

# NOISE/NEWS

## INTERNATIONAL

Volume 11, Number 4  
2003 December

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

**ACTIVE 04**  
Announcement and  
Call for Papers

**NOISE-CON 03**  
Report

**INTER-NOISE 03**  
Report

**Leo Beranek Receives the  
National Medal of Science  
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**Member Society Profile**  
The New Zealand  
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# INTERNATIONAL

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# NOISE/NEWS

## INTERNATIONAL

*The printed version of Noise/News International (NNI) and its Internet supplement are published jointly by the International Institute of Noise Control Engineering (I-INCE) and the Institute of Noise Control Engineering of the USA (INCE/USA).*

### 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.noiseneewsinternational.net](http://www.noiseneewsinternational.net)

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- Abstracts of feature articles in the printed version
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- 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

## INCE/USA is Moving Forward with a New Vision

**F**irst, During NOISE-CON 2003, our officers and directors formulated a vision for INCE/USA that will guide us over the next decade. Overall, we want to be the “primary and premier noise control organization” in the nation. Our goals should be to organize “must attend conferences” and to publish “must read *Noise Control Engineering Journal* articles”. Specifically, our priorities will be on the following four concurrent activities:

- Conferences (such as NOISE-CON 2004) and specialty symposia (such as ACTIVE 2004)
- Publications (such as *Noise Control Engineering Journal* and *Noise/News International*)
- Board Certification (refer to the Directory for details)
- Membership services (such as discounts, INCE web site, electronic papers, etc.)

Second, we are taking step to ensure that *NNI* remains a premier magazine that is solely dedicated to covering contemporary noise control issues, policies and technology. Some elements of a long-term plan are being formulated. Essentially, we will end up producing a better and attractively styled *NNI*. Emphasis will be placed on themed or topical issues, wider circulation (via distribution at conferences and more mailings), and active participation by guest editors and well-known contributors. Another idea that has been proposed is the electronic version (via CD-ROM or web based) of *NNI* or its sub-set that can be efficiently and economical disseminated to many readers around the world. We expect to resolve these issues soon.

Third, we are trying to increase the number of the *NCEJ* articles in print. Concurrently, it is desirable to raise its profile within the noise, vibration and acoustics community as we would want *NCEJ* to be the first choice journal when the noise control researchers are looking to publish the latest results and methods. A strong emphasis on special issues is being placed as that would enhance its value to our members. Personally, I separate the special issues

of *NCEJ* and other journals from regular issues in my Laboratory! I envision about 50% of the articles would eventually be published via special issues on contemporary issues though we will continue to invite independent articles from authors. We will try to disseminate *NCEJ* content alerts (via email) as this should enhance the visibility of *NCEJ*. Yet, INCE could try to publish books based on such special issues and/or specialized set of papers sessions from conference proceedings, assuming fiscal constraints would not impede us.

Fourth, we have instituted some discounts for INCE/USA members and associates; a letter was sent to the membership in October 2003. For example, members will receive all CDs and books from Bookmasters at discounted prices. Additionally, the NOISE-CON 2004 registration fee for INCE members will be about \$50 less than the public registration. I strongly encourage you to attend such conferences, which are vital to our profession.

Fifth, I would like to inform our members and readers that INCE has been grooming future noise control practitioners by promoting student paper contests during conferences. Over the last 2 years, we have received over 30 outstanding papers, and we have given awards to over 10 students from across the nation. We are now making efforts to recognize outstanding undergraduate students who pursue noise control engineering as a part of their curriculum.

Finally, it has been my honor and privilege to serve as the 2003 President, and I would like to thank all of you for supporting INCE/USA and its activities. Please visit our web site <[www.inceusa.org](http://www.inceusa.org)> and contact me at <[president@inceusa.org](mailto:president@inceusa.org)> if there are any questions or suggestions on the two columns I have written this year. 



**Rajendra Singh**

2003 INCE/USA  
President

## The Future of Acoustics in Australia?



**Marion Burgess**

*Asia-Pacific Editor*

**L**ike most scientists and technologists, acousticians are generally more interested in completing the task at hand and are rather passive with regard to taking any political action. However a number of events which have the potential to affect acoustics in Australia in the long term have made 2003 a watershed for the Australian Acoustical Society and prompted action.

There have been a number of government agencies in Australia that have provided independent testing and research facilities. Over recent years these agencies have been squeezed as economic rationalism has required more income generating projects to offset research projects. However in early 2003 it became apparent that a crisis had arrived.

The National Acoustic Laboratories (NAL) was sold to a developer with a lease back arrangement for 5 years with an option on a further 5 years. NAL has achieved international reputation for its work on fundamental research in hearing. As well as offices and laboratories, the multi-million dollar anechoic and reverberant chambers were built to the highest technical standards, are unique in Australia and provide independent measurement facilities. They were intentionally located in a quiet bushland setting but this now makes the site valuable for residential development.

The National Measurement Laboratory (NML) has provided a standard calibration service. The proposed restructure and merger of this facility does not provide for any senior acoustical scientists at all within the new organization, or for any dedicated section devoted to acoustics or ultrasonics. As well as participation in ISO work, NML has been responsible for overseeing acoustical standards in the entire Southern Pacific region and has trained acoustical standards scientists and technicians from Taiwan, Singapore, Indonesia, and New Zealand.

Major building acoustic testing facilities within the government research organization in Sydney were closed. Similar older facilities in Melbourne are

under threat partly through a projected relocation and partly because of staff reductions to just a single technical officer and no research staff. Research staff from these facilities have played an important part in work on International and Australian standards. Their involvement on topics of particular interest to our tropical region, such as noise from intense rain on the roof, will now cease.

While some of this work is now being undertaken in Universities and by larger companies these rarely undertake longer term strategic research projects nor support ongoing participation in national and international standards and similar organizations. During 2003 the Australian Acoustical Society has begun to take actions to prevent any further erosion of the facilities and resources in Australia. The first step was to canvass representatives from key groups within the Society membership and develop a list of "Top Ten Issues" of concern. A number of the issues related to matters that could be dealt with by the Society. Those which related to political action were extracted from this list and a position paper on the "Future for Acoustics In Australia" was prepared (both these documents are available at [www.acoustics.asn.au](http://www.acoustics.asn.au)). Once this was endorsed by the Society it became the basis for action.

The Society is a member organization of the Federation of Australian Scientific and Technological Societies (FASTS). FASTS represents the interests of some 60,000 scientists and technologists in Australia and works to influence the formulation of science and technology policy to the economic, environmental and social benefit. One of the activities of FASTS is the annual Science Meets Parliament Day when scientists from around the country converge on the parliament in the national capital. As the Society now has a consensus on a number of issues it supported two representatives to participate in this event – Joe Wolfe and me. We joined over 250 scientists to spend a day of preparation and then a day in the corridors of parliament house. FASTS had arranged a schedule of meetings between the scientists and politicians plus other media launches and events, which kept us busy for the entire day. We both experienced

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somewhat similar reactions, and not unpredictable reactions, from the politicians during the interviews. Those politicians from the opposition party listened carefully and suggested follow up communications. Those from the current government tended to support the current policies and referred to economic rationalism.

This is just the start of political actions by the Society. We aim to try to work within the political system and not be too confrontational – attempts at mass rallies or similar would be unlikely to be successful as most of our membership is still too conventional. We do not believe we can reverse the recent closures but we do hope that we can prevent any further erosion of publicly funded acoustics facilities and research resources. I hope that I will have some successes to report in a year's time. 

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## The New Zealand Acoustical Society

The New Zealand Acoustical Society (NZAS) was organized in 1973 during the Third New Zealand Acoustics Symposium held at the University of Auckland on 1973 August 21-23. As early as 1966 during earlier symposia in Wellington (the national capital), there had been discussion concerning the formation of a national society, but it was not until 1973 that the New Zealand Acoustical Society was launched with Harold Marshall as its first president. The NZAS was formally incorporated as a professional society in 1982. It was decided in 1973 that the NZAS Conference would be held biannually and the venue would rotate between Auckland, Wellington and Christchurch, New Zealand's three principal cities. It was also decided to continue with the numbering system for the conferences. The 16th Biennial Conference was held in 2002.

During its 30 years of existence, the Society has enjoyed a significant growth in membership and stature. Branch meetings of the Society are now held in Auckland, Wellington and Christchurch bimonthly with invited presentations on topics of current acoustical interest. Since Auckland is the main population centre (one third of all New Zealanders live in this city), most of the Society's activities take place there. The Auckland branch meetings are held at the University, which is also the home of the Acoustics Research Centre. The Centre operates a national testing facility (for building materials' performance, equipment sound power measurements, etc.) and complements the Society's bimonthly meetings with seminars and a weekly "acoustical lunch club" where local acousticians meet to keep in touch and exchange ideas.

From its beginning, the members of the NZAS have been concerned with problems associated with noise and its control. Indeed, at the Third Conference, which witnessed the formation of the Society, all of the papers presented were concerned with some aspect of noise.

Members also have a keen interest in international acoustical events. In 1980, when the Tenth International Congress on Acoustics was held in Sydney, Australia on the other side of the Tasman Sea, a Satellite Conference was arranged in

Auckland (1980 July 19-20) on themes dealing with underwater acoustics (Ambient Noise in the Sea) and architectural acoustics (Acoustics of Educational Buildings). In 1998, the Society hosted INTER-NOISE 98 in Christchurch, a congress that was very well attended.

Members of the Society are very active in the development of national and international standards in acoustics. New Zealand is a participating member of IEC/TC29, ISO/TC43 and ISO/TC43/SC1, hosting the IEC/TC29 plenary meeting in Rotorua (1991). New Zealanders are actively participating in IEC working groups on electroacoustic instrumentation and ISO working groups on acoustical measurements. Of particular interest: New Zealand's Airport Noise Management Standard NZS 6805:1992, with its use of the "Airnoise Boundary" concept based on sound exposure in "pasques", has influenced international trends in aircraft noise control. Also of interest are two documents, 6801:1999, Acoustics—Measurement of Environmental Sound and 6802:1999, Acoustics—Measurement of Environmental Noise.

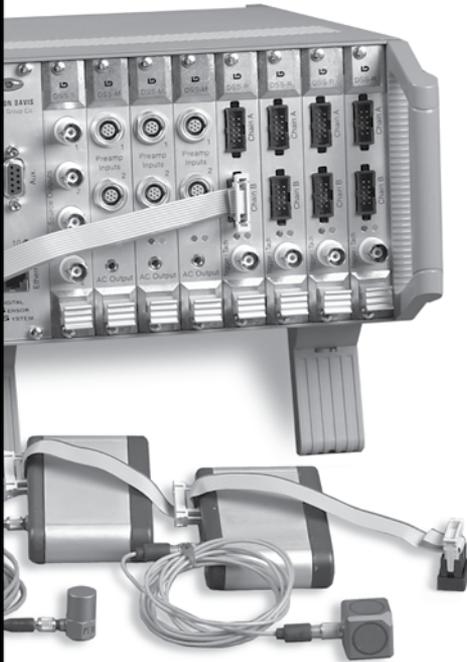
Since 1988, the Society has produced its own quarterly publication, *New Zealand Acoustics*, which serves as a medium for the exchange of news and views and promotes the sense of being part of the Society, particularly for those members who cannot attend branch meetings. Each issue contains at least one original research paper, together with local news, events and information on people and products.

The New Zealand Acoustical Society is geographically the most remote of the acoustical societies of the world. Through its quarterly publication, bimonthly branch meetings and biannual conferences, the Society serves as the unifying force for New Zealanders interested in acoustics and noise control. For more information, visit the Society's web site, [www.nzas.auckland.ac.nz](http://www.nzas.auckland.ac.nz). 

*This is the 44th in a series of articles on the Member Societies of International INCE. This is an update of the profile that appeared in the 1995 March issue of this magazine.—Ed.*

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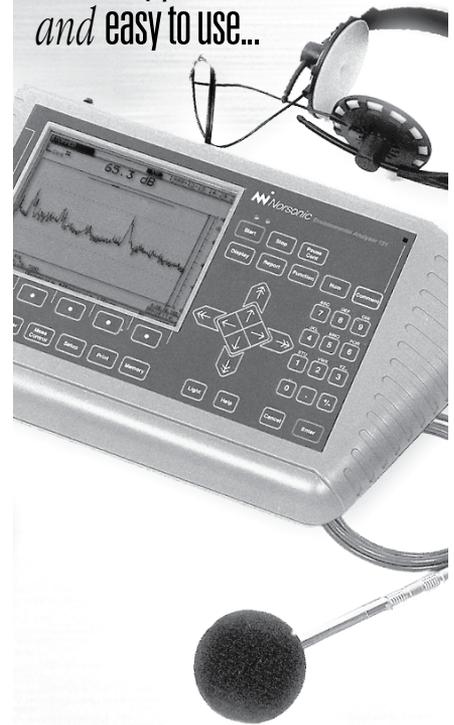
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For individuals who become new members or associates of INCE/USA in 2004, there is a reduced membership fee. See the membership application on pages 145-146 of this issue.

# ACTIVE 04

## THE 2004 INTERNATIONAL SYMPOSIUM ON ACTIVE CONTROL OF SOUND AND VIBRATION

Williamsburg, Virginia, USA

2004 September 20-22

### ANNOUNCEMENT AND CALL FOR PAPERS

#### General Information

ACTIVE 04, The 2004 International Symposium on Active Control of Sound and Vibration, is being organized by the NASA Langley Research Center, and is being sponsored by the Institute of Noise Control Engineering of the USA. The Symposium will be held on 2004 September 20-22 at the Williamsburg Hospitality House, which is surrounded by the eighteenth century elegance of historic Williamsburg, Virginia, USA. Plans call for 3 days of technical presentations with one or two plenary speakers on each day reviewing topics of special relevance.

The Symposium is a continuation of the biannually-organized meetings on Recent Advances in Active Control of Sound and Vibration which were held at the Virginia Polytechnic Institute in Blacksburg, Virginia, USA in 1991 and 1993, the International Symposium on Active Control of Sound and Vibration which was held in 1991 in Tokyo, Japan, ACTIVE 95 which was held in Newport Beach, California, USA in 1995, ACTIVE 97 which was held in Budapest, Hungary in 1997, ACTIVE 99 which was held in Fort Lauderdale, Florida, USA in 1999, and ACTIVE 02 which was held in Southampton, United Kingdom, in 2002.

Richard J. Silcox of the NASA Langley Research Center will be the general chair for the Symposium. Gary P. Gibbs, also of the NASA Langley Research Center will be the chair of the technical program. Randolph H. Cabell and George C. Maling, Jr. will serve as editors of the Symposium Proceedings. It is expected that approximately 150 technical papers will be presented covering all aspects of active control, including noise and vibration, sound fields in enclosures and other spaces, and "smart" materials.

## Objectives of the Symposium

The objectives of ACTIVE

04 are to review the current research and application areas in the active control of sound and vibration and to highlight future directions for this technology. Papers are invited in any area of active sound or vibration control including but not limited to:

- Active Control of Sound in Vehicles
- Active Control of Outdoor Sound
- Active Control of Architectural Acoustics
- Active Control of Audio Environments
- Active Structural Acoustic Control
- Semi-Active (Adaptive) Control
- Active Vibration Control
- Active Vibration Isolation
- Feedforward Control
- Feedback Control
- Hardware for Active Control
- Transducers for Active Control
- Smart Materials and Structures
- Active/Passive Systems
- Commercial Applications of Active Control

## Venue

Williamsburg, Virginia is not only one of America's major conference destinations, but is also a very popular tourist attraction. The symposium hotel is the Williamsburg Hospitality House, a 295-room hotel that features excellent conference facilities and modern guest rooms furnished in 18th century style. The hotel is within easy walking distance of the shops and restaurants in Merchant's Square, and the Duke of Gloucester Street—the main street through the historic area of Colonial Williamsburg. Visitors can walk freely through the district and enjoy food and drink in colonial-style taverns, or can purchase tickets at the Visitors Center for entry into the various historic buildings that line the streets in the area.

Williamsburg is also a major shopping destination with many small shops and outlet stores available to visitors.

Together, Jamestown, Yorktown, and Williamsburg form the Historic Triangle, and are connected by the Colonial Parkway system. Jamestown offers an indoor museum and outdoor displays related to the site of the first permanent English colony established in America in 1607. Visitors to Yorktown can tour the Revolutionary War battlefield where the American Revolution ended. Symposium attendees can reach Williamsburg through the Newport News/Williamsburg International Airport (PHF) about 20 minutes away, or through either the larger Norfolk International Airport (ORF) or Richmond International Airport (RIC), both about 50 minutes away. Limousine service and rental cars are available at each airport. Amtrak service is also available to Williamsburg; the train station is about two blocks from the hotel. Williamsburg is about 120 miles from Washington, D.C., and is 28 miles from Hampton, Virginia, home of the NASA Langley Research Center.

## Reply Coupon

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If so, the title of my session could be \_\_\_\_\_

# ACTIVE 04

## Contributions Invited

Technical papers in all areas related to the active control of sound and vibration are welcome. A list of principal topics is on the previous page of this announcement. Abstracts should be submitted in the format enclosed with this announcement. The deadline for receipt of abstracts for ACTIVE 04 is 2004 April 26. All ACTIVE 04 abstracts should be sent to the Administrative Secretariat; the address is in the "Administrative Secretariat" and "Invitation to Submit Abstracts" portions of this announcement. The abstracts of accepted papers will be published in a booklet available at final registration.

Papers submitted for presentation at ACTIVE 04 must be of full length (8-12 pages). Instructions for preparation of the paper will be provided when the abstract is accepted by the technical program committee.

Manuscripts for publication in the symposium proceedings are due on 2004 July 02. Papers will be available on a CD-ROM at final registration. It is planned that this CD will also include the papers presented at ACTIVE 95, ACTIVE 97, ACTIVE 99, and ACTIVE 02.

## Invitation to Submit Abstracts

**Abstract Due Date:**  
**2004 April 26**

**Address for  
Abstract Submission:**  
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### **PAPER TITLE BOLD UPPER CASE LETTERS**

(20 words maximum)

First author's name, address, telephone number, Fax, and e-mail for correspondence  
Additional authors' names and addresses (if any)

**Text of the Abstract:** An abstract of not more than 200 words is required for each paper, whether invited or contributed. Abstracts longer than 200 words will be edited or truncated. For abstracts submitted by postal mail, the text of the abstract should be double spaced. The abstract should include

- (1) a brief description of the problem being addressed,
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# NOISE-CON 2003: Report

NOISE-CON 03, the 2003 National Conference on Noise Control Engineering was opened by INCE/USA president Rajendra Singh on the morning of June 23 in Cleveland, Ohio. Professor Singh pointed out that this is the second NOISE-CON meeting to be held

in Ohio, the first being NOISE-CON 85, which was held on the campus of the Ohio State University in Columbus in 1985.

He reviewed the major activities of INCE/USA—publications, conferences, board certification of members, and membership in the Institute. He introduced Beth Cooper from the

NASA Glenn Research Center and general chair of NOISE-CON 03 who pointed out that, unlike previous NOISE-CON conferences, the 2003 conference does not have a theme. Her objectives, she said, have been to broaden the interests of noise control engineers by placing some emphasis on hearing conservation, to merge the noise interests of NASA with those of INCE/USA, and to encourage registrants to attend sessions that they might not normally attend. If these objectives are met, she said, attendees may view the theme of the conference as *New Perspectives in Noise Control*.

She thanked all of those who contributed to the organization of the meeting, individuals at NASA who have been greatly supportive of the conference, and the team at the Iowa State University that organized the meeting. She gave special thanks to several sponsors: *Sound & Vibration* magazine, which assisted with publicity, ACO Pacific and Quest Technologies, which provided support for the CD-ROM of the conference proceedings, National Instruments, which provided bus transportation—both for the NASA tour and

the reception at the Rock and Roll Hall of Fame—and the Eckel Corporation, which provided special binders for conference materials.

She then introduced Richard Williams, Chief Medical Officer at NASA Headquarters who said that NASA is very much interested in noise because it has an impact on the agency's basic mission, which is to

- improve life here,
- extend life to there, and
- to find life beyond.

He pointed out that the medical care for some 17,000 NASA employees as well as the astronaut program is needed to protect individuals in many different environments—under water, on the ground, and through the air into space. He then reviewed some of the key issues—microgravity, radiation, and confinement. Noise, he said, has long been recognized as insidious and debilitating, and that, four years ago, NASA included noise as one of the top issues to be addressed.

He brought greetings to the attendees from Julian Earls, Deputy Director of the NASA Glenn Research Center who was unable to be present at the opening plenary.

Beth Cooper then introduced Col. John Allen, a U.S. Air Force audiologist who holds a Ph.D in both audiology and bioacoustics. He is currently detailed to NASA, and has had a major influence on the acoustics of the International Space Station (ISS). In his presentation, titled "Noise from the Earth to the Stars—Propagation, Impact, Control, and Unknowns, he began by giving the audience the feeling that space flight is very quiet, but quickly pointed out that this is not the case. He divided his presentation

into three parts—the NASA industrial complex, terrestrial noise, and space-



*Col. John Allen presents the first NOISE-CON 03 plenary speech.*

*INCE/USA president Rajendra Singh opens NOISE-CON 03.*



*Beth Cooper (left) of the NASA Glenn Research Center welcomes the delegates and explains the objectives of NOISE-CON 03.*

*Richard Williams (right) explains NASA'S interest in noise to the NOISE-CON 03 delegates.*

based noise. An important message was imparted to the audience: "Fix our problems...please!"

In discussing the early history of aviation, he began with some of the noise problems encountered by World War II pilots. He said that audiologists could tell from audiograms what kind of airplane the pilots had generally flown—noise induced hearing loss having recognizable characteristics. He pointed out that, with all of the advances in aircraft design, designers frequently forget about the people. Emphasis was on getting the airplane off the ground, and not about noise. Vibration, he said, was frequently more important than noise. Many of the early test pilots were "cowboys" who cared only about pushing the aviation envelope, and not about noise—except in so far as it affected communication with the ground.

All NASA sites, he said, are part of the "industrial complex," and all have noise issues. He then gave a brief description of the missions of NASA sites—the Kennedy Space Flight Center, Ames, the Jet Propulsion Laboratory, the Langley Research Center, the Glenn Research Center, and the Goddard Space Flight Center. Health and safety, he said, is a big issue at NASA headquarters, and noise is one of the concerns. He said that many of the early production facilities and run-up facilities were designed with no concern for noise, but today that is not the case.

In relation to terrestrial noise, he described the tremendous sense of power one gets while watching a shuttle launch, and said that for a brief period of time (eight minutes from ground to orbit), the crew can be exposed to sound pressure levels as high as 120-125 dB. Exterior levels 600 feet from the launch site, he said, can be 150 dB. Three miles away, levels can be 115 dB, and 10 miles away 105 dB.

Once the vehicle is in orbit, levels, he said, are in the range 60-70 dB.

Levels in the International Space Station, he said, are in the range 60-70 dB, which may not be a hazard, but is continuous and may affect safety, on-board communications, and activities outside the Station. For long duration missions, there can be additional problems such as interference with sleep. He then presented a video tour through the ISS that demonstrated noise levels in the various compartments.

He discussed some of the medical impacts of long-term exposure to noise, and pointed out some of the common problems such as face-to-face communications and warning signals. One complication, he said is the international nature of the ISS.

He then turned to some general design issues, and said that although it is a big challenge to engineer noise out of equipment, the costs not to do so are very high, and used VA costs as an example. He emphasized the importance of noise- and vibration-free mechanisms, enhanced acoustical treatment, and improved communication systems.

He discussed metrics that can be used to determine success or failure to solve noise problems. Success is good results from assessment of hearing acuity and low communications errors. In the long term, having astronauts wearing hearing aids, and complaints from "significant others" are signs of failure!

He emphasized that NASA needs assistance in solving its noise problems so that the outcome measures described above mean that the agency has succeeded in its mission to control noise exposure.

Following the opening plenary, four parallel sessions were held for the remainder of the day. There were three sessions on ISS acoustics, three devoted to a workshop on power plant noise control, two on classroom acoustics, and single sessions on product noise control, active control, standards, and architectural noise control.

Late in the afternoon, a reception was held to mark the opening of the equipment exposition—well managed by Richard J. Peppin. More than 35 companies exhibited a very wide variety of equipment, including instruments for measurement of noise, noise control facilities, products for control of noise and vibration, and software for prediction of noise levels.

At the second plenary session held on Tuesday morning, June 24, an INCE/USA awards ceremony was held. The winners of the student paper prize competition were announced, and each student came forward to be recognized for his accomplishment. This portion of the ceremony is covered in the INCE Update Department elsewhere in this issue of NNI. A highlight of the ceremony was the presentation of the INCE/USA Distinguished Noise Control



*Professor Robert J. Bernhard, left, receives the INCE/USA Distinguished Noise Control Engineer award from INCE/USA president Rajendra Singh. Professor Bernhard's wife, Debbi, center, looks on.*

Engineer Award to Robert J. Bernhard, director of the Ray W. Herrick Laboratories at Purdue University. The award recognizes individuals who have rendered conspicuous and consistently outstanding service to the Institute and to the field of noise control engineering over a sustained period. Professor Bernhard was cited *"For contributions to numerical, experimental, and active methods in noise control, and for exemplary service to noise control education and to INCE."* The award consists of a certificate and an engraved silver Revere Bowl.

The award was previously given to Leo L. Beranek in 1997, George C. Maling, Jr. in 2001, and to William W. Lang in 2002.

The second plenary lecture followed the awards ceremony. The presentation was by William J. Murphy and John R. Franks from the National Institute for Occupational Safety and Health (NIOSH). Commander Murphy, a physicist from the NIOSH Engineering and Physical Hazards Branch, Hearing Loss Prevention Program, presented the paper, which was titled "How loud is that leaf blower in the window?"

*Commander William J. Murphy delivers the second plenary speech at NOISE-CON 03.*



Using a leaf blower as an example, his key point was that it is not possible for a consumer to know how loud the device is—since there is no noise label. We should all care about this situation, he said, but there is no labeling or inspection by the Occupational Safety and Health Administration (OSHA) and no longer any EPA labeling program. With some 10 million persons having noise induced hearing loss, noise, he said, is the most common occupational hazard. He urged attendees to develop quieter products, to purchase quiet products, to use hearing protection when necessary, to educate the public, and to join with other organizations in partnerships to promote the development of quiet products and hearing conservation.

One concern, he said, that NIOSH is targeting is hearing loss and tinnitus in carpenters, who make up a large fraction of noise-exposed workers. Engineering noise controls, he said, should be right up front with a hearing damage criterion of 85 dB for 8 hours.

He then turned to hearing protectors, especially fit and risk factors. He reviewed the effect of the Noise Control Act of 1972, which led to specifications—occasionally enforced—on hearing protector performance. While these requirements are still in force, he said, new rating labels are required.

He then returned to problems with leaf blowers, both levels required to control annoyance and levels at the operator's position. He discussed the role of the Outdoor Power Equipment Institute, but said that if there are city and state ordinances to control these levels, manufacturers will build according to the requirements.

Parallel sessions followed the plenary for the remainder of the day. The power plant noise workshop continued, and a variety of other topics were covered—including industrial and information technology noise control, vibroacoustics, mining noise, transportation noise, and tire noise.

On Tuesday afternoon, a tour of the NASA Glenn Acoustics Facilities. Approximately 85 attendees saw the Acoustical Testing Laboratory, the Aeroacoustic Propulsion Laboratory, and the Low Speed Wind Tunnel.

On Tuesday evening, a reception was held in the Rock and Roll Hall of Fame—a short distance from the conference hotel, which was the Cleveland Renaissance Hotel, an upscale Marriott brand.



*From left to right: Jerry Lauchle reviews INCE/USA technical activities; David Holger reviews the publication of NCEJ; Paul Schomer reviews INCE/USA operations in general; Joseph Cuschieri discusses the future of INCE/USA; Courtney Burroughs explains future INCE/USA activities in electronic publications.*

The first item on the agenda for the Wednesday morning plenary was a short INCE/USA business session. President Rajendra Singh presided, and introduced speakers leading INCE/USA activities. The speakers were Jerry Lauchle, VP for technical activities, David Holger, editor-in-chief of *Noise Control Engineering Journal*, George Maling, managing editor of this magazine, Paul Schomer, INCE executive director, Joe Cuschieri, INCE president-elect, and Courtney Burroughs—responsible for special electronic publications.

Then followed a multi-media presentation by Kurt Yankaskas of the Naval Sea Systems Command. He discussed a wide variety of naval noise sources—with the common theme that excessive noise can degrade performance. He showed that hearing-impaired persons can take longer to perform specific tasks than non-hearing-impaired persons, and explained one disaster—a collision—caused by poor communications. He discussed, and illustrated by audio samples, various noise levels on aircraft carriers, in the cockpit of an F15, and in other naval vehicles.



*Kurt Yankaskas presents the final plenary speech at NOISE-CON 03.*

He then returned to the hearing conservation theme and pointed out that there are very significant threshold shifts in all of the armed services. He said that the projected cost of hearing impairment is 12 billion U.S. dollars over a 30-year retirement period.

He called for an engineering evaluation of ear plugs and the degradation of hearing as well as a review of standards for noise control.

He then turned to specific noise sources—such as the modeling of noise on the deck of aircraft carriers, the need for design of quiet propellers, reduction of ventilating noise, design of mufflers, pump noise, and other sources.

*“...hearing protective equipment used today is of an old design... new designs with active noise control should be effective—at least at low frequencies.”*

He said that much of the hearing protective equipment used today is of an old design, and said that new designs with active noise control should be effective—at least at low frequencies. Flight deck noise levels, he said, are too high for active control to be effective. He concluded by saying that there will be a great refit opportunity as the fleet returns to the USA.

There were 270 registrants at the meeting, and more than 100 exhibitor personnel. There were 126 papers presented—including more than 30 papers presented by NASA-associated authors.

There were two post-conference seminars, which were both well attended by the NASA community and others. The seminars were on Controlling Noise Emission (low-noise design) and Aeroacoustics.

The papers are on the CD-ROM prepared for the meeting, which also contains the NOISE-CON proceedings for 1996, 1997, 1998, 2000, and 2001. Also included are the papers presented at the Sound Quality Symposium, which followed NOISE-CON 98 in Ypsilanti, Michigan. The CD-ROM is available from Bookmasters, Inc. for 70 USD plus 2 USD (in the USA) or 5 USD (other countries) for shipping and handling. Shipped by first class mail in the USA and by air mail to other countries. To purchase the CD-ROM over the Internet, go to [www.atlasbooks.com/marktplc/00726.htm](http://www.atlasbooks.com/marktplc/00726.htm). Mail orders should be sent to Bookmasters, Inc., Distribution Services Division, 30 Amberwood Parkway, Ashland, OH 44805, USA. 

# INTER-NOISE 2003: Report

*The thundering sound of a Korean drum provided a dramatic opening to the 2003 INTER-NOISE Congress—held on 2003 August 25-28 at the International Convention Center Jeju on Jeju Island, Korea. Jeju is the largest island in Korea, and is located in the Pacific Ocean just off the southwestern tip of the Korean peninsula. It is a mountainous volcanic island with spectacular views of the coastline and inland terrain.*

## inter.noise



*A performance on a Korean drum opens INTER-NOISE 03.*



*Secretary General Jeong-Guon Ih offers practical advice on the INTER-NOISE Congress.*

General Secretary Jeong-Guon Ih, made a few remarks at the opening session and then introduced the Congress President, Hee Joon Eun who welcomed delegates on behalf of the INTER-NOISE 03 organizing committee. Then followed the official opening of the congress by International INCE president Tor Kihlman. There were two co-presidents of the congress, Young-Pil Park, president of the Korean Society for Noise and Vibration Engineering, and Chun-Duck Kim, president of the Acoustical Society of Korea who also

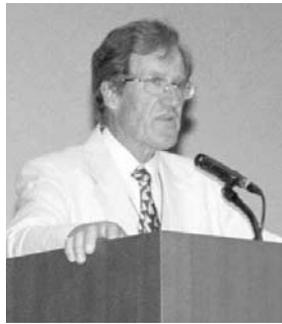
welcomed the delegates on behalf of their professional societies. Local greetings were also brought by a representative of the provincial government.

In addition to the congress opening with a Korean drum, delegates were well entertained by a musical performance on a traditional Korean stringed instrument. The session was very well balanced with practical information on the activities to take place during the congress, introductory remarks, and Korean cultural elements.



*Jang Moo Lee presents the opening keynote address.*

Jang Moo Lee, a professor at Seoul National University presented the keynote lecture, which was titled “Analysis of structure-borne sound of various systems.” The purpose of his lecture was to give some examples of structure-borne sound radiation, and to compare some very old structures to modern structures. Using the principles of cavity resonance, he showed that the generation of sound in a 1300-year



*From left to right: Congress President Hee Joon Eun welcomes the delegates; International INCE President Tor Kihlman describes I-INCE activities and opens the congress; Young-Pil Park, President of the Korean Society for Noise and Vibration Engineering, brings greetings from KSNVE; Chun-Duck Kim, President of the Korean Acoustical Society brings greetings from ASK; A local government representative welcomes delegates to Jeju Island.*

old Korean bell is similar to the generation of sound in a passenger vehicle with a trunk. He went on to discuss the acoustical characteristics of bells—comparing the sound of a Korean bell with the Liberty Bell—and discussed the shapes of bells from Korea, China, and Japan. He presented some principles of bell design and modeling—for example modeling a bell as a variable-thickness cylinder. He returned to more modern problems such as the radiation of structure-borne sound into a vehicle interior. He emphasized structural and acoustical coupling, and presented a study of the effect of an air gap between the roof and headliner of a vehicle, which can be used to reduce sound levels. He also discussed the treatment of a passenger car compartment and trunk as a coupled system—treating the car and trunk as separate cavities. He completed his lecture with a discussion of active control of a car floor to reduce sound levels and an analysis of the squeal of disk brakes.

Following the opening session, a welcome reception for all delegates was held in the Sunken Garden of the ICC Jeju Convention Center. Unfortunately, the weather did not cooperate for the planned outdoor reception.



*Michael Vorländer presents the second keynote address.*

The following morning, Michael Vorländer, a professor at Aachen University in Germany presented the second plenary lecture titled “Auralization in noise control.” One key question in noise control, he said, is how to interpret the results of an acoustical analysis. For example, single-number ratings can be misleading and two sounds may have the same one-third octave band spectrum, but may sound quite different. Auralization, he said, is a tool for making judgments by listening to sounds created by a source and a filtering system, which may be quite complex. Although the basic analysis tool is convolution, signals have many dimensions (loudness, etc.), and decisions must be made as what is important. He turned to the problem of

source/transmission path interactions, and then to various analysis methods—finite element modeling, boundary element modeling and statistical energy analysis—and how they affect the choice of a filter to model system performance. He gave examples of auralization in room acoustics and factory noise.

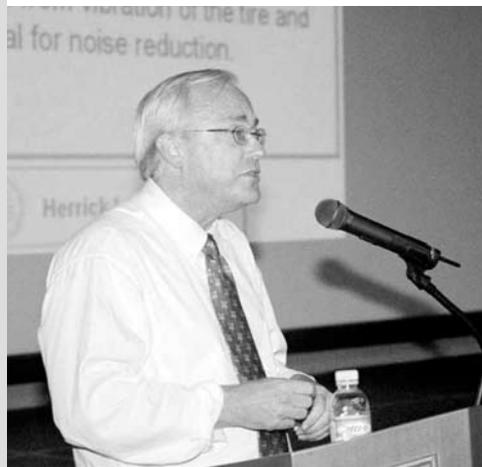
He discussed the tapping machine as a source of impact sound and the need to determine both the impedance of the source and the impedance of the floor in order to make a realistic model for auralization studies, and presented preliminary results. He then turned to binaural transfer path synthesis where both an airborne path and a vibration path may exist, and gave studies of washing machines and vehicle noise as examples. In closing, he suggested that auralization could be added to visualization for marketing and other purposes.

## INTER-NOISE 2003 Exposition

The exposition was managed by Duck-Joo Lee from the Korea Advanced Institute of Science and Technology. The booths were well-placed in a central area of the conference center. Thirty-six exhibitors from 10 countries participated in the exposition, and occupied 48 exhibit booths. Companies participating were:

- 01dB Acoustics and Vibration-Metavib Technologies, France
- ABC Trading, Korea
- Acoustics Group, Korea Institute of Machinery and Materials, Korea
- ATES, Korea
- AVT Co., Ltd., Korea
- Beijing ShengWang Acoustic-Electric (BSWA)Technology Co., Ltd., China
- Brüel & Kjær, Denmark
- Center for Information Storage Device (CISD), Korea
- DataKustik GmbH, Germany
- Degussa Röhm Plexiglas, Germany
- DICESVA S.L., Spain
- ESI Group & Vibro-Acoustic Sciences, Inc., France
- Face Trading Company, Ltd., Korea
- G.R.A.S. Sound & Vibration, Denmark
- Hanglas, Korea
- HanKook AAC, Korea
- imc Messysteme GmbH, Germany
- Larson Davis Inc., A PCB Group Company, USA
- LMS Korea, Korea
- MSC Software, Korea
- MTS Systems Corporation, Korea
- Müller-BBM Vibroakustik Systeme, Germany
- Namyang Novitech Co., Ltd., Korea
- National Instruments, Korea
- Norsonic AS, Norway
- Center for Noise and Vibration Control (NOVIC), KAIST, Korea
- OROS, France
- Rion Co., Ltd., Japan
- Sekisui Korea Co., Ltd., Korea
- SEVIT TECH, Korea
- Sony Precision Technology, Inc., KTM Engineering, Inc., Japan
- SoundPlan, USA
- Sunil Measuring System Co., Ltd., Korea
- SVANTEK, Poland
- TaeJong Development CO, Ltd & Nittobo, Japan
- WooJoo Hi-Tech Corp, Korea

## INTER-NOISE 2003: Report *continued*



*Stuart Bolton (top) presents the third keynote address; Young-Pil Park (center) presents the fourth keynote address; Paul R. White (bottom) presents the fifth keynote address*

Professor Stuart Bolton of Purdue University, USA gave the third plenary speech titled "The reduction of tire/road interaction noise."

Professor Yong-Pil Pak of Yonsei University, Korea gave the fourth plenary presentation titled "Noise and Vibration in Information Processing Devices." He gave examples of various noise sources in information processing—such as paper feed mechanisms, printers, scanners, hard drives and optical drives, and reviewed some of the things people say about computer noise. Manufacturers, he said, are forced to reduce noise and vibration from their equipment not only because of its effect on users, but because the noise and vibration may affect the operation of the mechanism itself. He identified fan noise as the main source of noise from computers, but then turned to hard disks and optical disks as important sources of noise—not only in computers, but in many other pieces of equipment such as home electronics and communications equipment. The tendency to make this equipment smaller and smaller, he said, causes problems with key dimensions well below that of the diameter of a human hair. There are also benefits, he said, such as recording densities up by a factor of  $10^4$  while prices drop by a factor of  $10^3$ .

He then discussed analysis techniques such as sound power determination, scanning systems using sound intensity, vibration measurements using accelerometers and laser doppler vibrometers, and methods for measuring sound absorption (2-microphone method). He illustrated how sound intensity maps can be used to identify ball bearing defects in hard drives—with 5-8 dB noise reductions after control measures are introduced. He said that air flow turbulence can affect the performance of hard drives and optical drives. He discussed spindle system design and



*INTER-NOISE 03 delegates are entertained by a performance on a traditional Korean stringed instrument.*

touched briefly on smart spindle systems, smart isolation mounts, and piezoelectric shunts. He concluded by saying that it is very important to pay attention to noise and vibration in information processing systems not only because of annoyance to users, but because of important performance issues.

Paul White of Southampton University, UK gave the fifth keynote speech titled "Non-stationary and non-linear signal processing." Traditional signal processing techniques, he said, depend on classical assumptions such as linearity, and stationary gaussian signals, but that modern digital signal processing techniques can remove the need for such assumptions. All real systems are non-linear, non-stationary, and non-gaussian, although the classical assumptions may be a good approximation to the real situation. He discussed complicated signals such as speech in connection with time-frequency analysis, and various models which are non-linear where filter coefficients may vary with time. He also discussed some parametric models, and their application with respect to helicopter gearbox monitoring, and finally Volterra models for weakly non-linear systems.

Professor Toshio Sone from Akita Prefectural University, Japan gave the sixth keynote speech titled "Environmental noise and personal noise exposure." He discussed the results of several surveys taken in Japan—objective surveys to determine noise exposure in terms of 24-hour A-weighted equivalent levels and subjective



*Toshio Sone presents the sixth keynote address.*

surveys to determine the reaction of individuals to various sound levels and types of sound. The results include the noise exposure of workers in various occupations as well as the noise exposure as a function of the tasks performed and noise exposure as a function of means of commuting to work. The noise exposure of housewives was also studied. Then, the response of workers and residents to their acoustical environment was studied. A large fraction of the respondents were annoyed by traffic noise, and about the same fraction (60%) were just generally annoyed by environmental noise of no particular origin.

Professor Wen Bangchun from Northeast University, China gave the seventh keynote speech titled "The progress of noise control in China." He predicted that 200 billion Yuan (about 8.2 billion U.S. dollars) is needed for control of noise in China. He said that legislation for noise control is now progressing rapidly, and that two of the "hot points" are the development of monitoring equipment and instrumentation as well as the application of new materials and structures for noise control. There are now standards in place for vehicle noise, noise around airports, and factory noise, so, he said, the basis for noise control in cities has been established. Because China is now a member of the World Trade Organization, he said, the country must get into the international track and be concerned with both product quality and environmental protection in factories.

Transportation noise, he said, is a very serious problem in China, and a "hot point" for control of vehicle noise is the design of lightweight barriers—for road vehicles as well as rail vehicles. He gave some examples of noise barriers in Chinese cities, and said that a standard for noise barrier design would soon be published.

He discussed other serious noise problems, including subway stations and ventilating



*Wen Bangchun presents the seventh keynote address.*

# 2003

towers, and noise from elevated trains. The latter, he said, would benefit from such technologies as floating structures, acoustical materials, barriers, and damping materials. Aircraft noise is also a serious problem in China, he said, and consideration is being given to a “polluter pays” system, which will force airlines to discontinue the use of noisy airplanes.

He recognized that noise control is required in the early stages of a design because application of techniques late in the cycle is difficult and expensive. There is, he said, a Chinese instrumentation industry, but that the equipment is not as sophisticated as that available on the international market. He said that there are noise control programs in 400 factories, and that there are 10 standards in place for measurement and assessment of facilities, but that there are still disparities relative to progress on the international level, and that facilities must be improved.

He said that there is work in China on sound absorptive materials such as micro-hole perforated plates, aluminum fiber materials, perforated plates and bonded fabrics—and work on vibration isolating materials.

The trend, he said, is for noise pollution to become the biggest environmental problem in Chinese cities, and that although there has been much hard work, many techniques applied, training available, and some progress made, much more effort to control noise is required.

The congress banquet was held in the Lotte hotel. The speeches were short and entertaining, and the quality of the Korean food was outstanding and served buffet style. The show, with traditional dances by the Kun Hee-suk Dance Team, was very much appreciated.

Professor Philip J. Morris of the Pennsylvania State University, USA gave the eighth keynote speech titled “Aeroacoustics: Classical and Modern Approaches.” He began with the notion of acoustical analogies, the idea that the equations of fluid motion can be put into the form of a linear operator (such as the wave equation) and a source term. He showed how the source term could be derived following the work of Lighthill, and how the well-known 8th power law followed from that analysis. He discussed convection effects, the contributions of other workers in the field, and gave an explanation of why, in the case of sound generation by turbulence, only a small portion of turbulent energy is actually radiated as sound.

He then discussed an alternative acoustical analogy that he and a co-author developed, which is based on the equations of motion written in terms of the velocity and the logarithm of pressure. One of the two source terms in the formulation can be thought of as a “vortex force.” He showed how this model works better than the original analogy in the prediction of far field spectral density.

He then discussed some problems in computational fluid dynamics (CFD)—a field that has grown rapidly with the availability of very fast computers. One example he gave related to predictions of landing gear noise. He then touched briefly on thermoacoustics problems before concluding with the statement that there is great potential for CFD (for both steady and unsteady flow) and acoustical methods such as acoustical analogies for noise prediction. Unfortunately, he said, this doesn’t necessarily tell one how to reduce noise.

Professor Jens Blauert of Ruhr Universität, Germany presented the final keynote speech titled “Concepts behind sound quality: some basic considerations.” He said that in 1986 he was surprised to receive an invitation to give a paper at INTER-NOISE 86 on sound quality because the subject was not thought of



*Philip J. Morris (top) presents the eighth keynote address; Jens Blauert (bottom) presents the ninth keynote address.*

as related to noise control engineering. However, even at that time, it was becoming clear that A-weighted sound levels were not sufficient to describe the perception of sounds. Noise is not just unwanted sound, he said, and emphasized that much of what we “hear” does not come through the ears. Psychoacoustics and an understanding of psychophysical measurements allow physical instruments to be designed to determine the “character” of sounds. This is not necessarily quality, he said because quality is related to function, and the quality of the sound of a product enables us to put a value on the character of the sound. The area of product sound quality (PSQ) shows how cognition, action, and emotion play a role in making a judgment by the user, resulting in a quality “event” as the output.

He then turned to binaural models, and how binaural activity can be used to study sound in concert halls, classrooms, and in cars—and also for speech recognition. He concluded with a simplified model of PSQ where the inputs are the character of the sound and some reference, and processing

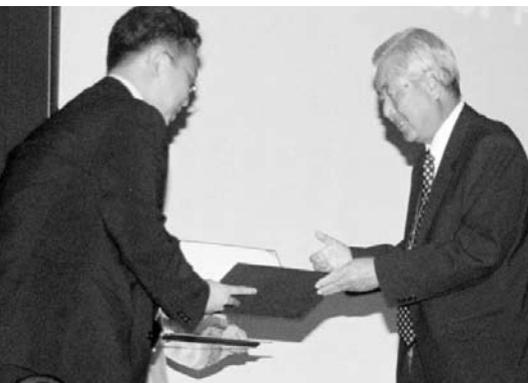
in terms of comparison and appraisal lead to a judgment of sound quality.

The closing ceremony followed the last keynote. One of the outstanding features of the congress was the poster sessions. There were 103 papers presented in three poster sessions, and prizes for the best posters were given by Honorary Congress President Il-Whan Cha at the closing session.

A statistical overview (updated below) of the congress was given by General Secretary J.-G. Ih, and the farewell speech by Congress President Hee Joon Eun left all of the delegates with very warm feelings about the experience of attending a congress in Korea. Finally, Ondřej Jiříček Program Committee Chair for INTER-NOISE 04, representing INTER-NOISE 04 General Chair Josef Novák, invited all of the delegates to attend the 2004 congress in Prague, Czech Republic, and showed a video of the attractions in the city. The 2004 congress will be held on 2004 August 22-25.

The total attendance at the INTER-NOISE 03 Congress was 953. This included 180 exhibition-only attendees and 39 accompanying persons. There was a total of 105 sessions—including the nine keynote lecture sessions. The technical program was very well arranged by Soogab Lee.

The proceedings of the congress were published on a CD-ROM, which contains 658 technical papers. 



*Honorary Congress President Il-Whan Cha, right, awards a poster prize at the INTER-NOISE 03 closing ceremony. A donation for the prizes was given by Finegold & So, consultants.*

## The 2004 Martin Hirschorn IAC Prize

The \$5000 Martin Hirschorn IAC Prize is made possible by a grant from the Martin Hirschorn IAC Fund established with the New York Community Trust. The grant is for a permanent endowment managed by the INCE Foundation, the income from which is used to award the prize. In 2004, the prize will be awarded for the sixth time. It will be awarded for:

*The best paper on new and/or improved cost effective noise control and/or acoustical conditioning products as published in the two years preceding the award.*

All papers published in *Noise Control Engineering Journal* in the years 2002 and 2003 will be considered for the prize. However, submissions from other journals are welcome, and will also be considered by the Awards Committee.

Authors who wish to submit one or more of their publications for consideration must send five copies of each paper to the address at the bottom of this announcement. The deadline for receipt of entries is 2004 April 12.

## 2004 Student Paper Prize Competition

Institute of Noise Control Engineering of the USA will give up to five prizes of \$1000 each at NOISE-CON 04, The 2004 National Conference on Noise Control Engineering. The conference will be held in Baltimore, Maryland on July 12-14. These awards are funded by the INCE Foundation.

INCE/USA will award up to five prizes of \$1000 each to students who are judged to have produced the best papers for the NOISE-CON 2004 Proceedings. The winning students also receive a complimentary registration for the conference. To be eligible for one of these awards, a student must:

- Obtain an entry form from the address below.
- Submit an abstract of the paper—clearly marked as an entry into the student competition. The abstract must be received no later than 2004 March 05
- Submit a paper six pages in length—clearly marked as an entry into the student competition. The paper must be received no later than 2004 March 31. Note that this is earlier than the NOISE-CON 2004 deadline for receipt of papers, 2004 April 15.

The NOISE-CON 04 Announcement and Call for Papers is on the Internet. Go to <http://www.inceusa.org>. All materials required for participation in these competitions should be submitted to:

Institute of Noise Control Engineering  
Business Office  
210 Marston Hall  
Iowa State University  
Ames, IA 50011-2153

*New  
membership  
requirements  
should lead  
to an increase  
in INCE/USA  
membership.*

## **INCE/USA**

### **New INCE/USA Membership Requirements**

INCE/USA has modified its requirements for full membership. The need for a university class in the fundamentals of acoustics or for passing the fundamentals exam has been eliminated for those with a degree in engineering, physical science or architecture with at least 5 years of experience in noise control engineering. For those with degrees in other disciplines, articles in *Noise Control Engineering Journal* can be substituted for the need to pass the fundamentals exam.

#### **The new principal requirements for becoming a full Member of INCE/USA are:**

1. be enrolled as an INCE Associate (Member applicants are automatically enrolled as associates while their credentials are reviewed);
2. have earned a baccalaureate (or equivalent four-year academic degree) or higher degree from a qualified program in engineering, physical science or architecture offered by an accredited university or college  
*or*  
have had at least one sole-author paper or two first-author papers published in or accepted for publication in *Noise Control Engineering Journal*;
3. have instructed, or have enrolled in and achieved a grade of "B" or better in, at least one full-semester (i.e., three credit or more) course of instruction offered by an accredited university or college devoted to the physical principles of acoustics  
*or*  
have demonstrated at least five years experience in noise control engineering involving research, teaching, professional practice or any combination thereof; and
4. have the application form endorsed by an INCE Member.

A satisfactory grade on the INCE Fundamentals Examination will be considered sufficient for election to membership in lieu of requirements 2 and 3 above.

INCE/USA continues its policy of deeply discounted first year dues. The details are on the membership application on pages 145-146.

## **Ferdy Martinus is Awarded the 2003 Martin Hirschorn Prize**

Ferdy Martinus of the University of Kentucky was awarded the \$5000 Martin Hirschorn Prize at an awards ceremony during the NOISE-CON 03 conference held in Cleveland, Ohio in 2003 June. In odd-numbered years, the prize is awarded "...as a contribution to the education of a graduate student studying noise control engineering in the United States of America who proposes a project related to an application of noise control engineering and/or acoustical conditioning of architectural spaces." The project involves reconstruction of the particle velocity in a simulated air-conditioning duct for use as a boundary condition in a boundary element analysis to obtain the sound pressure in the duct opening and the radiated power. The method could lead to new methods for determining sound power of fans and the insertion loss of silencers.



*Ferdy Martinus, left, receives the 2003 Martin Hirschorn Prize for his student project, "Reconstruction of Acoustic Particle Velocity on an Open-Ended Duct." The award was presented by INCE/USA President Rajendra Singh, center, and, right, Executive Director Paul Schomer.*

## **Four students are awarded prizes in the 2003 Student Paper Prize Competition**

At the NOISE-CON 2003 Conference in Cleveland, Ohio in 2003 June, four students were awarded prizes for their papers published in the NOISE-CON 03 2002 Proceedings. The awards consist of a check for \$1000, complimentary registration at the

congress, and the opportunity to win an additional \$500 if the paper is expanded and accepted for publication in *Noise Control Engineering Journal*. The awards are funded by the INCE Foundation, and the decisions concerning the awards are made by the Honors and Awards committee of INCE/USA. The awards were presented by Rajendra Singh, president of INCE/USA.



A student paper prize was awarded to Daniel A. Hicks and Kha Vu of the Michigan Technological University, Houton, Michigan for their paper "Study and Reduction of Noise From a Pneumatic Nail Gun." Left to right, Kha Vu, Daniel A. Hicks, 2003 INCE/USA President Rajendra Singh, and INCE/USA Executive Director Paul Schomer. The paper is [NC03\\_205.pdf](#) on the NOISE-CON 03 CD-ROM.



Kenji Homma, left, of the Virginia Tech Vibration and Acoustics Labs in Blacksburg, Virginia receives his student prize from Rajendra Singh, center, and Paul Schomer, left. The paper, titled "Broadband Active-Passive Control of Small Axial Fan Noise Emission," is [NC03\\_206.pdf](#) on the NOISE-CON 03 CD-ROM.



Jeong Woo Kim, left, of the Ray W. Herrick Laboratories, Purdue University, West Lafayette, Indiana receives his student prize for his paper "Sound Transmission Through Lined Composite Fuselage Structures: Formulation of Anisotropic Poroplastic Theory." Rajendra Singh, center, and Paul Schomer, right, presented the award. The paper is [NC03\\_207.pdf](#) on the NOISE-CON 03 CD-ROM.

### Contributions to the INCE Foundation

Contributions to the INCE Foundation may be made by check or in conjunction with INCE Member dues. Checks should be made payable to the INCE Foundation and sent to George C. Maling, Jr., president, INCE Foundation, 60 High Head Road, Harpswell, ME 04079. All contributions will be gratefully acknowledged.

Individuals or companies contributing \$100 or more to the Foundation will receive a copy of the 96-page booklet titled *Noise and Vibration Control—Principles and Applications*. The booklet is a collection of drawings and explanatory text that illustrate the principles of noise control. The material was prepared by the late Stig Ingemansson, and copies of the booklet were donated to the INCE Foundation by Ingemansson Technology AB in Gothenburg, Sweden.

Recognition levels for donations to the INCE Foundation are:

- Benefactor: \$1000 and up
- Patron: \$500 - \$999
- Sponsor: \$250 - \$499
- Donor: \$100 - \$249
- Friends: up to \$99



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USA student  
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# Institute of Noise Control Engineering of the United States of America, Inc.

Application for:  INCE Associate .....INCE Associate applicants should complete this page only.  
 INCE Student Associate (must be a full-time student) .....INCE Student Associate applicants should complete this page only.

Please type or print clearly. Date \_\_\_\_\_

Title  Mr.  Ms.  Dr.  Prof.  I am a consultant

Name (last, first, middle) \_\_\_\_\_

Date of birth \_\_\_\_\_

## Home Contact Information

Home address \_\_\_\_\_

City \_\_\_\_\_ State/Province \_\_\_\_\_

Zip/Postal code \_\_\_\_\_ Country \_\_\_\_\_

Home telephone \_\_\_\_\_

Home fax \_\_\_\_\_

Home e-mail \_\_\_\_\_

## Business Contact Information

Business/Organization name \_\_\_\_\_

Business address \_\_\_\_\_

Position title \_\_\_\_\_

City \_\_\_\_\_ State/Province \_\_\_\_\_

Zip/Postal code \_\_\_\_\_ Country \_\_\_\_\_

Business telephone \_\_\_\_\_

Business fax \_\_\_\_\_

E-mail \_\_\_\_\_

## Areas of Interest (Please select by numbering your first, second, and third areas of interest.)

- |   |   |
|---|---|
| 01 ___ Sources                                    | 09 ___ Transportation Noise             |
| 02 ___ Propagation                                | 10 ___ Building Acoustics               |
| 03 ___ Passive Control                            | 11 ___ Industrial Noise                 |
| 04 ___ Active Control                             | 12 ___ Community Noise                  |
| 05 ___ Perception and Effects of Noise            | 13 ___ Information Technology Equipment |
| 06 ___ Instrumentation and Measurement Techniques | 14 ___ Product Noise Control            |
| 07 ___ Prediction and Modeling Techniques         | 15 ___ Other                            |
| 08 ___ Standards                                  | (describe) _____                        |

## Preferred Method of Contact

Home  Business

Applicant's Signature \_\_\_\_\_ Date \_\_\_\_\_

## For Students

I certify that the applicant is a full-time student

Faculty Member's Signature \_\_\_\_\_

## Annual Fee for INCE Associates and Members

	Fee	Special 1st-Year Rate
Student .....	USD 20	USD 20
Domestic USA ...	USD 95	USD 50
Outside USA ...	USD 120	USD 75

INCE Associates and INCE Members receive both *Noise/News International* and *Noise Control Engineering Journal* and will receive reduced registration fees at INCE/USA conferences.

## Payment Information

### Check

Payment by check must be in U.S. dollars and drawn on a U.S. bank or on a bank with a correspondent relationship in the United States. Checks requiring a collection fee charged to INCE will be returned.

### Credit Card Information

- VISA  
 MasterCard  
 American Express

Card Number \_\_\_\_\_

Expiration Date \_\_\_\_\_

Signature \_\_\_\_\_

## Application Submission

### Mail

Please mail this application form with check or credit card information to the address below.

### Fax

Fax this application with credit card information to 515-294-3528.

## Contact Information

Institute of Noise Control Engineering  
210 Marston  
Iowa State University  
Ames, IA 50011-2153 USA  
Phone: 515-294-6142  
Fax: 515-294-3528  
E-mail: [ibo@inceusa.org](mailto:ibo@inceusa.org)

*This page to be completed only by applicants for INCE Membership.*

### Principal requirements for becoming a full INCE Member

1. be enrolled as an INCE Associate (Member applicants are automatically enrolled as associates while their credentials are reviewed);
2. have earned a baccalaureate (or equivalent four-year academic degree) or higher degree from a qualified program in engineering, physical science, or architecture offered by an accredited university or college  
OR have had at least one sole-author paper or two first-author papers published in or accepted for publication in the *Noise Control Engineering Journal*;
3. have instructed, or have enrolled in and achieved a grade of "B" or better in, at least one full-semester (i.e., three-credit or more) course of instruction offered by an accredited university or college devoted to the physical principles of acoustics  
OR have demonstrated at least five years experience in noise control engineering involving research, teaching, professional practice, or any combination thereof; and
4. have the application form endorsed by an INCE Member.  
**A satisfactory grade on the INCE Fundamentals Examination will be considered sufficient for election to membership in lieu of requirements 2 and 3 above.**

### Education Beyond Preparatory School

College/University	Location	Degree	Major	Year received
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

### Acoustics Course(s)

List not more than two courses in the fundamentals of acoustics taught or taken for credit (identify college/university, department, course title and number, year, and credits; include grade received and name of instructor).

### Experience

Describe your interests and/or professional experience in the field of noise and its control. Include any special interests, number of publications, patents, etc.

### NCEJ Publications

Please give complete citation, including authors.

### Endorsement

The endorser, an INCE Member whose signature appears below, verifies that the information supplied by the applicant is accurate to the best of the endorser's knowledge.

Endorser's name (*please print*) \_\_\_\_\_

Endorser's signature \_\_\_\_\_ Date \_\_\_\_\_

### Applicant's Statement

I hereby make application for INCE membership. I certify that the statements made in this application are true, complete, and correct. If elected to membership, I will be governed by the articles of incorporation, bylaws, and policies of INCE/USA.

Full signature of applicant \_\_\_\_\_ Date \_\_\_\_\_

## BELGIUM

### ISMA Conference to be Held in Belgium

The next edition of the ISMA Noise and Vibration Engineering Conference will be held in Leuven on 2004 September 20-22. The conference is organized by the division PMA of the K.U.Leuven. ISMA2004 is part of a sequence of annual courses and biennial international conferences on structural dynamics, modal analysis and noise and vibration engineering. The last conference was organized in September 2002 and was attended by more than 400 people. Full CD-ROM conference proceedings were published.

*More details can be obtained from the ISMA Conference secretary, K.U.Leuven, PMA Division, Celestijnenlaan 300B, B-3001 Heverlee, Belgium. Tel: +32 16322482; Fax: +32 16322987; e-mail: lieve.notre@m.ech.kuleuven.ac.be; Internet: www.isma-isaac.be.*

## EUROPE

### Work of the EU Noise Steering Group

The home page of the EU noise steering group, [forum.europa.eu.int/Public/irc/env/noisedir/home](http://forum.europa.eu.int/Public/irc/env/noisedir/home), is the web site dedicated to the work of the group and to the implementation of Directive 2002/49/EC of the European Parliament and Council relating to the assessment and management of environmental noise. The web site requires a sign in, which is normally granted to users from institutions and others with an interest in environmental noise policy. Instructions are provided on how to obtain access. A search of the site for noise resulted in 73 hits on items related to noise policy in a number of different areas.

### EU Issues Noise Computation Guidelines

On 2003 August 03, the Commission of the European Communities published guidelines on revised interim computation methods for industrial noise, aircraft noise, road traffic noise, railway noise, and related noise emission data (OJ L212 49). The document was published to provide recommended methods for Member States with no computational methods to adopt, or, for Member States which have computational methods to change methods if desired. The document:

- Gives a generalized formula for  $L_{den}$  that covers between two and four evening hours,

- defines a receiver height of 4 meters above ground for purposes of noise mapping, and allows meteorological correction for long term levels,
- adopts a French road traffic noise method, XPS 31-133 with several pages of modifications,
- recommends the Dutch RMR Method, and adapts it to EU use,
- recommends for aircraft noise the method ECAC doc 29, but provides additional procedures which are in line with EC Directive 2002/49/EC, and
- follows ISO 9613-2 for industrial noise, except that assessment periods (day, evening, night) have to be introduced, and atmospheric absorption has to be calculated.

The full document may be downloaded from [europa.eu.int/comm/environment/noise/home.htm#guidelines](http://europa.eu.int/comm/environment/noise/home.htm#guidelines).

*Background information on the EU noise program, its Noise Expert Network, environmental noise directives, a summary of ongoing activities, and a summary of other related activities may be found at [europa.eu.int/comm/environment/noise/home.html](http://europa.eu.int/comm/environment/noise/home.html).*

## UNITED KINGDOM

### Hugo Fastl is Awarded 2003 Rayleigh Medal

Dr. Hugo Fastl of the Institute of Man-Machine-Communication, Technical University of Munich, has been awarded the 2003 Rayleigh Medal by the Institute of Acoustics in the U.K. He was cited for his outstanding and lasting contributions to acoustics, in particular his leadership in psychoacoustics and his pioneering work on sound quality. He completed his doctorate in Munich in 1974, became Academic Director at the Technical University in 1987, and Professor of Technical Acoustics in 1991.

He worked closely with the late Professor Zwicker for many years making pioneering psychoacoustic experiments on concepts such as loudness, sharpness and roughness. His many influential publications include the book, with Zwicker - Facts and Models in Psychoacoustics. Perhaps his most important contribution has been in putting the psychoacoustic concepts and models into practical application, with, for example, the first analogue, and then digital

*The Rayleigh  
Medal is  
awarded to  
Hugo Fastl.*

loudness meter. These developments put vital tools into the hands of noise control engineers, and have formed the basis for the field of sound quality. He has shown continued leadership in efforts to standardize methods and metrics through ISO, the German DIN organization, and American National Standards Institute, ANSI.

### **Jane Bevan Wins D.W. Robinson Prize**

Jane Bevan was presented with the D.W. Robinson Prize at a ceremony at the Institute of Sound and Vibration Research, Southampton, U.K. on 2003 July 22. This prize, made jointly with the Institute of Sound and Vibration Research, is awarded every year, in memory of the late Professor Douglas Robinson and goes to the writer of the best ISVR M.Sc. dissertation on a topic in the human aspects of sound and vibration or audiology.

### **Heathrow Night Flights to Continue**

Residents living under the Heathrow flightpath have failed to get a ruling upheld which could have led to a ban on night flights. The European Court of Human Rights ruled in 2001 that flights between 2330 BST and 0600 BST violated the human rights of eight people living around the west London airport by disturbing their sleep.

But the government has won an appeal against that ruling. It said an end to night flights would have a major impact on British airlines and give rival European companies an unfair advantage.

It was estimated that the extra cost to British Airways alone of switching flight times could have been as much as £320m.

The anti-aircraft noise group HACAN ClearSkies, which brought the case to the European court, was encouraged by what it interpreted as a ruling that it should be allowed to pursue the case in the UK courts.

*More details can be found at a BBC News web site: <http://news.bbc.co.uk/1/hi/england/london/3053106.stm>*

### **Action Line for Noise Complaints is Established**

ENCAMS, which stands for Environmental Campaigns, a public charity, has established a noise

hotline in a few towns in the UK. More information can be found at [www.noisehelp.com](http://www.noisehelp.com). Other environmental action groups in the UK concerned with noise are:

- [www.nasca.org.uk](http://www.nasca.org.uk),
- [www.superscript.co.uk/ukna](http://www.superscript.co.uk/ukna),
- [www.noiseabatementociety.com](http://www.noiseabatementociety.com), and
- [www.nfh.org.uk](http://www.nfh.org.uk).

### **UK Engineers to Develop "Silent" Aircraft**

The web site of the *Daily Telegraph* carried a report filed on 2003 November 11 on the launch of a new aircraft design - said to be so quiet that the noise would be imperceptible beyond airport boundaries. An 18-member team from the University of Cambridge in the UK and MIT in the USA will work on the design - backed by the UK CAA, British Airways, and Rolls-Royce. A key seems to be a radical design of the airplane so that the engine noise can be shielded from the ground. For further information, go to [www.telegraph.co.uk/news/main.jhtml?xml=news/2003/11/11/noise11.xml&sSheet=news/2003/11/11/ixhome.html](http://www.telegraph.co.uk/news/main.jhtml?xml=news/2003/11/11/noise11.xml&sSheet=news/2003/11/11/ixhome.html).

### **DEFRA Issues Three Noise Reports**

The UK Department for Environment, Food, and Rural Affairs (DEFRA) has issued three research reports related to noise and nuisance. *Phase 2 of Research into Neighbour and Neighbourhood Noise* is built on an earlier Phase 1 report that identified examples of best practices in noise control from the rest of Western Europe. This document develops a range of practical options that could form a possible national neighborhood noise strategy.

The second report (MORI) assesses the nature of noise, its extent and significance based on public opinion research, and makes recommendations for future action.

The third report (MCM) covers implications for noise disturbance arising from liberalization of licensing laws.

*Further descriptions, and links to download these documents may be found at*

- [www.defra.gov.uk/environment/noise/erm/index.htm](http://www.defra.gov.uk/environment/noise/erm/index.htm)
- [www.defra.gov.uk/environment/noise/mori/index.htm](http://www.defra.gov.uk/environment/noise/mori/index.htm)
- [www.defra.gov.uk/environment/noise/mcm/index.htm](http://www.defra.gov.uk/environment/noise/mcm/index.htm)



*Bernard Berry, IoA Vice President - International and I-INCE VP for Europe and Africa, presents the D W Robinson Prize to Jane Bevan, shortly after the recent graduation ceremonies at ISVR.*

## **Beranek is Awarded the National Medal of Science**

Dr. Leo L. Beranek, INCE.Bd.Cert., one of the founders of Bolt Beranek and Newman, and charter INCE/USA president, was presented with the National Medal of Science by president George W. Bush. The award was presented at a White House ceremony in Washington, DC on 2003 November 06. The president cited Beranek for his leadership, dedication and contributions to the art and science of acoustics; for co-founding one of the world's foremost acoustical research and consulting firms; and for sustained contributions to scientific societies and civic organizations.

He received the S.D. degree from Harvard University, and, during World War II, he designed new aircraft voice communications that overcame communication problems at high altitudes, where many aircraft operated. His design of microphones and earphones became standard throughout the U.S. military and the British Royal Air Force. He also developed noise insulation methods for crews inside aircraft. He earned a Presidential Certificate of Merit for his work.

He joined the faculty of the Massachusetts Institute of Technology (MIT) in 1948, where he and MIT



*Leo Beranek receives the National Medal of Science from President George W. Bush.*

colleagues formed Bolt Beranek and Newman, which would become renowned for its acoustics research and consulting. During the introduction of jet aircraft into the U.S. commercial and military fleets, he made a major contribution by developing measurable criteria of the effects of jet noise on people.

His contributions to noise control engineering are well known world wide. He gave INCE/USA the publication rights to his book *Noise and Vibration Control*, and is currently working on a revision of another book, *Noise and Vibration Control Engineering*.

He is also a leader in architectural acoustics. His research on the acoustic characteristics of 55 concert halls throughout the world was published in a 1962 book, *Music Acoustics and Architecture*, and a new book on concert hall acoustics was published this year.

In 1971, Beranek led a group of investors to own and operate WCVB-TV, Channel 5 in Boston, where his leadership turned the station into a recognized nationwide leader for superb local programming.

In 2004, Dr. Beranek will celebrate his 90th birthday.

## **Erich Thalheimer receives ARTBA Globe Award**

Erich Thalheimer, INCE.Bd.Cert., has received the 2003 Globe Award from the American Road and Transport Builders Association (ARTBA). The award was for his development and implementation of a noise control program for the Boston, Massachusetts Central Artery/Tunnel (CA/T) Project, generally known as the "big dig." The award was presented at a ceremony in Washington, CD on 2003 September 12.

The construction noise control program at the CA/T Project has succeeded in finding a balance between the need for peace and quiet in abutting communities with the project's need to perform construction work both day and night to meet schedule milestones. The noise control program has managed to accommodate a wide array of conflicting interests including residential and commercial abutters, local elected officials, project schedule managers, construction

*Beranek  
receives  
National Medal  
of Science*

Ludwig William

Sepmeyer

1910–2002

contractors and regulatory inspectors. Over the past ten years the program has evaluated many construction noise control options applied to the noise sources, along the pathways or affecting the listeners directly, and the project has adopted, embraced and promoted the more effective noise mitigation methods. Through the promotion of the CA/T noise control program and its successes many other large-scale urban infrastructure projects and abutting communities will surely benefit as well.

**Ludwig William Sepmeyer  
1910–2002**

Ludwig Sepmeyer, INCE.Bd.Cert., (“Sep” to his many friends) died at home in West Los Angeles on 2002 July 18 in his 91st year. He was born in East St. Louis, Missouri on 1910 November 06.

He began his undergraduate education at the Los Angeles campus of the University of California. However, he wanted to study engineering, which was not part of the curriculum at that time at the Los Angeles campus. After completing relevant pre-requisite courses, he transferred in 1930 to the University of California at Berkeley, where he majored in Electrical Engineering.

The late Richard H. Bolt was a classmate of Sep’s at Berkeley and sparked his interest in acoustics. Sep joined the Acoustical Society of America in 1932 June.

After graduating from Berkeley, Sep entered the graduate program at UCLA where he studied architectural acoustics under Vern O. Knudsen. At UCLA, he helped Bob Gales with Bob’s research by designing frequency-equalizing circuits.

During the 1940s, Sep worked for the University of California Division of War Research (UCDWR) in the U.S. Navy’s laboratory on Point Loma in San Diego, where Vern Knudsen was Chief Scientist. Bob Gales and Bob Young also worked at the laboratory in those years. Sep was responsible for the recordings of ocean ambient noise that were associated with the development of the Knudsen curves of underwater-noise vs. sea-state. It was during this period of Sep’s professional career that he developed his long interest in the design and

construction of electrical (later electronic) filters: low-pass, high-pass, and bandpass of various design implementations.

Sep was elected a Fellow of the Acoustical Society of America in 1944 May.

After 1945, he was associated for a time with the U.S. Navy’s research office in Pasadena, California. He worked for the RAND Corporation in Santa Monica during the early years of the space program. At RAND, he performed such esoteric tasks as estimating the sound pressure levels in a missile silo during launch. He later joined the System Development Corporation (SDC) as an electrical engineer. He became interested in the vibrational modes in rooms excited by sounds and authored two seminal papers on this subject that were published in the *Journal of the Acoustical Society of America*.

Sep was a member of the ASA Committee on Membership (1969-1972), the Technical Committee on Engineering Acoustics (1986-1998), the Technical Committee on Architectural Acoustics (1967-2000 and Chair from 1977 to 1980), and the Committee on Standards (1972-1991). He received the Silver Certificate in 1957 and the Gold Certificate in 1982.

Sep was active in the work of Accredited Standards Committees S1 on Acoustics and S12 on Noise. In the 1980s, he led the effort to revise the obsolete 1966 issue of the American National Standard for bandpass filters, subsequently published as ANSI S1.11-1986. He also was part of the Working Group of IEC Technical Committee 29 that prepared International Standard IEC 61260:1995 for bandpass filters.

Sep was an Initial Member (Board Certified in 1978) of INCE/USA. For many years, he was a private consultant in acoustics, primarily involved with architectural acoustics and noise control projects.

In addition, he was a Fellow of the Audio Engineering Society and an active member of the Los Angeles Electronics Club and the Hollywood Sapphire Club.

His research in acoustics and electroacoustics led to several clever concepts for measurement of acoustic energy density and sound intensity, masking of unwanted sounds in open-plan offices, understanding of large-scale Helmholtz resonators, and variable reverberation for multi-purpose auditoria.

—Alan H. Marsh

### **Robert Hugh Tanner**

After a career in acoustics and engineering science that spanned more than 65 years, Robert Hugh Tanner, INCE.Bd.Cert. died quietly on 2 November 2002 in Naples, Florida.

He was born on 1915 July 22 in London, England. His early education in England culminated in a B.Sc. in engineering from Imperial College, London, in 1936. After graduation, he began his professional career with the British Broadcasting Corporation as a pioneering audio engineer who developed audio techniques and studied the acoustics of coupled rooms for the world's first high-definition television station.

During World War II, He served with the Royal Signals regiment of the British Army, doing R&D in artillery sound ranging, ultra low frequency microphonics, sound-ranging recording, and other military applications. Following military service, he returned to the acoustics section of the BBC research department, where he worked on the acoustical design of broadcast studios and concert halls. He participated in an investigation of the difficult acoustics of London's Royal Albert Hall and, in 1946, became holder of a patent on an early automatic reverberation meter.

In 1947, he and his young family immigrated to Belleville, Ontario, Canada, where he began a 22-year career with the Northern Electric Co. He was responsible for numerous developments in audio, including speech-input equipment for radio and television applications, professional-quality public-address and sound-system equipment, the design of two innovative large master-control switching systems for the Canadian Broadcasting Corporation's facilities in Montreal and Winnipeg, and the development of a practical electret microphone.

He began a parallel career in acoustical consulting in 1955. Five years later, he moved to Ottawa to form Northern Electric's R&D division, Bell Northern Research, for which he managed the development of products ranging from audio equipment to microwave relay stations. In 1962, he earned an M.Sc. degree from his alma mater, Imperial College, with a thesis entitled "The Acoustical Design of a Festival Theatre."

Bob was active for many years in professional society activities, particularly those supporting the Institute of Electrical and Electronics Engineers. After serving as director of the IEEE Canadian Region, he chaired the IEEE long-range planning committee. He then became, successively, the organization's secretary, executive vice-president, and, in 1972, president. He was the first and only member of the Canadian engineering profession to hold the presidency, and he was the first person from outside the US ever to be elected to that position.

In recognition of his skills as an engineer and as a manager, Bob was appointed in 1973 as director of industrial research at the Canadian Department of Communications, in Ottawa, Ontario. In 1975, he relocated his acoustical consulting practice to Naples, Florida, where it flourished for the rest of his life. He was consultant of record on more than 1000 projects in the US, Canada, and overseas. Especially proud of his work on the Philharmonic Hall in Naples, Italy, he regularly attended concerts, musicals, and traveling Broadway shows there, a testament to the successful acoustics he helped create.

He received many honors in his lifetime. In 1974, he received the IEEE Canadian Region's highest honor, the McNaughton Gold Medal. In 1981, the IEEE presented him with the Haraden Pratt Award.

Bob was a kind, caring, able, and devoted individual who helped immeasurably to advance the acoustics profession. He was a truly accomplished and creative acoustical engineer who was greatly admired by colleagues and clients alike. 

—William W. Lang

—William J. Cavanaugh

*Robert Hugh  
Tanner  
1915–2002*

## Acoustics 2003

### AUSTRALIA

#### Future Directions Workshop is Held

At the end of May 2003, the Council of the Australian Acoustical Society held a two-day workshop for its executive members investigating Future Directions for the Society. The group of 14 spent the first day with discussions led by a moderator on what were perceived to be the key issues of concern to the Society. In particular these were the challenges in attracting new members, providing the services for the existing members and more effectively running the Society and using the volunteer committee members. The discussions on the second day hinged on the outcomes of a report on the Top Ten Issues facing acoustics in Australia. These can be summarized (not in any order of priority) as:

- Public face for acoustics
- Educate the youth on acoustics
- Improve the education of those working in acoustics
- Retain and expand publicly funded acoustic facilities
- Retain acoustic expertise in publicly funded organizations and agencies
- Retain reputation of profession
- Grow the membership
- Involve all members – specialist sub groups
- Professional support
- Encourage research

The report suggested possible actions for each of the items and the meeting came to a consensus on the appropriate actions. This report is available from the AAS website, [www.acoustics.asn.au](http://www.acoustics.asn.au)

While it was considered that the workshop was a success a true measure will be that the agreed actions will be implemented in the future months.

### Acoustics 2003

The annual conference for the Australian Acoustical Society was held at the Gold Coast, a superb seaside area just south of Brisbane, Qld, Australia on 2003 November 03-05. The theme for this conference was Transportation Noise. More information is available from [www.acoustics.asn.au](http://www.acoustics.asn.au), and an article about the conference will appear in the March issue of this magazine.

### Brisbane Noise Strategy. Brisbane is the capital city of Queensland

The City Council has recently introduced a draft Long-term Integrated Strategy Targeting Environmental Noise, with the catchy acronym of LISTEN. The document provides a range of strategies and management actions and sets out tangible actions to be pursued, both collectively and individually, to manage the impacts of environmental noise. The performance measures are to be based on reduction of complaints and on community noise surveys. Further information is available from the Principal Environmental Health Officer, Frank Henry. E-mail: [pepo@brisbane.qld.gov.au](mailto:pepo@brisbane.qld.gov.au).

### JAPAN

The Japan Society of Mechanical Engineering (JSME) organized a joint meeting with the Acoustical Society of Japan (ASJ) on vibration and sound. The meeting called "VSTech 2003" was held in Hiroshima city on June 5-6, 2003. In the meeting, three main subjects were covered:

1. Trouble shooting of mechanical sound,
2. application of sound energy to engineering science, and
3. mechanical design based on sound quality.

One mechanical engineer said "Recent technology can produce machines with satisfactorily high quality in the mechanical point of view. However, consumers in the market want to know the quality of sound that is radiated from the machine. We should know the exact relationship between mechanical vibration and sound radiation. Also we should be careful about human response to sound quality that is very important in the market nowadays." It is said that sound quality control engineering becomes important as well as noise control engineering where A-weighted sound pressure level is the major index of noise.

The next joint meeting will be held two years from now in the same city. 

## LMS

### ***LMS International and the PCB Group Announce Distribution Agreement for LMS Pimento***

LMS International has announced that LMS Pimento, the ultra portable noise and vibration analyzer is now available from Larson Davis Inc., a PCB Group company. With this new distributorship, customers will benefit from the complete testing solution offered by Larson Davis, including the multichannel Pimento acquisition hardware, PCB Piezotronics transducers and microphones, and the Pimento acquisition and analysis software. Under the agreement, Larson Davis will provide full software support and hardware service for the LMS Pimento system.

LMS Pimento is the personal noise and vibration instrument for professionals on the move. It can handle most tasks in general data acquisition & DSP, rotating machinery, structural analysis, acoustics including sound power measurements. It comes in a highly portable unit that is equally at home in the lab or in the field. Starting with 4 channels, it is easily expandable up to 24 channels and the results are compatible with the LMS systems that are used by most Fortune 500 companies today.

The new software Revision 4.50 of LMS Pimento expands Pimento with functions for sound intensity measurements and supports additional ISO standards for sound power measurements. Also a full Modal Analysis package is available to LMS Pimento users.

### ***LMS Introduces LMS SCADAS 305 for Mobile Noise and Vibration Data Acquisition***

With the release of the LMS SCADAS 305 mobile testing system for noise and vibration, LMS further extends its range of testing solutions. The latest and truly mobile member of the LMS SCADAS III family can be installed just as easily in the test laboratory as in a test vehicle. Supporting 4 up to 20 channels in a compact frame, the LMS SCADAS 305 is said to set a new benchmark for high-performance mobile testing.

The newly released data-acquisition front-end is not just easy to carry; it also offers easy cable connections. All cables, including the AC/DC power cable, plug in the front side of the LMS SCADAS 305, facilitating installations in locations that are small or difficult to access. The wide-range power supply accepts AC and DC input voltages, but can also operate from the built-in battery.

The mobile testing system packs the renowned quality and acquisition power of LMS SCADAS III into

a compact and rugged design, offering a versatility of data-acquisition and signal-conditioning capabilities and maximum ease of transportation. The hardware architecture that it shares with other LMS SCADAS III test equipment makes that signal-conditioning modules are easily interchangeable.

The scalability and modularity of LMS SCADAS III enables its users to apply a high number of measurement channels in extensive testing campaigns, or divide the channels over multiple simultaneous testing assignments. The tight integration and optimal tuning between LMS SCADAS III test hardware and LMS Test.Lab / LMS CADA-X software makes that this test platform offers maximum performance and reliability.

### ***LMS Delivers Capabilities for Flow-induced Noise Simulation***

LMS International, has announced the availability of new capabilities in LMS SYSNOISE to simulate flow-induced noise and aeroacoustic phenomena long before the physical prototype stage. LMS SYSNOISE uses the results of a Computational Fluid Dynamics (CFD) model to create aero-acoustic sources and predicts the radiation and scattering of sound waves induced by fluids. Typical applications include wind noise from vehicle side mirrors, and sunroofs, turbulence noise on a high-speed train or an aircraft landing gear, and fan noise in ventilation systems, HVAC, home and office equipment.

The new module in LMS SYSNOISE Rev 5.6 calculates flow-induced noise, using the results of Computational Fluid Dynamics (CFD) through a direct coupling with industry-standard codes such as CFX, Fluent and Star-CD. The simulation process starts with solving the flow equations using CFD models. Next, the CFD data are passed to SYSNOISE and post-processed to define sets of equivalent sources characterizing the aero-acoustics noise. Finally, SYSNOISE computes the radiated and/or scattered noise using its regular BEM (Boundary Element Method) or FEM (Finite Element Method) acoustic solvers, giving results at the surfaces and at any point in the field. The post-processing capabilities of LMS SYSNOISE further deliver the necessary insights in the acoustic behavior of the design.

*For more information (Europe) contact Bruno Massa, LMS International, Telephone: +32 16 384 200; e-mail: bruno.massa@lms.be. In the United States, contact Sarah Zajas, LMS North America, Telephone: +1 248 952 5664; e-mail: sarah.zajas@lmsna.com*

*LMS offers new analyzer, data acquisition, and noise simulation capabilities.*

*Universal Silencer  
introduces emissions  
solutions.*

*Used equipment  
available at Larson  
Davis.*

*Scantek has new  
measuring instruments.*

## **Universal Silencer, Inc. (USI)** *Universal Silencer Supplies Emissions/Noise Control Solutions for Engines*

Universal Silencer, Inc. (USI), has two emissions solutions available for stationary diesel and gas engine applications: a combination silencer/catalyst and an emissions catalyst unit.

The combination silencer/catalyst is a unique variation of the USI EN Series heavy-duty engine exhaust silencer, extended slightly to allow room for catalyst insertion. This new solution utilizes one of two catalyst capturing techniques within the silencer shell. The first employs a gasket-wrapped catalyst module, which fits tightly between internal guide rails. The second uses a torturous path configuration, which uses serpentine interlocks around the catalyst to prevent gas bypass. Both designs completely seal the silencer and ensure that exhaust gas passes through the catalyst. For the greatest emissions reduction results, special care is given to enable exhaust gas uniformity prior to passing through the catalyst. The combination silencer/catalyst solutions are available in four performance grades, with overall attenuation to 40 dB.

USI's base catalyst housing packages are large end-in, end-out configured units with a flanged inlet and outlet connection. Conical sections or standard dished silencer heads are used, depending on the pressure drop requirements of the unit. The cylindrical housing body can incorporate either of the catalyst capturing designs as the combination silencer/catalyst units. This complete catalyst package includes multiple pressure, temperature and other measuring ports, and is available in various stainless steels or standard carbon steel.

*For more information about these emissions-based solutions, call Universal Silencer at 888 300 4273. E-mail: [kenneth.l.murray@Universal-Silencer.com](mailto:kenneth.l.murray@Universal-Silencer.com).*

## **Larson Davis, Inc.** *Larson Davis Announces Instrument Clearance*

Larson Davis, Inc. has announced the availability of used equipment available at reduced prices. The equipment is demo equipment, loaner equipment and over-produced new product. Quantities are limited, and all items are on a first come-first served basis.

*The list of equipment is posted on the company's web site. Go to [www.larsonDavis.com](http://www.larsonDavis.com) or contact the company. Larson Davis, Inc., 1681 West 820 North, Provo, UT 84601, USA. Telephone: +1 801 375 0177; Fax: +1 801 375 0182; E-mail: [customerservice@LarsonDavis.com](mailto:customerservice@LarsonDavis.com).*

## **Scantek** *Scantek Introduces its Newest Range of Pocket- Sized Meters*

Scantek, Inc. now offers a series of three pocket sound meters from the Castle Group. The three meters are basic, rugged, compact, simple to use, do the job, are of high quality, and are inexpensive. The GA213 measure A- and C-weighted sound level, peak, and holds maximum. The GA215 also provides integrated (average or  $L_{eq}$ ) metrics. And the GA256 dosimeter gives for 3 dB or 5 dB tradeoffs, dose, exposure, projected dose, and peak and maximum levels.

Scantek, Inc. 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, and BSWA Transducers.

## *A New Line of Vibration Instruments from Germany: Sensors, Amplifiers, Calibrators, Monitoring*

Scantek, Inc., is pleased to announce that it now distributes *Metra Mess-und Frequenztechnik Radebeul* (Metra) instruments. The company provides a full line of high-quality and affordable vibration transducers, power supplies, calibrators, and signal conditioners for North and South America.

The Metra line, very popular in Europe and known for high quality and reliability, consists of charge and ICP<sup>®</sup> powered general purpose, seismic, triaxial, miniature, shock, and seat accelerometers. In addition to the transducers, the line includes a set of charge and ICP<sup>®</sup> amplifiers, conditioning modules and multi-channel amplifiers and accessories. Its portable accelerometer exciter/calibrators handle up to 500 gr and its small, affordable calibration system allows every user to do his/her own traceable calibrations.

A color data sheet is available at [www.scantekinc.com/datasheets/mmfcatalog.pdf](http://www.scantekinc.com/datasheets/mmfcatalog.pdf)

The Metra line of vibration instruments and transducers takes its place with the other full range of sound-level meters, hand-held FFTs, and vibration frequency analyzers available at Scantek. All products are supported with full calibration facilities at Scantek, Inc., in Maryland.

*For further information, contact Richard J. Peppin, Scantek, Inc., 7060-L Oakland Mills Road, Columbia, MD 21046, USA. Telephone: +1 410 290 7726; Fax: +1 410 290 9167; Internet: [www.scantekinc.com](http://www.scantekinc.com); E-mail: [PeppinR@ScantekInc.com](mailto:PeppinR@ScantekInc.com).*

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**Eckel*****Fire-resistant Panel Systems Provide Safe, Efficient Sound Control in Entertainment, Hospitality, and Recreational Facilities***

By installing Eckel's noise control panel systems, facilities such as nightclubs, restaurants and foodservice operations, pubs and bars, theaters and auditoriums, museums and galleries, health clubs, gyms, and similar public gathering spaces can easily and economically improve their rooms' acoustic environment...and meet all usual building-code requirements for fire safety.

The sound-absorbing metal wall and ceiling panel systems available from Eckel Industries, Inc., Cambridge, Massachusetts, include: Eckoustic® Functional Panels (EFPs), Textured Functional Panels (TFPs), Acoustic Lay-in Panels (ALPs), and Delta Acoustic Panels. These architectural panel systems have been fire tested by an independent laboratory in accordance with ASTM E84 (81a). They demonstrate a flame spread of from 5 to 10 (dependent upon panel style) and a smoke density of no more than 10. In addition to their fire resistance, all of the panels are simple to install and maintain, are easily cleaned, and retain their acoustic integrity over time.

The fire-resistant, high-acoustic performance EFPs, for instance, can be spot located on walls and/or ceilings to achieve a reduction in noise and reverberation level within a room. This system is said to be an ideal solution for quickly upgrading the acoustic environment of an existing facility. That is, since EFPs are independent panels, they can be put into place without relocating already installed utilities. EFPs not only are suitable for renovation programs but also offer numerous benefits for new construction projects.

When a cloth finish for wall or ceiling surfaces is desired, the TFPs – finely perforated and embossed metal panels – provide a nubby, faux-cloth appearance while overcoming most flammability worries. Noise control is thereby achieved, along with décor and fire-safety requirements.

The perforated metal ALPs offer noise control and fire resistance in spaces where there are grid systems. These high-performance panels, offered in both textured and plain styles, can fit in standard 2x2 and 2x4 lay-in grid systems. They are an excellent way to obtain maximum ceiling sound absorption and indestructibility.

The Delta Acoustic Panels feature a panel design and edge geometry, which creates an "unrevealed edge" so that the panel sides are virtually invisible.

Acoustic treatment with this wall/ceiling panel system provides superior sound absorption combined with fire safety.

In addition to these panel systems for background noise and reverberation control, several other standard fire-resistant panels are available from Eckel, including highly-ruggedized versions. Custom spot and continuous noise control treatments are also offered.

*For more information, contact Eckel Industries, Inc., Acoustic Division, 155 Fawcett Street, Cambridge, MA 02138. Telephone: +1 617 491 3221; Fax +1 617 547 2171; E-mail: eckel@eckelacoustic.com.*

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**E-A-R Specialty Composites*****New ISOLOSS® NV Damping Materials from E-A-R***

E-A-R Specialty Composites has introduced a new family of sheet damping materials and composites that are said to not only minimize structural vibration and impact noise, but also withstand exposure to radiant heat, soil, and fluids. ISOLOSS NV materials are faced with a 1-mil aluminized polyester film that deflects heat rays, helping to keep the underlying material and substrate cooler for optimal damping performance. The silvery facing also reflects light into enclosed equipment, facilitating routine maintenance. It helps protect against degradation by dirt, grease, and chemicals as well.

ISOLOSS NV composites combine .035- or .075-inch-thick NV damping sheet with 1-inch-thick acoustical absorbing foams. The composites control both structural vibration and impact noise, with the installation ease of one product. Both NV sheets and composites are easy to cut and install and are backed by pressure-sensitive adhesive. Standard sheets are 54 inches by 48 inches, but custom sizes and constructions are available.

ISOLOSS NV materials provide extensional, composite, and constrained-layer damping in a wide range of electromechanical equipment such as medical, lab, and office equipment, appliances, industrial and commercial equipment, HVAC enclosures and vehicles of all types.

*Additional information is available by contacting E-A-R Specialty Composites, 7911 Zionsville Road, Indianapolis, IN 46268. Telephone: +1 877 327 4332; Fax: +1 317 692 3111; Internet: www.earsc.com; E-mail: solutions@earsc.com.*

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**Kistler Instrument Corp.*****Accelerometer for Vibration Measurements at High Temperature***

Measuring simultaneous acceleration signals in three orthogonal axis, the 8795A50M5 is housed in

*Eckel announces  
fire-resistant panel  
systems.*

*New sheet damping  
materials available  
from E-A-R.*

*Kistler introduces  
new accelerometer.*

## *New pressure sensors*

*available from PCB*

*Piezotronics.*

*Endevco introduces*

*new triaxial*

*accelerometer.*

a cube-shaped package with a notched corner that allows for identification of the sensor's orientation when working in blind areas. The patented K-SHEAR® design, employing a quartz sensing element, provides a wide operating frequency range along with extremely low sensitivity to thermal transients and base strain. The 8795A50M5 is a low-impedance, voltage-mode, piezoelectric accelerometer that operates reliably at temperatures up to 165°C.

With a measuring range of 150 g, the 8795A50M5 accelerometer has a frequency response of 1Hz to 4Hz and a 100 mV/g sensitivity. This 32-gram, cube-shaped sensor features a welded titanium housing that is easily installed either by stud or adhesive. This voltage-mode sensor is CE-compliant and can be powered by a wide variety of any industry-standard IEPE voltage-mode, piezoelectric sensor power sources. Applications include critical vibration and NVH testing, general laboratory as well as modal testing.

*For further information, contact Don Beehler, Kistler Instrument Corp., 75 John Glenn Drive, Amherst, NY 14228-2171. Telephone: +1 716 691 5100; Fax: +1 716 691 5226; Internet: [www.kistler.com](http://www.kistler.com); E-mail: [don.beehler@kistler.com](mailto:don.beehler@kistler.com).*

### **PCB Piezotronics**

#### ***High-sensitivity Pressure Sensors Detect High-intensity Acoustic Sound-pressure Levels***

Two new ICP® dynamic pressure sensors from the Pressure Division of PCB Piezotronics, Inc. offer the ability to measure low-level pressure and high-intensity sound-pressure levels, both acoustic and ultrasonic. These sensors are designed for monitoring pulsations, turbulence, and noise in hydraulic and pneumatic systems; detecting pressure fluctuations in exhaust systems, compressors, turbines, pumps, and pipelines; and measuring noise of jet engines, rocket motors, and weapons discharge.

ICP® sensors feature built-in signal-conditioning microelectronics to produce clean, low-impedance voltage output signals. These new units have sensitivities of 1,000 mV/psi (Model 106B51) and 5,000 mV/psi (Model 106B52) and feature rugged, solid-state, all-welded stainless steel construction for use in environments unsuitable for standard microphones.

#### ***High-capacity, Three-component Force Sensors***

High-capacity ICP® and charge output three-component force sensors from the Force/Torque Division of PCB Piezotronics, Inc., simultaneously measure dynamic or quasi-static forces in three orthogonal directions (X, Y, and Z). Sensors are structured with three quartz elements that provide

long-term stability, repeatability, and linearity with a wide dynamic range of 10,000 lb. In the z-axis and 4,000 lb. In the x-, y-axes. Hermetically-sealed stainless steel construction make these sensors ideal for applications such as force-limited vibration testing, modal analysis, engine mount analysis, cutting tool force monitoring, and impact testing.

Model 260A03 ICP® version utilizes built-in microelectronics to convert the high-impedance charge to a low-impedance voltage and provides a voltage output of 0.25 mV/lb in the z-axis and 1.25 mV/lb in the x- and y-axes. Model 260A13 charge output version operates with in-line charge converters or laboratory-style charge amplifiers and provides a charge output of 15 pC/lb in the z-axis and 32 pC/lb in the x- and y-axes.

*For further information, contact Andrea Mohn, Marketing Assistant, PCB Piezotronics, Inc., 3425 Walden Avenue, Depew, NY 14043-2495. Telephone: +1 800 828 8840; Fax: +1 716 684 0987; Internet: [www.pcb.com](http://www.pcb.com); E-mail: [amohn@pcb.com](mailto:amohn@pcb.com).*

### **Endevco**

#### ***Model 7267A Triaxial Accelerometer for Steady-state or Long-duration Pulse Measurement***

The Model 7267A is a replaceable-element triaxial accelerometer. It measures acceleration in three mutually-perpendicular axes; theoretical lines drawn through the centers of the seismic masses intersect at a single point. The Model 7267A is said to be ideal for applications that require steady-state or long-duration pulse measurement, including anthropomorphic dummies used in automotive crash testing. This accelerometer meets SAE J211 specifications, the highest standards of performance for electronic instrumentation.

Each of the Model 7267A's three sensors is easily replaceable, requiring only a single screw for installation or removal. Solder pins provide electrical connection for a nine-conductor cable. Both top and side cable entry holes are provided.

A 10-foot cable and mounting base are available as accessories. Sensors, housing, and a cable clamp are available as replacement components. Endevco's Model 136 three-channel system, Model 4430A or OASIS 2000 computer-controlled system is recommended as signal conditioner and power supply.

*For further information, contact Anthony Chu, Product Manager, ENDEVCO, 30700 Rancho Viejo Road, San Juan Capistrano, CA 92675. Telephone: +1 949 493 8181; Fax: +1 949 661 7231; Internet: [www.endevco.com](http://www.endevco.com); E-mail: [Anthony@endevco.com](mailto:Anthony@endevco.com).*



*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](http://www.i-ince.org).*

## 2004 July 12-14

### **NOISE-CON 2004, The 2004 National Conference and Exposition on Noise Control Engineering**

Baltimore, MD, 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](mailto:IBO@inceusa.org). Internet: <http://www.inceusa.org>.

## 2004 August 22-25

### **INTER-NOISE 2004, The 2004 International Congress and Exposition on Noise Control Engineering**

Prague, Czech Republic. Contact: INTER-NOISE 2004 Congress Secretariat, Technická 2, 166 27 Praha 6, Czech Republic. Tel. +420 224 352 310; Fax: +420 224 355 433; e-mail: [internoise2004@fel.cvut.cz](mailto:internoise2004@fel.cvut.cz). Internet: <http://www.internoise2004.cz>.

## 2004 September 20-22

### **ACTIVE 2004, The 2004 International Symposium on Active Control of Sound and Vibration**

Williamsburg, Virginia, USA. Contact: Richard J. Silcox, Mail Stop 463, NASA Langley Research Center, Hampton, VA 23681. Tel. +1 757 864 3590; Fax: +21 757 864 8823; e-mail: [r.j.silcox@larc.nasa.gov](mailto:r.j.silcox@larc.nasa.gov).

## 2005 August 06-10

### **INTER-NOISE 2005, The 2005 International Congress and Exposition on Noise Control Engineering**

Rio De Janeiro, Brazil. Contact: Prof. Samir N.Y. Gerges, Mechanical Engineering Department, Acoustics and Vibration Laboratory, University Campus - Trindade, Florianopolis, SC - CEP 88040-900, BRAZIL. Tel. +55 48 2344074; Fax: +55 48 2320826; e-mail: [samir@emc.ufsc.br](mailto:samir@emc.ufsc.br).

## 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](mailto:IBO@inceusa.org). Internet: <http://www.inceusa.org>.

# Acknowledgements

## INCE/USA Liaison Program

ACO Pacific, Inc. .... Belmont, California  
 Brüel and Kjaer Instruments ..... Decatur, Georgia  
 Cavanaugh Tocci Associates ..... Sudbury, Massachusetts  
 G.R.A.S. Sound and Vibration ..... Vedbaek, Denmark  
 Colin Gordon and Associates ..... San Mateo, California  
 Harris Miller Miller and Hanson, Inc. .... Burlington, Massachusetts  
 Higgott Kane Industrial Noise Control ..... Cambridge, Ontario, Canada  
 Industrial Acoustics Company ..... Bronx, New York  
 IBM Corporation ..... Armonk, New York  
 Iowa State University ..... Ames, Iowa  
 Larson Davis Laboratories ..... Provo, Utah  
 Noise Control Engineering, Inc. .... Billerica, Massachusetts  
 Overly Door Company ..... Greensburg, Pennsylvania  
 The Pennsylvania State University ..... State College, Pennsylvania  
 Purdue University ..... West Lafayette, Indiana  
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 Scantek, Inc. .... Columbia, Maryland  
 Vibro-Acoustics ..... Scarborough, Ontario, Canada  
 Wyle Laboratories ..... Arlington, Virginia

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 Brüel & Kjør ..... Nærum, Denmark  
 LMS International, NV Numerical  
 Integration Technologies ..... Heverlee, Belgium  
 Casella Group ..... Hitchin, Hertz, United Kingdom  
 Norsonic AS ..... Tranby, Norway  
 Rion Company, Ltd. .... Tokyo, Japan

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 Korean Institute for Science and Technology,  
 Science Town, Taejon-Chi  
 Portugal ..... Laboratório Nacional de Engenharia Civil, Lisboa  
 Russia ..... Noise Control Association of the  
 Baltic State University, St. Petersburg  
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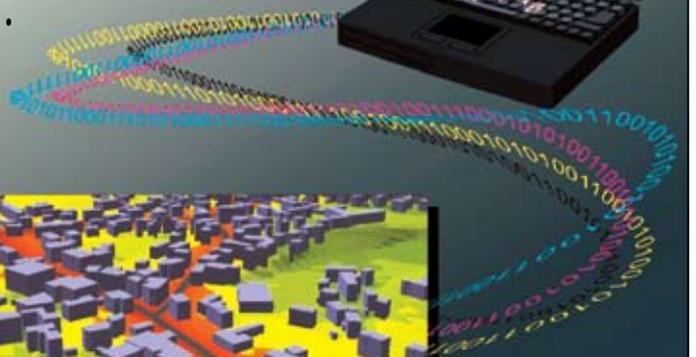
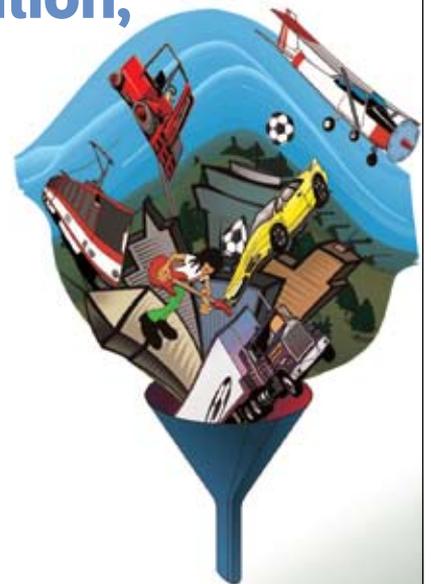


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