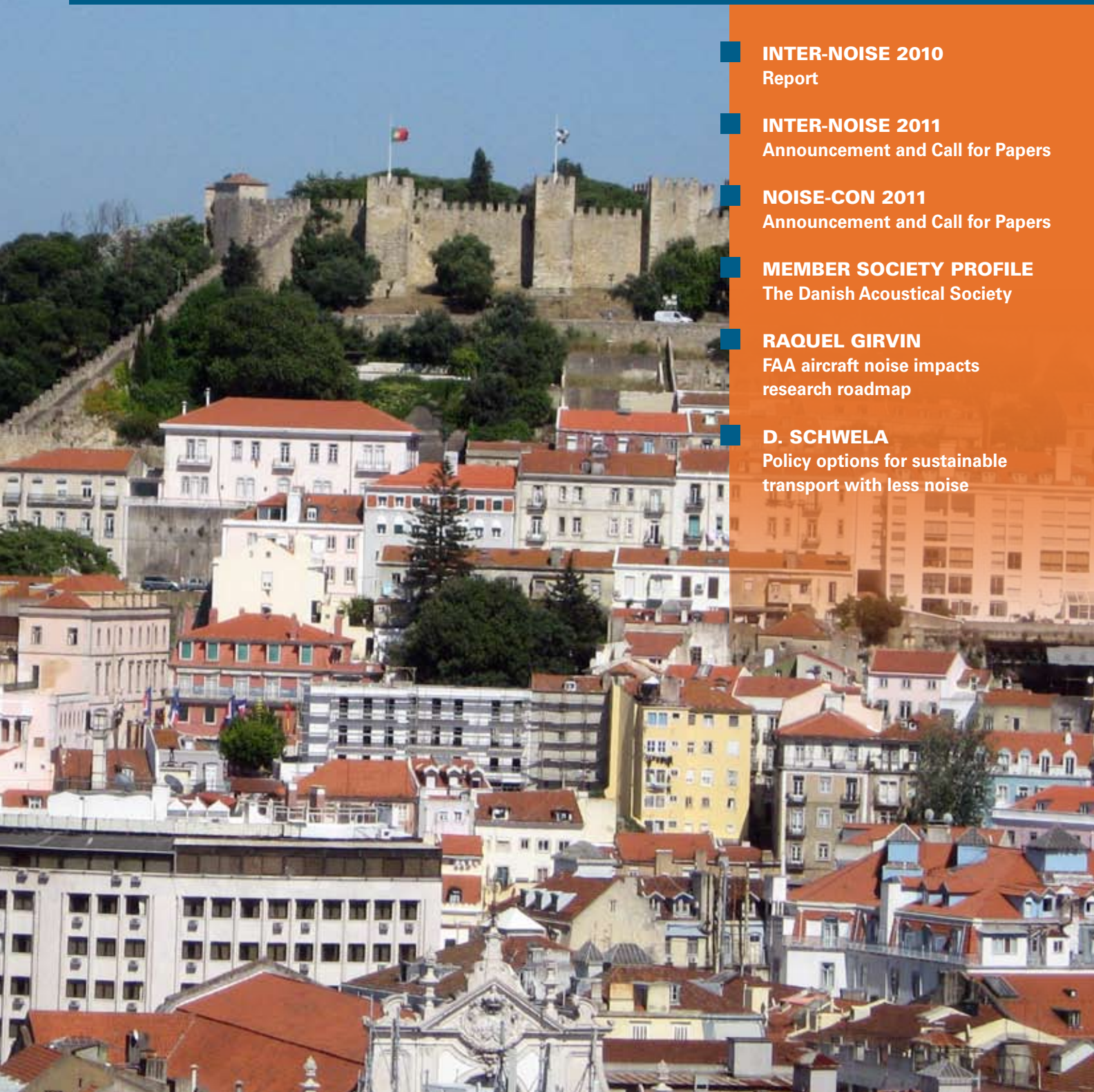
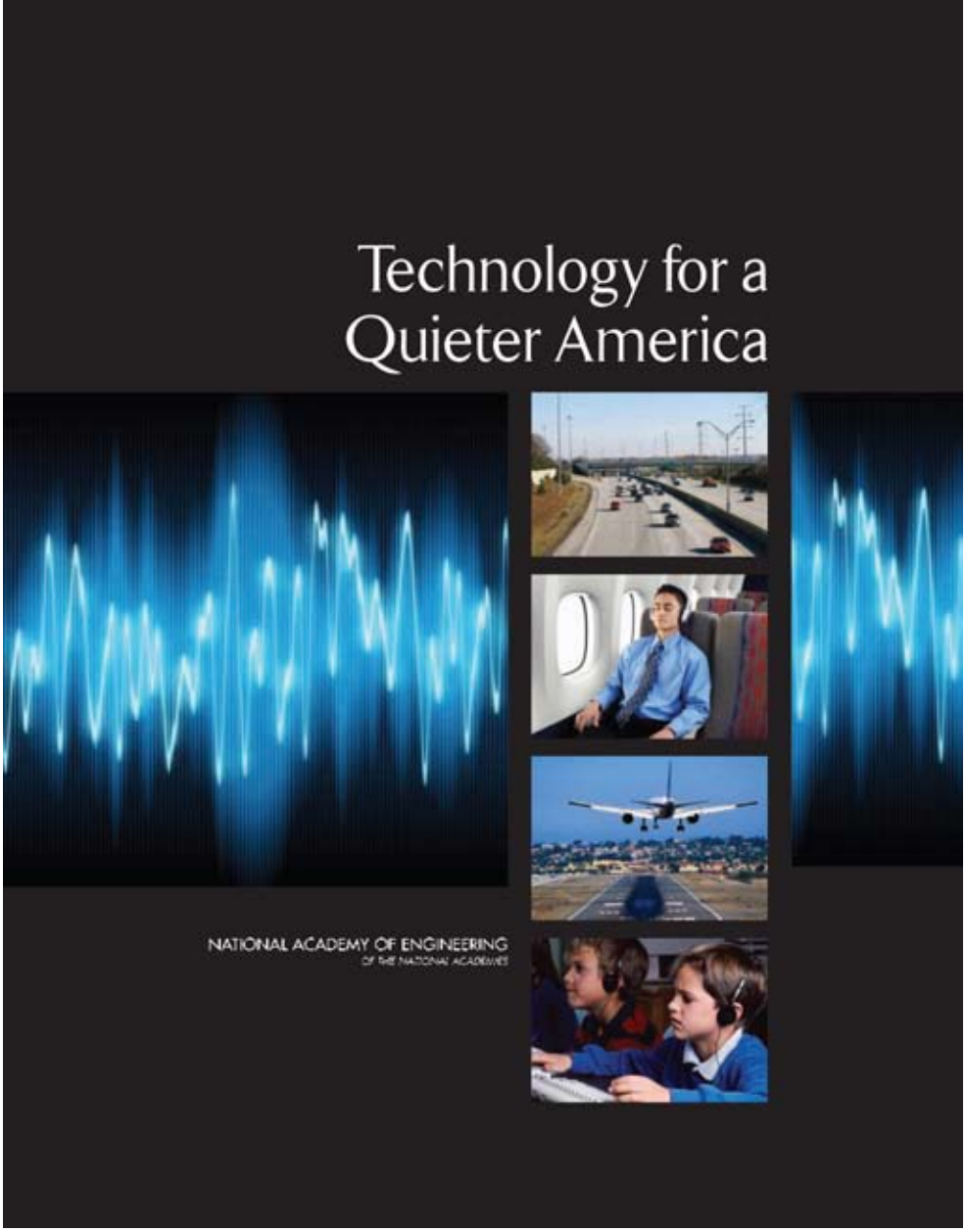
NOISE/NEWS INTERNATIONAL

Volume 18, Number 3
2010 September

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





In 2006, NAE initiated *Technology for a Quieter America*, a multi-year study to review state-of-the-art noise-control engineering, describe the technological, economic and political climate for noise control, and identify gaps in research. During the past three years, a 14-member umbrella committee, chaired by NAE member George Maling (managing director emeritus of the Institute for Noise Control Engineering of the USA), five subcommittees, and focused working groups have explored three categories of issues related to noise-control engineering and public concerns: applications of current technologies; research and development initiatives; and intra-governmental and public relations programs. The report is now available from the National Academies Press.

Technology for a Quieter America assesses major sources of noise (transportation, machinery and equipment, consumer products, etc.), how they are characterized, efforts to reduce noise emissions, and efforts to reduce noise in work places, schools, recreational environments, and residences. The report reviews regulations that govern noise levels and the roles of federal, state, and local agencies in noise regulation. It also examines cost-benefit trade-offs between different approaches to noise abatement, the availability of public information on noise mitigation, and noise-control education in U.S. schools of engineering.

Findings of the report focused on several critical areas: Hazardous noise-Occupational noise exposure limits should be reduced and engineering controls should be the primary focus of controlling workplace noise. "Buy-quiet" programs that promote the procurement of low-noise equipment and allow market forces to operate can play an important role.

Cost Benefit analysis: The Federal Aviation Administration has been proactive in cost-benefit analysis of noise reduction at airports; these studies, along with similar research from Europe, could lead to highway noise reduction. The report examines the relative merits of "low noise" highways and the use of noise barriers.

Metrics: Advances in the ability to collect, store, and analyze noise data challenge us to reexamine metrics that were developed in the 1970s. Purchase information: http://www.nap.edu/catalog.php?record_id=12928

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Meetings

Features

Departments

Cover Photo:
Downtown Lisbon and the São Jorges Castle. Photo by George Maling

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NOISE/NEWS INTERNATIONAL

This PDF version of Noise/News International 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). This is the first volume that is being published in PDF format only. The PDF format means that the issues can be read by freely available software such as that published by Adobe and others. It reduces publication time, saves printing costs, and allows links to be inserted in the document for direct access to references and other material. Individuals can sign up for a free subscription to NNI by going to the web site http://www.noisenewsinternational.net

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 and its Internet Supplement

www.noisenewsinternational.net

The primary change in this PDF-only volume of *NNI* is the ability to have "hot links" to references, articles, abstracts, advertisers, and other sources of additional information. In some cases, the full URL will be given in the text. In other cases, a light blue highlight of the text will indicate the presence of a link. At the end of each feature or department, a light blue back to toc will take the reader back to the table of contents of the issue.

- The Internet supplement contains additional information that will be of interest to readers of *NNI*. This includes:
- The current issue of *NNI* available for free download
- *NNI* archives in PDF format beginning in 2003
- A searchable PDF of annual index pages
- A PDF of the current *NNI* conference calendar and a link to conference calendars for worldwide meetings
- Links to I-INCE technical activities and I-INCE Technical Reports

Progress in International Activities

The 39th International Congress and Exposition on Noise Control Engineering (INTER-NOISE 2010), was held in Lisbon, Portugal, from 13-16 June, 2010. The Congress was co-organized by the Portuguese Acoustical Society (SPA) and the Spanish Acoustical Society (SEA). The main theme of the Congress was Noise and Sustainability, highlighting the need to preserve the future generation's stability and existence, without compromising global development. In addition to a strong technical program, a large number of exhibitors were present to show and promote their latest tools, equipment and materials The technical program also included five plenary talks and three short courses. On behalf of I-INCE, I would like to sincerely thank the Congress co-Presidents, Jorge Patricio and Antonio Pérez-López, the Technical Program Chair, Luis Godinho, as well as the entire Organizing Committee. A report on the meeting begins on page 147 of this issue.

This year, I-INCE held a workshop for Young Professionals during the Congress. The workshop was organized by Professor Raj Singh, I-INCE Vice President of Technical Activities. The purpose of the inaugural workshop was to mentor young noise control engineers and scientists, discuss some research problems at the cutting edge of technology, and provide an informal forum for networking between senior and junior professionals. Plans are underway to hold such workshops at future INTER-NOISE Congresses.

As announced last year, grants were awarded in Lisbon to Young Professionals early in their careers. These grants are meant to assist young noise control engineers and scientists in attending the INTER-NOISE Congresses. The grants included a signed certificate, conference registration, with the remainder of the fee grant presented to the winners at the conference to partially offset travel expenses. A total of twelve grants were awarded during the workshop for Young Professionals; the list has been posted on the Internet. Plans are now underway to award the grants in Osaka.

A third forum of the International Council of Academies of Engineering and Technological Sciences (CAETS) was held on 2010 June 14-16 in Lisbon during INTER-NOISE 2010. The forum was sponsored by the Royal Swedish Academy of Engineering Sciences (IVA), the Royal Academy of Engineering (UK), and the National Academy of Engineering (US). This forum was a follow-up to the 2009 August forum in Ottawa to assess the technology available today and what future technology is needed to reduce the noise emissions of manufactured products at the source.

The CAETS Lisbon forum consisted of four sessions and covering the following topics:

Session 1: China's challenging design requirements for low-noise products
Session 2: The worldwide Green Agenda and product noise
Session 3: Technology and public demands for a quieter world
Session 4: Action on the CAETS noise control technology assessment

It has become increasingly evident that the noise climate, particularly in the cities and suburban areas of the world, is deteriorating and is dominated by the noise emissions of transportation vehicles, consumer devices, and other machinery and equipment. Relief for the world's people in their homes and neighborhoods, public spaces, and workplaces can best be achieved if consideration is given to reducing the noise emissions of these sources. Moreover, considering all the existing measures to build a quieter world, the wide distribution of low-noise products will have the highest efficiency/cost ratio. To this end CAETS has established a Noise Control Technology Committee to focus on evaluations of the technology now available as well as the technology needed to suppress the noise emissions of these dominant sources. A Memorandum of Understanding between the International Institute of Noise Control Engineering (I-INCE) and CAETS concerning cooperative joint activities is being negotiated. More information will follow in due course

The 40th International Congress and Exposition on Noise Control Engineering will be held in Osaka, Japan 2011, September 4 - 7. The Congress already has a well developed web site providing detailed information on the venue, travel to Osaka, accommodation, etc. The Announcement and Call for Papers begins on page 150 of this issue I look forward to greeting you in Osaka next year. back to toc

Gilles Daigle
President,
International INCE

US Quieter Pavement Update

Paul Donavan, Pan-American News Editor

In the past decade, there has been a resurgence of interest and activity in tire/pavement noise in the US. Following on from the extensive work done in Europe and Asia, interest in the US has focused on the use of quieter pavement as a cost effective means for reducing traffic noise at source. Initially, much of the quieter pavement research work was advanced by the states of California and Arizona. Today, however, the interest has expanded to at least thirteen states as well as the Federal Highway Administration (FHWA). In 2008, a "pooled fund" research activity was formed by seven state highway agencies with the FHWA as a means to advance this work and the National Cooperative Highway Research Program (NCHRP) has sponsored several research projects. In addition, at least six more state agencies are in the actively exploring quieter pavement options. At the national level, much of the direction for this activity was developed in two FHWA Tire/Pavement Strategic Planning Workshops held in 2004 and 2006. These brought together academics, government agencies, industry representatives, and subject area experts at one time to develop and update a roadmap for researching and implementing quieter pavements.

Much of the work in the earlier to middle years of the decade focused on several key demonstration projects and the development of tire/pavement noise databases examining the range in performance of existing pavement designs. Supporting this was the implementation of the on board sound intensity (OBSI) method for evaluating the noise performance actual roadway pavements on-board, very near the tire/pavement source. The application of this technology was initially developed by the California Department of Transportation and further advanced by NCHRP research. This method has since been investigated as documented in NCHRP Report 630 and by the American Association of State Highway Transportation Officials as well as being promulgated by other standards organizations. OBSI can be readily and accurately implemented on normal passenger cars vehicles. As a result, there are at least sixteen different users of this method in the US with the number continuing to grow. The widespread use of this method has provided knowledge on the range of pavement performance (13 dB or more) as measured both in the US and Europe, the relationship of tire/pavement noise source levels to those measured alongside roadways, and what makes one pavement quieter than another.

Although much of the earlier work on quieter pavements dealt with the performance of new pavements, more recently there has been somewhat of a change in emphasis. When using quieter pavements as an option for highway noise abatement, one concern is how long the benefit of the quieter pavement will last. More traditional methods such as sound barriers are considered to perform consistently in perpetuity where the acoustical performance of pavements typically degrades with time. This issue of acoustic longevity has now become a "hot topic" for the application of quieter pavement. Unfortunately, evaluating the acoustic longevity of pavement over its life cycle takes a long time. Fortunately, some studies are now in their tenth year or more with even more studies on both asphalt and concrete pavements in their seventh or eighth year. In addition, more statistical studies of pavements of similar design, but different construction dates have helped to shed some light on this issue. In parallel with acoustical longevity studies, NCHRP is also in the midst of a research project to develop methodologies for evaluating pavement and barrier strategies for noise mitigation. The objective of this research is to provide a means by which agencies can make decisions about either strategy or combination of strategies based on the total life cycle cost of building sound barriers and/or maintaining the acoustic performance of the pavement.

Although there has been considerable progress in the area of quieter pavements in past decade, there are still challenges to be addressed for applications in the US. Porous pavements generally show potential as being among the quietest of the quieter pavements; however, its use throughout the country, particularly in colder climates, is questionable without further research. The use of studded snow tires and tire chains in some areas of country rapidly degrade both the acoustic and material functional performance of many of the better performing quieter pavement designs. Controlling production variability of both asphalt and concrete pavements also requires further understanding in order to re-capture some 3 dB or more that can be lost by uncontrolled variation. Finally, educating the public on what can and cannot be accomplished by quieter pavements has become important as the word spreads throughout the country (largely via the Internet) on some of the more remarkable cases where large noise reductions been demonstrated.

Danish Acoustical Society

The Danish Acoustical Society (DAS), founded 55 years ago, as the first of the four Scandinavian acoustical societies, by a group of professionals that included Prof. Dr. Tech. Fritz Ingerslev and Dr. Tech. Per V. Brüel.

Since its beginnings in 1955, DAS' membership has grown to over 300 professionals, including over 20 sustaining members. Since its 50th anniversary in 2005, DAS has grown by over 20%, indicating the continued strength of Danish acoustics. Seventy percent of the membership is from industry, 20 percent from national and local institutions, and 10 percent from higher education. To encourage new members and to promote lifelong affiliation with the group, graduate students receive a complimentary one-year membership. The society remains dedicated to its original goals: to promote and propagate nationally the knowledge of acoustics and its practical application, and to establish national and international contact between people interested in acoustics, in particular cooperation with Scandinavian, European, and other foreign organizations. DAS has played an important role in organizing several major acoustic meetings and the next big event is Forum Acousticum in Aalborg from 27th June to 1st July 2011 (www.fa2011.org), an event which DAS is proud to host for hopefully over 1000 attendees.

DAS focuses its activities in five specialty areas: building and room acoustics, electroacoustics, environmental acoustics, machinery acoustics, and psychoacoustics. Activities in each area are organized by the relevant Technical Comittees, thus ensuring a high level of activity and broad representation of its members. One of the major events is the annual DAS "Day of Acoustics" where speakers from all aspects of the society are invited. DAS is especially interested in connecting scientists and practitioners within its specialty areas.

DAS assists in the review process of new acoustical standards from the Danish Standards (including ISO) and provides input to the Danish Environmental Protection Agency on new acoustical guidelines.

Management of the society is in the hands of a six- member board - at the time of writing; Claus Møller Petersen (Grontmij - Carl Bro), president, and board members Douglas Manvell (Brüel & Kjær), Søren Rasmussen (Cowi), Peter Møller Juhl (Southern Danish University), Birgit Rasmussen (National Building Research Instiute) and Finn Agerkvist (Danish Technical University). The society is supported by a part-time treasurer and secretariat. The Society's web address www.d-a-s.dk contains information on meetings, hearings of proposals for new standards, and links to courses in acoustics as well as links to sponsor's websites (including job notices) and websites of other acoustical organizations. DAS can be contacted at email das@d-a-s.dk.

DAS is affiliated to the European Acoustics Association (EAA) and the International Institute of Noise Control Engineering, and DAS members receive publications from these two organizations at no extra charge. Members of DAS are also admitted to the Nordic Acoustical Society (NAS) whose activities include organizing the Baltic-Nordic Acoustical Meetings (B-NAM) held every other year in either Denmark, Finland, Sweden, Norway, or Iceland. The next B-NAM regional conference will be hosted by DAS and held in Hans Christian Andersen's enchanting birthplace of Odense on 18-20 June 2012 (for more information see www.bnam2012.com).

DAS looks forward to seeing many new and existing international colleagues at the 2011 Forum Acousticum in Aalborg.

This is the 73nd in a series of articles on the Member Societies of International INCE. This is an update of the profile that appeared in the 2001 September issue of this magazine.—Ed.

Member Society Profile is a regular feature of *Noise News International*. If you would like to have your society featured, please contact George Maling at inceusa@aol.com.

The Lisbon University Chorus performed at the opening ceremony of INTER-NOISE 2010.

The 39th International Congress on Noise Control Engineering and Exposition, INTER-NOISE 2010, jointly organized by the Portuguese Acoustical Society (SPA) and the Spanish Acoustical Society (SEA), was held in Lisbon, Portugal, from June 13-16th, 2010. The Congress was sponsored by the International Institute of Noise Control Engineering (I-INCE) and honoured with the High Sponsorship of His Excellency the President of the Portuguese Republic. Several Portuguese governmental bodies, such as the Portuguese Environmental Agency, the National Laboratory for Civil Engineering, and the Portuguese Foundation for Science and Technology, have given the Congress their institutional support. The Ibero-American Federation of Acoustics (FIA) also supported the INTER-NOISE 2010, by awarding a dozen FIA Grants to scientists from South America Countries.

The Congress theme was Noise and Sustainability. This theme was addressed by distinguished lectures and dedicated structured sessions, which were scheduled to specifically deal with sustainable principles.

The opening ceremony on Sunday afternoon, started with a performance of the Lisbon University Chorus, and was followed by the welcome speeches, respectively from the Congress Co-President, Prof. Jorge Patrício, D. Antonio Pérez-López on behalf of SEA, Prof. Pedro Martins da Silva as the Congress Honorary President, Prof. Samir Gerges on behalf of FIA, Prof. Tor Kihlman presenting the CAETS Forum, and Dr. Gilles Daigle who, as I-INCE president opened the Congress formally. See opening for Professor Patrício's opening remarks.

INTER-NOISE 2010 featured 844 high-level technical papers, 786 presented as oral in 13 parallel sessions running continuously, and 53 as poster, with presentations grouped in two days, Monday and Tuesday.

Five plenary lectures addressing the sustainability concepts (environment, societal, economics and efficiency) were given by outstanding specialists,

The opening plenary speakers were (left to right) Jorge Patrício, Antonio Pérez-López, Pedro Martins da Silva, Samir Gerges, Tor Kihlman, and Gilles Daigle.






The Lisbon Conference Center, the venue for INTER-NOISE 2010.

respectively Professors Hideki Tachibana (General view of road traffic noise problem), Abigail Bristow (Valuing noise nuisance), Brigitte Schulte-Fortkamp (The tuning of noise pollution with respect to the expertise of people's mind), Gilles Daigle (Effectiveness of Noise Barriers), and Samir Gerges (Hearing protectors: noise attenuation and comfort). See plenary_lectures for abstracts of the above papers.

The Congress attendance was very large. More than 1200 people, including 87 accompanying persons, enjoyed the event. The exposition comprised 44 booths (the maximum allowable number), representing 42 companies, that came to Lisbon to show their most recent products, services, equipments, software. In addition to being open to registrants, 250 "exhibition only" visitor's passes were issued for the exposition.

The number of authors involved in the papers was almost twenty five hundred. Approximately 53 countries were represented at INTER-NOISE 2010. Parallel events such the 3 short courses, held immediately before the Congress, the CEN and ISO standards meetings after the Congress, and the CAETS Forum which ran in parallel with INTER-NOISE-2010, marked the Congress as an event which attracts satellite meetings.

The social program consisted of a welcome and a farewell reception. The welcome reception was held on Sunday after the Opening Ceremony and the farewell reception on Wednesday after the Closing Ceremony. Both receptions were attended by almost 700 people. On Monday, all the participants were invited to attend a Port of Honour, which is a Port Wine tasting held at a municipal garden in Lisbon. The venue provided INTER-NOISE attendees with a magnificent view of the city at dusk.

The Banquet, held on Tuesday at a typical farm for teaching equestrian arts, consisted of a horse show and a folk presentation exhibiting old Portuguese traditions, and was the high point of the congress social activities. Congress co-President Jorge Patrico offered a toast to the success of INTER-NOISE 2010.

Tours for accompanying persons were also offered on all three days of the congress.

The chair person's dinner kindly offered by the Congress Golden Sponsor CDM, held on Sunday evening on a river boat cruise, will be remembered as an outstanding event, and one important for the for a smoothly-running congress.

The five lecturers (left to right): Hideki Tachibana, Abigail Bristow, Brigitte Schulte-Fortkamp, Gilles Daigle, and Samir Gerges

Congress co-president Jorge Patrício offers a toast to the success of the congress.

The closing ceremony, held on Wednesday, comprised a farewell speech by Prof. Jorge Patrício on behalf of the organizing committee, and was followed by the INTER-NOISE 2010 technical chair (Prof. Luís Godinho) who gave the audience a brief overview of congress statistics, Salvador Santiago on behalf of SEA, who also made reference to the upcoming event organized by SEA and SPA, in Léon, in October, and Dr. Gilles Daigle who made reference to the 12 winners of the I-INCE young scientist grants and closed the Congress officially. A short time for presentation of the forthcoming congresses was scheduled, and used by Samir Gerges to present the FIA Congress in Cancun, Mexico in November, and Marion Burgess to present the ICA in Sydney, Australia in August. Finally, Ichiro Yamada the President of next INTER-NOISE, which will be held in Osaka, Japan, next year made an invitation to all attendees to participate at INTER-NOISE 2011.

The success of the INTER-NOISE 2010 Congress was only possible, due to the work of many people, whose names are: Sónia Antunes, Luís Godinho, Octávio Inácio, Carlos Fafaiol, Joel Paulo, Carlos César, Diogo Alarcão, António Ferreira e Helena Desidério. The Congress proceedings (DVD) can be purchased to Portuguese Acoustical Society (spacustica@lnec.pt) at a cost of € 50 each. See the announcement on the second page of this issue.

The INTER-NOISE 2010 is now finished. Other future challenges exist. Acoustics is continuously growing, and all of those who organized the INTER-NOISE 2010 feel happy and proud. The congress contributed to the development of acoustics and noise control engineering, not only in the Iberian Peninsula but worldwide.

— Jorge Patrício
Co-President of INTER-NOISE 2010

Photos from the banquet

Some of the closing ceremony speakers (left to right): Prof. Luís Godinho, Salvador Santiago, Marion Burgess.

Dear Colleagues,

Ichiro Yamada, Congress President

INTER-NOISE 2011, the 40th International Congress and Exposition on Noise Control Engineering, will be held in Osaka, Japan From 2011 September 4 through September 7. The Congress is sponsored by the International Institute of Noise Control Engineering (I-INCE) and co-organized by the Institute of Noise Control Engineering Japan (INCE/J) and the Acoustical Society of Japan (ASJ). The organizers and the Organizing Committee of the Congress extend a warm welcome to all prospective participants world-wide and invite all to join us in Osaka to discuss the latest advances in noise and vibration control engineering and technology, focusing on our Congress Theme of "*Sound Environment as a Global Issue.*"

INTER-NOISE 2011 will feature a broad range of invited and contributed papers, together with plenary lectures by distinguished speakers. There will be extensive exhibitions of noise and vibration control technology, measuring instruments, equipment and systems from all over the world. Technical papers on the congress theme will be accepted with a special acknowledgement. Research papers in all other fields of noise and vibration are welcome.

INTER-NOISE 2011 will be held at the Osaka International Convention Center (Grand Cube Osaka), directly connected to the Rihga Royal Hotel and easily accessible for international flights. Grand Cube Osaka is located close to the city centre of Osaka, which is the second largest city in Japan and is the center of commerce, culture, food, etc in the Kansai Area with many historical sites such as Osaka Castle. It is our pleasure to welcome you to INTER-NOISE 2011 and Osaka. We are sure you will enjoy all aspects of the Congress and Osaka. We look forward to meeting you in Osaka.

Sincerely,

Ichiro Yamada, Congress President
On behalf of the INTER-NOISE 2011 Congress Organizing Committee

TECHNICAL TOPICS

1. Machinery Noise
2. Aeroacoustics and Fan Noise
3. Aircraft Noise
4. Railway Noise
5. Automobile Noise
6. Road Noise
7. Noise Barrier
8. Noise Control Materials
9. Duct Noise
10. Vibroacoustics, Isolation and Damping
11. Room and Building Acoustics
12. Active Noise and Vibration Control
13. Outdoor Sound Propagation
14. Measuring Techniques
15. Instrumentation and Standards
16. Signal Processing and Analysis
17. Numerical and Computation Techniques
18. Sound Quality
19. Low Frequency Noise and Infrasound
20. Effect of Sound and Vibration on Human
21. Speech and Sleep Disturbance
22. Psychological and Physiological Acoustics
23. Community Noise
24. Soundscape
25. Environmental Noise
26. Airport Noise
27. Noise Policy
28. Noise Labeling
29. Costs and Benefits of Noise Control
30. Nonlinear Acoustics
31. Ultrasound
32. Underwater Sound

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Philip A. Nelson (UK)
Robert J. Bernhard (USA)
Patricia Davies (USA)
William W. Lang (USA)
Rajendra Singh (USA)

LIST OF STRUCTURED SESSIONS

NOISE SOURCES

Noise from Information Technology Devices
Fan Noise
Aeroacoustics/Turbomachinery Noise (Mechanism & Simulation)
Aeroacoustics/Numerical Simulation
Aeroacoustics/Self-Excited Tone
Aeroacoustics/Measurement & Control
Aircraft Noise Prediction & Control
Noise Emission and Limitation for In-Service Road Vehicles and Tires
Tire/Road Noise
Noise from Vehicles Driving over Bridge Joints
Electromagnetic Acoustic Noise
Railway Interior Noise and Vibration
Railway Noise
Characteristics and Control of Machinery Noise
Nonlinear Acoustic Problems Related to Transportation

MEASUREMENT, SIMULATION AND SIGNAL PROCESSING

3D Sound Reproduction
Numerical Methods in Acoustics
Identification and Localization of Noisy Vehicles in Traffic Flow
Robust Speech Processing in Noisy Environments
Numerical Modeling for Building and Room Acoustics

SOUND PROPAGATION AND NOISE CONTROL

Acoustics in the Workplace -- Technology and Performance
Materials and Structures for Noise and Vibration Control
Floor Impact Sound -- Evaluation and Control
Prediction of Sound Transmission in Buildings
Acoustics of Sustainable Buildings
Active Noise Control -- New Target of ANC
Outdoor Sound Propagation in Living Environment
Long-Range Propagation of Impulsive Noise
Noise Barrier
Marine Vehicle and/or Offshore Structure Noise
Hearing Protectors
Building Envelop Design for Noise Mitigation (Traffic Noise Façade Screening)
Building/Environmental Acoustics

SOUND EVALUATION

Comfortable Sound Design
Noise Evaluations Based on Psychoacoustics
Low Frequency Noise
Quiet Vehicle
Vehicle Interior Noise
Speech and Sleep Disturbance
Warning Signal in Noisy Environment/Noise Hazards
Accessibility—on Acoustics of Special Environments Regarding the Handicapped and Senior Citizens, such as Interior Spaces, or Noise from Electric Cars
Warning Signal for Increased Safety
Sound Quality Issues in Community Noise

VIBRATION EVALUATION

Effect of Vibration on Human
Psychological and Physiological Effects of Vibration
Multi-modal Sensation or Vibration Evaluation and Multimodal Interaction
Standardization of Human Response to Vibration

ENVIRONMENTAL NOISE

Economic Valuation of the Sound Environment
Community Noise and Public Health
Noise Surveys and Response to Noise
Wind Turbine Noise and Its Effects on People
Soundscape: from Understanding to Implementation
New Standard of Soundscape
Applications of Soundscape Research in Community Noise Control
Challenging Noise Policy: from Local to Global
Soundscape Design for Creating Secure and Comfortable Society: Basic Study and Applications
Environmental Noise Management - Achievements from the Past to the Future
Strategic Noise Maps for Europe
Environmental Management towards Airport Sustainability
Balanced Approach of Airport Noise
Managing Noise Issues around Airport and Military Facilities
Airport Noise Modeling and Monitoring
Reducing the Uncertainty to Noise Assessment Using Supplements and Alternatives to A-weighted DNL/DENL

CALL FOR PAPERS

Papers related to the technical areas listed above are especially welcome for presentation at the INTER-NOISE 2011 Congress, but technical papers in all areas of noise and vibration control can be submitted for inclusion in the technical program. Abstracts must be submitted in the format described in this announcement. The deadline for the receipt of the abstract is February, 15th, 2011. Notification of the paper's acceptance will be sent to the authors up to April, 15th, 2011. Full paper Manuscripts for publication in the congress proceedings are due on June 8th, 2011.

The manuscripts must be prepared according to the format described on the Congress home page. Final manuscripts must be submitted in PDF format by June 8th, 2011.

All registrants for the INTER-NOISE 2011 will receive a printed booklet containing all abstracts, a final technical program, and a CD that will include all INTER-NOISE 2011 papers. The Congress organizers reserve the right to schedule the papers for the appropriate sessions and presentation format, i.e., poster versus oral presentation in technical sessions.

Abstracts can be submitted through the registration link on the Congress web site: http://www.internoise2011.com. The format requirements for the submitted abstracts are listed as below:

1. Paper title (20 words maximum)
2. One or two subject classification numbers (classify your paper using the detailed classification of subjects at http://www.i-ince.org/data/classification.pdf)
3. First author's name, address, phone number, fax, and email for correspondence
4. Additional authors' names and addresses (if any)
5. Indicate specific type of paper
   - invited paper or contributed paper
   - prefer oral or poster presentation
6. Text of the abstract, not exceeding 250 words, and a minimum of 100 words.

The text should include:

- Brief introduction of the problem being addressed
- Importance of the problem
- Method of the development used for problem solving
- Original contribution of the work
- Conclusions

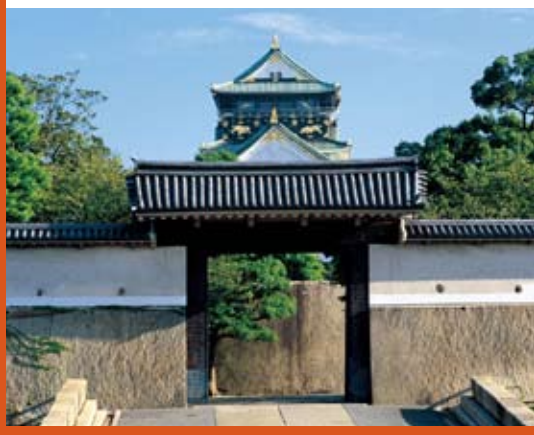
IMPORTANT DATES

DEADLINE OF ABSTRACT SUBMISSION:
February 15th, 2011

NOTIFICATION OF ABSTRACT ACCEPTANCE:
April 15th, 2011

DEADLINE OF FULL PAPER SUBMISSIONS:
June 1st, 2011

DEADLINE OF EARLY REGISTRATION:
June 8th, 2011



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REGISTRATION

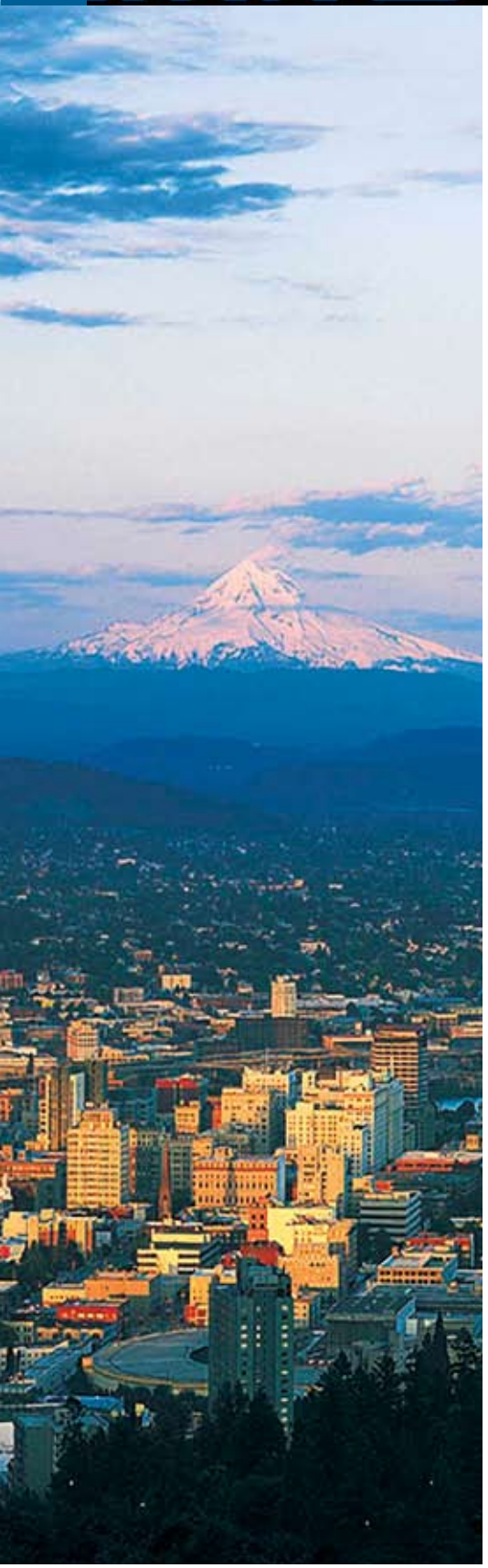
INTER-NOISE 2011 congress registration on the web site: http://www.internoise2011.com/ will be available from December 1st, 2010. When the registration is completed, an e-mail acknowledgment of the registration from the Congress Secretariat will be automatically sent back to the e-mail address provided on the registration. Payment of the registration fee will be also available on-line using credit card payment.

EXPOSITION

A dedicated exhibition space will enable companies to display the latest in technology and services in the areas of noise and vibration. The area will be the focal point for coffee and refreshments during breaks in the technical schedule. The exhibition will kick-off Monday morning, run all day Tuesday, and wrap-up by noon on Wednesday. For further information, contact Exposition Manager: TOSHIKAZU Satoh, e-mail exhibition_manager@internoise2011.com

LANGUAGE

The official language of the Congress is English



Announcement and Call For Papers

Introduction

The 25th conference of the Institute of Noise Control Engineering, NOISE-CON 2011, will run concurrently with the summer meeting of the Transportation Research Board, Committee on Transportation-Related Noise and Vibration (TRB ADC40 - www. adc40.org) on Monday through Wednesday (25-27 July, 2011). This conference is joining the overlapping transportation noise and vibration interest of the two organizations in Portland, Oregon to take advantage of the strong public interest and readily accessible public transportation project sites currently found in the Pacific Northwest.

The technical program for the joint conference will provide an opportunity for public and private organizations to share technical information on noise and vibration topics associated with high speed rail, light rail systems, highway surface and tire noise and aircraft noise to name a few. In addition, the technical program will include papers in areas such as *Experience with Measuring and Modeling of Wind Turbine Noise, Control of Noise Both Interior and Exterior to Buildings, Industrial Noise Measurement and Control, Product Noise Measurement and Control, Noise Measurement Equipment and Techniques, Structural Noise Transmission and Control and Community Noise Measurement and Control.*

Kerrie Standlee, P.E. of Daly-Standlee & Associates, Inc. in Beaverton, Oregon is the General Chair for the meeting. Carole Newvine, Oregon Department of Transportation, is the TRB ADC40 committee meeting contact. Hugh Saurenman of ATS Consulting in Los Angeles, California and Paul Donavan of Illingworth & Rodkin, Inc. in Petaluma, California are the Technical Co-Chairs for the meeting.

An exposition of vendors of noise-control related materials, instrumentation and software companies will commence on Monday evening with a reception sponsored by the vendors and end on Wednesday morning at noon. A social gathering for attendees will occur at an off-site location to include special activities for conference members as well as family guests. A special accompanying guest program will also be included as part of the conference to encourage attendees to bring their families and consider the Portland conference as the beginning of wonderful vacation location.

Finally, NOISE-CON 2011 will celebrate the 40th Anniversary of INCE-USA by holding a special social event to recognize the founding organizers and past presidents of the organization.

DEADLINES
NOISE-CON 2011

Abstract ..... March 4, 2011

Final Paper ..... May 13, 2011

Exposition

A dedicated exposition space will enable companies to display the latest in technology and services in areas of noise and vibration. The area will be the focal point for coffee and refreshments during breaks in the technical schedule of both meetings on Tuesday.

Exposition Schedule:

Monday, 25 July 2011
- Set-up - 12:00 P.M. to 16:00 P.M.
- Exposition and Opening Reception - 17:00 P.M. to 19:30 P.M.

Tuesday, 26 July 2011
- Exposition - 0800 A.M. to 16:00 P.M.
- Coffee Break - morning and afternoon
- Exposition and Closing Reception - 16:00 P.M. to 18:30 P.M.
- Tear down (optional) - 18:30 P.M. to 20:00 P.M. or group museum visit

Wednesday, 27 July 2011
- Tear down - 0800 A.M. to 12:00 P.M.

The exposition is now sold out. A list of vendors can be found on the exposition page of the NOISE-CON 2011 conference web site.

Venue

The Portland Marriott Downtown Waterfront is the venue for the joint meeting. It is located on the Oregon riverfront near Portland State University and several attractions in the downtown area.

ROOM RATE INFORMATION

A block of guest rooms at discounted rates has been reserved for meeting participants at the Portland Marriott Downtown Waterfront. Early reservations are strongly recommended. **Note that the special INCE/TRB guest room rates are not guaranteed after 22 June 2011**. You must mention the Institute of Noise Control Engineering when making your hotel reservations over the phone in order to obtain the special INCE/TRB guest room rates.

- Single/Double/Triple/Quadruple Occupancy: $149 USD
- Limited number of Government Rate Rooms available
- All rooms are subject to tax (currently 12.5%)
- Reservation cut-off date: 22 June 2011

Please make your reservations directly with the Portland Marriott Downtown Waterfront. Remember to mention the Institute of Noise Control Engineering/Transportation Research Board to obtain the special INCE/TRB room rates. Reservations can also be made directly online at the hotel's web site.

Short Courses

A selection of short courses in noise control topics will be available on the Sunday before the conference.

Course #1: Practical Aspects of Acoustical Enclosure Design
Instructor: Daniel J. Kato

Course #2: Noise from Information Technology Products
Instructor: Marco Beltman, Intel Corporation

Course #3: INCE Fundamentals Exam Preparation and Optional Exam
Instructors/Exam Administrators: James D. Barnes, Acentech; Mark Storm, URS Corporation

For more details, see the short courses page on the conference web site.

Student Paper Competition

A student paper competition will be held with $1000 prizes for up to five student papers. Entry information will be posted on the conference web site in the near future.

Social Events

There will be four social events available to attendees and registered accompanying guests of NOISE-CON/ADC40 2011 joint conference.

- Institute of Noise Control Engineering's 40th Anniversary celebration event will occur on Sunday, 24 July 2011 and will include a dinner cruise down the Willamette River on the Portland Spirit. The cost for this event is additional to the conference fee and registration for the event can be made on the conference registration form.
- Two Exposition Exhibitor's Receptions will occur on Monday, 25 July and Tuesday, 26 July 2011. There is no additional cost for these events to registered conference attendees and registered accompanying guests and pre-registration is not required.
- The main conference social event will be held on Tuesday evening, 26 July 2011 following the Exposition Exhibitor's Reception. The event will take place at the Oregon Museum of Science and Industry (OMSI). There is no additional cost for this event to registered conference attendees and registered accompanying guests but pre-registration is required. Registration for this event can be made on the conference registration form.

Conference Registration

Information will be posted on the conference registration page of the conference web site.

More Information

See the conference web page for more information.

FAA aircraft noise impacts research roadmap

Raquel Girvin, Federal Aviation Administration, Office of Environment and Energy, 800 Independence Ave., SW, Washington, DC 20591

This article is an edited version of a paper which appeared in the NOISE-CON 2010 Proceedings. — Ed.

ABSTRACT

Improving efficiency through airspace redesign, airport capacity expansion, and other initiatives of the US Department of Transportation Federal Aviation Administration (FAA) Next Generation Air Transportation System (NextGen), may be hampered without an aggressive program to address the environmental consequences of aviation. Aircraft noise remains a key environmental concern. How to reduce the impacts of aviation noise efficiently and effectively requires that we improve our understanding of the noise problem by itself as well as in relation to other environmental concerns. This paper describes efforts initiated by the FAA Office of Environment and Energy to identify and map out research needed to provide the best scientific evidence on the impacts of aircraft noise exposure in order to inform FAA policy on land use compatibility and noise impact/mitigation criteria. With greater scientific understanding, we expect to improve our noise mitigation efforts by reducing the effects of noise where and when it matters, within the context of all environmental consequences of aviation. In addition, the research is intended to help gain greater public trust in and increase the public's understanding of how the FAA describes aircraft noise exposure and its effects.

Introduction

The Federal Aviation Administration (FAA) continues to work towards providing the safest, most efficient aviation system in the world that operates in an environmentally sound manner. Contours of annual average noise exposure for long-established U.S. airport communities have decreased because of continuing reductions in the amount of noise emitted by individual aircraft and other noise mitigation measures, despite aviation's growth. Nevertheless, airport communities remain concerned about aircraft noise, as illustrated by the public's response to aircraft operations from the newly opened runways at Chicago O'Hare and Seattle-Tacoma airports.[1] Improving efficiency through airspace redesign, airport capacity expansion, and other initiatives of the FAA Next Generation Air Transportation System (NextGen), may be hampered without an aggressive program to address the environmental consequences of aviation noise.

Based on the advice of its Research, Engineering and Development Advisory Committee (REDAC), the FAA Office of Environment and Energy (AEE) is developing a comprehensive research roadmap addressing critical noise impacts research needs, with collaboration and participation from researchers across numerous disciplines and around the world, as well as with the broad community of aviation stakeholders including the public. Such a roadmap will enable FAA and interested parties to define systematic, focused, and complementary research programs, in which limited resources could be pooled to advance the scientific knowledge on how best to address the impacts of aviation noise on society. We envision a periodic review to track research progress against the roadmap as well as adjust FAA policy as warranted by new knowledge gained from the research.

State-of-the Practice for Noise Impact Analysis, Mitigation, and Land-Use Compatibility Guidelines at FAA

For aviation noise impact analysis, cumulative noise energy exposure of individuals to noise resulting from aviation activities must be established in terms of yearly day/night average sound level (DNL) as FAA's primary metric (as stated in FAA Order 1050.1E, "Environmental Impacts: Policies and Procedures") [1]. The criterion establishing significant noise impact from a proposed action is: "A significant noise impact would occur if analysis shows that the proposed action will cause noise sensitive areas to experience an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure when compared to the no action alternative for the same timeframe." This significance threshold is anchored by the exposure-response relationship between DNL and the percentage of the exposed population "Highly Annoyed" (%HA),

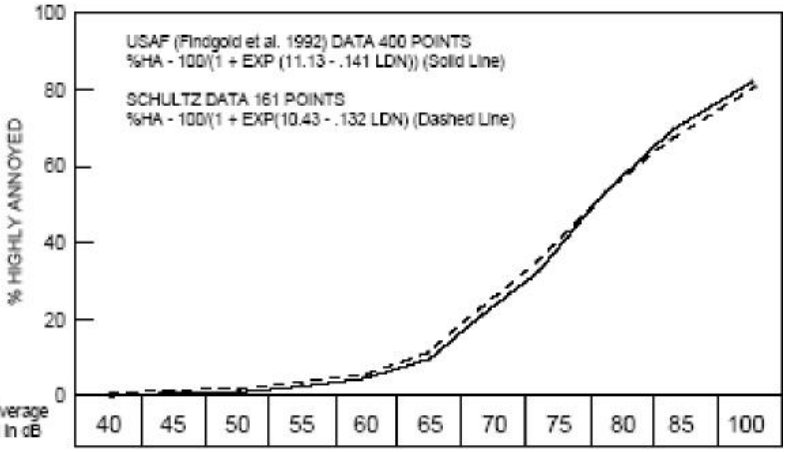
1. "New Runway Causing New Noise Problems", *THE JOURNAL & TOPICS NEWSPAPERS* | THURSDAY, NOVEMBER 27, 2008, http://www.journal-topics.com/eg/08/eg081127.3.html; "New O'Hare runway seeing tons of traffic, and nearby residents not keeping quiet"; Chicago Tribune, Friday, December 05, 2008, http://archives.chicagotribune.com/2008/dec/05/local/chi-ohare-noise_05dec05; "Sea-Tac neighbors feel duped over 3rd-runway noise", The Seattle Times, December 11, 2008, http://seattletimes.nwsource.com/html/localnews/2008493979_runway11m.html

originally derived from studies of urban and suburban community responses to transportation noise by Schultz (1978) [2] and re-affirmed by the Federal Interagency Committee on Noise, FICON (1992) [3]. See Figure 1. However, FAA recognizes that different criteria as yet undefined are needed for noise-sensitive areas within national parks, national wildlife refuges and historic sites, including traditional cultural properties, where other noise is very low and a quiet setting is a generally recognized purpose and attribute.

FAA supports the assessment of aircraft noise impacts by developing and maintaining noise-evaluation models and methods. Airport community noise from aircraft takeoffs and landings is computed using the Integrated Noise Model (INM); for larger-scale analyses involving multiple airports in a region or changes in air traffic operations, noise exposure throughout a region is computed using the Noise Integrated Routing System (NIRS). Current modeling capabilities are primarily for conventional subsonic aircraft operating at a maximum of 18,000 ft above ground level (AGL). FAA is developing an integrated aviation noise and emissions model called the Aviation Environmental Design Tool (AEDT) so interdependencies between noise and emissions impacts can be assessed. AEDT computes noise based on methods developed for INM and NIRS.

To characterize specific noise effects tailored to local concerns or to describe noise exposure to the public in other ways in addition to DNL, FAA uses supplemental analyses and a variety of single-event and cumulative noise metrics on a case-by-case basis. Individual supplemental metrics have limitations and do not provide a complete analysis of the magnitude, duration, or frequency of the noise events under study. FAA guidance cautions that a supplemental noise analysis is not, by itself, a measure of adverse aircraft noise or significant aircraft noise impact.

Figure 1 — Correlation between annoyance and noise exposure, FICON (1992).



Calculated %HA Points											
USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

FAA land use guidelines generally consider land uses compatible with airport operations in areas where the annual average aircraft noise exposure is below 65 dB(A) DNL. Airport noise-compatibility programs are usually based on establishing or maintaining compatible land uses in areas at or above 65 dB(A) DNL. There are exceptions. Deference is given to local authorities to determine acceptable and permissible land use in specific noise contours according to "local needs or values" (Code of Federal Regulations Title 14 Part 150). The guidelines are not sufficient to determine the noise compatibility of areas within a national park or national wildlife refuge, nor do they address noise effects on wildlife.

Critical Research—Goals, Objectives, and Needs

The primary goal for the noise impacts research is to ensure that the best scientific evidence of how aircraft noise exposure affects people, animals, and structures informs FAA policy on land use compatibility and noise impact/mitigation criteria. With greater scientific understanding, we expect to improve our noise mitigation efforts by reducing the effects of noise where and when it matters, within the context of all environmental consequences of aviation. In addition, the research is intended to help gain greater public trust in and increase the public's understanding of how the FAA describes aircraft noise exposure and its effects. To achieve these goals, FAA's Office of Environment and Energy has identified critical research needs as described below.

Noise Effects on Health and Welfare

Despite a large body of research [4], how best to quantitatively characterize the relationship between aircraft noise exposure and its impacts remains to be answered, in part because of significant research methodological differences. And with much of recent research conducted outside the US, the challenge for FAA lies in determining the extent to which sleep quality, children's learning, and other aspects of public health and welfare are affected by aircraft noise, especially where land uses are considered compatible with aircraft noise exposure. Critical research is therefore needed to quantify potential noise impact on health and welfare in areas considered noise-compatible (i.e., beyond 65 dB(A) DNL) by establishing correlations between noise exposure metrics and impacts.

A complicating feature of analyzing the impacts of aircraft noise is the subjectivity of human response to sounds, where non-acoustic factors together with other acoustic factors not captured by the

DNL metric, may also affect community annoyance levels. Questions that persist include whether using other metrics in combination with or in lieu of DNL would correlate better with community annoyance, as well as what significance threshold(s) should be used. Critical research is thus needed to determine whether the current basis for establishing significant impact needs updating to better reflect the current state of community response to today's aircraft noise exposure.

Noise in National Parks and Wilderness

FAA recognizes that the 65 dB(A) DNL significant noise threshold inadequately addresses the effects of noise in naturally quiet areas such as National Parks and wilderness. The significance of impacts at noise exposure levels below 65 dB(A) DNL remains to be determined both for visitors and wildlife. Airspace redesign efforts and aircraft operations higher than 18,000 feet AGL, which generally do not contribute as much noise to urban and suburban communities as departures and landings, may have a greater impact in these quieter settings. Therefore, critical research is needed to quantify impact to National Parks and wilderness areas exposed to aircraft noise by establishing correlations between noise exposure metrics and impacts, and model noise propagation from aircraft operations above 18,000 feet AGL.

Noise Modeling Extensions

As discussed above, FAA has a well-established program to update analytical tools to model noise from subsonic aircraft operations at or near airports. However, the capability to model noise from aircraft on-ground operations may need enhancement. In addition, FAA must prepare to develop the ability to model noise for future aircraft with substantially different (and some potentially significant) noise characteristics from conventional subsonic aircraft, such as aircraft with open rotors or hybrid wing body aircraft and aircraft flying supersonically over land (presuming they have achieved yet-to-be-determined publicly acceptable low sonic boom levels). Therefore, critical research is needed to model noise propagation from aircraft on-ground operations and potentially from all flight phases of future unconventional aircraft and engine configurations.

Social Costs of Aircraft Noise

FAA is developing a cost-benefit analysis model to inform the environmental decision making process. Computing the social costs of aircraft noise for comparison with other environmental impacts, whether by monetization or other means will require knowledge gained from the other critical research areas mentioned above. Critical research is therefore needed to quantify the social cost of noise relative to other environmental impacts.

Developing Research Roadmaps for Aircraft Noise Effects

There are numerous potential effects of aircraft noise on public health and welfare which need to be studied separately. This paper focuses on the current efforts at addressing aircraft noise-induced annoyance and sleep disturbance. The FAA Office of Environment and Energy organized and sponsored a one-day forum in Ottawa, Canada, following INTER-NOISE 2009 on August 27, 2009, in which international experts and stakeholders discussed specific research questions addressing the effects of aircraft noise on annoyance and sleep disturbance. Subsequently, the FAA held a two-day workshop to map out the research needed on the same two topics in December 2009 in Washington, DC. A follow-on workshop was held in March 2010 in San Diego, CA. Preparatory material for these meetings together with the outcome of the meeting discussions are documented in reports available online.
(See www.fican.org/faaworkshop.html)

The research questions regarding sleep disturbance revolved around what types of research should be considered to assist FAA in establishing policy in this area, differences between research methodologies, and appropriate aircraft noise metrics. The research questions regarding annoyance revolved around improving upon FAA's current policy reference.

Annoyance Research

The prevalence of annoyance in communities exposed to transportation noise is estimated using a simple model derived from a meta-analysis of community noise surveys. The model correlates noise exposure in terms of DNL with the percentage of a population who self-report a high degree of annoyance to noise (reported as "percent highly annoyed" or %HA). The annoyance research roadmap aims to improve upon the predictive ability of the first-order approximation model used by FAA (Fig. 1) in estimating annoyance to aircraft noise exposure.

Among the key issues the research needs to address is the large scatter in community survey data that have been acquired over the decades and around the world. Sources of data variability that remain to be fully investigated cover a wide range of acoustic and non-acoustic considerations. The DNL metric may not adequately capture the influence on annoyance of such non-acoustic factors as differences in airport operations in terms of the number and types of aircraft operating, as well as when throughout a day the aircraft are operating. The FICON model is derived from data for all transportation modes, but evidence has shown significant differences in the correlation between DNL and %HA among the modes [5]. The prevalence of annoyance for communities exposed to a step change in noise may be different from those with gradual or little change in noise exposure. Furthermore, it is likely that

cultural, attitudinal, climatic, and housing construction differences contribute to differences in people's assessment of their degree of annoyance. Acoustic factors that may affect the prevalence of annoyance include differences between background sound level and differences between an individual's noise exposure and the attributed DNL. Sound characteristics other than level, such as tonal and frequency content, may also contribute to annoyance but are not captured in the DNL metric.

Another issue important to address is that the majority of US data were acquired twenty to thirty years ago when aircraft noise levels were higher but there were fewer aircraft operations than today. As in other countries or regions, questions have arisen regarding the applicability of older data to today's aviation environment.

The approach to addressing these issues is to first re-analyze existing data, focusing on aircraft-induced annoyance and systematically investigating all the sources of data variability possible given the available data. These meta-analyses are expected to lead to an improved model with greater predictive ability, at the same time identifying the limitations of existing data in providing answers to the research questions. Significantly improving the annoyance model will require that new community studies in the United States be designed specifically to address the remaining knowledge gaps be conducted.

A related research topic that has arisen derives from the important distinction between personal annoyance with aircraft noise and public or community action against aircraft noise. Whereas personal annoyance can be determined by social surveys of sample populations, public or community action manifests as complaints to an airport, organized expression of dissatisfaction or, occasionally, legal action. Part of the approach to improving the predictive ability of the annoyance model is to study complaint and other public action data for insight into other sources of data variability.

The research roadmapping discussions have also identified the importance of helping the public better relate their experience of individual noise events to metrics we use to describe their noise exposure, because aircraft noise evokes psychological as well as physiological responses. An approach to addressing this issue is to systematically evaluate best communication practices for different situations, based on recent studies identifying best practices for communicating with the public. This study would then lead to models or standards for communicating aircraft noise exposure and effects to the public.

Adverse public action against airport capacity expansion or airspace efficiency improvement has been difficult to predict. Therefore, in addition to improving knowledge on health and welfare effects of aircraft noise and effectively communicating with the public, discussions have also identified the need to systematically review factors that have led to public action against airport and airspace redesign projects. Such a study would help develop a model to predict the likelihood of adverse public action so that FAA and aviation authorities can proactively interact with communities and address their concerns.

Sleep Disturbance Research

Present FAA policy addresses land use compatibility and impact solely in terms of type of land use and the value of aircraft-produced DNL. While DNL takes into account the increased sensitivity to noise during nighttime hours by including a 10 dB penalty on nighttime flights, researchers have found that other noise metrics relate better to the effects of nighttime aircraft noise on sleep. Accordingly, one part of FAA's focus for research is the relationship between nighttime aircraft noise and its effects on sleep.

Both acoustic and non-acoustic factors may produce sleep disturbance, which in turn can lead to effects on performance and health. The research roadmap aims to develop a model that relates how noise exposure affects sleep and the after-effects of sleep disturbance. One of the key research issues is that studies to date on aircraft noise-induced sleep disturbance have been conducted for small population samples and only on healthy adult subjects. Furthermore, few such studies have been conducted in the United States. Therefore, the question arises whether those studies and results could apply to the broad U.S. population. Another significant issue is that while several models have been developed correlating sleep disturbance with night time aircraft noise, they have been based on different measures of sleep disturbance and noise. The reliability of the different models remains to be determined.

Some research has shown that study subjects awaken more easily from noise as morning approaches. Having the ability to estimate this difference would permit a distinction between the sleep disturbance effects of aircraft operations at different times. Other gaps in the knowledge include how aircraft noise-induced sleep disturbance compares to other causes of sleep disturbance, how to determine if an awakening was spontaneous versus one that was caused by aircraft noise, and what the relationship is between sleep disturbance and next-day and long-term effects. Such a relationship would suggest consequences beyond disturbing sleep.

While there has been no consensus on the value of examining/reviewing previous studies to determining whether the issues above can be better understood, there appeared to be sufficient support to do so, such that a review and meta-analyses of existing data should be an initial step in the sleep research roadmap. Studies relating noise from any source and sleep would be reviewed for their usefulness in

addressing the research gaps as well as to design type and scale of future studies. The meta-analyses would analyze sources of variability in the existing data, and complaint data might provide additional insight to the problem. Sources of variability could include the influence of non-acoustic factors on sleep disturbance such as cultural differences, different house construction techniques, and window-opening practices.

The currently available sleep disturbance models should be evaluated and tested to identify their strengths and weaknesses, determine if they produce reasonable results, and whether they could serve policy development. Considerable work on understanding the causes and effects of sleep disturbance should be reviewed to determine if it can help advance the limited knowledge on the effects of noise-produced sleep disturbance. Studies that relate sleep disturbance to next-day measures of performance, sleepiness, or other effects should be evaluated. Also, most sleep studies have accumulated all awakening and noise event data across all nights by subject. Reanalysis of the data by evaluating nights separately by subject so that the disturbance can be correlated with nights having significantly different levels of noise may help improve sleep disturbance models. The World Health Organization-Europe has proposed night noise guidelines for Europe using the nighttime equivalent sound level outdoors, L_{night},outside as the noise metric. Some studies have found that, although sleep disturbance increases with increasing L_{night},outside, better agreement between nighttime noise and disturbance is achieved by including number of operations. It would be useful to examine the relationship between L_{night},outside and predicted sleep disturbance using available models.

Given that studies of the effects of aircraft noise on sleep are limited and technologies have been developed for better data collection, new studies need to be designed and pursued. The broad community of sleep and health researchers will be engaged and findings from reviews of existing work described above will be used as guides in addressing remaining knowledge gaps on aircraft-noise-induced sleep disturbance across US populations.

Table 1 — FAA annoyance and sleep disturbance research roadmap planning panels.

Panelists for Sleep Disturbance:

Mathias Basner	University of Pennsylvania
Patricia Davies	Purdue University
Jim Fields	Independent Consultant
Barbara Griefahn	Leibniz Research Center, TU Dortmund
Sarah McGuire	Purdue University
Nick Miller	HMMH

Panelists for Annoyance:

Kenneth Hume	Manchester Metropolitan University
Sandy Lancaster	Dallas-Ft Worth International Airport
Mayor Arlene Mulder	O'Hare Noise Compatibility Commission
Paul Schomer	Schomer and Associates, Inc
Catherine Stewart	U.S. Department of Army
Kevin Shepherd	NASA

Considerations for Future Studies

Given the internationally diverse field of researchers on noise effects, future US studies should be developed cooperatively with the international research community and ensure that important variables and survey questions are included in the studies. Gathering consistent data internationally will improve the understanding of the problem, and should increase the abilities of airports and communities worldwide to work together addressing the aircraft noise issue.

Future studies should also use state-of-the-art technologies to acquire noise data and conduct surveys. Noise level measurement techniques to complement surveys need to consider recent developments in instrumentation and associated software. For example, sound level monitors have the ability to make digital recordings of events, and promising pattern recognition software may be available to automate noise source identification. Use of Internet/wireless communication may also improve acoustic measurement capabilities.

Concluding Remarks

Improving efficiency through airspace redesign, airport capacity expansion, and other initiatives of the FAA Next Generation Air Transportation System (NextGen), may be hampered without an aggressive program to address the environmental consequences of aviation. Better scientific understanding of aviation's environmental impacts is needed to help ensure NextGen's success.

This paper describes efforts initiated by the FAA Office of Environment and Energy to identify and map out research that will provide the best scientific

evidence on some of the potential impacts of aircraft noise in order to inform FAA policy on land use compatibility and noise impact/mitigation criteria. In addition to the topics of annoyance and sleep disturbance covered in this paper, FAA will investigate the other critical research areas described above. With greater scientific understanding, we expect to improve our noise mitigation efforts by reducing the effects of noise where and when it matters, within the context of all environmental consequences of aviation. In addition, the research is intended to help gain greater public trust in and increase the public's understanding of how the FAA describes aircraft noise exposure and its effects.

Acknowledgements

The FAA annoyance and sleep disturbance research roadmap development has benefitted from the support of two planning panels. Therefore, many thanks go to the planning panelists listed in Table 1. Participants at the Ottawa, Canada forum and the workshops in Washington, DC and San Diego, CA, identified in the summary reports, have also made significant contributions to identifying key research issues and how best to address them. Last but not least, the author gratefully acknowledges Mr. Nick Miller from Harris Miller Miller and Hanson, Inc. (HMMH) for facilitating all our research roadmapping discussions to date and organizing and summarizing material developed to prepare for the meetings as well as the outcomes of the meetings. The author takes full responsibility for any errors in this paper.

References

1.United States Department of Transportation Federal Aviation Administration National Policy Order 1050.1E Change 1 Effective date March 20, 2006, http://www.faa.gov/documentLibrary/media/order/energy_orders/1050-1E.pdf

2.T.J. Schultz, "Synthesis of Social Surveys on Noise Annoyance", *J. Acoust. Soc. Am.*, 64, 377-405, (1978).

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Policy options for sustainable transport with less noise

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Abstract

Currently, road and air traffic as well as the related noise is increasing in developed and developing countries. On the roads, there is a trend for more powerful and noisier vehicles, particularly trucks and lorries. This growth of personal and goods transportation and related exposure to noise and air pollutants is unsustainable. Currently, protective measures are often roadside barriers and insulating windows for which taxpayers usually end up footing the bill. Noise barriers, walls and insulation are hugely expensive, only ease the problem for those behind the wall or in protected buildings, spoil the natural landscape, and may influence mental health. Policies of local noise prevention measures include: Reducing noise at its source, i.e., strict noise emission limits in the type approval procedures for tyres, new motor vehicles, international trains, and aircraft; environmental zones or low noise emission zones (access restrictions for heavy/noisy vehicles); night-time driving or flight bans; speed limits; traffic flow management; transport demand management including the promotion of public transport; and cycling and walking. Some of these measures are also beneficial in term of reduced air pollutant and greenhouse gas emissions, accidents and infrastructure wear.

In this paper, these policy options are discussed.

Introduction

In urban and regional centers, noise is increasing due to road and airport runway operations. Agglomerations both in developed and developing countries currently suffer environmentally and economically from motor vehicle congestion, noise and air pollution. On the roads there is a trend for more powerful and noisier vehicles, particularly trucks and lorries. This growth of personal and goods transportation and related exposure to noise and air pollutants is unsustainable. In addition, growing road and air traffic leads to increased greenhouse gas emissions, which accelerate climate change.

Current measures to reduce exposure of the general population to noise and air pollutants include strict emission limits, noise barriers, walls and insulation. Strict emission limits on vehicles help reduce noise, air pollutant and greenhouse gas emissions. They are, however, offset by increasing numbers of vehicles plying on the roads. Noise barriers, walls and insulation are hugely expensive, only ease the problem for those behind the wall or in protected buildings, spoil the natural landscape, and may influence mental health. At the moment, local or municipal authorities, and therefore taxpayers, usually end up footing the bill for this type of noise remediation. Noise emissions from transport can lead to adverse health effects such as annoyance, sleep disturbance, cognitive effects in children, cardiovascular ailments, and particularly in developing countries, hearing impairment. Concurrent with these effects are those related to air pollution from transport and those to be expected from greenhouse gas emissions and climate change.

Urban sprawl has led to increasing the distances that people have to travel for daily tasks. Increased car dependence is damaging human health and the environment and condemning more and more residents to isolation in outlying suburbs. A poorly integrated transport system is also reducing employment opportunities and access to essential city services.

Urban areas, therefore, need a new approach to transport that prioritises sustainability and accessibility as guiding principles. Cities and regional centres would benefit from a refocusing of priorities towards

- liveable cities;
- public transport;
- other forms of transport (cycling and walking);
- urban village concepts;
- fewer roads, particularly fewer freeways.

This will require policy change related to institutional cultures governing transport and land use planning, financial structures, and infrastructure funding decisions.

The primary objectives of this policy change are to:

- Reduce travel demand by reducing unnecessary goods and passenger movements;
- reduce vehicle kilometres travelled;
- reduce noise pollution and exposure;
- improve air quality;
- improve social equity of transport;
- improve economic efficiency; and
- limit transport infrastructure that results in urban sprawl.

In this paper these policy options are discussed.

Health impacts of noise

The WHO Guidelines for Community Noise [1] and the Night Noise Guidelines for Europe [2] present the health impacts of noise pollution: noise-induced hearing impairment; interference with speech communication; sleep disturbance; psycho-physiological, mental-health and performance effects; effects on residential behaviour and annoyance; and interference with intended activities.

Fig. 1: Guidelines for Community Noise [1]

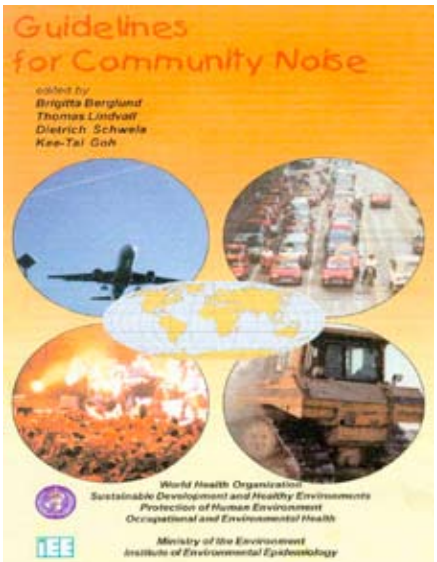
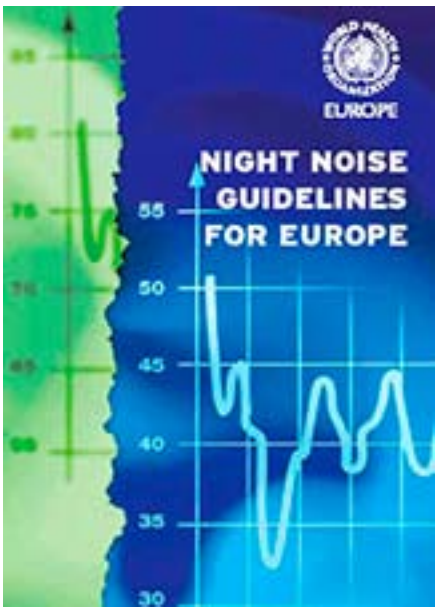


Figure 2: Night Noise Guidelines for Europe [2]



Hearing Impairment

Hearing deterioration is associated with the ageing process. Noise-induced hearing impairment is worldwide the most prevalent irreversible occupational hazard. WHO estimates that 278 million people worldwide have moderate to profound hearing difficulties both from ageing and noise exposure [3] . However, hearing impairment is not expected to occur at $L_{Aeq,8h}$ levels of 75 dB(A) or below, even for prolonged occupational noise exposure. In developing countries, environmental noise is an increasing risk factor for hearing impairment since noise levels are substantially higher than those in developed countries [1] .

The main social consequence of hearing impairment is a severe social handicap as it does not enable people to understand speech in daily living conditions. Even small values of hearing impairment (10 dB averaged over 2 000 and 4 000 Hz and over both ears) may adversely affect speech comprehension.

Speech Intelligibility

Environmental noise may mask other acoustical signals that are important for daily life, such as door-bells, telephone signals, alarm clocks, fire alarms and other warning signals, and music. The inability to understand speech results in a large number of personal handicaps and behavioral changes. Particularly vulnerable are the hearing impaired, the elderly, children in the process of language and reading acquisition, and individuals who are not familiar with the spoken language.

Sleep Disturbance

Uninterrupted sleep is a prerequisite for good physiological and mental functioning. The primary effects of sleep disturbance include difficulty in falling asleep; awakenings and alterations of sleep stages or depth; increased blood pressure, heart rate and finger pulse amplitude; vasoconstriction; changes in respiration; cardiac arrhythmia; and increased body movements. The interruption of sleep is a major effect of environmental noise. It may cause primary effects during sleep, and secondary effects that can be assessed the day after nighttime noise exposure. The probability of being awakened increases with the number of noise events per night and their amplitudes. The secondary, or after-effects, the following morning or day(s) include reduced perceived sleep quality; increased fatigue; depressed mood or well-being; and decreased performance.

Cognitive Effects

Noise can adversely affect performance of cognitive tasks. Although noise-induced arousal may produce better performance in simple tasks in the short term, cognitive performance substantially deteriorates for more complex tasks. Reading, attention, problem solving and memorization (recall) are among the cognitive effects most strongly affected by noise [4, 5, 6]. Noise can also act as a distracting stimulus. Impulsive noise events may produce disruptive effects as a result of startle responses. Noise exposure may also produce after-effects that negatively affect performance. In schools around airports, children chronically exposed to aircraft noise under-perform in proof reading, in persistence on challenging puzzles, in tests of reading acquisition and in motivational capabilities.

Cardiovascular Effects

A recent meta-analysis [7] established a pooled dose-effect curve for the association between road traffic noise levels and the risk of myocardial infarction. An increase in risk was found with increasing noise levels above 60 dB(A). The HYENA study [8] established a dose-effect relationship between noise exposure at different European airports and the risk of hypertension. Although the associations found are weak, the effect is somewhat stronger for ischaemic heart disease than for hypertension. Still, these small risk increments are important because a large number of people are exposed.

Social and Behavioural Effects of Noise

Annoyance. Noise can produce a number of social and behavioural effects as well as annoyance [9] . These effects are often complex, subtle and indirect and many effects are assumed to result from the interaction of a number of non-auditory variables. Equal levels of different traffic and industrial noises cause different magnitudes of annoyance. Noise above 80 dB(A) may also reduce helpful behavior and increase aggressive behavior [10] .

Tinnitus. Tinnitus is the general term for sound perception (e.g. hissing or ringing) that cannot necessarily be attributed to an external sound source. Tinnitus can cause one or several of the following consequences: sleep disturbance; cognitive effects; anxiety; psychological distress; depression; communication problems; frustration; irritability; tension; inability to work; reduced efficiency; and restricted participation in social life. Acute and chronic noise exposure can cause incapacitating tinnitus [11, 12] .

Policy Options for Sustainable Transport and Noise Reduction

There are several routes to sustainable transport and noise abatement. First, noise emissions can be reduced at their source, through measures relating to vehicles, tyres, and road surfaces. Second, traffic flow management (TFM) measures such as speed limits, night-time curfews, and improvements in traffic flow can lead to reduced noise levels. Third, transport demand management (TDM) can reduce the number of trips and consequently noise. TDM promotes sustainable travel choices by building houses at relatively high density in compact settlements, by supporting city and town centers and by designing streets in ways which make walking, cycling and public transport easy [13] . Fourth, noise imissions1 can be reduced by means of barriers and/or insulation measures.

At-source measures that reduce overall emissions, traffic management and transport demand management measures are preferable to noise exposure measures reducing imissions at the local level [14, 15, 16, 17].

At-source Measures

Road vehicles. Measures that tackle the basic sources of noise are technical measures to reduce noise emissions from vehicles, tyres and road surfaces. Tyre/road noise is basically due to [18] :

- Tread impacts and shocks;
- air resonance;
- tyre/road surface friction.

Porous road surfacing materials reduce tyre/road noise because

- tiny holes in the porous surfaces – approximately 20 per cent of volume - suppress the compression and expansion of air in the tyre tread profiles (Figure 3);
- the acoustic absorption reduces mechanical and aerodynamic noise.

Figure 3: Silent road surface [19]

At-source measures are generally more cost-effective than those of noise barriers and building insulation [20, 21]. Measures to reduce the noise from tyres and vehicle propulsion can achieve noise reductions at relatively low cost. Moreover, at-source measures such as reduction of noise emissions from vehicles and tyres are a direct application of the polluter pays principle since the costs are borne by the car driver.

At-source measures at the vehicle level, however, have the disadvantage that penetration of the vehicle fleet takes several years for tyres and almost a decade for motor vehicles [22] .

Railway Noise. Railway noise is reduced through [23] :

- Continuously welded rails;
- close coupling of coaches and freight vehicles;
- use of disk brakes instead of tread-brake designs (Figure 4);
- use of wheel shields and tuned absorbers on freight trains;
- track retrofit (Figure 5)
- use of bogie shrouds;
- low height trackside barriers.

Optimized wheels and wheel absorbers on freight vehicles and retrofitted trains reduced railway noise by 7 dB(A) while bogie shrouds gave a further noise reduction of 3 dB(A) [23]

Figure 4: Vehicle with disk brakes [23]

Figure 5: Retrofitted track with trackside barrier (50 mm above top of rail) [23]

Aircraft Noise. Aircraft noise arises from the engines and from the movement of turbulent air over the airframe. Noise

reduction has focused mainly on reducing engine noise. For new subsonic jets and heavy propeller-driven aircraft the noise standards of Chapter 4 of Annex 16 to the Chicago Convention applies since 2006 [24] . In view of the fact that airframe noise is becoming more and more important and the growth of aircraft fleets more stringent certification standards beyond Chapter 4 will become necessary.

Traffic Flow Management

Traffic flow management includes measures to reduce the number of vehicles on the road, measures to smoothen traffic flow by road bypasses, roundabouts and intelligent tuning of traffic lights, speed limits and night-time bans on trucks and lorries. A smaller number of vehicles reduces not only noise but also air pollutant and greenhouse gas emissions. Fewer cars plying on the roads also improve road safety. Specific traffic flow management measures (Figures 6, 7) may reduce noise levels between 2 and 7 dB(A) [25] :

- Traffic calming (≤ 4 dB(A));
- 30 km/h zone (≤ 2 dB(A));
- roundabouts (≤ 4 dB(A));
- round-top/circle-top road humps (≤ 2 dB(A));
- speed limits (≤ 4 dB(A));
- night time restrictions on heavy goods vehicles (≤ 7 dB(A)).

Speed limit enforcement, especially for speeds between 50 and 80 km/h in urban areas has a positive effect on transport noise.

Figure 6: Traffic calming through roundabout [26]

Figure 7: Speed reducing humps [27]

Traffic flow management measures involve only limited investments and have a direct effect because they can easily be enforced. However, the costs associated with potential travel time losses may be significant.

For railways and aircraft measures relating to operating conditions are the only means of traffic flow management.

Sustainable Transport and Planning

Transport demand management can reduce the number of vehicles by promotion of public transport, encouraging cycling and walking, congestion charges and parking management. In order to influence travel behavior it is imperative that [25] :

- Opportunities be taken within the planning process to make cycling, walking and public transport the modes of choice. These modes must be made more convenient than car usage for the majority of journeys, in order to promote genuine modal shift. They should be supported by the necessary management and regulatory measures;
- the need to travel is reduced by good urban design which maximizes sustainable transport;
- the future needs of a community are considered and captured through good quality planning before infrastructure is put in place;
- destination analysis is applied to predict travel behavior and trip generation. This should ensure that, from inception to maturity, appropriate sustainable travel choices can be provided both within and beyond urban areas;
- housing, schools, health centers, employment needs, existing land-use and transport facilities are considered in an integrated approach;
- the connectivity between urban areas, major zones of employment, retail/ leisure facilities and the existing road and rail network is duly considered;
- all stakeholders and the general public are informed and consulted.

Urban Design and Planning

Urban planning is currently characterized by an over-emphasis to serve motorized transport (Figure 8). Therefore an alternative hierarchy should be envisaged which serves all users including pedestrians in a balanced way. Urban design should consider the following hierarchy in any street design process [25]:

1. Pedestrians
2. Cyclists
3. Public transport use
4. Specialist service vehicles (e.g. emergency service vehicles, waste etc)
5. Other motor traffic

Figure 8: The ultimate unsustainable outcome of business-as-usual scenarios [28]

Urban design features that encourage sustainable transport and reduce noise include [25] :

- Traditional compact city layouts. A compact city is an urban area with "walking neighborhoods." These are

typically characterized as having a range of facilities within 10 minutes walking distance (around 800 metres). The propensity to walk or cycle is influenced by distance and attractive, safe, stimulating and quiet surroundings;

- situating key services such as health centers and schools in central locations within urban or suburban areas;
- comprehensive direct networks for walking, cycling and public transport, with routes for private motor traffic taking a lower priority. This may include providing additional routes for sustainable modes. Providing sustainable modes can give them an advantage over private car users and so reduce the tendency for people to drive, especially for short journeys, and produce noise;
- shopping areas favorable for pedestrians which are served by direct cycle routes and public transport;
- creation of environmental, low noise emission zones in residential areas whose streets are designed as places for people instead of just motor traffic.
- limited private vehicle access to homes and services;
- reduction of the dominance of motor vehicles through shared space streets and squares to improve conditions for cyclists and pedestrians;
- car-free areas within urban centers.

Promoting Cycling and Walking

In smaller towns of up to 10,000 dwellings, the majority of journeys should be feasible on foot or by bicycle. For larger urban areas, walking and cycling may need to be implemented by additional measures, such as public transport. In order to make walking and cycling more convenient and attractive, the following measures may be useful [31] :

- A cycling and walking infrastructure that offers direct, continuous, and, uninterrupted routes to shopping areas, schools, and community facilities (Figure 9);
- secure bike storage in attractive cycle stands (Figure 11);
- create and/or improve cycling and walking facilities that link shopping areas, schools, and community facilities to the surrounding areas;
- improve road safety by pedestrian walks, footbridges, lighting etc);
- provision to pedestrians and cyclists of additional links not accessible to motor vehicles (Figure 12);
- provision of cycle centers, e.g. for bike rental.

A good incentive for cycling could be to rent bikes for free (Figure 13).

Reduction in Car Dependency

A key component of promoting sustainable transport is to encourage reduced car dependency. Reduced car dependency emits less noise, air pollutants and greenhouse gases and can be promoted by the following measures [31] :

- Creation of completely, or partially, car-free sites;
- limitation of car spaces and/or charge for residential car parking (Figure 14);
- restriction of car parking to residents with disabilities and visitors;
- restriction of car access at certain times of day;
- limitation of car access to the periphery of urban residential areas;
- design of roads and streets that favour low car flow (Figure 15);
- referential treatment for eco-friendly, low-noise cars (e.g. electric vans), and scooters (Figure 16);
- provision of alternative access to local taxi services, home delivery vehicles, and on-demand public transport provision (Figures 17, 18).

Figure 9: Curbside cycle lane [29]

Figure 10: A pedestrian zone [30]

Figure 11: Arty cycle stands [32]

Figure 12: Accessible for bicycles only [33]

Figure 13: Free bike rental [34]

Figure 14: Residential car parking [35]

Figure 15: Lombard Street, San Francisco [36]

Figure 16: Toyota Prius hybrid car [37]

Figure 17: Local taxi service [38]

Figure 18: Home delivery vehicle [39]

Providing Access to Public Transport

Public transport (trains, light rails, buses, trams) should provide direct and fast connections to key destinations such as urban centers, major employment and leisure zones. Public transport will need to be frequent, reliable and easily accessible. Urban residents could be given vouchers for free travel funded by the taxpayers. This will help to cut car use, reduce noise, air pollutant, and greenhouse gas emissions.

One bus carrying 80 people keeps 64 cars of an urban street (Figures 19). Conventional buses running one per three minutes can carry up to approximately 1,600 passengers per hour, keeping 1,280 cars of the road, unless there is severe traffic congestion [40] .

Figure 19: Number of cars replaced by a bus [41]

One suburban train carrying 1,000 passengers keeps 800 cars (occupied by an average of 1.2 persons) off the road, substantially reducing noise and air pollution. Encouraging public transport use, land use would be more efficient. A double track railway requires a land reservation only 25 metres wide compared with a 100 metre wide reservation for a six-lane freeway [42] . A double track railway with a three-minute succession of trains can carry over 20,000 passengers per hour in either direction [40] , more than 3.5 times the capacity of a six-lane freeway where passenger cars drive at 120 km/h, having an average distance of 80 m between them, and are occupied by an average of 1.2 persons per car.

Goods Vehicles

Road freight transport is growing rapidly, and with it the noise from truck engines and their tyres. Trucks have become significantly quieter thanks to technology forcing standards, but louder tyres and the growing truck fleet undermine the overall effect. For truck tyres, the spread between loudest and quietest currently available models is 10 dB [43] .

Goods to be delivered into and out of urban areas should be performed by eco-friendly vehicles in order to reduce noise, air pollution and the carbon footprint of the goods moved. This may include freight transfer centers and/or low-emission delivery vehicles. In addition, it is necessary to remove freight from roads in favor of less environmentally damaging rail (Figure 20).

Figure 20: Translocation of goods from road to rail [44]

Recently, the Transport Salaried Staff's Association (TSSA) has dispelled ten commonly held myths on rail freight [45] . In consequence, rail freight is not

1. only suitable for bulk cargoes but can compete for general traffic;
2. limited to long distance movements;
3. only viable from siding to siding;

4. expensive and does pay its way;
5. slower than road transportation;
6. more expensive than road transportation.
   In addition, TSSA states that
7. bulk rail freight is not in more decline than other modes;
8. modern wagons have less impact on tracks and avoid severe wear and tear costs;
9. doubling of rail freight could significantly reduce freight travelling by road and congestion;
10. typical freight trains match the speed of semi-fast passenger trains.

On top of that, rail freight transport is not subject to weekend, public holidays and night-time driving bans on heavy goods vehicles in some countries of Europe [46]

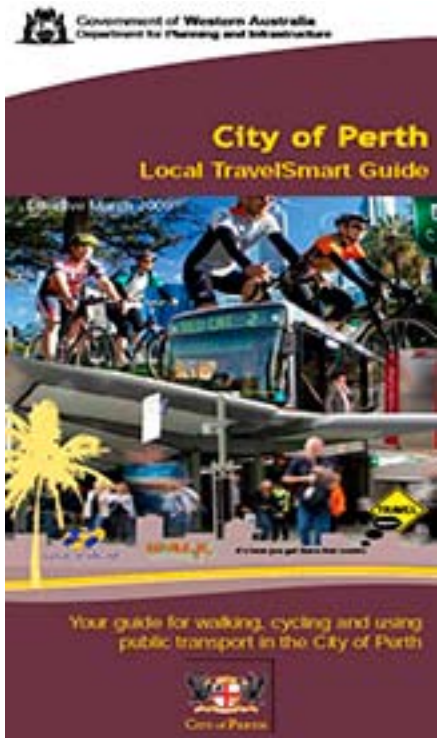
Nighttime Driving or Flight Bans

In its Night Noise Guidelines for Europe the WHO recommends a limit Lnight,outside of 40 dB(A) for the protection of human health [2] . L_{night},outside is an annual average of equivalent sound level $L_{Aeq,8h}$ outside the bedroom. The WHO Guidelines for Community Noise recommend a level $L_{Aeq,8h}$ of 45 dB(A) [1] . Adverse health effects are observed at levels above 40 dB(A) L_{night},outside such as sleep disturbance, insomnia, increased awakenings, and increased use of drugs and sedatives. At level of 45 dB(A) L_{night},outside 21,862, 134,651, 477,289, and 180,184 inhabitants are exposed at Amsterdam, Frankfurt, London, and Paris airports, respectively.

In Austria, Switzerland, and some States of Germany, nighttime driving bans exist for heavy freight vehicles [47] . In the U.K. more than 40 per cent of supermarkets are subject to curfews on delivery lorries, usually from 10pm to 7am [48] . These curfews are however challenged by new legislation. Curfews for motorcycles exist also in cities and towns of Germany [49] . Such traffic curfews, however, are beneficial only if located at the subjective night of exposed persons [50] .

In Europe, there is a lot of debate among stakeholders about nighttime flight bans. Governments and aircraft carriers hold that nighttime flights are necessary. Nongovernmental organizations claim that in spite of technological progress to reduce the noise from individual aircrafts people still suffer from the same or higher noise levels due to the increase in number and size of starting and landing aircraft [51] . Many of the Europe's leading airports, including Berlin, Düsseldorf, Frankfurt, Hamburg, London-Heathrow, Munich, Zürich enjoy nighttime passenger curfews of 6-8 hours [52] . The European Court decided in 2001 that the economic benefits of night flights are insufficient to outweigh the detrimental impact on people's quality of life [51] . However, in 2003 the European Court's Grand Chamber overturned the previous ruling [51] . Of the approximately 300 US airports listed in the Boeing airports database, 73 are listed as having night-curfews [53] . Airports without such regulations include Amsterdam, Barcelona, Madrid, Paris-CDG, and Tokyo.

Figure 21: Perth's TravelSmart programme [54]



Community and Education Initiatives

Community and education initiatives can have significant impacts in making transport and travel patterns more sustainable. For example, Perth's TravelSmart program (Figure 21), piloted in 1999, achieved a 90 per cent increase in cycling, 20 per cent increase in public transport and a 16 per cent increase in walking trips. The program resulted in a 10 per cent reduction in car use as driver-only trips. A year later these changes of travel behavior had largely been sustained [31; 54] . Similar programs have recently been completed in other West Australian cities [55] .

Barriers and Insulation

If at-source measures at road vehicles still lead to excessive noise exposure, noise barriers and insulation of dwellings can reduce the propagation of noise. On average, noise barriers reduce noise levels by 3-6 dB(A), depending on their design and height [22] . Roadside noise barriers are only useful for protection of dwellings close to motorways and bypass roads in urban and non-urban areas where pedestrians do not cross. For dwellings located farther away from such roads or at higher elevations roadside noise barriers do not provide a solution. Sound is still heard by a receiver [56] by (1) diffraction, i.e., scattering of sound waves from the top edge of the barrier, (2) scattering of sound waves from turbulent air masses above and beyond the barrier, and (3) refraction (bending) over the barrier (Figure 22). Other disadvantages of noise barriers include:

- Aesthetic impacts for motorists and neighbours (Figure 23);
- necessity to design custom drainage that the barriers may interrupt;
- costs of design, construction and maintenance.

The average cost of a noise barrier is around € 300 per m^2, or 1,000,000 per km, depending on its construction and the materials used [22] .

Figure 22: Efficiency of a roadside barrier [56]

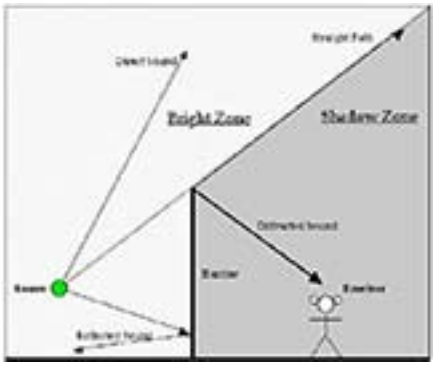


Figure 23: Unaesthetic impression of a roadside barrier [56]

Figure 24: Noise insulating window [58]

Noise protection can also be achieved through the installation of soundproof windows and insulated walls. In the USA soundproof windows are priced according to size and most will range from $350 to $900 [57] .

Conclusions

Noise from transport—road, rail and aircraft—can have serious impacts on human health in terms of annoyance, sleep disturbance, cognitive effects, physiological and, particularly in developing countries, physical effects. Current transport policies often compensate increasing use of vehicles by increasing the building of roads, which leads to urban sprawl. Such policies are unsustainable. Four different routes for policy options to achieve sustainable transport with less noise (and air pollution and greenhouse gas emissions) are discussed in this article. Policy actions include at-source measures, traffic management, transport demand management and measures to hamper noise propagation. The most cost-effective options are the first three, which can provide more transport sustainability. The fourth option is most expensive, only partially effective, and does not contribute to transport sustainability.

In order to accomplish transport sustainability it is also imperative to limit the growth of private transport, to promote public transport with eco-friendly vehicles, to change our cities from being dominated and polluted by motor vehicles to being much more pedestrian- and cyclist-friendly. Ultimately, also the economy of constant growth which is unsustainable has to be reconsidered.

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Pan-American News

Paul Donovan, Pan-American Editor

USA

Access Board Moves Towards Rulemaking for Classroom Acoustics Standards

Poor classroom acoustics impact learning for all children, but the effects are pronounced for those with hearing loss, speech or learning impairments, and those who learn English as a second language. At a recent meeting, the Access Board (the Board) unanimously voted to undertake rulemaking to address acoustics in classrooms by referencing a voluntary consensus standard that was developed with support from the Board.

The Board, which has been active in this subject for a number of years, first became involved in response to a petition from the parents of a child with a hearing loss urging action to ensure access to learning through good classroom acoustics. In response, the Board supported the Acoustical Society of America (ASA) in establishing a new acoustical standard for classrooms. More recently, the Board worked with ASA on revising and reformatting this standard, which has been accredited by the American National Standards Institute (ANSI). Consistent with long-standing recommendations for good practice in educational settings, the ANSI/ASA S12.60 Classroom Acoustics Standard sets specific criteria for maximum background noise and reverberation time in classrooms. By itself, the standard is voluntary unless referenced by a state code, ordinance, or regulation. A growing number of states, local jurisdictions, and boards of education have adopted the standard or implemented their own requirements or directives with similar criteria.

The Board worked with the International Code Council (ICC) to make the standard applicable to school construction and renovation through building codes. In May, the Board submitted a proposal to the ICC to reference the standards in the next edition of the International Building Code, the lead model building code in the U.S., but was unsuccessful despite growing support among the codes community, design professionals, and trade associations. Consequently, the Board is proceeding with rulemaking to add scoping provisions to its ADA and ABA Accessibility Guidelines that would apply the ANSI/ASA standard to classrooms that are newly constructed or significantly renovated. The Board will gather information on cost impacts in preparation for a proposed rule that will be made available for public comment. For further information, visit the classroom acoustics homepage or contact Marsh Mazz at mazz@access-board.gov, +1 202 272 0023 (v), or +1 202 272 0082 (TTY).

New National Standards Released for Acoustics in Permanent and Modular Classrooms

When planning or renovating schools' permanent and relocatable buildings, architects and designers can now refer to two new standards that provide important information for creating a healthy acoustic environment.

The Acoustical Society of America, headquartered in Melville, NY, announced the publication of a newly revised, two-part standard that addresses classroom acoustics. These documents are also a valuable resource for school boards, school facilities personnel and parents who need to understand the importance of minimizing distracting noise in the classroom and creating an acoustical environment that is conducive to learning.

The national standards are now available as a two-part series. The first part, ANSI/ASA S12.60-2010/Part 1, "American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 1: Permanent Schools, is a major revision of ANSI S12.60-2002. The particular issues related to acoustics in relocatable classrooms are addressed in ANSI/ASA S12.60-2009/Part 2, "American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 2: Relocatable Classroom Factors."

Thanks to a unique partnership of industry supporters Armstrong Ceiling Systems, Trane, and Owens Corning, ASA is able to offer both standards for download from the ASA online store at no cost to the user. "Every school official in the country can have these useful resources at hand because cost is not a prohibitive factor," said Dr. Paul D. Schomer, ASA's Standards Director.

These standards and many other national and international standards can be obtained in PDF format from the Acoustical Society of America Online Store at: <http://asa.aip.org>. Standards may also be ordered by fax or mail from: Acoustical Society of America, 35 Pinelawn Road, Suite 114E, Melville NY 11747-3177, Phone: +1 631 390 0215, Fax: +1 631 390 0217, Email: <asastds@aip.org>.

Stewart Receives ASTM Award

Consultant Noral D. Stewart, Ph.D., of Raleigh, N.C., has received the ASTM International Award of Merit from Committee E33 on Building and Environmental Acoustics. The Award of Merit, which includes the accompanying title of fellow, is the highest ASTM honor for individual contributions to standards activities.

Committee E33 cited Stewart for his outstanding leadership skills and dedication in developing ASTM acoustical field and community noise standards. A member of ASTM and Committee E33 since 1985, he recently completed a term as E33 vice president and also works on several subcommittees and task groups. During his tenure with the committee, he has served as a liaison to other organizations in the architectural acoustics and noise control community, and has promoted the use of ASTM standards in building specifications. The committee recognized him with the Wallace Waterfall Award in 2005.

European News

Bernard Berry, European Editor

Europe

10th International Congress on Noise as a Public Health Problem

Imperial College London, 24-28th July 2011

The 10th International Congress on Noise as a Public Health Problem will be held from July 24th to July 28th in London, organised by the UK's Institute of Acoustics on behalf of the International Commission on the Biological Effects of Noise (ICBEN). This Congress aims to present the current state of research on the biological effects of noise on health and is suitable for research scientists, policy makers and industrialists concerned with the effects of noise.

We invite contributions in the following sessions that will be organized by team chairs. If you are uncertain which session your abstract should be in please email the most relevant team chair. The deadline for abstract submissions 14th February 2011; the deadline for paper submissions 16th May 2011

Team 1: Noise-Induced Hearing Loss
Chair: Prof. Adrian Davis
adriandavis@nhs.net
Team 2: Noise and Communication
Chair: Prof. Chantal Laroche
claroche@uottawa.ca
Team 3: Non-auditory Effects of Noise
Chair: Dr. Hugh W. Davies
hugh.davies@ubc.ca
Team 4: Effects of Noise on Performance and Behavior
Chair: Dr. Charlotte Clark
c.clark@qmul.ac.uk
Team 5: Effects of Noise on Sleep
Chair: Dr. Kenneth I Hume
k.i.hume@mmu.ac.uk
Team 6: Community Response to Noise
Chair: Prof. Takahashi Yano
yano@gpo.kumamoto-u.ac.jp
Team 7: Noise and Animals
Chair: Dr. Mardi Hastings
mardi.hastings@gatech.edu
Team 8: Interactions with Other Agents and Contextual Factors
Chair: Dr. Ronny Klæboe
ronny.klaboe@toi.no
Team 9: Policy and Economics
Chair: Larry S. Finegold
lsfinegold@earthlink.net

Abstracts should be submitted through the website (www.icben2011.org) where further instructions will be found

EU Considers Adding Noise to Electric Cars

The EU is investigating whether artificial noises should be added to 'near silent' electric cars to reduce risks to cyclists and pedestrians, with a view to imposing legal requirements by 2012.

According to an article in the Times, manufacturers are already testing noises that could be added to electric and hybrid cars, with white noise, computer noise and the Star Wars theme tune some sounds already considered. Warwick University is working with car manufacturers in the West Midlands, assessing various sounds by projecting them from a test vehicle and assessing the response of pedestrians.

The industry believes that artificial sounds would only be necessary below 20 mph because faster vehicles create enough tire noise to be heard.

The Netherlands

Sensibel Wins Dutch Innovation Award

Royal Haskoning's noise simulator Sensibel has been elected out of four category winners as the first winner of the 'Egg of Columbus' 2010. Minister Huizinga of the Ministry of Housing, Spatial Planning and the Environment (VROM) presented the 'Egg of Columbus' during a meeting which is dedicated to those involved in The Hague's small and medium-sized businesses. The 'Egg of Columbus' is the national prize awarded for sustainable innovations and is presented once every two years by VROM and four other ministries.

According to the jury members the noise simulator is truly an innovative service able to raise the level of discussions on sound and noise pollution. The jury members have high expectations and see great potential in this smart noise simulator that is ready to hit the market.

Citizens are exposed to several sound sources at the same time (railway, traffic on municipal roads, shopping centre, church bells) which together make one background sound. With Sensibel, it will be easier to explain the impact of infrastructure intervention such as the construction of an additional roadway."

This simulator is able to translate the outcomes of sound studies into accessible lifelike sound fragments. These sound fragments – in addition to the sound source that causes the launching of a study – contain all environment-related sources.

United Kingdom

NOISE Captures Environmental Noise Directive Data

The web site for NOISE, the Noise Observation and Information Service for Europe, is now capturing noise data generated as a result of the EU Environmental Noise Directive. Data available for download include the number of persons in a given agglomeration exposed to various ranges of noise level given in terms of DNL and Lnight.

The web site is at www.eionet.europa.eu.

Noise Action Week 2011 is Scheduled

U.K. Environmental Protection has announced that Noise Action Week will take place on 23 - 27 May 2011. All updates on the event will be posted on our website: www.noiseactionweek.org.uk. Please contact Carina Perkins for more information:

Email: carina.perkins@environmental-protection.org.uk

Asia-Pacific News

Marion Burgess, Asia-Pacific Editor

Australia

ICA 2010 in Sydney

The 20th International Congress on Acoustics (lCA) was held in Sydney, Australia from August 23rd to August 27th. There were over 1,000 registrants representing 38 countries. The largest representation came from Japan (25%) followed by Australia (18%) then US, Korea, and China, with 6% each. Over 30% of the registrations were students and the ICA-ASA Young Scientist awards assisted the participation by 29 young scientists from around the world. Over 900 papers were presented during 10 parallel sessions plus poster presentations.

The five plenary speakers included Australia's Graeme Clark, who spoke on cochlear implant speech perception and Joe Wolf whose talk was on the acoustics of wind instruments and their players. Torsten Dau from the Technical University of Denmark, the recipient of the 2010 ICA Early Career Award, spoke on human auditory processing in complex acoustic environments. Nico F. Declercq, who was the recipient of the 2007 ICA Early Career Award spoke on the interaction of sound and ultrasound with materials and Nicholas Makris spoke on Ocean Acoustic Remote Sensing of Marine Ecosystems.

The eight distinguished lecturers included: Reiko Mazuka on "Learning the sound system of Japanese: What does it tell us about language acquisition?" Steffen Marburg on "Energy based contribution analysis", Timothy Mason on "Sonochemistry - a proven tool for process intensification", Leo L Beranek on "Strength G, Reverberation Time RT, Listener Envelopment LEV, and Measurements Needed in Concert Halls", Irene van Kamp on "Noise and Health from different perspectives", Michel Versluis on "Nonlinear behaviour of ultrasound contrast agent microbubbles and why shell buckling matters", Dominique Collin on "Aircraft Noise: Research Challenges and European Approach" and Douglas Cato on "The effects of noise on marine animals in the context of their natural acoustic environment". During the ICA, Leo Beranek received both the ICA lifetime achievement award and an honorary fellowship from the Australian Acoustical Society.

Leo Beranek, left, receives his honorary fellowship from the president of the Australian Acoustical Society, Norm Broner. Photo by Glen Slough.

The venue was the Sydney Convention Centre which is right on the harbor and the views over the city and harbor were appreciated by all the delegates. The opening ceremony featured a "welcome to country" by an aboriginal spokesman accompanied by four aboriginal dancers and the playing of a didgeridoo. The welcome and closing receptions were held at the same venue. The conference banquet was held mid-week and comprised an international buffet.

Three associated meetings were held following the ICA: the International Symposium Musical Acoustics (ISMA) organized by Prof Joe Wolfe from UNSW in Sydney; the International Symposium on Room Acoustics (ISRA) organized by Densil Cabrera from Sydney University and the Symposium on Acoustics and Sustainability in Auckland, New Zealand.

The 21st ICA is to be held in Montreal, 2 to 7 June 2013 www.ica2013montreal.org/

Japan

IWRN 10 in Japan

The 10th International Workshop on Railway Noise was held in Nagahama, Japan on 18-22 October. IWRN is a unique international workshop that started in Derby, UK in 1976 specifically for the discussion of railway noise and vibration among world experts and practical engineers. Since then, it has grown into a gathering of over 100 experts in the field of railway noise and vibration. The 9th Workshop was held in Feldafing, Germany in 2007 and the 10th Workshop is the first to be held outside Europe or USA. Continuing the tradition of previous IWRNs, this Workshop provided a unique forum for researchers and experts in railway noise and vibration. There were no parallel sessions for IWRN10, to allow comprehensive discussion of topics. For more information see http://www.rtri.or.jp/IWRN10/

Acoustical Camera Shows Photo and Detects Noise Source Location

Scantek, Inc., is pleased to announce the availability of the newest product from Norsonic, the Nor848 Acoustic Camera.

The 225 microphones of our model Nor848 enable the user to perform noise analysis with far better response than other acoustic cameras. The system is battery operated and contains no signal analysis interface box between the camera and the PC – the simple LAN-cable will do! Quick and easy to set up before the noise analysis is performed, both live intensity plots as well as postprocessed analysis are available.

Features:

- Robust microphone system based on a circular antenna with 1,02 meter diameter weighting only 15 kg
- A total of 225 microphones as well as a wide-angle high-performance video camera are included in the antenna system
- No need for a signal processing interface box as all analogue to digital conversion electronics are hidden in the microphone antenna
- Operated on mains or 12Vdc input
- User friendly software with all required functions for overall and detailed analysis of complex noise situations based on beam forming formulas giving up to 30 dB ranges
- Color intensity plots based on level or frequency
- Overall, 1/1-octave, 1/3-octave and FFT analysis available
- Selectable upper and lower frequency limits
- Live waterfall plots
- Direct output of analyzing views to PDF report
- Competitive price
- Data Sheet is available

Scantek is committed to providing quality sales, competent and responsive instrument rental, instrument repair, service, and calibration of sound & vibration instrumentation. For more information, call (800) 224-3813 or visit www.scantekinc.com.

New Catalog from BSWA

BSWA has just released the New Product Catalog. The new catalog includes acoustic and noise testing products such as professional microphones, impedance tube, sound level meter, sound source, outdoor noise monitoring system, and etc. The new catalog can be downloaded from http://www.bswa-tech.com/pdf/BSWA%20Product%20Catalog-2010.pdf

LMS sells Noesis and the OPTIMUS Platform to Japanese Cybernet

LMS International has sold its subsidiary Noesis Solutions N.V. and the OPTIMUS product line to Cybernet Systems. This move by LMS further focuses key resources on meeting customer demands for LMS' engineering solutions and its flagship platforms: LMS Test.Lab, LMS Virtual.Lab and LMS Imagine.Lab.

In 2003, LMS created a separate company, Noesis Solutions, to develop and market its leading process integration and optimization product, OPTIMUS, to a wider spectrum of customers outside its core client base in the mechanical industries. Over the past years, the OPTIMUS product has been successfully promoted in a variety of other industries, such as electronics, telecom, and process industries via both LMS sales offices and independent distributors. Of these independent distributors, Cybernet Systems in Japan has been the most important. In a strategic move for both companies, Noesis and OPTIMUS will now fly under the Cybernet Systems banner. LMS customers will continue to have access to the industry-leading optimization technologies developed by Cybernet Systems and Noesis as part of the LMS Virtual.Lab and LMS Imagine.Lab platforms. LMS has formalized an R&D agreement with Cybernet/Noesis to integrate future updates of OPTIMUS technology in these two flagship LMS simulation platforms. Current users of OPTIMUS will benefit from seamless support from the global LMS sales operation. In 2011, Cybernet/Noesis will continue to expand the OPTIMUS customer base.

NHV Tools from National Instruments

National Instruments Noise Vibration and Harshness (NVH) tools allows a user to quickly develop systems that acquire and analyze two channels or two hundred channels. With platforms ranging from portable USB plug-and-play systems to embedded Ethernet data loggers with onboard analysis and control, our tools have been used for everything from simple sound pressure measurements to jet engine noise measurements.

NI sound and vibration analysis software, including both interactive, configuration-based software and NI LabVIEW™ analysis VIs, provides audio measurements, fractional-octave analysis, frequency analysis, transient analysis, sound power, sound intensity and order tracking measurements.

If your application requires a higher channel count, CLARITY is an NI PXI-based system that can manage data ranging from 200 to 2,000 channels. It is particularly suited for use in acoustics, structural test, wind tunnel testing, testing on large structures, bridge monitoring, jet engine testing, piping in nuclear power plants and other complex data acquisition projects. For more information: http://www.ni.com/

A New USB TEDS Sensor Interface Kit From the Modal Shop

The Modal Shop has introduced its new version of the TEDS (Transducer Electronic Data Sheet) Interface Kit – Model 400B76. The 400B76 offers the capability to communicate with TEDS sensors over the USB port of a Windows PC. An intuitive graphical interface allows the user to read TEDS from, and write TEDS to, sensors with a single mouse click.

Model 400B76 supports multiple IEEE 1451.4 compliant TEDS sensors as described by the IEEE Instrumentation and Measurement Society (IEEE Std 1451.4™-2004). Principal types of transducers supported are single axis and triaxial accelerometers, impact hammers, impedance heads, charge amplifiers, microphones, and microphone preamplifiers. Model 400B76 supports IEEE 1451.4 templates plus IEEE preliminary templates (also referred to as IEEE P1451.4, version 0.9). These include IEEE transducer templates numbered 0 to 28, as well as manufacturers' templates such as the geometry formats established by LMS International. The 400B76 is said to be an invaluable tool for reading, verifying, and updating TEDS sensor information and format, including calibration information, ensuring smooth operation of the transducer with your favorite data acquisition equipment.

The Modal Shop, Inc. offers many structural test products and accessories. TEDS rentals are available. For specification sheets, application data, competitive product upgrades, pricing or to schedule a rental, please contact The Modal Shop, Inc., 3149 E. Kemper Road, Cincinnati, OH 45241-1516, Internet: www.modalshop.com, (800) 860-4867, Fax (513) 458-2172 or e-mail: info@modalshop.com.

INCE Update

INCE/USA

INCE/USA Fellows are Honored at NOISE-CON 2010

Recently, INCE/USA established a program to award fellowship of the Institute to members to honor and recognize publicly any INCE/USA Member who has rendered service to INCE/USA and has made notable or distinguished contributions to the advancement of noise control engineering. Consideration is given to members who have notably promoted knowledge of noise control engineering. Members elected Fellows are known as "Fellow of the Institute of Noise Control Engineering of the USA."

The first group of Fellows was recognized twice at the NOISE-CON Conference held in Baltimore in April. There was a reception held on Saturday evening, April 17, and Fellows were recognized during the joint ASA and INCE/USA awards ceremony on April 21. A list of Fellows is below; citations and photographs may be found on the INCE/USA web site at www.inceusa.org/about/members/fellows.

Leo L. Beranek
Robert J. Bernhard
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Beth A. Cooper
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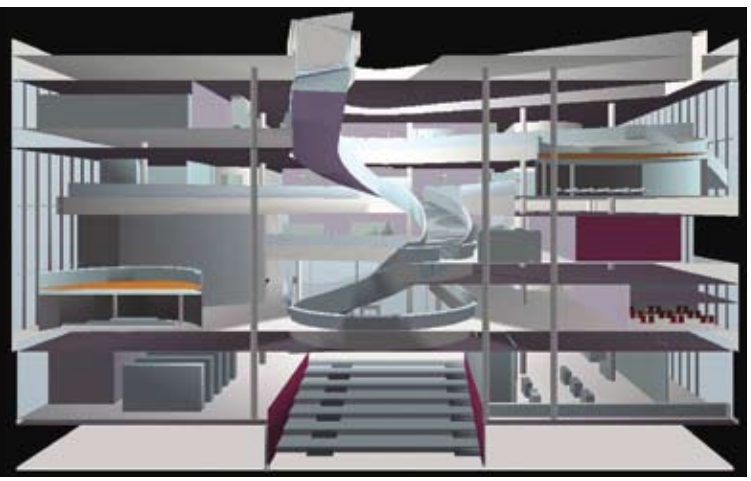
Rajendra Singh
Louis S. Sutherland
R. Bruce Tatge
Nancy C. Timmerman
Gregory C. Tocci
Eric E. Ungar
István L. Vér
Henning E. von Gierke*
David M. Yeager
*= deceased

INCE/USA Elects New Distinguished International Members

The status of INCE Distinguished International Member is conferred by the INCE Board of Directors upon eminent acousticians residing outside the U.S.A. who have personally made extraordinarily significant contributions to the theory and/or practice of noise control engineering. Six new distinguished international members have been elected by the INCE/USA Board of Directors. They are:

Jeremy Astley, Institute of Acoustics, UK
Bernard Berry, Institute of Acoustics, UK
Francis John Fahy, Institute of Acoustics, UK
Samir N. Y. Gerges, Iberoamerican Federation of Acoustics
Vyacheslav Maslov, Russian Acoustical Society
Jorge Patrício, Portuguese Acoustical Society

Biographical information for these members may be found at http://www.noisenewsinternational.net/docs183/bios.pdf a complete list of distinguished international members may be found at http://www.inceusa.org/about/members/distinguished. Information about the nominations process may be obtained from Eric W. Wood, Acentech, Inc., 33 Moulton Street, Cambridge, MA 02138-1118, USA.



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Conference Calendar

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

2011 July 25-27
NOISE-CON 11
Portland, Oregon
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9100 Purdue Road. Suite 200
Indianapolis, IN 46268-3165
Telephone: +1 317 735 4063
E-mail: ibo@inceusa.org
http://www.inceusa.org/nc11

2011 September 4-7
INTER-NOISE 11
Osaka, Japan
Contact: INCE/Japan
c/o Kobayasi Institute of Physical Research
3-20-41 Higashimotomachi, Kokubunji
Tokyo 185-0022
Facsimile: +81 42 327 3847
e-mail: office@ince-j.or.jp
home page: http://www.internoise2011.com

2012 August 19–22
INTER-NOISE 12
New York City, USA
Contact:
Institute of Noise Control Engineering-USA
Amy Herron, Conference Coordinator
INCE/USA Business Office
9100 Purdue Road. Suite 200
Indianapolis, IN 46268-3165
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Directory of Noise Control Services

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Mark your calendar and plan to participate!

NOISE-CON 2011

Portland, Oregon
July 25 – 27, 2011

The 27th annual conference of the Institute of Noise Control Engineering, NOISE-CON 2011, will run concurrently with the summer meeting of the Transportation Research Board, Committee on Transportation-Related Noise and Vibration (ADC40) on Monday through Wednesday (25-27 July, 2011). This conference is joining the overlapping transportation noise and vibration interest of the two organizations in Portland, Oregon to take advantage of the strong public interest and readily accessible public transportation project sites currently found in the Pacific Northwest. The technical program for the joint conference will provide an opportunity for public and private organizations to share technical information on noise and vibration topics associated with high speed rail, light rail systems, highway surface and tire noise and aircraft noise to name a few.

The INCE/USA Page at the Atlas Bookstore

www.atlasbooks.com/marktplc/00726.htm

INTER-NOISE 06 Proceedings

This searchable CD-ROM contains the 662 papers presented at INTER-NOISE 06, the 2006 Congress and Exposition on Noise Control Engineering. This, the 35th in a series of international congresses on noise control engineering was held held in Honolulu,Hawaii, USA on December 3-6, 2006. The theme of the congress was "Engineering a Quieter World."

The technical topics covered at INTER-NOISE 06 included:

- Aircraft and Airport Noise Control
- Community Noise
- Fan noise and aeroacoustics
- Highway, automobile and heavy vehicle noise
- Machinery noise
- Noise policy
- Product noise emissions
- Sound quality.

The NOISE-CON 05 Proceedings Archive (1996-2005)

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

Several papers are taken from sessions organized by the Noise, Architectural Acoustics and Structural Acoustics Technical committees for this 150th ASA meeting. The three plenary lectures related to noise and its impact on the environment are included. Also included are papers in one or more organized sessions in the areas of aircraft noise, tire/pavement noise, and hospital noise.

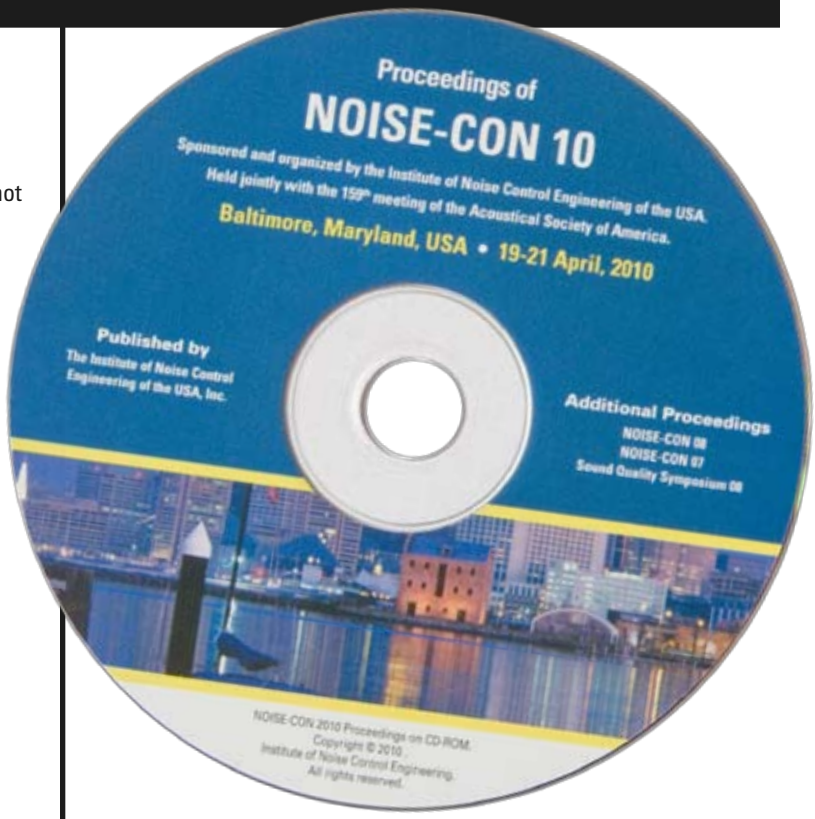
NOISE-CON 10 CD-ROM

This searchable CD-ROM contains PDF files of the 198 papers presented at NOISE-CON 10, the 2010 National Conference on Noise Control Engineering. NOISE-CON 10 was held jointly with the Acoustical Society of America on 19-21 April 2010 in the Marriot Waterfront Hotel in Baltimore, Maryland. This CD does not contain the papers presented as ASA contributions.

In NOISE-CON 10, there were 24 technical sessions:

- Rocket Noise Environments
- 15 papers Noise Control in Complex and Urban Environments
- 11 papers Ventilation, Fan and Duct Noise Control
- 21 papers Military Noise Environments
- 16 papers Case History, Application and Integration of Architectural Acoustics in Building Modeling
- 14 papers Materials for Noise Control
- Manufacturer Presentations
- 10 papers Building Design and Construction for Effective Acoustic Performance
- 10 papers Experimental Techniques
- 10 papers Construction Noise
- 14 papers Information Technology Noise
- 10 papers Aircraft Interior Noise

This CD also contains Proceedings from NOISE-CON 08, NOISE-CON 07 and papers on sound quality presented as SQS08, the 2008 Sound Quality Symposium. This CD-ROM supplements the NOISE-CON 05 CD-ROM which contains all of the papers published in NOISE-CON Proceedings from 1996 through 2005. These papers are a valuable resource of information on noise control engineering that will be of interest to engineers in industry, acoustical consultants, researchers, government workers, and the academic community.



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Parallel Sessions *(the number in parentheses is the number of sessions)*

- Acoustic and thermal interactions for energy efficient buildings
- Acoustic comfort in buildings
- Acoustical holography, imaging and beam forming (2)
- Acoustical metrology (instruments, measurements, standards, uncertainty) (cont.) + Instrumentation and standards (2)
- Action plans of urban areas: strategies and experiences (2)
- Active noise and vibration control (3)
- Aeroacoustics and fan noise
- Aircraft interior noise and related technology + Aeroacoustics and fan noise
- Aircraft noise modelling and control + Aircraft noise characterization
- Airport noise (2)
- Asphalt rubber pavements - noise and sustainability (2)
- Assessment and strategies for managing noise (2)
- Bioacoustics
- Building acoustics properties and comfort classes
- Characterization of structure-borne sound sources (2)
- Classroom acoustics
- Community noise around airports
- Community noise maps and action plans (2)
- Community response and exposure criteria in environmental situations
- Computational techniques in room and building acoustics
- Concert halls, theaters and opera houses (2)
- Diffraction reducing devices on noise barrier top
- Ducts and mufflers
- Economics of noise for sustainability
- Environmental noise (policy, standards, problems and approaches)
- Environmental vibration and its impacts on buildings and people
- Floor impact noise evaluation and control (2)
- General acoustics and vibration (2)
- Hearing protectors
- Industrial noise and noise at work
- Legislation and noise control policies
- Lightweight partitions and systems (2)
- longevity of pavements
- Low frequency and airport ground noise
- Measurements in room and building acoustics (3)
- Measurements of surface properties

- Metrics for environmental noise
- Musical acoustics
- New directions in noise and health research (2)
- Noise annoyance
- Noise barriers (2)
- Noise control engineering education
- Noise control materials
- Noise from information technology equipment
- Noise from renewable energy technologies
- Noise in healthcare facilities
- Noise mapping. Precision and uncertainty (2)
- Noise problems and solutions in developing and in transition countries (2)
- Non linear dynamics of acoustic resonators (2)
- Numerical techniques (FEM, BEM, IFEM, SEA) (3)
- Occupational noise (2)
- Outdoor sound propagation in living environment (2)
- Physiological health effects from environmental noise exposure
- Product sound auralization
- Psychoacoustics and sound quality (3)
- Psychological effects of noise (3)
- Public space acoustics for safety + Sustainable quiet buildings
- Recreational noise
- Signal processing and analysis (2)
- Sonic crystal noise barriers
- Sound insulation at low frequency
- Sound power measurements and analysis
- Soundscape and its applications (2)
- Soundscape-metrics (2)
- Speech communication in road vehicles
- Speech privacy
- Tire/road noise (2)
- Transportation noise (air, road, rail, marine vehicles) (3)
- Ultrasound
- Underground noise control
- Underwater acoustics
- Urban noise and its control
- Urban sound propagation and evaluation
- Vibration isolation and damping
- Vibro-acoustic performance of structures and vehicles (2)

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