies and practices for government agencies, and to develop an expanded research and education agenda. Surely INCE/USA members will be contacted for participation in this continuing study that will lead to an improved soundscape for the world in which we live.

The INCE/USA Business Office continues to operate very efficiently under the direction of Pamela Reinig at Iowa State University. The duties of the Interim Executive Director (ED) have been carried out exceptionally well by 2004 President Joseph Cuschieri. Although the fiscal year does not end until 31 March 2006, financially, INCE/USA appears to be in much better shape than it was in the last couple of years. At the end of last year, the Institute was in the red by about $9,700. Projections for 2005-2006 indicate that we will be in the black by over $100,000! Much of this is due to a very successful NOISE-CON 2005 managed under the leadership of Daniel Kato, and to the unselfish devotion of Joseph Cuschieri to do administrative work without compensation. He has been the principal author and negotiator for the five staff-related agreements signed in 2005. These include those for the INCE/USA Business Office, the Editor-in Chief (Courtney Burroughs, operation and travel expenses only), the Exposition Manager (Richard Peppin), the *Noise/News International* (*NNI*) Editor (George Maling, operation and travel expenses only), and NNI Advertising Manager (Richard Peppin). In 2006, the Institute's signature conference will be INTER-NOISE 2006; David Holger is to be recognized for his outstanding planning and management for this congress as General Chairman.

As we transition into 2006, important changes in the executive structure of INCE/USA are being considered. The most significant proposed change is the length of the President's term from one year to two years. Paul Donavan, the 2005 President Elect, has agreed to serve the two-year term if the change is approved by the Board of Directors. This change in term length has been predicated by a need for the President to have more time to become familiar with the many activities and inner workings of INCE/USA so that more efficient and proper presidential actions can be performed. The 2005 President will assist the 2006-2007 President in the first year of the term, while the 2007 President Elect will assist in the second year. It is also being proposed that the Executive Director position become a volunteer position with appropriate compensation for travel and other approved expenses.

The relationship between the Acoustical Society of America (ASA) and the INCE/USA has been a

continued on page 40

INCE/USA President to Serve a Two-Year Term

The European Union and Lawnmower Noise

EUROPE

The Mechanical Equipment Noise Database is Updated

The Enterprise and Industry Directorate of the European Union has available a database of the noise emissions of mechanical equipment which was last updated on 2005 December 21. The database was established because of Directive 2000/14/EC related to the noise emissions in the environment by equipment for use outdoors. The directive was implemented in two stages, the first being on 2002 January 03 and the second on 2006 January 03.

Noise Database 1.0 is broadly divided into two parts, equipment subject to noise limits and equipment subject to marking (labeling) only. As examples:

1. The first part contains a 160-page document on noise emission data of lawnmowers. (A 44-page document "A study into the available technology offering noise reduction for lawnmowers as presented to the European Union market" was published in 2002 April—in French. The document may be found at europa.eu.int/comm/enterprise/mechan_equipment/noise/pdf/lawnmowerreport.pdf.)
2. The second part of the database contains 12 pages on the noise emissions of leaf blowers.

The noise database may be found at europa.eu.int/comm/enterprise/mechan_equipment/noise/citizen/NoiseDatabase 1.0/app/.

Final Draft Report on Noise Mapping is Issued

The European Commission Working Group on Assessment of Exposure to Noise (WG_AEN) has released the final draft of a position paper, Version 2 dated 2006 January 13, "Good Practice Guide to Strategic Noise Mapping and the Production of Associated Data on Noise Exposure." The 129-page report may be found at europa.eu.int/comm/environment/noise/pdf/wg_aen.pdf. The URL for general information on the activities of the European Union related to noise is europa.eu.int/comm/environment/noise/

FRANCE

Fan Noise 2007 to be Held in France

The third symposium on fan noise, FAN NOISE 2007, will be held on 2007 September 17-19 in Espace Tête d'Or in Lyon-Villeurbanne, France. The venue is near the Centre Technique des Industries Aérauliques et Thermique (CETIAT), which has two persons on the Organizing Committee, F. Bessac and A. Guedel. Other members of the Committee are G. Allory from the Centre Technique des Industries Mécaniques (CETIM), and J. Tourret of INCE/Europe. The last symposium held in 2003 September at CETIM attracted 300 persons from 26 countries.

This three-day symposium will include keynote lectures and technical presentations in a single session (no parallel sessions). All types of fans, such as those used for instance in industrial processes, HVAC and electronic equipment, household appliances, automotive applications, fall within the topics of this conference. Papers on aerodynamic noise of wind turbines will also be considered for presentation. Conversely, high speed fans in aeronautic propulsion applications will not be considered here.

Topics to be presented include:

- Fan noise generation mechanisms
- Experimental methods for noise source location and analysis
- Theoretical and numerical methods for the prediction of unsteady flow and aerodynamic noise of fans
- Fan installation effects
- Optimisation of thermal and acoustic performance of systems including cooling fans
- Fan noise control by passive and active methods
- Design of low-noise fans
- Sound quality related to fan noise
- Aerodynamic noise of wind turbines

During the conference an exposition is planed on the following topics:

- Noise and unsteady flow measurement and analysis
- Flow simulation and fan noise prediction codes

- Active and passive noise control devices
- Low-noise fans

For more information, please visit the conference website: www.fannoise2007.org or direct your enquiries to: info@fannoise2007.org

UNITED KINGDOM

ISVR is Awarded the 2006 Queen's Anniversary Prize.

The 2006 Queen's Anniversary Prize for Higher and Further Education has been awarded to the Institute of Sound and Vibration Research, Southampton University. Professor Steve Elliot, ISVR Director and Vice Chancellor Bill Wakeham received the a medal and certificate in 2006 February from Her Majesty The Queen and HRH The Duke of Edinburgh.

The prize was awarded to the ISVR for sustained excellence and outstanding achievements in research in the field of sound and vibration.

More information is available from the web site of the Institute of Acoustics (www.ioa.org) and the Institute for Sound and Vibration Research (www.isvr.soton.ac.uk).

IOA Spring Conference Features Research and Careers

The Spring Conference of the Institute of Acoustics was held in Southampton on 2006 April 3-4, and was titled "Futures in Acoustics, Today's Research—Tomorrow's Careers." In addition to technical papers that included noise control and environmental acoustics, the conference featured a plenary session on career opportunities in acoustics. According to the Institute of Acoustics, "The demand for people with acoustical knowledge and skills has never been greater."

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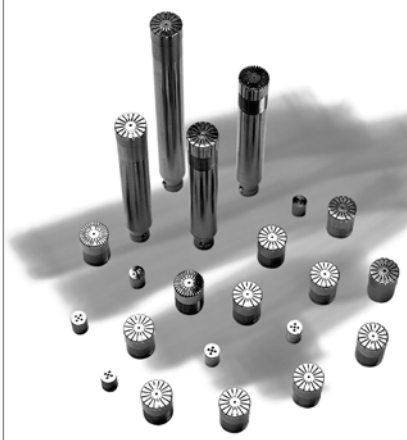

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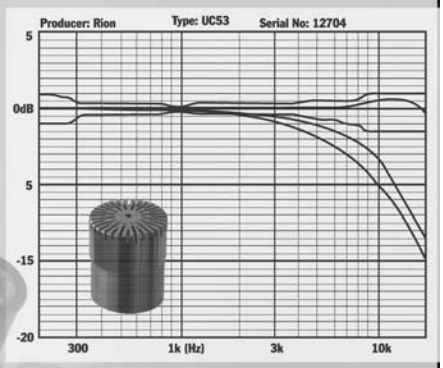

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INCE/USA Conference Proceedings on CD-ROM

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The NOISE-CON 05 Proceedings
This searchable CD-ROM contains 198 papers presented at the joint NOISE-CON 05/ASA 150th meeting as well as 749 papers from the NOISE-CON conferences held in 1996, 1997, 1998, 2000, 2001, 2003, and 2004 as well as the papers from the Sound Quality Symposia held in 1998 and 2002. All papers are PDF files.

Several papers are taken from sessions organized by the Noise, Architectural Acoustics and Structural Acoustics Technical committees for the 150th ASA meeting. The three plenary lectures related to noise and its impact on the environment are included. Also included are papers in one or more organized sessions in the areas of aircraft noise, tire/pavement noise, and hospital noise. Other papers cover to noise materials, mufflers and silencers, statistical energy analysis, acoustical facilities, product noise emissions, sound quality and perception, sound insulation of buildings, community noise, and environmental noise criteria. A collection of papers on United States and international noise policy is also included on the CD-ROM.

These papers are a valuable resource of information on noise control engineering that will be of interest to researchers in the academic community, government workers, engineers, acoustical consultants, and students.

The ACTIVE 04 Proceedings
This searchable CD-ROM contains 595 full length papers on active control of noise. The latest in the ACTIVE series of international symposia on active control of sound and vibration was organized by the NASA Langley Research Center, and was held in Williamsburg, Virginia, USA on 2004 September 20-22. One hundred and one papers from this meeting are on the CD-ROM. The remaining papers are from the ACTIVE Symposia held in 2002, 1999, 1997, and 1995; in addition, 33 papers from Book 2 on active control presented at NOISE-CON 97 have been included. The papers cover all areas of active control of sound and vibration.

www.atlasbooks.com/mktplace/00726.htm

Asia-Pacific News *continued from page 33*

acoustical directory, especially to get more awareness of what noise nuisance can cause in lesser developed countries. Maybe one day Thailand will have an acoustical association as well. You can check it out at www.acousticals.org.

The Beauty of Silence

The Thailand Cultural Environment Fund (CEF) and its partners are currently engaged in a six-month campaign and research project to address noise pollution in Thailand. Among the project's other objectives, the project team hopes it will provide a model for collaboration between the private sector, the government, and civil society. The campaign and research targets the general public and government agencies at all levels. The CEF is the lead organization and is joined in the campaign by the Business Council for Sustainable Development, Government Pollution Control Department, Bangkok Metropolitan Administration, Society of Environmental Journalists, Thailand Cycling Club and selected enterprises (e.g., shopping centers and hospitals). Internet: www.adb.org/NGOs/annex1013.asp

INCE Update *continued from page 37*

topic of discussion and concern with many members of both organizations. There has been some serious dialogue between the 2006-07 President of ASA, Anthony Atchley, and me regarding this topic. Areas that require a strong and continuous collaboration between the two organizations include: standards, meetings, noise policy, publications, and global leadership in the field of acoustic noise and its control. These and other areas are discussed in detail in an article presently being prepared for publication in both the *ASA magazine Acoustics Today*, and in *NNI*.

In summary, INCE/USA continues to make important contributions to the noise control engineering profession through its educational programs, conferences, publications, certification procedures, and participation in national and international programs. I wish to thank the officers, staff, members, and friends of INCE/USA for your support and encouragement during my one-year term as President of the Institute.

Gerald C. Lauchle
2005 INCE/USA President

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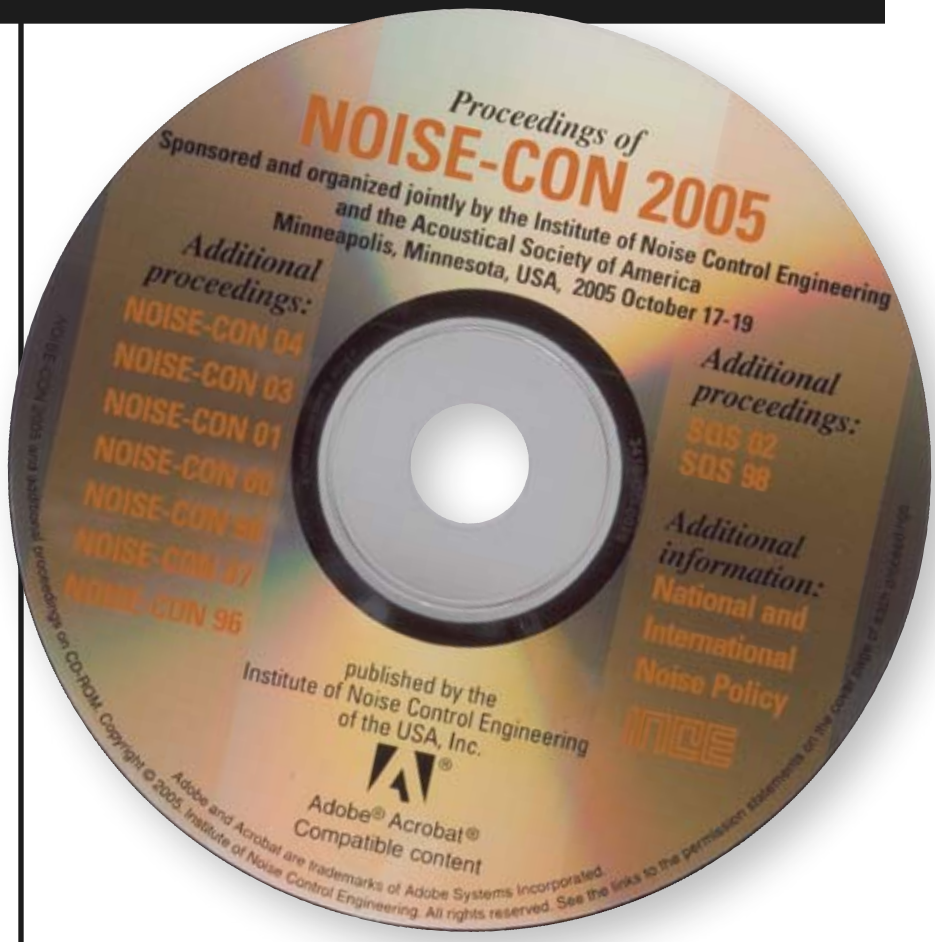

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RION

New 4-Channel Solid-State Data Recorder Available from Scantek

The RION DA-20 is a compact 4-channel data recorder that provides users a lightweight and high quality instrument to record various types of electronic signals and waveform data for sound and vibration on-site measurement. Transducers include constant current Electret condenser mics and single- and tri-axis accelerometers. The measurement data are stored on memory card (CF card) in WAV file and the stored data can be reproduced as analog signal or output to external signal analyzer. The CF card enables easy access to stored data download to PC, and the software DA-20 Viewer (supplied accessory) enables the time-history data display on PC or via WAV/CSV file output to PC. Optional software line-up is also available for waveform analysis.

For further information: http://www.rion.co.jp/asp/product/sound/ProC.asp?pos=I5&div=1

Scantek, Inc.

Instruments available from Scantek

Scantek, Inc., an ISO 17025 NIST accredited Calibration Laboratory, is a distributor for multiple sound and vibration lines, including Norsonic, RION, CESVA Acoustical Instrumentation, Castle Group, KCF Technologies, Metra Vibration Transducers, DataKustik, RTA Technologies, BSWA Transducers, EXTECH Instruments, and ROGA Instruments. Scantek is committed to providing quality sales, customer repair, service, and calibration of sound & vibration instrumentation.

For more information, call +1 800 224 3813 or visit www.scantekinc.com.

Larson Davis

Larson Davis Receives Additional ATEX Approvals for Spark® Personal Noise Dosimeters and Announces Data Logging Option

Larson Davis, a PCB Group Company, has announced that it has received European ATEX approvals (II 2 G, EEx ib IIB T4) for its Spark® dosimeters. The approval extends to all of the dosimeters in this product family: 703, 703+, 704, 705, 705+, 706, 706RC, which allows them to be used in hazardous surface locations for Industrial Hygiene and worker safety applications.

Larson Davis Spark® Dosimeters are said to combine ease-of-use and strength in a miniature, lightweight package. With seven intrinsically safe models available, Spark® provides days of operation on just two AA batteries, and has a windscreen that stays secured between calibrations. When used with Blaze® Noise Exposure Analysis software, personal noise dosimeter data can be converted into concise reports and full-color graphics.

Larson Davis provides a complete line of acoustic and vibration measurement systems, including dosimeters, sound level meters, preamplifiers, real-time analyzers, digital sensing systems, human vibration meters, microphones and calibrators for audiometric calibration, building acoustics, environmental noise monitoring, sound intensity, sound power testing in test and measurement, automotive, industrial, aerospace, and industrial hygiene applications.

Larson Davis has also announced the enhancement of the Soundtrack LxT™ to include a comprehensive time history data logging option.

The new Soundtrack LxT™ sound level meter offers what is said to be an innovative approach to sound measurement for compliance and worker noise exposure monitoring. Available in Type 1 or Type 2 versions, the SoundTrack™ provides an easy way to manage route or task-based workplace noise surveys. With operator route prompts and digital voice annotation, surveys are done quickly and easily by operators at all skill levels. Optional integrated real-time 1/1 and 1/3. Octave filter performs frequency band analysis instantly with no tedious 'step-through' required.

For more information, please contact Larson Davis toll-free at 888-258-3131, email sales@larsondavis.com, or visit www.larsondavis.com.

RION

Scantek

Larson Davis

LMS

The Modal Shop, Inc.

PCB Piezotronics, Inc.

LMS

Vibration Control System from LMS

LMS has introduced a new LMS Test.Lab Vibration Control solution, offering a 4 to 8 channel system for closed loop vibration control testing. The LMS Test. Lab Vibration Control system allows test engineers to qualify whether a product is fit for normal to extreme operating conditions, or to validate if the test item will survive rough transport conditions. The new solution supports endurance testing, online damage monitoring and trend analysis.

With the LMS Test.Lab Vibration Control system, test engineers can qualify the usage of their products under a wide variety of usage and transportation circumstances, and measure its performance over the expected lifetime. The new LMS Test.Lab Vibration Control system offers a complete solution to perform these vibration control tests and supports random, shock, sine and combined test modes. LMS Test. Lab Vibration Control also includes an integrated support of all common standards for vibration qualification testing, like the MIL STD 810, GAM EG-13 or IEC standards. The system offers a high degree of flexibility in setup definition to support non-standard specifications, allowing the use of more complex test profiles derived from field data using test tailoring. The system also supports safe, accurate and fast reproduction of the target reference spectra on a shaker installation, using 4 to 8 control channels.

LMS Test.Lab Vibration Control is said to be designed for maximum productivity, guiding the user through the complete test process from setup to final report. The native MS Windows software allows operators to automate very long duration tests with full security. The workflow-based user interface of LMS Test.Lab assists the user throughout the test. LMS Test.Lab guides him through the steps of defining the setup, validating the hardware instrumentation, productively monitoring the test execution and reporting the results.

The Modal Shop

The Modal Shop Offers An Accelerometer Linear Check Capability

The Modal Shop, Inc., a PCB Group Co., has introduced the addition of sensor linearity check capabilities to the Model 9155C Accelerometer Calibration Workstation.

The Model 9155C-501 Linearity option allows users to perform multipoint sensor linearity checks up to 40gpk using The Modal Shop's calibration-grade air-bearing shaker. Linearity checks can be performed up to an amplitude of 500gpk with a mechanical amplifier bar. Verifying linearity provides additional assurance of sensor health and performance, increasing confidence in measurement accuracy.

The software GUI automates data acquisition across specified amplitude range and integrates into The Modal Shop's Model 9155C Accelerometer Calibration Workstation that performs calibrations on both ICP® (IEPE) and charge mode accelerometers, providing both sensitivity and phase data. Calibrations are performed using the 'back-to-back' method according to ISO 16063-21. All sensor information and calibration data is managed within a Microsoft Access database that allows for customizable calibration reports conforming to the requirements of ISO 17025 for calibration certificates. The system also self-documents measurement uncertainty according to ISO 16063-21.

For more information on the Model 9155C Accelerometer Calibration Workstation or other sound and vibration sensor calibration products, contact THE MODAL SHOP, INC., 3149 E. Kemper Road Cincinnati, OH 45241-1516, Internet: www.modalshop.com, (800) 860-4867, (513) 351-9919, Fax (513) 458-2172 or e-mail: info@modalshop.com.

PCB

New Model 377A20 Random Incidence ½" ICPTM Microphone Offers Extended Frequency Range

The Vibration Division of PCB Piezotronics, Inc. (PCB®) introduces Model 377A20 prepolarized, 1/2"

Random Incidence (Diffuse Field) microphone, which operates from ICP® sensor power. The distinguishing feature of this model is its extended frequency range to 16 kHz (± 2dB). It has a sensitivity of 50 mV/Pa and a wide dynamic range (14.6 to 146 dB (A) re 20μPa). This microphone has a +150 °C (+302 °F) operating temperature range and coefficient for temperature of -0.001 dB/ °C.

This model is one of a full series of modern, pre-polarized, condenser microphones and preamplifiers available from PCB. Powered by a 2 to 20 mA signal conditioner and standard coaxial cables, these modern designs allow for significant savings in power supply and cabling cost, greater ease-of-use and operate from the same power required for ICP® accelerometers. This provides the advantage of using microphones with ICP® accelerometers in the same test, with the same signal conditioning equipment, minimizing set-up time.

Industrial Force/Process Monitoring Sensors

Piezoelectric sensors from the Force/Torque Division of PCB Piezotronics, Inc. (PCB®) utilize piezoelectric quartz sensing elements to measure dynamic and quasi-static forces on machinery structures. Piezoelectric sensors feature high rigidity and have no internal moving parts and thus are not susceptible to fatigue or sensitivity over millions of cycles. This makes them ideal for industrial process control and product quality assurance applications which require repetitive cycle measurement. In typical applications, upper and lower control limits are set to follow a desired force curve for the process; if the actual force curve deviates from the pre-set control limits, the process is shut down. This prevents acceptance of non-conforming parts as finished goods.

Applications include clinching, crimping, metal forming, plastic injection molding, pressing, punching, spot welding, stamping, and automatic assembly operations. PCB Series 208C General Purpose Force Sensors, Force Rings, Force Links, and Series M240 Strain Sensors are easy to install, and can be powered by any ICP® sensor signal conditioner.

New 16-Bit Rotary Torque Sensor for Machining Center Spindle Qualification Testing

TORKDISC® Rotary Torque Sensor System from the Force/Torque Division of PCB Piezotronics, Inc. (PCB®) is a compact in-line rotary torque sensor, ideally suited for spindle qualification testing of machining center and other torque measurement applications that require a robust torque transducer where axial space is at a premium. The torque sensor can aid in selecting proper spindle sizes by comparing rated power to actual torque delivered to cutting tools. The compact, low weight TORKDISC® features high torsional stiffness and low sensitivity to axial and thrust bending moments.

The TORKDISC® features a field-proven telemetry system that consists of an on-board electronic module that converts torque signals into a high-speed digital representation. Once in digital form, this data is transmitted to a non-contacting pick-up loop, with no risk of noise or data corruption. A remote receiver unit converts the digital data to a high-level analog output voltage, frequency output, and a serial digital output. The TORKDISC® Series offers capacities from 2,000 to 225,000 in-lb (226 to 25.4 k N-m) full-scale and maximum speeds to 15,000 RPM.

Other applications include dynamometer testing of gasoline and diesel engines, transmissions, transfer cases, and differentials and torque studies on pumps, fans and electric motors.

For information on all PCB products, contact Andrea Mohn, Marketing Coordinator, PCB Piezotronics, Inc., 3425 Walden Avenue, Depew, NY 14043-2495 USA. Telephone: +1 800 828-8840 X2216; Fax: (716) 684-0987; E-Mail: mktg@pcb.com; Internet: www.pcb.com

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USA ..... Graduate Program in Acoustics, The Pennsylvania State University, State College, Pennsylvania

Conference Calendar

Below is a list of congresses and conferences sponsored by International INCE and INCE/USA. A list of all known conferences related to noise can be found by going to the International INCE page on the Internet, www.i-ince.org.

2006 September 18-21

ACTIVE 2006

The 2006 International Symposium on Active Control of Sound and Vibration

Adelaide, Australia
Contact: ACTIVE 2006 Conference, School of Mechanical Engineering, The University of Adelaide, SA 5005 Australia
Internet: www.active2006.com

2006 December 03-06

INTER-NOISE 2006

The 2006 International Congress and Exposition on Noise Control Engineering

Honolulu, Hawaii, USA. Contact: Institute of Noise Control Engineering, INCE/USA Business Office, 210 Marston, Iowa State University, Ames, IA 50011-2153. Tel. +1 515 294 6142; Fax: +1 515 294 3528; e-mail: IBO@inceusa.org. Internet: http://www.inceusa.org.

2007 August 26-29

INTER-NOISE 2007

The 2007 International Congress and Exposition on Noise Control Engineering

Istanbul, Turkey.
Contact: Turkish Acoustical Society
Yeni Krizantem Sok. No 78
Ic Levent, 34330 Istanbul, Turkey
Tel: +90 212 279 95 22 • Fax: +90 212 264 65 07
E-mail: contact@internoise2007.org.tr
Internet: www.internoise2007.org.tr

2007 October 22-24

NOISE-CON 07, The 2007 National Conference on Noise Control Engineering

This conference will be held at the Grand Sierra Resort in Reno, Nevada. Contact: Institute of Noise Control Engineering, INCE/USA Business Office, 210 Marston, Iowa State University, Ames, IA 50011-2153. Tel. +1 515 294 6142; Fax: +1 515 294 3528; e-mail: IBO@inceusa.org. Internet: http://www.inceusa.org.

Directory of Noise Control Services

Information on listings in the Directory of Noise Control Services is available from the INCE/USA Business Office, 210 Marston, Iowa State University, Ames, IA 50011-2153; +1 515 294 6142; Fax: +1 515 294 3528; IBO@inceusa.org. The price is USD 400 for 4 insertions.

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