Volume 4, Number 3
1996 September

NOISE/NEWS INTERNATIONAL

A quarterly news magazine

In 1996, INCE/USA is celebrating the 25th year of its incorporation and the 25th Inter-Noise Congress.

A Committee Report
Noise and Health

Announcement and Call for Papers

ACTIVE 97

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inter-noise 97

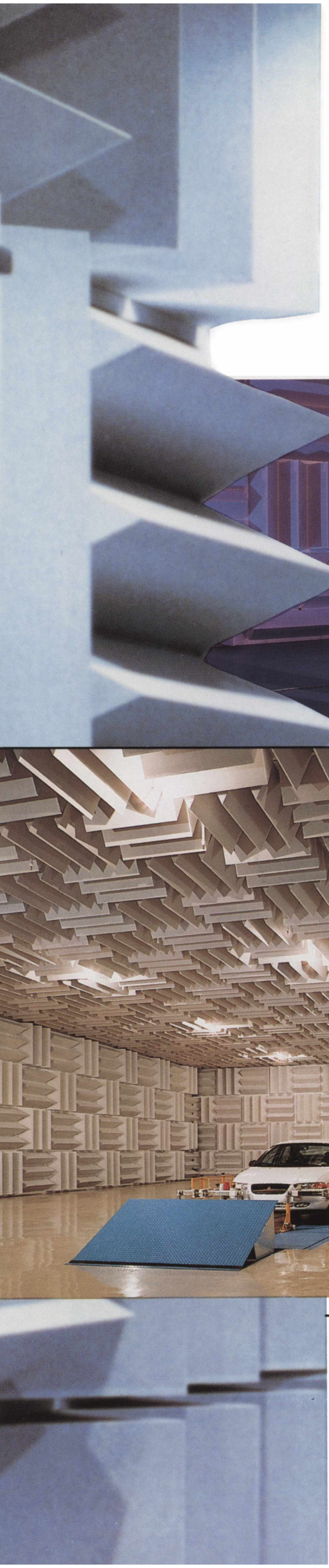
THE 1997 INTERNATIONAL CONFERENCE ON NOISE CONTROL ENGINEERING
BUDAPEST– HUNGARY
1997 AUGUST 25–27

Member Society Profile:
Deutsche Gesellschaft für Akustik

Announcement and Call for Papers

NOISE-CON 97

State College, Pennsylvania, USA
1997 June 15-17



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NOISE/NEWS INTERNATIONAL

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FEATURES

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NOISE/NEWS INTERNATIONAL

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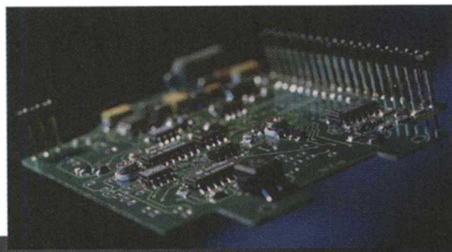
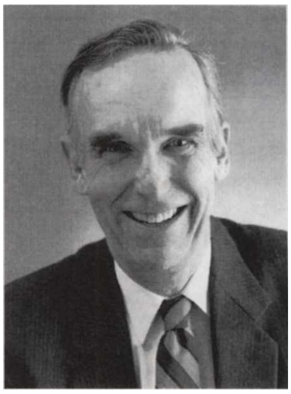


President's Column



Who Are We?

In the March/April issue of the *Bulletin of the Institute of Acoustics* (U.K.), outgoing President Alex Burd congratulated incoming President Bernard Berry on leading a team effort to make INTER-NOISE 96 in Liverpool an outstanding success. He noted that: "The opportunity is too good to miss and I propose to attend this, my first INTER-NOISE, and find what it is that persuades people to travel around the world each year." Indeed, who are we, the travellers who come from near and far each year to the annual INTER-NOISE congresses?

It seems fair to say that the participants at INTER-NOISE congresses are representative of those in the noise control community who are at the forefront of a rapidly-developing field. Perhaps, as we celebrate the 25th INTER-NOISE congress in Liverpool, a better question would relate to the success and growth of the INTER-NOISE series over the years.

While a determined effort has been made to maintain quality, growth has not been uniform. More than 1,300 persons attended the very first INTER-NOISE held in Washington, D.C., USA in the Fall of 1972. This was the largest meeting in acoustics, or one of its subfields, that had been held in the USA up to that time. Where did all these people come from and where, subsequently, did they all go? No one knows for sure, but in 1972 October, there was intense interest in Washington in legislation relating to noise control. Many of the "walk-ins" at INTER-NOISE 72 may have been participants or bystanders in the legislative battle. In any case, as soon as the legislation was passed, or perhaps at the first mention of the word "decibel" at an INTER-NOISE 72 technical session, many of these first-time attendees disappeared from the technical scene, and were not heard from again. Participation in INTER-NOISE congresses has increased gradually over the years, but it was not until INTER-NOISE 94 in Yokohama, Japan that attendance approached the same number present at the first INTER-NOISE more than twenty years earlier.

Many are present at an INTER-NOISE because it is a specialized conference covering a wide range of topics, all of them related to noise. Consider the topics covered by the abstracts accepted for INTER-NOISE 96 whose titles appeared in the 1996 March issue of this magazine. All of the major topics of the I-INCE Classification of Subjects in Noise Control Engineering are more or less uniformly covered by the INTER-NOISE 96 technical program. These include: noise sources, physical phenomena, noise control elements, vibration and shock, environmental noise, effects of noise and analysis of noise.

In summary, attendees at the INTER-NOISE series are professionals dedicated to some aspect of noise and vibration control who participate in order to: share the latest technical developments, discuss with colleagues the newest advances in the field, understand global trends, and changing directions, and possibly participate in standards development, other committee work or a satellite symposium or other learning opportunity offered in conjunction with INTER-NOISE.

Attendees participate in order to bring home with them a number of personal learning experiences that may help them in their work and may advance the field of noise control engineering in the future.

— William W. Lang
President, International INCE

Reader Service Number 26

Editor's View

Twenty-Five Years of Noise Control

By the time this issue of *Noise/News International* is published, INTER-NOISE 96, the 25th in the series of international congresses on noise control, will be history, and will go into the record books as the congress at which the largest number of technical papers were presented. The Proceedings of the congress contains more than 3300 pages, and is the largest number of pages ever published for an INTER-NOISE congress.

Surprisingly, the largest attendance at an INTER-NOISE Congress was at the first event in 1972. At that time, INCE/USA was a very small organization with very limited financial resources and essentially no experience in running international congresses. Malcolm Crocker, as General Chairman, arranged for 92 papers to be presented and produced a 564-page proceedings. Fortunately, the U.S. National Bureau of Standards (now the National Institute of Standards and Technology) operated the secretariat and handled the approximately 1400 registrants at the meeting.

The persons in attendance were obviously all interested in *noise*, but only a small fraction of those persons were interested in *noise control engineering* - as evidenced by the fact that attendance dropped dramatically for the next few years, at least for those congresses held in the United States. Yet the number of papers presented gradually increased as the profession expanded and INTER-NOISE became popular as a place to present new results and to network with colleagues.

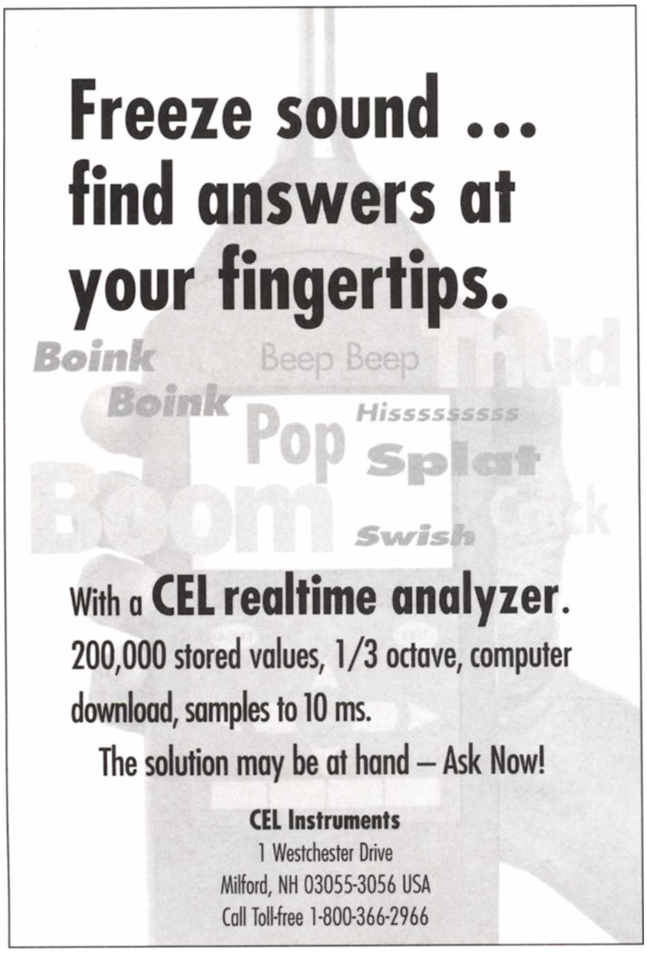
The theme of INTER-NOISE 96, *Noise Control -The Next 25 Years: Scientists, Engineers and Legislators in Partnership*, seems particularly appropriate because history has shown that engineers cannot do the job alone. What is needed is a scientific base for criteria, the ability to turn survey data into a clear indication of demand, legislators willing to respond to the demands of the public, engineers who can not only get the job done but who can translate scientific results into engineering criteria, and be sure that any legislation clearly takes appropriate criteria into account.

That a great deal has been accomplished in the past 25 years is evident from a review of the 1996 INTER-NOISE Proceedings. In the United States, INCE/USA has recognized the progress of the last twenty-five years by producing a special issue of *Noise Control Engineering Journal* which reviews the progress that has been made, and discusses future trends. Seven survey papers in the issue cover noise environments outdoors and community noise, occupational noise, recreational noise, aircraft noise, noise standards, federal regulations, and the global marketplace for quiet products.

Will we run out of problems to solve in the next 25 years? I think not. Industrialized nations are becoming more conscious of noise problems every day, developing nations are experiencing growing pains as they become industrialized, and we are in a global economy which means that if noise matters to some customers, problems will be solved for the benefit of all.

We need to have good solutions to noise problems - solutions that can be implemented early in the design stage and at as low a cost as possible. We need to provide good tools for numerical methods and prediction of noise levels, and, above all, we need to provide the professional training to ensure that the noise control engineer is an integral part of every design team.

— George C. Maling, Jr.
Pan-American Editor



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Member Society Profile

Deutsche Gesellschaft für Akustik

The German Acoustical Society, Deutsche Gesellschaft für Akustik (DEGA), was founded as recently as 1989. Prior to that date, a number of German societies, devoted to physics and the classical engineering disciplines, covered various aspects of the field of acoustics through their working groups. DEGA was formed as a non-profit scientific society to integrate the interests of German-speaking acousticians working in all the theoretical and applied sub-disciplines of acoustics. No organization exclusively devoted to acoustics existed in Germany prior to the formation of DEGA.

One of the purposes of DEGA is to organize the annual DAGA congress which is co-sponsored with several other German scientific and engineering societies. DAGA (**D**eutsche **A**rbeitsge**g**emeinshaft für **A**kustik) is an acronym used for many years for the annual meeting. DAGA congresses have been held each year since 1970.

In addition to promoting the field of acoustics, other objectives of DEGA are: to bring together members of the society to exchange information, to publish news of the society, to assist in the publication of *Acustica/Acta Acustica* (the new publication of the European Acoustics Association (EAA) and Hirzel-Verlag, Stuttgart) to promote good relations with foreign societies having similar objectives, to give advice and support activities in research and development, education and professional advancement, and to support the work on national and international standards development in acoustics. DEGA supports other acoustical congresses, scientifically as well as financially. For example, the Ultrasonic World Congress that was held in 1995 September in Berlin. DEGA has a number of working groups:

- building and room acoustics
- electroacoustics
- hearing research
- underwater acoustics and geoacoustics
- musical acoustics
- ultrasound
- speech
- noise and vibration control
- physical acoustics
- education in acoustics

Everyone with an interest in acoustics is invited to become a member of DEGA. Students pay a reduced annual fee. Industrial firms are welcome as sustaining members. All members receive a reduced registration fee at the annual DAGA congress. All members receive *Acustica/Acta Acustica* six times per year free of charge.

DEGA is governed by a board consisting of the president, the vice president, the treasurer and three additional members of the board. In addition, the chairmen of the working groups and a number of representatives elected by the assembly of members constitute an advisory board.

DEGA uses the *Society News* department of *Acustica/Acta Acustica* to keep members informed of the activities of the society. The *Society News* department is supplemented by a newsletter published twice per year. DEGA also maintains a home page on the Internet where the latest news can be obtained. The URL is http://www.itap.physik.uni-oldenburg.de/dega.html.

An important activity of DEGA is the cooperation with and membership in the European Acoustics Association (EAA), thus supporting *Forum Acusticum*, the international convention of the EAA — held this year in Belgium.

Additional information on DEGA activities may be obtained by contacting the society at the address given in the International INCE directory on page 189 of this issue.

This is the fifteenth in a series of articles on the history and activities of the Member Societies of International INCE.— Ed

Effects of Noise on Health

Chapter 3 of a report on *Noise and Health* prepared by a committee of the Health Council of The Netherlands

In 1994, the Health Council of The Netherlands was asked to prepare an advisory report on the effects of noise on human health. In the report to the Minister of Health, Welfare, and Sports, and to three other Ministers in The Netherlands, Professor L. Ginjaar, President of the Health Council of the Netherlands, said that the committee responsible for the report asked him to draw the Minister's attention to the following:

A Health Council Committee concluded in 1971 that noise exposure is an important public health problem. Since then, the knowledge about the effects of noise on health has increased considerably. However, this has not lead to new insights. Also, today noise exposure presents a considerable public health problem, as the data in the committee's report illustrate. This implies that the measures that have been taken in the last decades have had only a limited effect, which is partly due to the increase in exposure. In my opinion, abatement of noise annoyance, of noise-induced hearing loss, and of other effects of noise on health should be an important part of a public health policy.

The report consists of an Executive Summary and four chapters: 1) Noise as a Public Health Problem, 2) Health and Noise Exposure, 3) Effects of Noise on Health, and 4) Noise Exposures in The Netherlands and Their Effects. This feature article is a slightly edited version of Chapter 3, Effects of Noise on Health, which is reprinted with the permission of Dr. W. Passchier-Vermeer, scientific secretary of the Health Council of the Netherlands. — Ed.

Noise-Induced Hearing Loss

Occupational Noise Exposure

Relations Between Noise Exposure and Noise-Induced Hearing Loss

The second edition of ISO 1999 "Acoustics -Determination of occupational noise exposure and estimation of noise-induced hearing impairment" (ISO90) gives a calculation method for the determination of hearing threshold levels of populations exposed to all types of noise (steady-state, intermittent and impulse) during working hours. The noise exposure is characterized by the noise exposure level, L_{EX}. In this report L_{EX} is denoted by $L_{EX,occ}$, indicating the exposure concerns *occupational* noise. Relations are given between $L_{EX,occ}$ and noise-induced permanent threshold shift (NIPTS) for frequencies in the range from 500 to 6000 Hz, and for exposure times up to 40 years. These relations are expressed in statistical terms (median values of NIPTS as well as values from the 0.05 to the 0.95 fractile). The relations show that NIPTS is a phenomenon which occurs predominantly in the higher frequency range from 3000 to 6000 Hz; the effect is largest at a frequency of 4000 Hz. With increasing equivalent sound level and increasing exposure time, hearing loss also occurs at the lower frequencies, more specifically at 2000 Hz. For prolonged occupational noise exposure, ISO 1999 shows that permanent threshold shift is not induced by noise with $L_{EX,occ}$ values at and below A-weighted sound levels of 75 dB(A). (*In this report, the unit of level is the decibel (dB). However, the unit symbol is followed by (A) to denote the A-weighted sound level in decibels [dB(A)]. — Ed.*).

The value of 75 dB(A) below which there occurs no noise-induced permanent threshold shift from occupational noise exposure had already been given by the World Health Organization in 1980 (WHO80). Also, the draft Physical Agents Directive of the European Union specifies this level at 75 dB(A).

Exposure to Impulse Noise
There is evidence that temporary effects on hearing from exposure to impulse or impact noise are different from those of exposure to more or less steady-state noise. However, epidemiological studies could not show any systematic difference between permanent threshold shifts from occupational exposure to impulse or impact noise and from steady-state noise (Pas89a) with the same equivalent sound level. Regarding shooting noise this seems to hold only for equivalent sound levels up to 85 dB(A) over a period of 8 hours; for higher equivalent sound levels shooting noise may be more damaging than should have been expected from its equivalent sound level (Smo82).

At very high levels mechanical damage of the hearing organ may occur. To avoid this, adults should not be exposed to *peak* levels exceeding 140 dB. Possibly, for children a lower value is appropriate. This value is, as yet, unknown.

Identifying Sensitive Persons
ISO 1999 shows that variation in human sensitivity to noise-induced permanent threshold shift increases with noise exposure level; variation is considerable at high equivalent sound levels. However, there are as yet no tests for identifying individuals that may be susceptible to noise-induced hearing loss before the hearing damage occurs. ISO 1999 presumes females and males to be equally susceptible.

Non-Occupational Noise Exposure

Non-occupational noise exposure can be divided into four categories:

- exposure to environmental noise in the living environment such as: traffic, industrial and residential noise
- exposure to noise from home-based activities
- exposure to noise from traffic during travel between home and work/school
- exposure to noise during leisure (*noise includes music*).

The committee is of the opinion that extrapolation of the calculation scheme in ISO 1999 to (a combination of) the daily non-occupational noise exposures as specified above is justified. This implies that, for adult populations, a permanent threshold shift is not induced by noise with $L_{Aeq,24h}$ values at and below 70 dB(A), whether noise exposure is prolonged or not.

The committee regrets the lack of information on the patterns of exposure of populations to non-occupational noise. Due to this lack of information, only global estimates can be made and general conclusions be drawn concerning noise-induced hearing loss from non-occupational noise exposure.

Susceptible Groups

A pregnant woman's exposure to noise may affect the hearing of the unborn child. The two epidemiological studies that examined the hearing acuity of young children with mothers who had been exposed to occupational noise during pregnancy, both showed an increase in percentages of children with high-frequency hearing loss. On the basis of these results, the committee concludes that equivalent sound levels of 85 dB(A) or higher during an 8-hour working day appear to be detrimental to the hearing of the unborn child. It recommends that further research should be undertaken to verify whether, at equivalent sound levels lower than 85 dB(A), increased hearing loss in young children occurs, especially when it concerns exposure to low frequency noise and vibrations.

Data from animal experiments indicate that young children may be more susceptible to noise-induced permanent threshold shift than adults. Such an increased susceptibility has not been confirmed by epidemiological studies in human populations. Spreng (Spr90) considers a difference of 5 dB(A) applicable for certain types of exposures. (*This concerns exposures with rapid increases of the sound level, such as in the case of low-flying fighter-jets. The middle ear of children may then react differently from that of adults.*)

Males exposed to occupational noise, who have high plasma cholesterol levels in blood, have an increased risk of noise-induced hearing loss in comparison to occupational noise exposed male populations with normal cholesterol levels (Axe85a).

Social Consequences of Hearing Loss

The main social consequence of hearing damage concerns the inability to understand speech under day to day living conditions. Since speech is the most common means of communication between people, a decreased understanding of speech should be considered a severe social handicap.

In the case of the combination of age-related hearing loss (presbycusis) and occupational noise-induced hearing loss, decrease in speech intelligibility is a process which may proceed over years. Understanding speech first starts to become difficult in noisy surroundings (cafeterias, parties, noisy meetings). Next, difficulties occur during church services, theatrical performances and public meetings, even when people with hearing damage place themselves close to the speaker. Once the hearing impaired start compensating for their handicap, others will recognize the decreased hearing capacity. In the next stage, telephone calls start to present problems and conversations in fairly quiet surroundings become difficult, the more so when they involve strangers. Eventually, understanding the speech of close friends and family starts to become critical. A decreased hearing capacity can be partially compensated by lip reading, even without the hearing-handicapped listener being aware of it.

Even small values of hearing damage may have an effect on understanding speech in normal live. In investigations of groups of people with noise-induced hearing loss, a decrease in speech understanding has been observed at hearing threshold levels from 10 dB, averaged over 2000 and 4000 Hz and averaged over both ears (Smo86, Pas85). When the hearing threshold level exceeds 30 dB, again averaged over 2000 and 4000 Hz and over both ears, the hearing damage becomes a noticeable social handicap (Smo86, Pas87a,b).

Classification of Health Effects

The committee is of the opinion that there is sufficient evidence for a causal relationship between noise and hearing loss. Exposure-effect functions are specified in ISO 1999. For occupational noise exposure $L_{EX,occ}$ is taken as noise measure and for non-occupational noise exposure $L_{Aeq,24h}$ is the measure to be used. Observation thresholds correspond to a value of $L_{EX,occ}$ of 75 dB(A) and a value of $L_{Aeq,24h}$ of 70 dB(A).

Although there is sufficient evidence for a causal relationship between occupational noise exposure during pregnancy and hearing loss in babies, the available data do not allow it to be specified whether and to what extent hearing loss occurs below a value of $L_{EX,occ}$ of 85 dB(A).

Noise-induced Stress-related Health Effects

Stress

The reactions to a stressor can be of a psychological, behavioral and somatic nature. Psychological effects concern feelings of fear, depression, frustration, irritation, anger, helplessness, sorrow and disappointment. Examples of behavioral reactions to a stressor are social isolation, aggression and resort to excessive use of alcohol, tobacco, drugs or food. Psychological and behavioral stress may have a direct or indirect effect on physiological processes within the body. (*In this respect, it is not always obvious in the analysis of the results of an epidemiological study whether observed differences in behavior of a noise-exposed group and of a group of people not exposed to noise should be considered as a direct or indirect result of exposure to noise or as a confounding factor. Take as an example effects of traffic noise on the prevalence of ischaemic heart disease and on smoking, presuming that smoking is a risk factor for this heart disease. It could be argued that smoking is associated with stress and that due to stress from daily exposure to high levels of road traffic noise, the relative number of people smoking and the cigarettes smoked increase. Smoking should then not be considered as a confounding factor and corrections should not be applied on the test results with respect to this factor. On the other hand, should smoking be considered as a confounder, corrections should be applied, when exposure to noise is associated with ischaemic heart disease in the analysis of the test results.*) A great number of laboratory experiments have demonstrated changes in various somatic, physiological and biochemical factors in humans due to acute noise exposure. These experimental studies show that noise should be considered as an unspecific stressor that stimulates central nervous system and hormonal activity (Isi93, Mar88, Mar90).

Research into long-term noise-induced stress-related health effects has been limited mainly to cardiovascular disorders. To a far lesser extent, epidemiological research has been carried out regarding changes in biochemical parameters and parameters of the immune system. There is a complicated interaction between the hormonal and immune system. Hormones produced by the pituitary gland interact with immune factors, whereas both hormones and immune factors have an impact on the brain. The connections with parts of the limbic system, the system which largely determines emotional activity, are also of importance.

Research into the chronic effects of long-term exposure to noise involves inherent difficulties:

- Cardiovascular and biochemical changes are nonspecific; a number of other factors may cause these changes, some of the factors possibly not yet being identified. A major problem in epidemiological research is to control these factors.
- In epidemiological research, it is time-consuming and difficult to obtain good quantitative data about the noise exposure, especially about past exposure. For example, noise maps of cities may be used in road traffic noise studies. Using these maps could give a non-systematic misclassification of the noise exposure of some inhabitants. Such a misclassification will obscure a noise-induced effect.
- People intervene to a certain extent in their own living and working situation, e.g. by moving to more quiet surroundings or by changing their job.

This may result in a selection in which people who are *noise-proof* will remain in noisy situations and those who are not will leave the situation.
- There are great differences in individual susceptibility.

Cardiovascular Effects in the Working Environment

Epidemiological research into the long-term stress-related health effects has been focused on changes in the blood pressure of workers exposed to occupational noise and on the prevalence of hypertension among these workers (Dij84, Isi80a, Isi93; for other references see Pas93a,b). Hypertension has been defined, according to the World Health Organization, as a systolic blood pressure of at least 160 mmHg (*1 mmHg corresponds to approximately 0.13 kPa*) and/or a diastolic blood pressure of at least 95 mmHg.

The committee concludes that prolonged exposure to occupational noise may contribute to increased blood pressure and hypertension. These effects have been shown to occur at equivalent sound levels during the working day of at least 85 dB(A). Effects of chronic exposure at lower noise levels such as in offices have hardly been studied.

Other noise-induced effects on the cardiovascular system have been observed in workers exposed to high or extremely high equivalent sound levels during the working day, such as an increase in abnormalities in the electrocardiogram, more heart beat irregularities, faster pulse rate, faster increase in heart rate during a physical test and slower recovery of vascular constriction during a noise exposure test. Apart from abnormalities in the electrocardiogram, the other noise-induced effects seem not be detrimental to health, taken into account the extent of the effects in so far they were due to noise exposure.

Cardiovascular Effects in the Living Environment

Long-term effects of exposure to noise in the living environment have only been investigated in relation to road and air traffic noise to which people are exposed in their own homes (Alt87, Alt89, Bab88, Bab90, Bab92, Bab93a,b, Bie89a,b, Isi80b, Isi93, Jon92b, Kni76; for other references see Pas93a,b). These exposures are usually much lower than those to occupational noise, but the exposed population is much greater. A complicating factor in the determination of noise exposure in homes is that people are not only exposed to traffic noise, but also to various, often even louder, noises from other sources. Furthermore, housing features (e.g. single or double glazing) and personal habits (e.g. closing windows, moving to quieter sides of the house, staying indoors during the summer) affect the actual noise exposure.

Several studies on the effects of traffic noise have had the occurrence of changes in blood pressure and hypertension, and the risk of ischaemic heart disease as their subject. Epidemiological studies show that, in general, there are no obvious effects from exposure to traffic noise on the mean systolic and diastolic blood pressure, except in children. However, the committee considers the observed increase of, at most, 10 to 15 mmHg (Coh80, Kar68) in the average systolic and diastolic blood pressure in children to be of a temporary nature and not relevant for permanent health damage.

The committee draws the following conclusions from the results of epidemiological research:

- there is little evidence for an increased risk of hypertension and of ischaemic heart disease in people living in areas with traffic noise at outdoor equivalent sound levels (from 0600 to 2200 hours) below 70 dB(A).(*There are some indications that this value might have to be lowered to 65 dB(A) once the results of additional studies become available.*)
- the relative risk of ischaemic heart disease and of hypertension starts to increase for persons living in areas with road or air traffic noise at equivalent sound levels above 70 dB(A) (from 0600 to 2200 hours).

Biochemical Effects

Epidemiological studies on the effects of high to very high environmental and occupational noise exposures on the biochemical (*this concerns specific hormones and metal-ions (Mg^{2+})*) composition of the blood of exposed people mostly show noise-induced changes which should be expected if noise acts as stressor. Several studies also show changes which indicate an increased risk of ischaemic heart disease (Bab88, Bab90, Bab92, Bab93, Isi80b,c). However, there are only limited data available. Therefore the committee is unable to establish to what extent changes in blood composition occur under which particular environmental and occupational circumstances. However, laboratory studies with volunteers show that such effects may occur.

Effects on the Immune System

No epidemiological investigations except for the Caerphilly and Speedwell Collaborative Heart Disease Studies (Bab92, Bab93) have been carried out into the effects of noise on the immune system. This study has revealed an increased concentration of leucocytes in blood in the case of exposure to high levels of road traffic noise.

Effects on the immune system might ultimately lead to an increased prevalence of infectious diseases, such as influenza and inflammations, and possibly cancer. No epidemiological studies concerning such effects of noise exposure have been reported.

Effects on the Unborn Child

In view of the available research data, it cannot be excluded that noise exposure of pregnant women to air traffic noise in the *living* environment may affect the birthweight of the baby. Should a reduced weight at birth occur, this is only at noise exposures with L_{dn} values greater than 62 dB(A) (more than 40 Ke). The available data virtually exclude an aircraft noise-induced risk of the occurrence of congenital defects.

The studies on the health of babies whose mothers were exposed to *occupational* noise during pregnancy suggest that there does not seem to be a higher risk of lower birthweight and of premature birth; the results with regard to congenital defects are contradictory, whereas those related to increased risk of spontaneous or imminent abortion and death at birth are questionable.

Susceptible Groups

People highly annoyed by low levels of road traffic noise have an increased risk of hypertension. Men exposed to high levels of road traffic noise in the living environment and also exposed to occupational noise have an increased risk of ischaemic heart disease compared to men exposed to road traffic noise only (Bab90). Pregnant women exposed to occupational noise show an increased risk of hypertension during pregnancy, compared to pregnant women not exposed to occupational noise. People with noise-induced sleep disturbance have an increased risk of hypertension and ischaemic heart disease compared with people in the same living environment without sleep disturbance (Isi93). Exposure of hospitalized patients to relatively high levels of noise from sources inside or outside the hospital delays recovery and wound healing.

Classification of Health Effects

The committee is of the opinion that the following classifications are applicable:

- biochemical effects: limited evidence
- hypertension: sufficient evidence
- ischaemic heart disease: sufficient evidence
- effects on immune system: limited evidence
- birthweight: limited evidence
- congenital defects: evidence suggesting lack of a causal relationship.

For occupational industrial noise-induced hypertension, the observation threshold probably has a value of $L_{EX,occ}$ below 85 dB(A). For groups exposed to values of $L_{EX,occ}$ of 90 dB(A) and above the relative risk is 1.7.

For environmental road- and air traffic noise-induced hypertension the observation threshold has a value of $L_{Aeq,06\text{-}22h}$ of 70 dB(A) (measured outdoors). For ischaemic heart disease the same value is applicable. Groups exposed to higher values (70 to 80 dB(A)) will have a relative risk of hypertension and of ischaemic heart disease of about 1.5.

Psycho-social Effects

Subjects studied in epidemiological research with respect to psycho-social effects from noise in the living environment include noise annoyance, effects on psycho-social well-being and the question of whether noise-induced feelings of irritation have such an impact that they increase the number of admissions to psychiatric hospitals. Effects studied in the working environment concern annoyance and increased absenteeism from the worksite.

Noise annoyance is a feeling of resentment, displeasure, discomfort, dissatisfaction or offence which occurs when noise interferes with someone's thoughts, feelings or actual activities. The capacity of a given sound to annoy depends on its physical characteristics including sound level, spectral characteristics and variations with time. These variables are characterized by onset times, durations and repetition rates. However, annoyance also depends on non-acoustical, cognitive factors, such as fear with regard to the noise source, the conviction that the noise exposure could be reduced by third parties, individual noise sensitivity, the degree to which an individual feels able to control the noise, whether the noise stems from a new situation or technology, and, to a lesser extent, the recognition that the noise source gives rise to problems other than mere noise exposure or that it results from an important economic activity. Demographic variables - age, sex, socio-economic status - are almost unrelated to annoyance from a given noise source.

Noise annoyance and psycho-social well-being can both be evaluated using questionnaires. Psycho-social well-being concerns depression, relaxation, activity, passivity, aggression, general well-being and social aspects, such as group interaction and willingness to help.

Annoyance in the Living Environment

Noise from Road Traffic, Trains and Airplanes
Recently defined exposure-effect functions relate annoyance to exposure to various types of traffic noise in the living environment (Mie92). Severe annoyance by noise from several types of traffic (aircraft, highway traffic, other road traffic, railroad traffic) starts to occur at L_{dn} values of 42 dB(A), annoyance starts at L_{dn} values of 37 dB(A) and some annoyance at 32 dB(A). (*Miedema defines severe annoyance as annoyance of at least 72 (on a scale with a lower boundary of 0, corresponding to being not at all annoyed, and an upper boundary of 100, corresponding to being extremely annoyed) (Mie92).*) These L_{dn} values were measured outdoors, in front of the dwellings. Annoyance increases most with L_{dn} for aircraft noise, followed by highway traffic noise, other road traffic noise and railroad noise. For the traffic noise exposures that were considered, there is a close relationship between $L_{Aeq,24h}$, L_{etm} and L_{dn}, due to a high correlation between the equivalent sound levels during the day and those during the night.

Noise from High-speed Trains
Noise from high-speed trains is of special importance these days, in view of the plans for a high-speed train network in Europe, including The Netherlands. Based on measurements made abroad, on the acoustical characteristics of this type of train noise and on the projected future use of high-speed trains, De Jong (Jon93) concludes that annoyance from noise produced by high-speed trains in the Netherlands will not exceed annoyance caused by conventional trains with equal L_{etm} values.

Noise from Helicopters and Small Aircraft

Noise from helicopters differs from that of conventional airplanes due both to the characteristic sound of the rotating blades (blade slap) and to the helicopter's lower speed, which make helicopters audible during a longer period. Furthermore, helicopters do not only pass an area, but often also circle above it for some time. This last comment is also applicable to some types of small aircraft.

Annoyance from passing helicopters and small aircraft has been found to be comparable to annoyance from conventional aircraft only when the duration of the noise is taken into account. Expressing exposure to helicopter noise in Ke is therefore not advisable, as this measure does not take the duration of noise events into account.

Noise of Low-flying Fighter Jets

Noise of low-flying fighter jets, with flight paths with a minimum height of 75 meter, contrasts with that of civil aviation in several aspects:

- under the low-flying corridor, the maximum sound level of an overflight is relatively high
- this very high level is not restricted to the surroundings of the airport, since low-flying corridors can be situated elsewhere
- the onset time of the noise from a low-flying fighter jet is relatively short.

It is estimated that noise from low-flying fighter jets is as annoying as noise from conventional aircraft with a 10 dB(A) higher equivalent sound level (Pas93a,b). Other effects in addition to annoyance, are to be expected. These include psychological effects such as fear and panic in adults and children.

Other Noise Sources in the Living Environment
Noise from stationary sources, such as industry, railroad shunting yards and artillery-ranges is more annoying than traffic noise, especially when the noise contains impulse or impact components (Vos85a, Vos85b). Annoyance from shunting-yards is comparable to that from passing trains for L_{dn} values up to about 60 dB(A), but is much more annoying at higher levels (Mie92).

There exists a relation between annoyance from indoor noises from neighboring dwellings and the sound insulation between dwellings: low values of sound insulation resulting in high percentages of people annoyed. Due to the large variability in the levels of outdoor noises from neighbors and noises in the neighborhood of private homes, e.g., people shouting, slamming car doors, the sound of car horns and lawn-mowers, and the variety of non-acoustical factors that also determine annoyance, it is difficult if not impossible to determine exposure-effect relations for these types of noises.

Accumulation of Noise Exposures
When people are exposed to more than one environmental noise source, annoyance is cumulated. Weighted summation of the annoyance effects provides a fair description of the accumulation (Mie93, Vos92). The resulting annoyance from two noise sources is sometimes much larger than the annoyance expected from the most disturbing source alone (Mie93).

Psycho-social Well-being

The limited research carried out with respect to effects from exposure to road traffic noise on psycho-social well-being does not permit a definite conclusion. Two investigations showed psycho-social well-being to be decreased in people living in very noisy areas (equivalent sound levels during the daytime over 70 dB(A)) compared to that of people living in quiet surroundings. This concerned social orientation, activity and depression. The third investigation showed psycho-social well-being of people not to be related to the noise level as determined in front of their dwelling, but to their noise sensitivity and to the extent to which noise penetrates into their bedroom and disturbs sleep (Ohr89, Ohr91).

Effects on Admission to Psychiatric Hospitals

For some people, psychological stress may lead to admission to psychiatric hospitals. A number of factors other than noise exposure in the living environment are involved in such admissions. The effect of aircraft noise in this respect has been studied in the vicinity of Heathrow Airport in the past twenty years. Taking into account several intervening factors, the most recent analysis showed a statistically significant increase in the percentage of admissions to psychiatric hospitals with exposure to aircraft noise. In areas with L_{dn} levels of more than 70 dB(A) (B more than 55 Ke) due to air traffic noise, admission to psychiatric hospitals was higher than in areas with L_{dn} values of less than 65 dB(A) (B less than 45 Ke); the prevalence ratio found was 1.1 (Kry90). However, since a causal relationship was shown in only one investigation and in only one analysis, the committee is of the opinion that care should be taken to generalize this relation to other situations and other populations.

Annoyance in the Work Environment

No relations have been established between noise annoyance experienced during working hours and noise level (Mie85). Only a very small part of the variance in annoyance in the workplace is attributable to variations in noise exposure. The following non-acoustic variables have a much greater effect than noise level on annoyance during working hours:

- meaningfulness and information content of the noise (discussions by colleagues in the surroundings of the workplace score high in this respect)
- predictability, avoidability and controllability of the noise
- attitude of the workers towards the noise source
- task demand
- individual susceptibility.

Annoyance in offices is already considerable at equivalent sound levels above 55 dB(A) during working hours. The few available results of epidemiological investigations show that 35% to 40% of the office workers exposed to an equivalent sound level of 55 to 60 dB(A) are severely annoyed. In industrial situations similar percentages of annoyed workers occur at equivalent sound levels over 85 dB(A). These results do not allow the determination of observation thresholds for annoyance in office and industrial workers.

Effect on Absenteeism in the Work Environment

Epidemiological studies suggest that the absentee rate increases if workers are exposed to higher equivalent sound levels during work. This was demonstrated for various industrial situations at equivalent sound levels higher than 75 dB(A) in one study (Mel92; CORDIS-study: Cardiovascular Occupational Risk Factor Detection in Israel (*In this study the prevalence ratio was 1.2 for equivalent sound levels from 75 to 85 dB(A) and 1.7 for higher sound levels.*) and in another study in the coal and steel industry (Sch91) at equivalent sound levels higher than 90 dB(A) (*in this study the prevalence ratio was 1.1*). On a small scale, a statistically significantly higher absentee rate was shown in office workers who were (very) frequently exposed to clearly audible noise events, compared to those seldom exposed to such events (Sch82) (*in this study the prevalence ratio was 1.3*). However, some of these studies have insufficiently taken into account confounding variables and others are flawed in other aspects. Therefore, the committee concludes that no causal relationships between absentee rate and industrial occupational noise exposure or exposure to noise in offices has yet been demonstrated conclusively.

Sensitive Groups

People annoyed by noise in the workplace show an increased post-work irritability which might affect their general well-being. Noise-sensitive people, people with fear of certain noise sources and people feeling they have no control over a noise situation (i.e., feel an abuse of power) have an increased risk of severe annoyance.

Classification of Health Effects

The committee is of the opinion that the following classifications are applicable:

- annoyance in the living and work environment: sufficient evidence
- psycho-social well-being: limited evidence
- admission to psychiatric hospitals: limited evidence
- absenteeism from work: limited evidence.

Exposure-effect functions have been specified (Mie93) for annoyance from environmental expo-

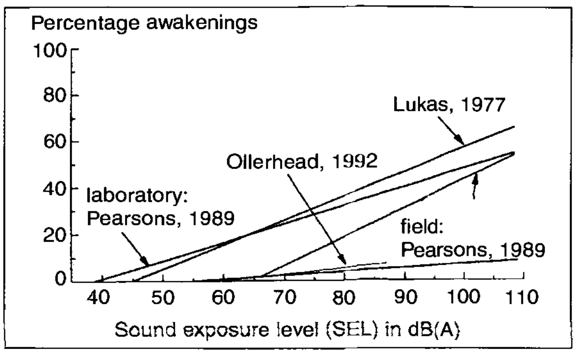

Fig. 1. Relations between the percentage of people with awakenings due to a night-time noise event and the indoor sound exposure level of such an event.

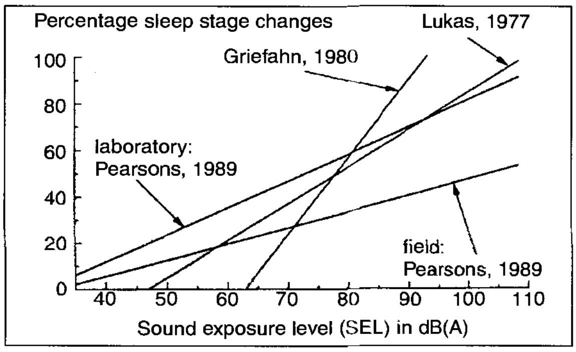

Fig. 2. Relations between the percentage of people with sleep stage changes due to a night-time noise.

sure to traffic and industrial noise. The observation threshold for severe annoyance corresponds to a value of L_{dn} of 42 dB(A).

Exposure-effect functions for annoyance from occupational noise exposure in offices as well as in industrial situations are lacking. Observation thresholds for office noise and for industrial noise exposure are well below $L_{EX,occ}$ values of 55 respectively 85 dB(A). At these values, the fraction of workers severely annoyed amounts to 35% to 40%.

Sleep Disturbance

Effect of Noise on Sleep

Night-time noises can disturb sleep (Gri76, Gri90a,b, Hof91, Hof92b, Jur83, Luk75, Mie93, Ohr83, Ohr88, Oll92, Pea89, WNN93). According to the advisory report of the Health Council on airplane noise and sleep (GR91), external factors such as noise may affect sleep in different ways, resulting in:

- degradation of sleep quality
- disturbance of functioning or performance the next day
- disturbance of mood the next day

Since many of the underlying experimental and epidemiological studies concern exposure to a wide range of types of noise sources, the conclusions about the influence of aircraft noise on sleep in the former Health Council report are also largely applicable to exposure to other types of intermittent traffic noises.

Effects on Sleep Quality

Sleep quality may be affected in various ways:

- by changes in sleep pattern
- by changes in sleep stages from deeper to less deep sleep
- by awakening during the sleeping period
- by changes in subjective assessment of sleep quality
- by changes in cardiovascular and hormonal parameters
- by changes in the immune system

Sleep Pattern

Night-time noise of sufficient intensity changes the sleep pattern in such a way that it increases the time awake during the sleep period and increases sleep latency (the time between lights out and falling asleep). According to the committee the results of experimental and epidemiological research do not permit the assessment of a level above which the sleep pattern starts to worsen. It is recognized, however, that at high levels of traffic noise a significantly greater percentage of the exposed population reports difficulties falling asleep than at lower levels.

Changes in Sleep Stages and Awakening

The sleep stages can be determined from electro-encephalograms (EEGs), measured while the subject is falling asleep and during sleep. The EEG is a continuous recording of the electrical activity of the cerebral cortex. The EEG, together with the electro-oculogram (EOG), indicate the sleep stages: W (waking), 1, 2, 3, 4, REM (Rapid Eye Movements).

For intermittent noise exposures such as produced by aircraft, trains and road traffic, various exposure-effect relations between the characteristics of night-time noise exposure and awakening and sleep stage changes have been derived. Figures 1 and 2 show these exposure-effect relations. The curves proposed by Griefahn (Gri76) and by Lukas (Luk75) are mainly derived from laboratory experiments. The curves of Pearsons (Pea89) distinguish between laboratory and epidemiological studies. The curve derived from the research by Ollerhead (Oll92) concerns epidemiological research. Comparison of the exposure-effect relations from field and laboratory studies supports the hypothesis that habituation results in fewer awakening reactions. This, however, seems less correct for changes between different stages of sleep, a statement which is supported by the results of the joint European field investigation (Jur83) into sleep disturbance. In the two field studies (Pea89, Oll92), the onset of noise-induced awakenings is found to be at a SEL of about 60 dB(A), measured indoors. The onset of noise-induced changes between sleep stages is found at a SEL value of about 35 dB(A). Based on the preliminary exposure-effect relation derived from the two field studies, the total number of awakenings and sleep stage changes during all nights of the year have been estimated as a function of the equivalent sound level indoors during the night (2300-0700h) due to aircraft noise, where this equivalent sound level during the night has been taken on a yearly basis (Pas94). This equivalent sound level has been taken as the noise exposure measure in the preparation of legal requirements concerning night-time flights around main airports in the Netherlands (WNN93).

Subjective Sleep Quality
The subjectively experienced quality of sleep of people exposed to high levels of night-time noise is lower than that for non-exposed people, even for persons who have lived for years in noisy surroundings (Jur83, Ohr89, Ohr90, Ohr91, Sch90, Mie93). In one investigation (Mie93) data on self-reported sleep disturbances due to traffic noise were gathered from questionnaires on noise annoyance. Analysis of these data indicated that at outdoor equivalent sound levels during the night (2300-0700h) from 40 dB(A) subjective sleep quality started to decrease. The committee is of the opinion that there is yet insufficient information to permit determination of the exact exposure-effect relation between subjective sleep quality and night-time noise, especially not at the lower noise exposure values, but that it is justified to take an equivalent sound level of 40 dB(A) during the night as observation threshold.

Cardiovascular and Hormonal Parameters During Sleep
Night-time noise exposure may increase heart rate during the night; habituation to this effect does not seem to occur. The observation threshold is equal to a SEL value of 40 dB(A), measured indoors.

The effect of night-time noise on the endocrine system has so far not been investigated in epidemiological studies, but only in a laboratory study (Gru92, Mas92). The latter study concerned changes in epinephrine and norepinephrine excretion in urine as a function of aircraft noise exposure (*The hormones epinephrine and norepinephrine are also denoted by adrenaline and noradrenaline. They are hormones related to stress.*). Statistically significant effects could be observed at indoor equivalent sound levels of 35 dB(A) (64 overflights). The study has been reported (Isi93) to show a high correlation between epinephrine levels and sleep stage changes. The committee is of the opinion that further research is necessary before conclusions can be drawn for hormonal effects.

The Immune System During Sleep
Only in a Japanese laboratory study by Osada (Osa68, Osa69, Osa72, Osa74) in the period from 1968 to 1974 were changes in the percentages of leucocytes and granulocytes in blood measured. The committee does not consider the results of the Osada research as proof of an effect of noise exposure during sleep on immune system function. Although noise exposure at night may affect the immune system, as daytime noise exposure may do, experimental confirmation of such an effect is still lacking.

After-Effects

The performance during the day, in relation to noise exposure during the previous night, is usually measured by testing reaction time. Epidemiological research showed that the reaction time of residents exposed to night-time noise for years was longer when they had been exposed to more noise during the previous night (Jur83). The committee is, however, of the opinion that the available data do not allow levels to be specified at which these noise-induced effects on performance the next day start to occur. Most studies into the effect of night-time noise on mood the succeeding day showed a decrease in mood of persons exposed to high levels of night-time noise. An outdoors equivalent sound level of 60 dB(A) during the night is the observation threshold.

Sensitive Groups

Ill people, older people and people with sleeping difficulties show more noise-induced sleep disturbance, especially with respect to inability to fall asleep (after being awakened), than do other adults. Older people also have an increased risk of being awakened by night-time noise (WNN93).

Classification of Health Effects

According to the committee the following classifications apply:

- changes in sleep pattern: sufficient evidence
- changes in sleep stages and awakening: sufficient evidence
- subjective sleep quality: sufficient evidence
- heart rate frequency: sufficient evidence
- hormonal system: limited evidence

- immune system: inadequate evidence
- mood next day: sufficient evidence
  performance next day: limited evidence

Although the committee has concluded that there is sufficient evidence for a causal relationship between night-time noise exposure and various effects on sleep, exposure-effect functions are lacking for some of these effects. Exposure-effect functions have been specified for awakening and for sleep stage changes with exposure specified as SEL-values (Pea89). Observation thresholds for the various noise-induced effects are with exposure specified as SEL-values:

- awakening: a SEL value (measured indoors) of 60 dB(A)
- sleep stage changes: a SEL value (measured indoors) of 35 dB(A)
- changes in heart rate: a SEL value (measured indoors) of 40 dB(A)

The number of awakenings and sleep stage changes have been related to the equivalent sound level during the night due to aircraft noise (near main airports) with the noise exposure taken on a yearly basis (Pas94). (*For this specific situation the observation threshold might be an equivalent sound level of 16 dB(A) taken over 7 hours during the night and measured indoors.*)

The observation threshold for subjectively experienced deterioration of sleep quality is found at a value of $L_{Aeq,night}$ of 40 dB(A), measured outdoors. After-effects, the day following night-time noise exposure, on mood and, presumably performance, have observation thresholds at night-time equivalent sound levels of 60 dB(A) measured outdoors.

Effects on Performance

Laboratory studies with test subjects have shown that noise exposures may have a significant effect on performance. While a task is being performed, noise may in test subjects increase arousal, alter the choice of task strategy, and decrease attention to the task. Noise may also affect social performance, mask speech and impair communication and it may distract attention from relevant social cues. When a task involves auditory cues, and these auditory signals are masked by noise, this will have an effect on task performance.

Even relatively low noise levels may have acute adverse effects. It is obvious from laboratory experiments that to a large extent habituation occurs. Performance of a task involving motor and monotonous activities is not always disturbed by noise; noise (music) can also enhance performance in these situations.

Due to the complex character of noise-induced effects on task performance and the many non-acoustical factors involved, no exposure-effect relations were drawn up.

People whose performance strategies are already limited for other reasons and people who are faced with multiple tasks, putting requirements on short-term memory, may be more vulnerable to the distracting effects of noise.

Epidemiological research into effects on performance of schoolchildren has shown that these children, when exposed to very high levels of aircraft or road traffic noise (equivalent sound levels during schooltime over 70 dB(A), measured outside the school) do show an impaired performance in cognitive tasks. They are distracted more easily and make more mistakes when they are exposed daily to high noise levels, while at school (Coh80, Kar68).

The committee is of the opinion that there is limited evidence for a causal relationship between noise exposure as experienced under normal living conditions and decreased performance in adults. There is sufficient evidence in the case of schoolchildren.

Combinations of Noise Exposures

People may be exposed to different noise sources in the same situation, e.g., to a combination of road traffic and train noise in the living environment. People may also be exposed to different noise sources, acting on them in different situations at different times, such as a combination of occupational noise during working hours and road traffic noise while at home.

Accumulated Effects from Different Sources in the Same Situation

Miedema and Vos studied annoyance from two or more environmental noise sources; their work resulted in models for these accumulated noise effects (Vos92, Mie93). Further research may show whether these models are also appropriate for stress-related environmental noise-induced health effects and for sleep disturbance. The combined effect of different noise sources on hearing levels is related to the equivalent sound level of the combined exposure.

Accumulated Effects from Different Sources at Different Locations

Concerning noise-induced hearing loss, the committee considers it appropriate to estimate the accumulated effect of combined exposures based on the equivalent sound level over the total relevant exposure period.

The only epidemiological research into the combination of noise exposure in the living and in the working environment on stress-related effects (cardiovascular and biochemical parameters) showed that effects of road traffic noise in the living environment are more pronounced in men who were also working in high noise levels (equivalent sound levels over 90 dB(A)) than in men without occupational noise exposure (Bab90). In this respect, occupational noise exposure may be considered a risk factor for ischaemic heart disease for people exposed to high levels of environmental noise.

Concerning annoyance, the preliminary conclusion from the scarce epidemiological research is that, irrespective of the extent of the noise exposure at work, only those persons annoyed by noise during working hours show an increase in post-work irritability from noise sources at home (Mel92).

Whether noise exposure during the daytime affects sleep quality the night after the exposure was only tested in laboratory research ((Fru88a,b, Fru90). The results were contradictory. One investigation showed noise exposure during the daytime to stimulate recovery processes of neural- and endocrine functions during sleep and another investigation showed no such effect.

Interaction of Noise with Other Agents

Effects on Hearing

Noise may interact with drugs and industrial agents to produce additive or even synergistic effects on hearing. The ototoxic properties of certain drugs, such as aminoglycoside antibiotics (the mycine drugs) are heightened by exposure to noise. Although high doses of salicylates (aspirin) accompanied by noise exposure can produce temporary hearing loss, increased permanent hearing loss does not seem to occur.

Several case reports have been published on acute and chronic effects of carbon monoxide on hearing. The hearing loss resulting from carbon monoxide exposure appears to be reversible in most cases and is associated with toxic effects in the central nervous system. In one epidemiological study, noise-induced hearing loss in welders and plant assembly workers appeared to be influenced by exposure to carbon monoxide.

Epidemiological studies on workers suggest that carbon disulfide, carbon tetrachloride, trichlorethylene and n-butanol induce sensorineural hearing loss. However, the number of studies and the size of the populations studied seem too small to allow a decision about a possible interaction between noise and solvents on hearing.

Heavy metals have also been mentioned as possible industrial ototoxic agents, but very few studies have tested this suggestion.

Noise and vibrations may have a combined effect on hearing. Several epidemiological studies showed that groups of workers exposed to noise and hand-arm vibrations had a noise-induced hearing loss that was more frequent and greater than that in groups of workers exposed only to noise or only to hand-arm-vibrations. The effects were more pronounced in workers suffering from vibration-induced white finger syndrome. All epidemiological studies concerned exposures to very high noise levels and very intense hand-arm-vibrations. For whole-body vibrations (rather than hand-arm) a smaller effect on hearing levels was observed in groups of workers exposed to a combination of noise and vibrations than in groups of workers exposed to noise only.

Other Health Effects

Epidemiological research into the effect of combined exposure to noise and other environmental agents on health other than on hearing is scarce. Investigations are usually carried out in the laboratory with test persons or with animals. Forestry workers using vibrating and noisy tools, with several years of daily exposure to noise, vibration and cold, showed bradycardia. In laboratory experiments it could be shown that other stressors, such as heat and whole-body vibration do exert, when combined with noise, a greater effect on pulse rate, blood pressure and catecholamines than does noise exposure alone. Notwithstanding the data from laboratory research, the committee does not deem it possible to draw any quantitative conclusions applicable to real-life

Summary of Noise-induced Effects

Table 1 summarizes the present data on the effects on health of exposure to noise. The observation thresholds are given in the measures used in the pertinent literature. The use of such a measure in the table does not necessarily imply it to be recommended for use in practical situations or regulations.

With respect to the use of noise exposure measures for the estimation of noise-induced health effects, table 1 shows that for all of these effects, with the exception of some aspects of sleep disturbance, observation thresholds are expressed in the equivalent sound level determined over a selected representative period during the 24 hour day. Usually, the existing exposure-effect relations characterize noise exposure by an equivalent sound level over a representative period. However, dependent upon the noise effect under consideration, these representative periods are different. Therefore, the committee concludes that there is, as yet, no single noise

Table 1.
(Possible) long-term effects of exposure to noise, classification of the evidence for a causal relationship, and data on the observation threshold.

Effect	Classification[a] of evidence	Situation[b]	Observation threshold		
			Measure	Value in dB(A)	In/out[c]
hearing loss	sufficient	occ	$L_{EX,occ}$	75	in
		env recr	$L_{Aeq,24h}$	70	in
		occ unb	$L_{EX,occ}$	<85	in
hypertension	sufficient	occ ind	$L_{EX,occ}$	<85	in
		env road	$L_{Aeq,06-22h}$	70	out
		env air	$L_{Aeq,06-22h}$	70	out
ischaemic heart disease	sufficient	env road	$L_{Aeq,06-22h}$	70	out
		env air	$L_{Aeq,06-22h}$	70	out
biochemical effects	limited	occ			
		env			
immune effects	limited	occ			
		env			
birthweight	limited	occ			
		env air			
congenital effects	lack	occ			
		env			
psychiatric disorders	limited	env air			
annoyance	sufficient	occ off	$L_{EX,occ}$	<55	in
		occ ind	$L_{EX,occ}$	<85	in
		env[d]	L_{dn}	42	out
absentee rate	limited	occ ind			
		occ off			
psycho–social well-being	limited	env			
sleep disturbance, changes in:					
sleep pattern	sufficient	sleep			
awakening	sufficient	sleep	SEL	60	in
sleep stages	sufficient	sleep	SEL	35	in
subjective sleep quality	sufficient	sleep	$L_{Aeq,night}$	40	out
heart rate	sufficient	sleep	SEL	40	in
hormones	limited	sleep			
immune system	inadequate	sleep			
mood next day	sufficient	sleep	$L_{Aeq,night}$	<60	out
performance next day	limited	sleep			
performance	limited	occ env			
	sufficient	school	$L_{Aeq,\ school}$	70	out

Notes to Table 1.

a classification of evidence of causal relationship between noise and health.
b occ = occupational situation, ind = industrial, off = office, env = living environment, recr = recreational environment, road = road traffic, air = air traffic, sleep = sleeping time, unb = unborn: exposure of pregnant mother, school = exposure of children at school.
c value relates to indoor or outdoor measurement. in the netherlands, the difference between the level measured outdoors and that indoors is 15 to 25 db(a) for dwellings with single glazing.
d observation thresholds for traffic and industrial noise; the observation threshold is lower for environmental impulse noise.

measure, such as $L_{Aeq,24h}$, from which all noise-induced health effects can be estimated, without a specification of the type of noise source, the situation and the period of the day, during which the exposure occurs. This seems especially appropriate for the estimation of sleep disturbance in real live situations, since a reliable relation between measures of night-time exposure and measures related to the 24-hour period does not exist.

Members of the Committee

The members of the committee that prepared the original report on which this feature is based were:

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ACTIVE 97

THE 1997 INTERNATIONAL
SYMPOSIUM
ON ACTIVE CONTROL OF
SOUND AND VIBRATION
BUDAPEST–HUNGARY
1997 AUGUST 21–23

ORGANIZED BY

THE ACOUSTICAL COMMISSION OF THE HUNGARIAN ACADEMY OF SCIENCES

THE SCIENTIFIC SOCIETY FOR OPTICS, ACOUSTICS, MOTION PICTURES AND THEATRE TECHNOLOGY (OPAKFI)

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Announcement and Call for Papers

ACTIVE 97 TO BE HELD IN BUDAPEST, HUNGARY

ACTIVE 97, the 1997 International Symposium on Active Control of Noise and Vibration, will be held at the Technical University of Budapest in the Capital of Hungary from 1997 August 21 to 23. It thus immediately precedes INTER-NOISE 97, the 1997 International Congress on Noise Control Engineering which is also being held in Budapest on 1997 August 25-27.

The symposium is being organized by the Acoustical Commission of the Hungarian Academy of Sciences and the Hungarian Scientific Society for Optics, Acoustics, Motion Pictures, and Theater Technology in cooperation with the Institute of Noise Control Engineering (INCE/USA) and the European Acoustics Association. This symposium has been designated by The International INCE Board of Directors as an International INCE Symposium.

In continuation of a series of meetings being held in Blacksburg, Virginia, USA, and Newport Beach, California, USA from 1991 through 1995, ACTIVE 97 will be the first international conference on active control in Europe. In accordance with its predecessors, six plenary keynote papers will be presented at ACTIVE 97. These papers will cover current aspects and the latest developments in active noise and vibration control. In addition, it is expected that 150 technical papers will present a broad overview of current activities and thus enable an intensive interchange of ideas, concepts, and results.

The symposium chairmen are Fülöp Augusztinovicz and Joachim Scheuren, and the technical program chairman is Steve Elliott. The proceedings editor is Gábor Horváth. The members of the scientific committee are Jiri Tichy (chairman), Alan Curtis, John FFowcs-Williams, Chris Fuller, Deiter Guiking, Hareo Hamada, Colin Hansen, Gérald Mangiante, Phil Nelson, Peter Sas, Richard Silcox, and Hideki Tachibana.

Symposium Secretariat:

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CONTRIBUTIONS INVITED

Technical papers in all areas related to the active control of sound and vibration are welcome. Abstracts proposed for presentation at the symposium must be received by the Symposium Secretariat no later than 1996 November 30. The abstracts should be approximately 250 words in length and should be submitted with the form on the third page of this announcement.

AREAS AND SUBJECTS OF INTEREST

- Active noise control
- Active vibration control
- Active control of structurally-radiated sound
- Application of active systems to industrial noise control

- Application of active systems to interior noise control
- Application of active systems to traffic noise control
- Application of active systems to marine noise control
- Application of active systems to vibration control
- Active vibration isolation
- Active control of building vibration
- Active control of fluid flow
- Active sound field reconstruction and modification
- Implementation and application of adaptive and smart structures
- Definition and application of psychoacoustic criteria to the active control of sound fields
- Feedforward control in active systems
- Adaptive controllers in active systems
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Budapest can be reached by plane, train, and automobile. The Symposium will be held at the Technical University of Budapest. Near the symposium venue, many hotels of various categories can be booked for registered delegates and their families before, during, and after the symposium. Tourists can enjoy Hungarian hospitality, special dishes, wines of the Tokay region, and traditional gypsy music.

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ACTIVE 97, the 1997 International Symposium on Active Control of Sound and Vibration

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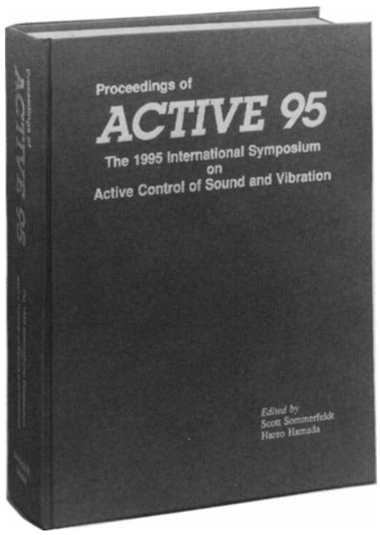

ACTIVE 95, the 1995 International Symposium on Active Control of Sound and Vibration, was held in Newport Beach, California, USA on 1995 July 06–08. More than 325 engineers and others interested in active control of sound and vibration attended the three–day meeting. The Symposium featured six plenary session papers that, together with 121 invited and contributed papers, appear in a 1400–page Proceedings. ACTIVE 95 was a follow–on to the two meetings on Active Control of Sound and Vibration held in Blacksburg, Virginia in 1991 and 1993, and a Symposium on Active Control of Sound and Vibration held in Tokyo, Japan in 1991.

Six plenary sessions were held during the Symposium, each devoted to a special area of active control. The lead plenary speaker was Professor Christopher R. Fuller, the founder of the meetings held at the Virginia Polytechnic Institute and State University in Blacksburg Virginia. His topic was "Active control of coupled wave propagation and associated power in fluid–filled elastic long pipes." He presented the results of a study on the active control of total power flow in fluid–filled elastic pipes by the use of structurally mounted actuators. Professor Mikio Toyhama of Kogakuin University in Tokyo, Japan was the second plenary speaker. In his presentation, titled "Room transfer functions and sound field control," he reviewed the nature of transfer functions in a reverberant space, and described the process of inverse filtering and its use in the control of sound fields. The third plenary lecture on active control of road noise inside automobiles by Professor Robert J. Bernhard of Purdue University in West Lafayette, Indiana, USA. Professor Hareo Hamada of the Tokyo Denki University in Tokyo, Japan presented the fourth plenary lecture. His topic was "Genetic algorithms used for active control of sound — search and identification of noise sources." Kam W. Ng, of the Office of Naval Research in Washington, DC, USA presented the fifth plenary lecture. He spoke on "Applications of active control," and gave many examples of control in vehicles and applications of interest to the U.S. Navy. The final plenary speaker was Professor Mendel Kleiner of the Chalmers University of Technology in Gothenburg, Sweden. His presentation, titled "Review of active systems in room acoustics and elecroacoustics," covered signal processing techniques for altering the sound field in rooms. In addition to these presentations, nineteen technical sessions devoted to active control were held during the Symposium.

The hard–cover proceedings book contains the papers presented at the Symposium, and each paper averages more than 10 pages in length. These full–length papers make a valuable contribution to the state of the technology in active control of sound and vibration. The Proceedings is now available to those who were unable to attend ACTIVE 95, may be obtained by returning the order form below.

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The 1997 National Conference on Noise Control Engineering 1997 June 15-17

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Penn State Scanticon
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1996 June 16-20

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ASA Technical Program Chairman

Announcement and Call for Papers

NOISE-CON 97, the 1997 National Conference on Noise Control Engineering will be held at the Pennsylvania State University in University Park, Pennsylvania on 1997 June 15-17. NOISE-CON 97 is being sponsored as a joint meeting by the Institute of Noise Control Engineering (INCE) and the Acoustical Society of America. The theme of NOISE-CON 97 will be *Frontiers of Noise Control.* Three *frontiers* will be emphasized, active control, vibration analysis for machinery health prediction, and numerical methods in noise control. Technical papers in all other areas of noise control engineering are also welcome.

NOISE-CON 97 will be held in conjunction with the 132nd meeting of the Acoustical Society of America which will take place at the Penn State Scanticon, a modern conference center on the Penn State Campus, on 1996 June 16-20. NOISE-CON 97 will open on Sunday, June 15 at the Nittany Lion Inn on the Penn State Campus with parallel sessions, a plenary session, and a reception. Technical sessions on Monday, June 16 and Tuesday, June 17 will be held concurrently with ASA sessions at the Penn State Scanticon. NOISE-CON 97 will conclude on Tuesday evening with a second reception. ASA sessions on topics other than noise control will begin concurrently with NOISE-CON 97 on June 16, and will continue through June 20.

Professor Sabih Hayek of Penn State will be the General Chairman for the ASA meeting, and Professor Jiri Tichy, head of the Graduate Program in Acoustics at Penn State, will be the General Chairman for NOISE-CON 97.

A joint equipment exhibition for the two meetings will be organized; it will open at the Penn State Scanticon on June 16 and close on June 18. The exhibition will include active noise control systems, computer-based instrumentation, sound level meters, sound intensity systems, signal processing systems, equipment for active noise control, acoustical materials, and devices for noise control.

Individuals may register for NOISE-CON 97 alone, the Acoustical Society meeting alone, or may pay a joint registration fee for both meetings.

ACTIVE 97, the 1997 International Symposium on Active Control of Sound and Vibration will be held in Budapest, Hungary on 1997 August 21-23. Those interested in active control are encouraged to attend ACTIVE 97. NOISE-CON 97 will, however, provide an opportunity for persons from the United States and other countries who are unable to attend ACTIVE 97 with a forum to present their research on active control, and will be a forum for the discussion of recent results in this rapidly-expanding field.

CONTRIBUTIONS INVITED

Technical papers related to the three *frontiers* mentioned above are especially welcome, but technical papers in all areas of noise control may be submitted for inclusion on the technical program. abstracts should be submitted in the format enclosed with this announcement. The deadline for receipt of abstracts is 1996 December 15. Manuscripts for publication in the conference proceedings are due on 1997 April 02.

Technical papers in all areas of noise control engineering will be accepted for presentation at the conference. Papers related to the three frontiers mentioned on the first page of this announcement are especially welcome. All areas of active noise and vibration control will be covered at NOISE-CON 97. Machinery diagnostics techniques will include advanced signal processing, analysis on defects and wear, preventative maintenance, and other topics related to condition monitoring. Numerical methods include finite element and boundary element methods, software for prediction of noise indoors and outdoors, and other numerical analysis techniques.

Technical papers in all areas of noise control engineering will be accepted for presentation at the conference. Papers related to the three frontiers mentioned on the first page of this announcement are especially welcome. Areas of *active noise control* of interest include:

- Active control of sound in ducts and enclosures
- Active control of free field radiation
- Active control of sound in vehicles
- Active control of structural radiation
- Active vibration isolation
- Active control of structural vibration
- Active control of nonlinear systems
- New developments in sensing and actuating techniques
- Advances in signal processing, algorithms, and controller implementation
- Innovations to reduce implementation costs

Use of vibration signatures in machinery component health monitoring has become a major research focus of both industry and the military. Topics of interest in *machinery diagnostics* include:

- Bearing signature analysis and failure mechanisms
- Gear and trive train analysis and failure mechanisms
- Electric motor/generator signature analysis
- Turbomachinery diagnostics and prognostics
- Acoustic detection of corrosion
- New sensor technologies for health monitoring

The advances in the computational capabilities of personal computers and workstations has made the use of *numerical methods* very popular. Areas of interest include advances in computational algorithms and application of numerical techniques related to:

- Finite elements and boundary elements
- Sound propagation prediction methods
- Numerical modeling of sound absorptive materials
- Direct computation of noise in the presence of flow
- Machine noise prediction

Papers on general topics in noise control are being arranged in cooperation with the technical committees on noise and architectural acoustics of the Acoustical Society of America. Topics of interest include:

- Acoustics of large spaces
- Combined exposure to noise and other hazards
- Combined exposure to sound and vibrations
- Consumer product sound quality
- Engineering controls for mining noise
- Design for low noise and quality control
- Measuring and modeling noise flanking transmission in floors
- Hearing loss
- Noise in school classrooms
- Power plant noise
- Product noise labeling
- Reactions to low level noise
- Room noise criteria
- Sensor self-noise
- Speech intelligibility in rooms

CONFERENCE VENUE

On Sunday, June 15, the technical sessions and a plenary session will be held at the Nittany Lion Inn in State College, Pennsylvania. The plenary session will be followed by a reception. On Monday and Tuesday, June 16-17, all technical sessions will be held jointly with the Acoustical Society of America at the Penn State Scanticon. Both venues are on the campus of the Pennsylvania State University in State College, Pennsylvania.

REPLY COUPON

Return this coupon if you are interested in attending NOISE-CON 97

NAME ______________________________

ADDRESS ______________________________

CITY______________ **COUNTRY OR STATE**______________ **POSTAL CODE**______________

[ ] I am interested in attending NOISE-CON 97.   [ ] I am interested in presenting a technical paper

[ ] My company may be interested in participating in the equipment exhibition

[ ] I would like to organize a special session for NOISE-CON 97. If checked, the subject area of the session could be:

____

Please return this coupon to: **Graduate Program in Acoustics,** Applied Research Laboratory, The Pennsylvania State University, P.O. Box 30, State College, PA 16801, USA.

FORMAT FOR SUBMISSION OF ABSTRACTS

NOISE-CON 97
1997 June 15 - 17
State College, Pennsylvania

⇒**PAPER TITLE IN BOLD UPPER CASE LETTERS** (20 words maximum)

⇒INCE Subject Classification (see reverse side)

⇒First author's name, address, telephone number, FAX, and e-mail (optional) for correspondence

⇒Additional authors' names and addresses (if any)

⇒**Text of the Abstract:** The text of the abstract should not exceed 250 words. The abstract is to be typed in the format as shown on this sheet following the title of the paper in upper case letters, the INCE subject classification, and the authors' names and addresses. The text should be typed double-spaced and should include: 1) a brief description of the problem being addressed, 2) why the problem is important, 3) a description of the original contribution of the work, and 4) pertinent conclusions.

Please send three copies (or one if by e-mail) of the abstract without a cover letter to:

NOISE-CON 97 Conference Secretariat
Graduate Program in Acoustics
Applied Research Laboratory
The Pennsylvania State University
P.O. Box 30
State College, PA 16804, USA
Telephone: +1 814 865 6364
FAX: +1 814 865 3119
e-mail: NOISECON97@aol.com

Note: Abstracts sent using overnight delivery services should be sent to Applied Rearch Laboratory at street address North Atherton Street, State College, PA 16802

THE DEADLINE FOR RECEIPT OF ABSTRACTS IS 1996 DECEMBER 15

I-INCE CLASSIFICATION OF SUBJECTS

GENERAL

00 General
01 INTERNATIONAL/INCE
02 INTERNATIONAL/INCE (Continued)
03 INTERNATIONAL/INCE (Continued)
04 INTERNATIONAL/INCE (Continued)
05 Publications (other than technical articles)
06 History and philosophy
07 Education
08 Noise programs
09 Definitions and descriptors

EMISSION: NOISE SOURCES (Noise generation and Control)

10 General
11 Noise-generating devices (including components and subassemblies)
12 Stationary noise sources
13 Moving noise sources including aircraft
14 Specialized industrial machinery and equipment

PHYSICAL PHENOMENA

20 General
21 Physical mechanisms of noise generation
22 Natural sources of noise
23 Propagation, transmission & scattering of sound (general wave equation)
24 Sound propagation in the atmosphere
25 Sound propagation in enclosed spaces
26 Sound propagation in ducts

NOISE CONTROL ELEMENTS (Noise control by external treatments)

30 General
31 Barriers and screens, shielding
32 Enclosures for noise sources
33 Sound isolating elements (including panels, partitions and curtains)
34 Filters, mufflers, silencers and resonators (conventional types)
35 Absorptive materials
36 Hearing protective devices
37 Noise attenuation and transmission in ducts
38 Special treatments (including active noise control)

VIBRATION AND SHOCK: GENERATION, TRANSMISSION, ISOLATION AND REDUCTION

40 General
41 Characteristics of sources of vibration and shock
42 Vibrating surfaces and structures (beams, plates, shells)
43 Propagation in structures (structure-borne noise)
44 Balancing of rotating and reciprocating machines
45 Reduction of impact forces; shock isolation and absorption
46 Vibration isolators and attenuators
47 Vibration-damping materials and structures
48 Vibration generators, shake tables
49 Effects of vibration and mechanical shock (on man, on structures)

IMMISSION: PHYSICAL ASPECTS OF ENVIRONMENTAL NOISE

50 General
51 Building noise control
52 Community noise control
53 In-plant noise control
54 Shipboard and offshore platform noise control
55 Outdoor plant noise control (design and construction)
56 Noise surveys

IMMISSION: EFFECTS OF NOISE

60 General
61 Perception of sound
62 Physiological effects
63 Psychological effects
64 Effects of noise on physical structures
65 Effects of noise on animals and other wildlife
66 Sociological effects; community reaction to noise
67 Economic effects
68 Environmental impact statements
69 Criteria and rating of noise

ANALYSIS

70 General
71 Instruments for noise and vibration measurement
72 Measurement techniques
73 Test facilities (design and qualification)
74 Signal processing
75 Analytical methods
76 Modeling, prediction and simulation
77 Sampling and quality control procedures
78 Audiometry, dosimetry and hearing measurements
79 Psychoacoustical evaluations and testing

REQUIREMENTS

80 General
81 Standards
82 Federal government legislation and regulations
83 State legislation and regulations
84 Other legislation and regulations
85 Ordinances, including zoning requirements
86 Building codes
87 Specifications
88 Auditing, enforcement and certification
89 Labeling

RESERVED FOR FUTURE EXPANSION

90 - 99

NOISE CONTROL

The illustrations in this feature article appeared first in a book published in Swedish by Arbetarskyddsfonden, the Swedish Work Environment Fund. The Fund was established by national legislation in Sweden to conduct research and education in the field of work environment improvement, and is jointly operated by Swedish employers and labor unions.

The book was translated into English and disseminated as a guide for workers and employers by the U.S. Department of Labor. It has also been translated into other languages, notably Finnish and Danish, but its overall circulation has been limited. The illustrations are being republished here to give them wider circulation, particularly among noise control engineers.

The formulation of the principles, the choice of examples and the preparation of preliminary sketches was the work of Stig Ingemansson. The original illustrations were prepared by Claes Folkesson.

The principles and practice of noise control are presented in eight sections:

A. Sound behavior
B. Sound from vibrating plates
C. Sound production in air or gases
D. Sound production in flowing liquids
E. Sound propagation indoors
F. Sound propagation in ducts
G. Sound from vibrating machines
H. Sound reduction by enclosure walls.

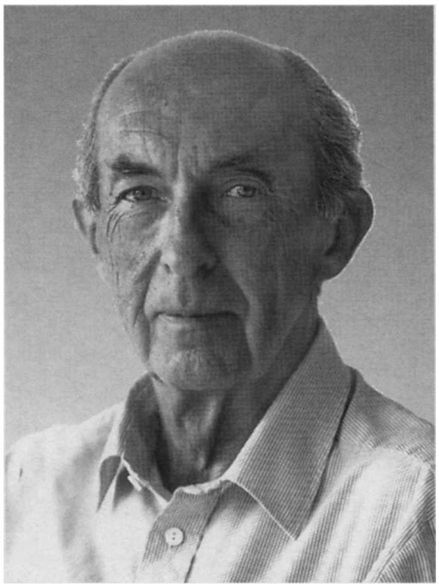
The text of the U.S. Department of Labor translation has been checked and improved by the author. The illustrations are being published serially in **Noise/News International**. *Illustrations A1 through A4 appeared in NNI, Vol 2 No. 2, 1994 June, pages 108-115. Illustrations A5 through A8 appeared in NNI, Vol 2. No. 3, 1994 September, pages 185-193. Illustrations B1 through B3 appeared in NNI, Vol. 2, No. 4, 1994 December, pages 244-249. Illustrations B4 through B6 appeared in NNI, Vol. 3, No. 1, 1995 March, pages 46-51. Illustrations B7 through C2 appeared in NNI, Vol. 3, No. 2, 1995 June, pages 120-127. Illustrations C3 through C5 appeared in NNI, Vol. 3, No. 3, 1995 September, pages 178-183. Illustrations C6 through D1 appeared in NNI, Vol. 3, No. 4, 1995 December, pages 238 - 243. Illustrations D2 through E2 appeared in NNI, Vol. 4, No. 1, 1996 March, pages 40-45. Illustrations appearing in this issue are the following:*

E3. Cover layers with large perforations that may be used without reducing absorption.
E4. Panels on studs absorb low frequencies.
E5. Sound barriers may be combined with sound absorptive ceilings.
F1. All duct changes reduce sound transmission.

These illustrations should assist engineers in explaining to others the fundamental principles of noise control. —Ed.

Stig Ingemansson is the founder of Sweden's leading consulting firm in acoustics. He was a lecturer in acoustics for many years at Chalmers University of Technology, Gothenburg, Sweden, and recently received an honorary doctorate from the university. His address is: Stig N.P. Ingemansson, DNV Ingemansson AB, Gullbergs Strandgata 6, Box 276, S-40 124 Gothenburg, Sweden.

Principles and Practice (Part 9)

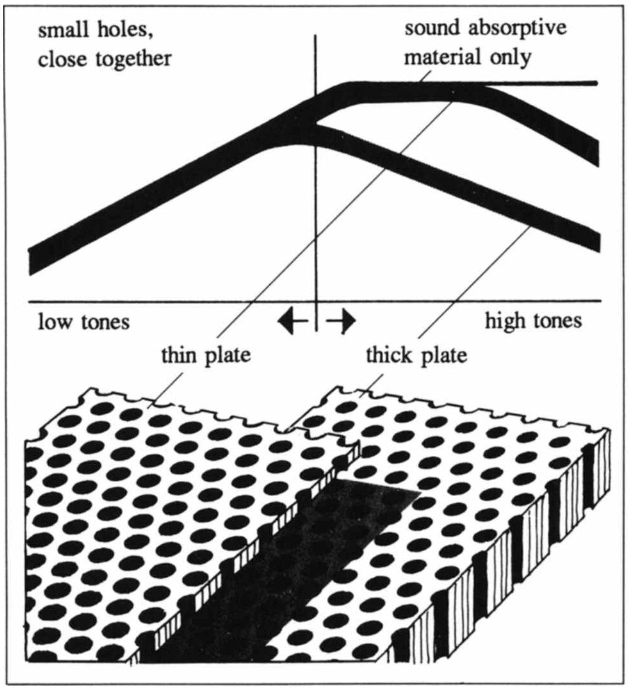


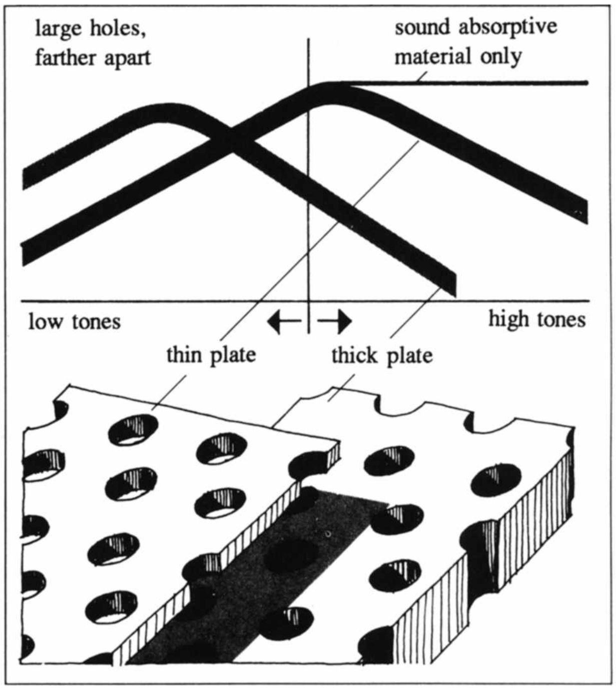
Stig Ingemansson

COVER LAYERS WITH LARGE PERFORATIONS MAY BE USED WITHOUT REDUCING ABSORPTION

For a variety of reasons, a covering material may be needed to protect a porous sound absorptive material. This can be done without reducing the effectiveness of the absorptive material if the covering has a sufficient number of openings. For example, a 15% open area is sufficient for a 1 mm thick sheet–metal layer. The thicker the cover layer, the larger the number of perforations that will be required. It is better to perforate with many small holes than with a smaller number of large holes.

Principle





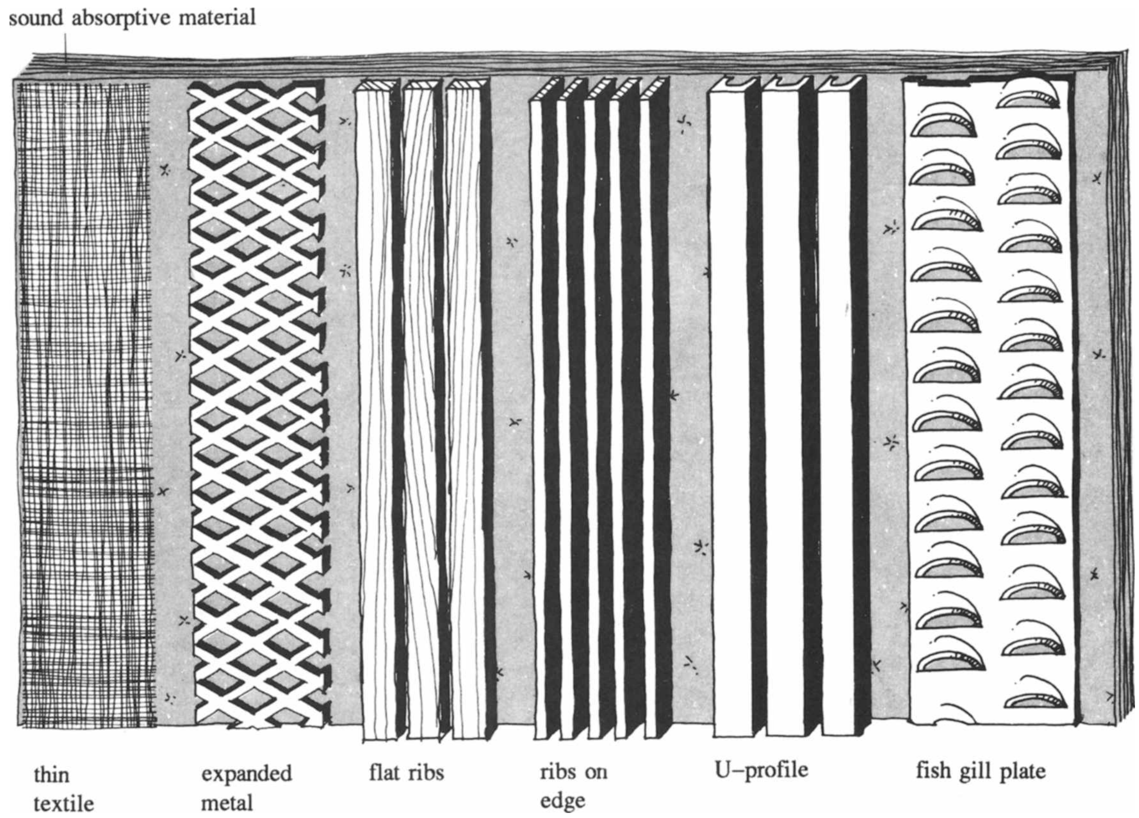
Application of wall and ceiling sound absorptive materials

Example

Sound absorptive material is required on many wall and ceiling surfaces in a building. To provide a more attractive environment, it is desirable to have many absorbers with different appearances.

Control Measure

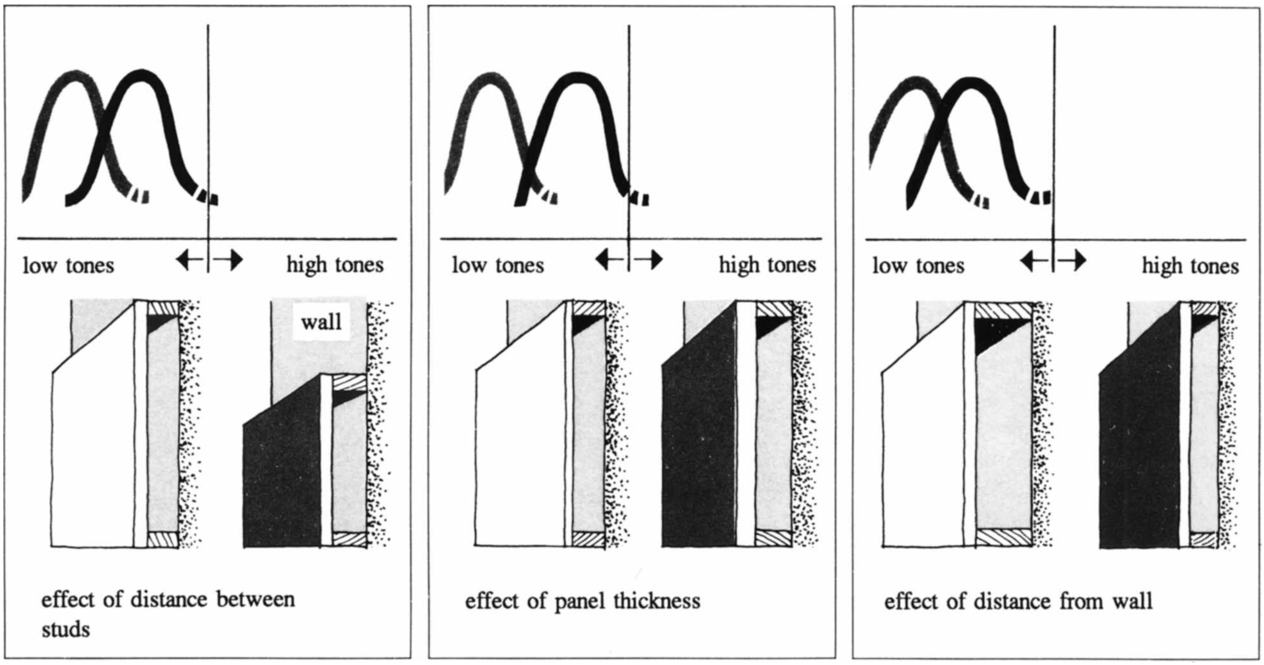
The same porous material is used on all surfaces, with varying thicknesses. Different covering materials provide the desired variation in appearance.



PANELS ON STUDS ABSORB LOW FREQUENCIES

Thin panels, fastened to a system of studs, absorb low frequencies. The absorption is effective over a narrow frequency range. This range is determined by the stiffness of the panels and the distance between the studs. If the panels are fastened to studs on a wall, the distance from the wall also has an effect. A panel with large internal damping absorbs over a wider frequency range.

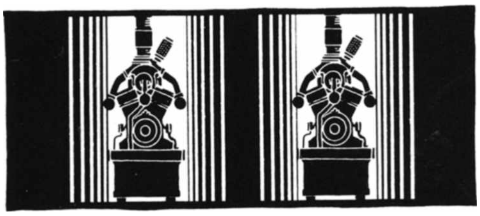
Principle



Application in a machine room with loud low-frequency noise

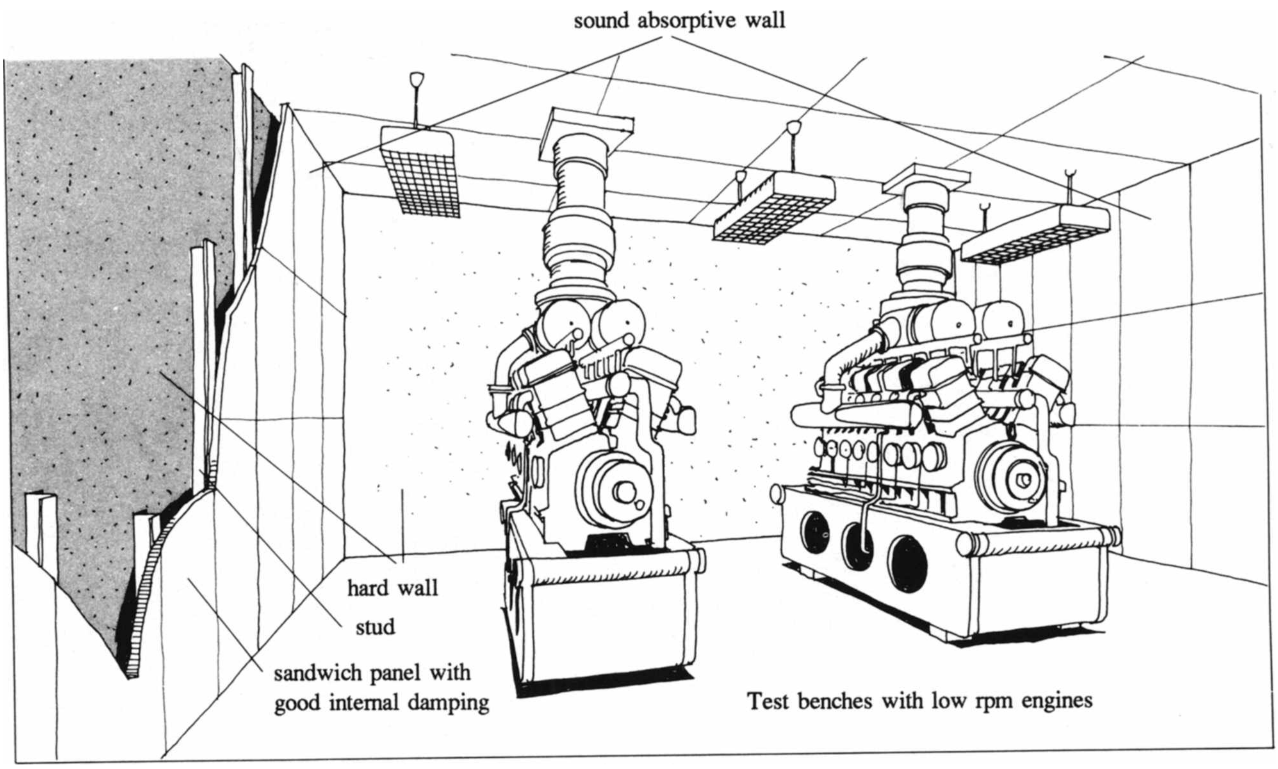
Example

Low-frequency resonance in an engine test room produced a very loud tone near the walls and in the center of the room. When the engine rotation speed was changed significantly, the tone disappeared completely.



Control Measure

The walls were covered with panels on studs to provide the greatest absorption in the frequency range of the loudest tone. In order for the sound absorptive material to continue to function even in the case of slight variations from the normal rotation speed, a layer with good internal damping was used, which provided a wider frequency range with good absorption. As a result, the resonance and the loud tone disappeared.

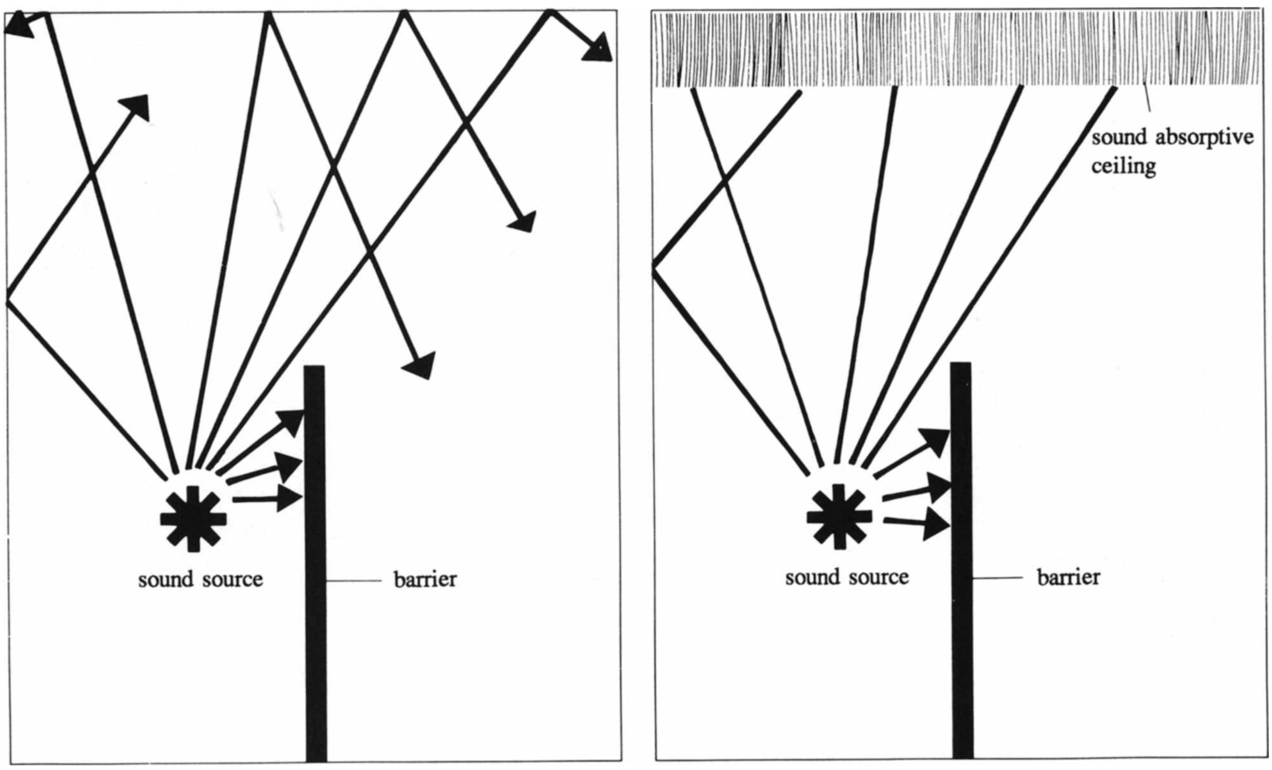


E5 SOUND PROPAGATION INDOORS - ABSORPTION

SOUND BARRIERS MAY BE COMBINED WITH SOUND ABSORPTIVE CEILINGS

High frequency noise can be reduced by using a barrier. The barrier is more effective the taller it is and the closer it is placed to the source. The effect of a barrier is considerably reduced if the ceiling is not covered with a sound absorptive material.

Principle



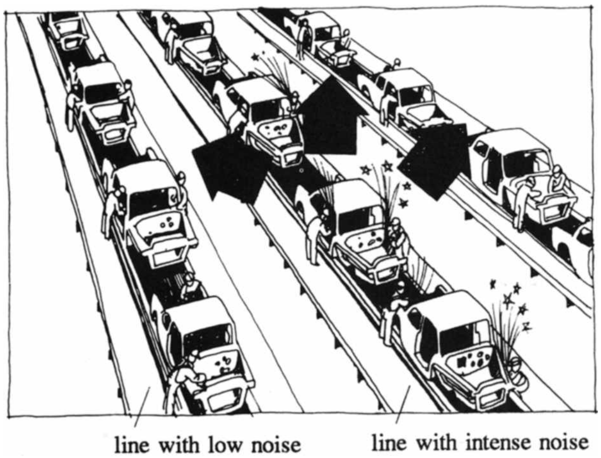
Application on a factory floor

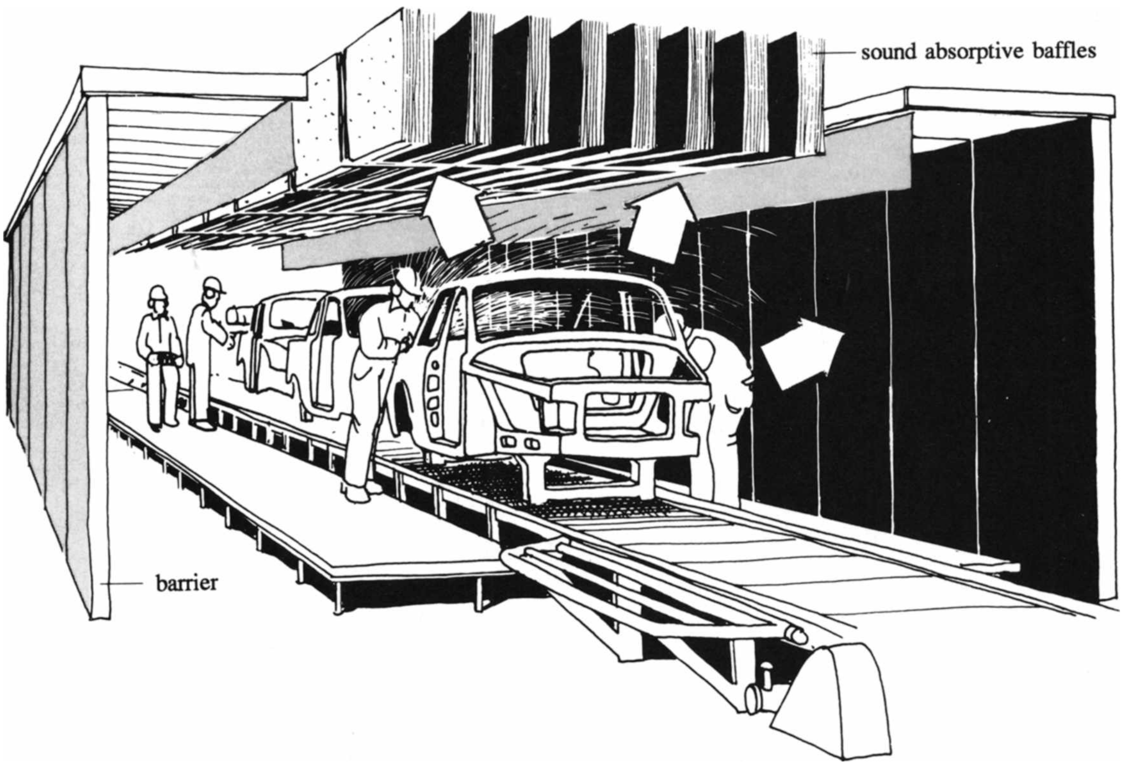
Example

In an auto plant with several assembly lines, the work on one line is noisier than the others. Grinding work on the bodies produces a shrieking, high frequency sound, disturbing everyone in the plant.

Control Measure

The other lines are protected from the grinding noise by means of barriers on both sides of the line and sound absorptive baffles suspended above the open area.



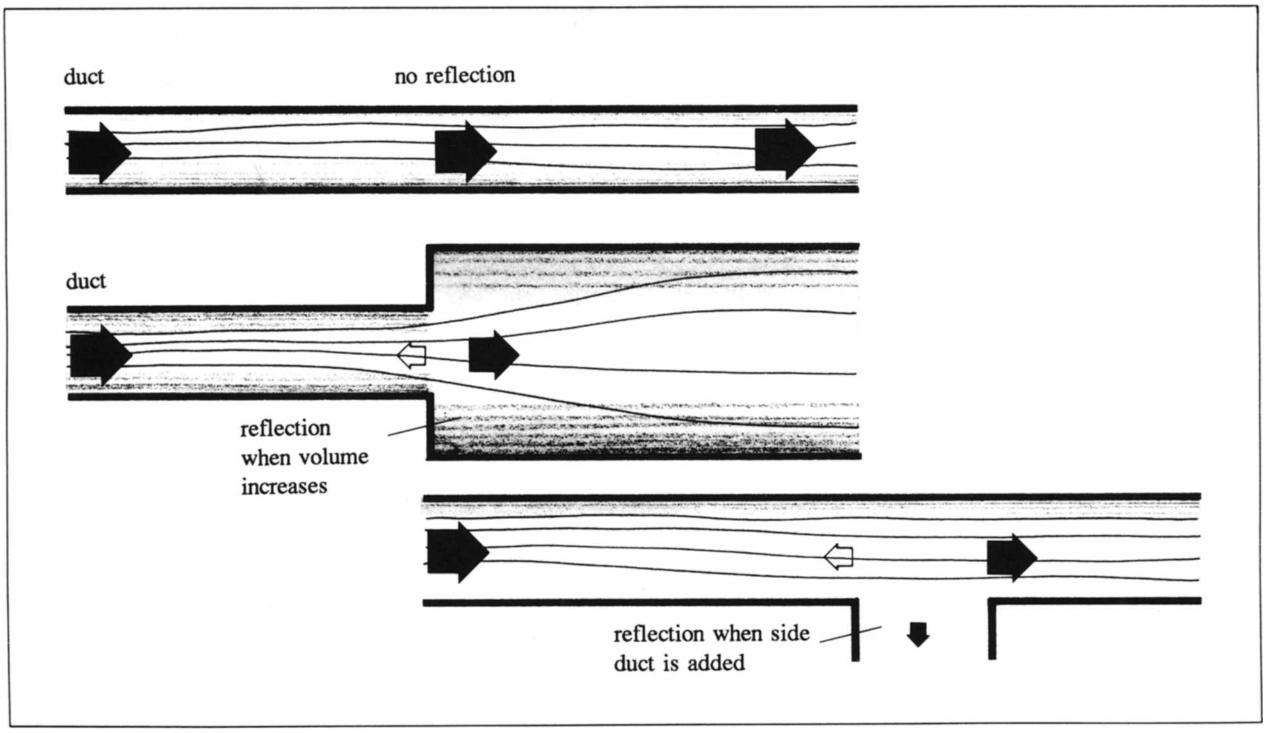


F1 SOUND PROPAGATION IN DUCTS - REACTIVE MUFFLERS

ALL DUCT CHANGES REDUCE SOUND TRANSMISSION

With every change in the pathway, some sound energy is reflected back. In a duct, this applies to all changes in cross–section due to bends and branches, as well as to changes in volume, shape, and wall material. Reflections are useful for sound damping. A muffler that reflects sound energy back to the source is a reactive muffler. One that converts sound into heat is a dissipative muffler.

Principle



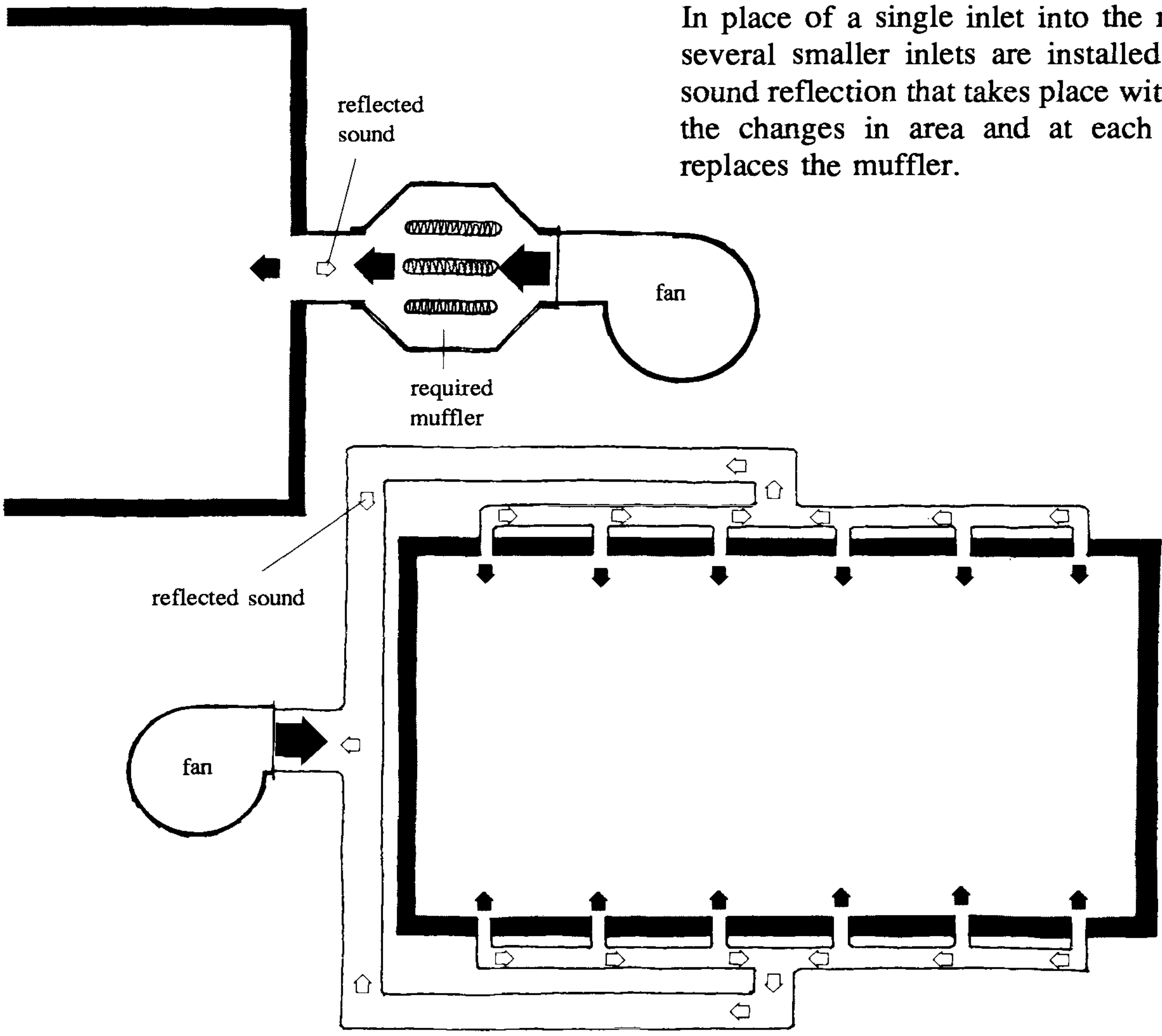
Application to a ventilating system

Example

An area is to be provided with mechanical ventilation. There is sufficient space for the fan to be installed, but not for a required muffler.

Control Measure

In place of a single inlet into the room, several smaller inlets are installed. The sound reflection that takes place withe all the changes in area and at each bend replaces the muffler.



People

Peppin is Elected ASME Fellow

Richard J. Peppin, P.E., a resident of Rockville, MD, and eastern regional manager at Larson Davis Laboratories, Inc., has been named a Fellow of the American Society of Mechanical Engineers. He is president-elect of INCE/USA and will become the president in 1997.

The Fellow grade is conferred upon a member with at least 10 years active engineering practice who has made significant contributions to the field. Mr. Peppin holds degrees from the City College of the City University of New York, West Virginia University, and the Rensselaer Polytechnic Institute. He is also a member of the Acoustical Society of America, the American Society of Testing and Materials, the American Society of Heating, Refrigerating and Air-Conditioning Engineers and the Society of Automotive Engineers. He is a registered professional engineer in New York, New Jersey, Maryland, and Ontario, Canada.

Phil and Ginny Swartz are Honored by INCE

On March 27, an awards dinner for Philip and Ginny Swartz was held at Le Pavillon restaurant in Poughkeepsie. They have been longtime supporters of INCE/USA activities; Phil retired as manager of INCE/USA exhibitions in 1995. He was exhibition manager for INTER-NOISE 84, INTER-NOISE 89, NOISE-CON 91, INTER-NOISE 92, NOISE-CON 93, NOISE-CON 94, AND INTER-NOISE 95. Louis C. Sutherland, INCE President during Phil's last exhibition in 1995, wrote that he personally expressed his sincere thanks for Phil's long and untiring efforts. "Your enthusiastic management," he said, "of the exhibitions at NOISE-CON and INTER-NOISE meetings has been a real benefit to INCE over the years, Phil, and I want to thank you and your lovely wife for all of your help."

Phil and Ginny Swartz were presented with a plaque which expressed thanks from the current INCE president, David M. Yeager.

INCE/USA managing director, George Maling (left), presents a special plaque to Phil and Ginny Swartz on 1996 March 27.

Larry Royster and Elliott Berger are 1996 Recipients of National Hearing Conservation Association Awards

The National Hearing Conservation Association has announced the recipients of the *Award for Outstanding Contribution to the Field of Hearing Conservation* and the *Michael Beall Threadgill Award for Outstanding Service to NHCA* at its Annual Conference in San Francisco in 1996 February. The 1996 recipients of these awards are Larry H. Royster and Elliott H. Berger respectively. Mr. Berger is a Board Certified Member of INCE/USA.

The first award was established by NHCA in 1990 to be awarded to an individual whose work is exemplary in the hearing conservation field. Royster was recognized for his pioneering efforts in developing methods for evaluating the efficacy of hearing conservation programs and for refining and teaching the elements of effective hearing conservation and fundamental and advanced concepts in engineering noise control.

The second award was established in 1985 to honor individuals who, by their outstanding commitment of time and effort, have contributed in a significant way to the growth and continuing excellence of NHCA. Elliott H. Berger, the 1996 recipient of this award, has been an active member of NHCA since 1982; his serious involvement with the association began in 1989 when he served as Vice President and Program Chair. Since then, Mr. Berger's significant contributions have extended to every NHCA program, greatly improving the way NHCA conducts its conferences and the business of the association.

Garrett Named UTC Professor at Penn State

Steven L. Garrett, professor of physics in the Naval Postgraduate School, Monterey, California, USA, has been named the United Technologies Corporation Professor in Acoustics in Penn State's College of Engineering. He will hold a joint appointment in Penn State's Applied Research Laboratory.

Garrett recently has worked on thermal acoustic refrigeration and fiber optics sensing. He is the co-holder of 12 patents covering a range of acoustical instrumentation and fiber optics applications.

"Steve Garrett brings a solid record of research and technology development in acoustics and a strong background in graduate acoustics education," says David N. Wormley, engineering dean. "He's an outstanding fit for our acoustics program." Penn State's Graduate Program in Acoustics is the largest such program in the world, with approximately 100 graduate students.

Garrett joined the Naval Postgraduate School faculty in 1982 as assistant professor of physics and was promoted to full professor in 1989. During his tenure at Monterey, he served as chair of the Engineering Acoustics program.

Wicoxon Research Names Director of Sales and Marketing

Wilcoxon Research has announced the addition of Mr. Paul Taylor to the firm as the Director of Sales and Marketing.

Mr. Taylor will be responsible for managing the growth of WRI's account management, strategic marketing, customer service and product development programs.

Wilcoxon Research manufactures a wide range of vibration instrumentation equipment, specializing in internally amplified piezoelectric accelerometers. For over 30 years, Wilcoxon Research has contributed to the vibration monitoring field.

Pan-American News

G.C. Maling, Jr., *Pan American Editor*

USA

INCE/USA Publishes Special Issue of NCEJ on Noise Control. The May-June issue of *Noise Control Engineering Journal* is a special issue with the sub-title *Noise Control — Where do we stand today?* The issue is a collection of papers which were first presented at the 129th meeting of the Acoustical Society of America (ASA) was held on 1995 May 30-June 03 in Washington, DC. *(See NNI, 1995 September, page 189. — Ed.)*

Since NCEJ is published in cooperation with the Acoustical Society of America, the special issue was overprinted, a special cover added, and extra copies were made available to the ASA for distribution to its members and others interested in noise control. The session was chaired by Henning E. von Gierke of the Medical Research Laboratory, Armstrong Aerospace, Wright Patterson Air Force Base, Ohio, and Daniel L. Johnson of Biophysical Operations, EG&G Special Projects in Albuquerque, New Mexico. They also edited the special issue.

The five papers that appear in the issue are:

Noise environments outdoors and the effects of community noise.
Edgar A.G. Shaw, Institute for Microstructural Sciences, National Research Council, Ottawa, Canada.

Progress in controlling occupational noise exposure.
Alice H. Suter, Alice Suter and Associates, Ashland, Oregon, USA and Daniel L. Johnson, EG&G Special Projects, Albuquerque, New Mexico, USA.

Recreational exposure to noise and its effects.
Alf Axelsson, Hearing Research Laboratory, Lindholmen Dev., Gothenburg, Sweden.

NASA noise reduction program for advanced subsonic transports.
David G. Stephens and F.W. Cazier, Jr., NASA Langley Research Center, Hampton, Virginia, USA.

25 years of progress in noise standardization.
Paul D. Schomer, U.S. Army CERL, Champaign, Illinois, USA.

Federal regulations and other activities in noise control.
R.L. Miller, Harris, Miller, Miller & Hanson, Inc., Burlington, Massachusetts, USA.

A global vision for the noise control marketplace.
Bennett M. Brooks, Brooks Acoustics, Vernon, Connecticut, USA, T. James DuBois, Acentech, Canoga Park, California, USA, Robert M. Hoover, Hoover and Keith, Inc., Houston, Texas, USA, George C. Maling, Jr., INCE/USA, Poughkeepsie, New York, USA, and Louis C. Sutherland, Palos Verdes, California, USA.

The issue has been mailed to all members of INCE/USA and all library subscribers to NCEJ. Those who wish to receive a copy of the special issue with the special cover should contact Elaine Moran, Acoustical Society of America, 500 Sunnyside Blvd., Woodbury, NY 11797, USA.

ASA To Host International Congress on Acoustics. The major international congress covering all aspects of acoustics, the International Congress on Acoustics (ICA) will, in 1998, be held in Seattle, Washington, USA in conjunction with the 135th meeting of the Acoustical Society of America (ASA). This will be the 16th in a series of international congresses on acoustics held since 1953. The congress will be held in Seattle on 1998 June 20-28.

As a joint meeting. ASA/ICA '98 will bring together experts from all fields of acoustics and will provide an international forum for the open exchange of scientific information.

The chair of ASA/ICA '98 is Lawrence A. Crum of the Applied Physics Laboratory, University of Washington, Seattle, Washington, USA. Other members of the organizing committee include Patricia Kuhl of the University of Washington Department of Speech and Hearing Sciences who will serve as technical program chair, and Charles Schmid, Executive Director of the Acoustical Society of America.

Scheduled events include a welcome reception on Saturday evening, June 20, and opening ceremony with a speaker followed by a reception on June 21, a cruise and salmon bake dinner on June 24, and a banquet on June 25.

For further information, contact Nancy Penrose, ASA/ICA '98 Secretariat, Applied Physics Laboratory, University of Washington, 1013 NE 40th Street, Seattle, WA 98105, USA. Telephone: +1 206 543 1275; FAX: +1 206 543 6785; e-mail: penrose@apl.washington.edu.

TWA Flight 800 Disaster: Recorded Sounds. On 1996 July 17, the cockpit voce recorder of TWA Flight 800 stopped moments after a loud impulsive sound was recorded by four microphones. As this issue went to press, the authorities were not sure of the origin of the sound which brought down the aircraft off the Long Island, USA coast killing all on board. The content and interrelationship of these microphone signals should provide important clues as to the origin of the sound. To help television viewers understand signal analysis, ABC television enlisted the aid of the RH Lyon Corp to demonstrate several methods of sound analysis. David Bowen and Gladys Unger assisted with the demonstrations, and ABC news aired the demonstration on national television. On 1996 August 12, the *New York Times* reported that the last of the luggage containers had been retrieved, and that there was no visible evidence of damage from a bomb.

European News

A. Cops, *European Editor*

HUNGARY

Progress on the INTER-NOISE 97 Congress. Congress Organization was one of the items covered in a report on the INTER-NOISE 97 Congress when the organizers reported to the International INCE Board of Directors in August in Liverpool. Among the persons responsible for the congress are: **Tamás Tarnóczy**, Honorary Congress President who organized the 7th International Congress on Acoustics in 1971, **András Illényi**, General Chairman, Faculty of Informatics and Electrical Engineering of the Technical University of Budapest (TUB), **Frigyes Reis**, Scientific Chairman, TUB Faculty of Architecture, and **Ferenc Kvojka**, General Secretary, head of the Noise and Vibration Laboratory of the Public Health Institute of Budapest (and also secretary of the Department of Noise and Vibration Control of OPAKFI). **András Kotschy**, Head of the Advisory Council, Congress Manager, and vice General Chairman is an expert in acoustics and noise control in the Hungarian joint venture Mahla A.G. München, **István Antal**, Exhibition Manager is with the Hungarian Broadcasting Company and has managed many exhibitions, and the treasurer of INTER-NOISE 97 is **Ildikó Bába** who takes part every year in organizing international events.

INTER-NOISE 97 will immediately follow ACTIVE 97 *(See the Announcement and Call for Papers in this issue. — Ed.)*. The Congress will be held at the Technical University of Budapest on 1997 August 25-27. The Announcement and Call for Papers appeared in the June issue of *NNI*, pages 96-99. The Secretariat can be reached by e-mail: in97.opa@mtesz.hu.

SOUTH AFRICA

In the *Newsletter* of the Southern African Acoustics Institute (SAAI), it was reported that a committee consisting of Vincent Robertson, John Hassall, and Abrie Breed have been appointed to a committee to study the possibility of holding an INTER-NOISE Congress in South Africa. The newsletter reported that "The yearly INTER-NOISE Congress is, in all probability, the most important event on the international calendar in the field of acoustics and related subjects. It is always attended by a very large contingent of delegates, and is supported by some of the most noted names in acoustics. Hosting such an event will, therefore, be of enormous benefit for South Africa in general, and acoustics in particular." The committee will report back at the next meeting of the SAAI Council.

SWEDEN

Restructuring the International Commission on Acoustics is Proposed. Professor Tor Kihlman of Chalmers University of Technology in Gothenburg, Sweden, has, as Chairman of the International Commission on Acoustics (ICA), announced a plan to restructure the ICA to make the organization more responsive to the needs of acousticians and acoustical societies around the world. The ICA is currently a subcommittee of the International Union of Pure and Applied Physics (IUPAP). The proposal is to become an affiliated commission of IUPAP and to adopt new governing rules. The matter will be taken up in 1996 September by the IUPAP General Assembly.

If approved, the new statutes will allow for acoustical societies around the world to become Member Societies of the Commission, and will allow them to appoint official delegates who will form a General Assembly of the Commission. The first meeting of the General Assembly is planned in connection with the next International Congress on Acoustics which is planned for 1998 in Seattle, Washington, USA. *(See the Pan-American News Department in this issue. — Ed.)*

SWITZERLAND

Addendum to *NNI* Article. *The material below is an addendum to "Professional Societies in the Fields of Acoustics and Noise Control — Their Publications and Their Conferences" which appeared on pages 8-20 of the 1996 March issue of NNI — Ed.*

The International Association Against Noise, the Association Internationale Contre le Bruit (AICB), with secretariat in Luzern, Switzerland, sponsors international congresses every other year dealing with all matters related to noise. The list of past congresses was received too late to include in the feature article published in the 1996 March issue of this magazine entitled: "Professional Societies in the Fields of Acoustics and Noise Control — Their Publications and Their Conferences." The dates and locations of past AICB congresses are listed in the table below.

1960 Zurich, Switzerland
1962 Salzburg, Austria
1964 Paris, France
1966 Baden-Baden, Germany
1968 London, England
1970 Groningen, The Netherlands
1972 Dresden, Germany
1974 Basel, Switzerland
1976 Budapest, Hungary
1978 Baden-Baden, Germany
1980 Varna, Bulgaria
1982 Vienna, Austria
1984 Sarajevo, Yugoslavia
1986 Basel, Switzerland
1988 Balatonfured, Hungary
1990 Baden-Baden, Germany
1992 Prague, Czech Republic
1995 Bologna, Italy

UNITED KINGDOM

A complete report on INTER-NOISE 96 will appear in the 1996 December issue of this magazine. The congress, held in Liverpool, UK on 1996 July 30-August 02 was a great success with more than 1200 persons in attendance. There were 600 technical papers on noise presented in parallel sessions, and 78 papers presented in poster sessions. There were fifty-two companies exhibiting at INTER-NOISE 96. A pre-congress report indicated that delegates from 42 countries attended INTER-NOISE 96.

Asia-Pacific News

A. Lawrence, *Asia-Pacific Editor*

AUSTRALIA

Australian Acoustics Conference. Sessions on noise and other topics are planned for the National Australian Acoustical Society Conference which will be held at the Novotel Brisbane Hotel on 1996 November 13-15. Key technical areas of interest include legislation and information on the latest measuring equipment, software and noise control products.

Further information can be obtained from Eventcorp, P.O. Box 5718, West End, Queensland 4101, Australia

Literature Review of Impact Noise Reduction in the Sheet Metal Industry is Published. The 1996 April issue of *Acoustics Australia* contains an interesting literature review article on noise reduction in the sheet metal industry. The article is authored by D.M. Eager of the University of New South Wales and H.M. Williamson of the Australian Defence Force Academy. Impact noise from punch and power presses is covered, and the article shows that much is known about the mechanisms of noise generation in these machines.

The article contains 111 references to books and papers devoted to impact noise.

For more information, contact the Editor, *Acoustics Australia*, Acoustics and Vibration Centre, Australian Defence Force Academy, Canberra, ACT 2600, Australia.

NEW ZEALAND

New Zealand to Host INTER-NOISE 98. The South Island of Christchurch, New Zealand will be the venue for INTER-NOISE 98, the 1998 International Congress on Noise Control Engineering. The congress will be held in the Convention Centre, a new facility being built in the center of Christchurch. This will be the first INTER-NOISE in New Zealand, and will provide an introduction to the land known as the "last paradise" on earth, and land of astonishing variety and great beauty. INTER-NOISE 98, which will be held on 1998 November 16-18, will be followed by a satellite symposium on recreational noise to be held Queenstown — a particularly beautiful area on the South Island. As mentioned in the June issue of *NNI*, attendees who wish to plan a vacation in conjunction with the congress can obtain a free booklet, New Zealand, from the New Zealand Tourism Board, P.O. Box 95, Wellington, New Zealand.

Attendees at INTER-NOISE 98 may then travel to Australia for the 7th International Congress on the Biological Effects of Noise (ICBEN), an event held every five years, and scheduled for Sydney, Australia on 1996 November 22-27. *(See NNI, 1996 March, page 48. — Ed.)*

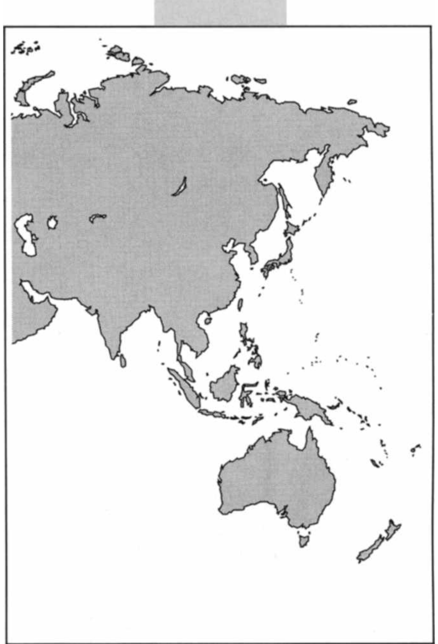
The INTER-NOISE 98 Congress was very visible at INTER-NOISE 96 in Liverpool in August with a full color flyer and a booth providing information about travel to New Zealand.

Writing in the 1996 June issue of New Zealand Acoustics, INTER-NOISE 98 General Chairman Harold Marshall said:

"...Planning for INTER-NOISE 98 is proceeding sweetly. Our principal Delegate to the Liverpool INTER-NOISE in July will be Chris Day who will present the General Chairman's Overview to the I-INCE Board. He will be supported by a team including John Quedley, Brian Mace, and Malcolm Hunt that will be equipped with video presentations and a publicity stand.

A full colour flyer inviting expressions of interest has been designed for Liverpool. Finally, the Committee is very grateful for the offers of involvement in planning for INTER-NOISE 98 we have received. If you would like to be part of the action, let us know."

A home page on the Internet has already been established for INTER-NOISE 98. The URL is:
http://www.auckland.ac.nz/internoise98/



For those who would like additional information for planning purposes, the organizers can be reached by e-mail at:

internoise98@auckland.ac.nz

INCE Update

The Boards of Directors of International INCE and INCE/USA welcome the opportunity afforded by this department of *NNI* to bring readers up to date on the activities of the two organizations. Published here are reports on actions taken and planned by the two Boards, activities of committees, summaries of discussions and decisions of general interest, etc. Announcements and reports of the major conferences of I-INCE and INCE/USA will be found in other *NNI* departments. It is the intent of this department to keep the reader informed of what's going on within the two organizations that jointly share the responsibility for the publication of *Noise/News International.*

INCE/USA

(The letter below was drafted by a committee of INCE members appointed by 1996 INCE President David M. Yeager and sent by Dr. Yeager to the U.S. National Institute for Occupational Safety and Health (NIOSH). NIOSH issued requested comments on a draft document, Criteria for a Recommended Standard: Occupational Noise Exposure, which, if adopted, could have a significant impact on the way noise is controlled in American industry. The document deals with a number of important changes in current practice, including the exchange rate, hearing protectors, requirements for entering a hearing conservation program, definition of hearing impairment, and other related issues. — Ed.)

From: David M. Yeager, Ph.D.
1996 INCE President
Motorola Corp., Room 2319
8000 W. Sunrise Blvd.
Ft. Lauderdale, FL 33322
Phone: +1 954 723 4997
Fax: +1 954 723 4334
email: edy003@email.mot.com

To: Linda Rosenstock, M.D., MPH
Director, NIOSH
Centers for Disease Control and Prevention
200 Independence Ave., SW
HHH Building, Room 715-H, P-06
Washington, DC 20201
(513) 533-8285 (fax)

Subject: Comments from the Institute of Noise Control Engineering on the Draft NIOSH Criteria for a Recommended Standard -Occupational Noise Exposure - Revised Criteria 1996

The Institute of Noise Control Engineering is a non-profit professional organization formed in 1971. A primary objective of the Institute is to advance the technology of noise control with emphasis on engineering solutions to environmental noise problems. The following are comments on the subject document that impact noise control engineering:

Section 5.4 - Engineering and Administrative Controls. This section is well written and is appropriate information for persons undertaking engineering noise controls for their facilities. The Institute of Noise Control Engineering agrees that "Engineering Controls should be the first order of protection from excessive noise exposure". Any future revisions to the current OSHA noise regulation should emphasize engineering noise controls.

Section 7.1 - Noise Control (Research Needs). The Institute of Noise Control Engineering agrees that "Research is needed to reduce noise exposures through engineering controls ...". The economic environment makes it difficult for industry to undertake its own research and development of noise control engineering techniques and applications. For the welfare of our industrial society it is appropriate for the government to fund or offer economic incentives for research resulting in lower noise workplaces and reducing the risk of worker hearing loss.

Section 1.4 - Engineering and Administrative Control and Work Practices. It will be difficult and costly for industry to implement engineering controls to "...ensure that workers are not exposed to noise above the REL of 85 dBA, 8-hour TWA". The present OSHA regulation requires reducing noise to 90 dBA, 8-hour TWA, using a 5 dB exchange rate. The NIOSH Criteria Document recommends 85 dBA, 8-hour TWA using a 3 dB exchange rate. This is a much more difficult criterion to meet, significantly affecting the approach to noise control engineering. Under the draft criterion, many more workers will be exposed to unacceptable noise, requiring engineering controls. Industry will be faced with the compounding efforts to implement engineering controls in more areas of its plants, plus more extensive controls to meet the draft criterion. The medical community may deem that the draft 85 dBA/3 dB criterion is appropriate for the health of workers; NIOSH should understand that meeting that criterion will be a significant financial burden to industry.

Section 1.5 - Hearing Protectors. The provision that "Workers shall be required to wear hearing protectors when their noise exceed 85 dBA regardless of duration" may be counterproductive to the implementation of engineering controls (the preferred approach to reducing the risk of worker hearing loss). Operating plant management will often require engineering noise control efforts to reduce noise low enough to allow removal of hearing protectors from workers. Designing controls to reduce noise to 85 dBA 8-hour TWA is difficult, but reducing noise to 85 dBA regardless of duration will be significantly more difficult. Industry may choose not to fund the more numerous and more costly engineering control projects (to meet the draft 85 dBA criterion), rather deciding to rely on less expensive hearing protectors. This would be an unfortunate consequence of the provisions of Section 1.5.

General - The draft NIOSH Criteria document should address noise level requirements for new equipment. Manufacturers should be given incentives to provide low noise equipment for plant use. Manufacturers should be required to label their equipment, documenting noise levels at operating locations and equipment sound power levels. Such incentives and labeling requirements will assist industry in providing acceptable noise level environments for its workers.

Best regards,
/s/
Dr. David M. Yeager
1996 INCE/USA President
Institute of Noise Control Engineering of the USA

cc: Evey Cherow
Chairperson, The Coalition to Preserve OSHA and NIOSH
American Speech-Language Hearing Association
(301) 897-7354 (fax)

http://users.aol.com/inceusa/ince.html

The material on the INCE home page (URL above) has been described in a previous issue of *NNI*. This material is being updated on a regular basis. Below is a list of recent changes and additions to the home page. Most of the changes to the INCE/USA pages are not to the home page itself, but to links off the home page. With each log entry (latest ones are first), a very brief description of the path to follow is given.

1996 August 21
Updated the index to NCEJ abstracts and added abstracts from the 1996 July-August issue, Volume 44, No. 4. Look for the NCEJ cumulative index under the "Periodicals" portion of the home page.

1996 August 21
Updated the World Conference Calendar and the Specialized Meetings Calendar. Look under the "International Institute of Noise Control Engineering" portion of the home page.

1996 August 10
Added new employment information. See the portion of the home page titled "Employment Opportunities."

1996 August 10
Updated the e-mail list and telephone directories for INCE members. See the portion of the home page devoted to "Membership Information."

1996 August 09
Added a link to the NOISE-CON 97 Announcement and Call for Papers. See the portion of the home page under "Conferences and Conference Proceedings."

1996 July 19
Updated International INCE Member Society information, added a Member Society Profile for DEGA (Germany), and established a link to that page in the International INCE Directory. See the portion of the home page under "International Institute of Noise Control Engineering."

1996 July 19
Updated the index to NCEJ abstracts and added abstracts from the 1996 May-June issue (special issue on 25 years of noise control), Volume 44, No. 3. Look for the NCEJ cumulative index under the "Periodicals" portion of the home page.

1996 July 19
Updated the World Conference Calendar and the Specialized Meetings Calendar. Look under the "International Institute of Noise Control Engineering" portion of the home page.

1996 June 27
Added links to Hungary and information on INTER-NOISE 97 and ACTIVE 97. See the portion of the home page titled "Conferences and Conference Proceedings."

1996 June 25
Added new employment information. See the portion of the home page titled "Employment Opportunities."

1996 June 21
Added new employment information. See the portion of the home page titled "Employment Opportunities."

1996 June 02
In the NOISE-CON 96 page, added a section on surfing the web for information about the Seattle area. To locate this new section, go to the portion of the INCE home page titled "Conferences and Proceedings" and link to the NOISE-CON 96 page. An internal link to the new section is included in the "contents" at the top of the page.

1996 June 02
Added new employment information. See the portion of the home page titled "Employment Opportunities."

Product News

IAC Housing Controls Power Plant Noise in the United Kingdom. The Staines, UK, location of the Industrial Acoustics Company has is building very large acoustical buildings for power plant operators, and has installed one that is said to prevent the noise emissions of three Caterpillar 1 mW gas engine generator sets from creating a noise nuisance on a Lincolnshire trading estate. It is reported that the A-weighted sound level 1 m away from the enclosure itself is 65 dB.

The building, 15 m long, 13 m wide and almost 6 m high, incorporates a ventilation system to ensure adequate supplies of cooling and aspiration air to the three generator sets. Each generator draws an air volume of 22 m^3/s. The three 1 mW units operate 24 hours per day generating electricity for the national grid. For more information, contact Simon White, Industrial Acoustics Company, Walton House, Central Trading Estate, Staines, Middlesex, TW18 4XB, United Kingdom. Telephone: +44 1784 456251; FAX: +44 1784 463303. **Circle Reader Service Card 50.**

Precision Condenser Microphones and Related Products. The Modal Shop, Inc., in cooperation with Gunnar Rasmussen (formerly of Brüel & Kjær), now supplies a variety of precision condenser microphones and related instrumentation to sound and vibration laboratories. The Gunnar Rasmussen Signature Series line of acoustic instrumentation is based on over four decades of experience in development, design, calibration, and field use of microphones. These products are said to have proven their stability and versatility in all fields of acoustics.

The precision products include both prepolarized and externally polarized microphone cartridges, sound intensity probes, preamplifiers and power amplifiers, pistonphone calibrators, hydrophones, and necessary accessories. All products are available for both sale and monthly rental.

For further information contact Sales Dept., The Modal Shop Inc., 1776 Mentor Avenue, Suite 170, Cincinnati, OH 45212-3521. Telephone: +1 513 351 9919; FAX: +1 513 458 2172. **Circle Reader Service Number 51.**

Fast Fourier transform (FFT) Option is Available. Scantek, Inc., has announced the release of the Fast Fourier Transform (FFT) measurement option for the Norsonic Real-Time Analyzer Type 840. The new FFT option is said to set new standards of versatility for sound and vibration analysis.

The RTA840 FFT mode provides 801 display lines from .3 Hz to 25 Khz for both single and dual channels, with a dynamic range of 80dB.

There are 4 display modes: Power (PWR), Root Mean Square (RMS), Power Spectral Density (PSD) and Energy Spectral Density (ESD).

Time weightings include: Flat (Rectangular), Exponential, Hanning and Cosine Tapering with user definable positions and widths.

Narrowband intensity measurements are possible using the RTA Type 840 Sound Intensity measurement mode with the FFT measurement mode.

All measurements may be downloaded via the built-in 3.5" disk drive or stored on the internal hard disk of the RTA840.

For further information call or write Scantek, Inc., 916 Gist Ave., Silver Spring, MD 20910. +1 301 495 7738; FAX: +1 301 495 7739. E-mail: scantek@erols.com **Circle Reader Service Number 52.**

Digisonix® Active Sound and Vibration Control. Digisonix has been supplying Active Sound and Vibration Control products for industrial fan and commercial heating, ventilation, and air conditioning (HVAC) applications since 1986. In addition, Digisonix is working independently and with partners to develop a wide range of ASVC products for vehicle, commercial, and industrial applications.

Products available from Digisonix, Inc., include:

DIGIWARE™ Application Development Tools - This product combines proprietary Digisonix® ASVC Technology, leading-edge digital signal processing hardware, user-friendly software, technical support, and training to give customers powerful, yet easy-to-use, tools for integrating active control into their products.

DYNA-QUIET™ Active Silencing System - This product actively attenuates noise produced by industrial air-moving devices. Typical applications include air pollution control equipment, material transfer equipment, vacuum pumps, and blowers.

DIGIDUCT® Active Duct Silencer - This product attenuates noise from commercial fans in heating, ventilation, and air-conditioning equipment. It offers superior attenuation of low-frequency rumble with no restriction to the air flow.

In addition, licensing agreements and joint development programs are available. For more information contact Digisonix, Inc., Corporate Headquarters, 8401 Murphy Drive, Middleton, WI 53562-2543, USA. In the United Kingdom contact Digisonix, Inc., Stewart House, Brook Way, Leatherhead, Surrey KT22 7NA, UK. Telephone: +44 1372 377770; FAX: +44 1372 377747.**Circle Reader Service Number 53.**

Low Profile, Quartz Force Ring. PCB Piezotronics, Inc., introduces a low profile, quartz force ring. Just 0.2 inches (5mm) thick, this miniature ring Model 201A75 measures dynamic compression to 5000 lbs. (22,24kN). Built-in ICP(R) circuitry provides a low impedance, 1mV/lb. output. The stable quartz sensing element offers a linear, repeatable output over an extended operating range. The sensor is hermetically welded and constructed with an integral ruggedized 1-foot cable. BNC jack cable termination permits operation in laboratory or harsh industrial environments. This unit is ideal for crimp or press monitoring applications where sensor thickness is restricted.

For additional information, contact PCB's applications engineering group, PCB Piezotronics, Inc., Attn: Andrea Mohn, 3425 Walden Avenue, Depew, NY 14043. Telephone: 716-684-0001, FAX: 716-684-0987. **Circle Reader Service No. 55.**

New Noise and Vibration Control Brochure Available from 3M Industrial Tape and Specialties Division. Customized solutions for noise and vibration control are addressed in a new brochure now available from the 3M Industrial Tape and Specialties Division (ITSD). 3M's wide range of materials includes viscoelastic polymers, foam, acoustic materials, lightweight composites and custom materials, all of which assist manufacturers in reducing noise and vibration problems in their products.

It is said that computer engineers have been able to significantly reduce vibration in disk drives, improving read/write performance, with higher reliability and better overall design. The automotive industry uses 3M viscoelastic layer dampers to improve door panels and other areas of vehicle bodies, as well as under the hood to reduce noise and vibration in engine components.

In heavy construction, large viscoelastic dampers from 3M are used in large structures. The material adds damping without stiffness and increases a structural designer's options in reducing wind sway, while at the same time increasing occupant comfort. 3M damper designs also have been used worldwide in seismic applications.

For more than 15 years, 3M viscoelastic polymers have been part of commercial aircraft fuselage skins, reducing metal fatigue and unwanted noise. Viscoelastic polymers also have been incorporated into sporting goods such as tennis racquets and golf clubs, as well as in major appliances such as washing machines.

The 3M Industrial Tape and Specialities Division offers a full line of adhesives, tapes and other products to help manufacturers improve product design, assembly and performance. For additional information about the new noise and vibration control systems brochure, or for other 3M Industrial Tape and Specialties Division products, contact Steve Meenan, 3M, Telephone: +1 612 736 7196; FAX: +1 612 733 0729. **Circle Reader Service Number 54.**

PCB Introduces a Piezoelectric Impedance Head (Driving Point) Sensor. PCB has introduced Model 288C01 Impedance Head (driving point) sensor for the simultaneous measurement of force and acceleration at the driving point. The driving point measurement is said to be critical to experimental modal modelling because it is used to determine modal scale factors. Correlating the scaled experimental models to computer generated finite element models is essential in the validation stages of product design. Accurate prediction of both experimental and updated analytical models saves time and money in the product development cycle. This new two sensing element design dramatically improves the accuracy of scaled modal models. By imbedding a precision 100 mV/g shear mode ICP® accelerometer inside a 100 mV/lb ICP® force ring, this new sensor's geometry provides for truly colinear force and acceleration measurements. With minimal dynamic mass (3 gm), the sensor reduces loading and undesired applied moments. Additionally, accurate driving point measurements help test engineers validate reciprocity in multi-input (MIMO) tests. Current modal test driving point measurements often suffer from inaccurate amplitude and phase resulting from a separate accelerometer and reference force sensor being placed side by side. Additionally, most bulky impedance heads contribute additional inaccuracies through large moment loads. Immediate results in increased accuracy are seen by replacing older reference input force sensors with the new impedance head.

For additional information, contact PCB's application engineering group, PCB Piezotronics, Inc., Attn: Andrea Mohn, 3425 Walden Avenue, Depew, NY 14043. Telephone: +1 716 684 0001; FAX +1 716 684 0987. **Circle Reader Service Number 55.**

Multi-Purpose FFT Analyzer. Ono Sokki Technology, Inc., has introduced their new CF-5200 multi-purpose FFT spectrum analyzer. The CF-5200 is a two channel FFT that provides high speed and accuracy processing. The CF-5200 series features the Quick expert easy operation system. Just press a key categorized by measurement type, e.g. Vibration, Sound, Frequency, Response, Servo, etc., and all parameters are set out on the screen with detailed instructions for the selected function.

The 9.4" display provides 640-by-480 dot format. The CF-5200 makes use of the intrinsically clear TFT type of color LCD panel. This ability to recognize waveforms from their color is said to be extremely valuable when viewing a quad split display and in viewing an overlaid display. Frequency resolution of 1600 lines and channel-to-channel phase matching within ±0.1 degree enable high accuracy execution of frequency response function analysis, the most important feature of a 2-channel FFT analyzer. The most advanced feature of the new CF-5200 is its high computational power. The CF-5200 is said to be now more than 10 times faster than other conventional products, with an incredibly fast real-time rate of 32 kHz.

For more information, call Kenneth S. Ujiiye, Advertising Manager, Ono Sokki Technology Inc., 2171 Executive Drive, Addison, IL 60101. Telephone: +1 708 627 9700; FAX: +1 708 627 0004. **Circle Reader Service Number 56.**

Free Vibration Slide-Rule Calculator. Wilcoxon Research, Inc., is offering a free slide rule calculator for fast and easy sensor selection. The calculator features step-by-step instructions to assist you in determining the frequency and sensitivity requirements of a sensor to convert acceleration, velocity and displacement measurements. The unique design also easily converts linear levels to decibels, mils to micrometers, and Fahrenheit to Celsius.

Contact Wilcoxon for your free vibration calculator; you will also receive a copy of the new Industrial Products Catalog.

Wilcoxon Research manufactures a wide range of vibration instrumentation equipment, specializing in internally amplified piezoelectric accelerometers. For over 30 years, Wilcoxon Research has continued to make significant contributions to the vibration monitoring field with a commitment to innovative design, high quality, and service.

For more information, contact Lynn Lyons, Marketing Assistant, 21 Firstfield Road, Gaithersburg, MD 20878 - 1-800-WILCOXON. Telephone: +1 301 330 8811; FAX: +1 301 330 8873. **Circle Reader Service Number 57.**

The 3D Sonic Digitizer Model 5230XL. The Modal Shop Model 5230XL 3D Sonic Digitizer is said to bring the power of ultrasonic coordinate digitization to structural dynamic test and finite element analysis laboratories. The system acquires accurate three-dimensional geometric information from test structures and creates a formatted computer file for increased test efficiency. Its large working volume and ergonomic hand-held probe are said to provide flexible operation, outstanding performance, and eliminate access limitations encountered when using conventional rotary linkage arm type measurement systems.

By analyzing the time delays along a line of sight between sonic emitters and receivers, the exact location of the desired point may be determined. The receiving unit consists of an array of ultrasonic microphones. A hand-held probe includes two sonic emitters and a precise point locator to reach difficult-to-access geometry points. A single fixed emitter also continuously self calibrates the speed of sound in the working environment for reliable operation. By allowing rapid input on successive test points, the system measures and creates a complete X, Y, Z database of coordinates in just minutes.

For further information contact Sales Dept., The Modal Shop Inc., 1776 Mentor Avenue, Suite 170, Cincinnati, OH 45212-3521. Telephone: +1 513 351 9919; FAX: +1 513 458 2172. **Circle Reader Service Number 58.**

Phoenix Controls Introduces New Ultra Quiet Airflow Valve. Phoenix Controls Corporation has announced a major product development achievement in its new generation of airflow control valves. These new venturi valves, named Accel® II are said to be capable of operating at dramatically lower sound power levels than the previous generation Accel® valves. These lower sound power levels are achieved while maintaining the same speed of response (less than 1 second), accuracy (±5% of signal), reliability and low required maintenance of the Accel valves.

For additional noise control beyond that provided by the Accel II valves, Phoenix Controls is also introducing the Neutralizer to be used in conjunction with the Accel II valve. This patent pending device, utilizing unique tuned-resonator technology, is said to provide additional mid- and high-range passive noise cancellation at a fraction of the cost of traditional silencers.

For more information, contact Patricia Mormann, Marketing Communications Coordinator, Phoenix Controls Corp., 55 Chapel Street, Newton, MA 02158. Telephone: 617-964-6670; FAX: 617-965-4503. **Circle Reader Service Number 58.**

World Conference Calendar

This calendar includes major conferences which feature programs on noise and its control. The working language of each conference will be English, unless otherwise noted. This calendar does *not* include seminars, short courses, workshops and other small, specialized meetings which are listed elsewhere. The shaded entries in the calendar are conferences which are organized or sponsored by I-INCE or INCE/USA. Entries for this calendar are solicited from the I-INCE Member Societies and from other organizations. In order for a listing to appear in this calendar, information *must* be provided by the conference organizers concerning the sessions planned for the technical program that will be devoted to noise and its control. This is particularly important if the word *noise* does not appear in the name or theme of the conference. Send requests for listings of future meetings with required details to: World Conference Calendar, INCE/USA, P.O. Box 3206 Arlington Branch, Poughkeepsie, NY 12603, USA. FAX +1 914 473 9325.

1996 October 07-11
Acoustics Week in Canada, Calgary, Alberta, Canada.* Contact: D. Degagne, 640 Fifth Ave. SW, Calgary, Alberta, Canada. FAX: +1 403 297 3520.

1996 November 13-15
Australian Acoustical Society Annual Conference, Brisbane, Australia.* Contact: R. Palmer, P.O. Box 150, Mount Ommaney, QLD 4074, Australia. Telephone: +61 7 3806 7522; FAX: +61 7 3806 7999.

1996 November 17-22
Symposium on Turbomachinery Noise, ASME International Congress (IMECE), Atlanta, Georgia. Contact: N. Humbad, Ford Motor Company, CCO/ITC Room G301, 15031 S. Commerce Drive, Dearborn, MI 48120, USA. Telephone: +1 313 3213 8243; FAX: +1 313 594 1738;
e-mail: *nhumbad@for.com*

1996 December 02-06
132nd Meeting of the Acoustical Society of America, Honolulu, Hawaii, USA.* Contact: Elaine Moran, Acoustical Society of America, 500 Sunnyside Blvd., Woodbury, NY 11797, USA. Telephone: +1 516 576 2360; FAX: +1 516 576 2377.

1997 February 03-06
International Modal Analysis Conference, Orlando, Florida, USA. Contact: Society for Experimental Mechanics, 7 School St., Bethel, CT 06801. Telephone: +1 203 790 6373; FAX: +1 203 790 4472. e-mail: *sem@sem1.com*

1997 March 03-07
DAGA 97, German Acoustical Society Meeting, Kiel, Germany. Noise sessions will be presented in German. Contact: DEGA, German Acoustical Society, Carl von Ossietzky Universität, Dept. of Physics/Acoustics, D-26111 Oldenburg, Germany. Telephone: +49 441 798 3572; FAX: +49 441 798 3698; e-mail: *dega@aku.physik.uni-oldenburg.de*

1997 April 02-04
ASVA 97, International Symposium on Simulation, Visualization and Auralization for Acoustic Research and Education, Tokyo, Japan. Contact: Symposium Secretariat, Environmental Acoustics Lab., Faculty of Engineering, Rokko, Nada, Kobe, 657 Japan. FAX: +81 78 881 2508; e-mail: *asva97@icluna.kobe-u.ac.jp*

1997 April 09-11
International Conference on Boundary Element Technology, Knoxville, Tennessee, USA. Contact: L. Kerr, Conference Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK. Telephone: +44 1703 293223; FAX: +44 1703 292853. e-mail: *liz@wessex.witcmi.ac.uk*

1997 April 14-18
4th National Meeting of Société Française d'Acoustique, Marseilles, France; sessions on noise are planned in English and French. Contact: P. Mattei, CNRS-LMA, 31 chemin Joseph-Aiguier, 13402 Marseilles Cedex 20, France. e-mail: *mattei@alphalma.cnrs-mrs.fr*

1997 May 12-14
AIAA Aeroacoustics Conference, Atlanta, Georgia, USA. Contact: S. Engelstad, Acoustics, Lockheed Martin Dept. 73-47, Zone 0685, Marietta, GA 30063-0685. Telephone: +1 770 494 9178; FAX: +1 770 494 3055.

1997 May 20-22
SAE Noise & Vibration Conference & Exposition, Traverse City, Michigan, USA. Contact: Noise & Vibration General Committee, SAE/MJA, 3001 W. Big Beaver Road, Suite 320, Troy, MI 48084, USA. Telephone: +1 810 649 0420; FAX: +1 810 649 0425.

1997 June 04-06
International Conference on Computational Acoustics and its Environmental Applications, Terni, Umbria, Italy. Contact: L. Morton, Conference Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK. Telephone: +44 1703 293223; FAX: +44 1703 292853. e-mail: *lynn@wessex.witcmi.ac.uk*

1997 June 16-18
NOISE-CON 97, The 1997 National Conference on Noise Control Engineering, State College, Pennsylvania, USA. Being arranged in cooperation with the Acoustical Society of America. Contact: Institute of Noise Control Engineering, P.O. Box 3206 Arlington Branch, Poughkeepsie, NY 12603, USA. Telephone: +1 914 462 4006: FAX: +1 914 463 0201;
e-mail: *NOISECON97@aol.com.*

1997 June 16-20
133rd Meeting of the Acoustical Society of America, State College, Pennsylvania, USA.* Contact: Elaine Moran, Acoustical Society of America, 500 Sun-

nyside Blvd., Woodbury, NY 11797, USA. Telephone: +1 516 576 2360; FAX: +1 516 576 2377.

1997 August 21-23
ACTIVE 97, The 1997 International Symposium on Active Control of Sound and Vibration, Budapest, Hungary. Contact: ACTIVE 97 Secretariat, OPAKFI, Fö u. 68, H-1027 Budapest, Hungary. Telephone/FAX: +36 1 202 0452.
e-mail: *A97.opa@mtesz.hu*
An International INCE Symposium

1997 August 25-27
INTER-NOISE 97, the 1997 International Congress on Noise Control Engineering, Budapest, Hungary. Contact: OPAKFI, H-1027 Budapest, Fo u. 68, Hungary. Telephone/FAX: +36 1 202 0452.
e-mail: *IN97.opa@mtesz.hu*

1997 September 01-04
International Modal Analysis Conference, Tokyo, Japan. Contact: N. Okubo, Dept. of Precision Mechanics, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo 112, Japan. FAX: +81 3 3817 1820.
e-mail: *jmac@okubo.mech.chuo-u.ac.jp*

1997 September 17-19
New Zealand Acoustical Society Biannual Conference, Christchurch, New Zealand.* Contact: Secretary, N.Z. Acoustical Society, P.O. Box 1181, Auckland, New Zealand. FAX: +64 9 309 3540.

1997 December 01-05
134th Meeting of the Acoustical Society of America, San Diego, California, USA.* Contact: Elaine Moran, Acoustical Society of America, 500 Sunnyside Blvd., Woodbury, NY 11797, USA. Telephone: +1 516 576 2360; FAX: +1 516 576 2377.

1998 March 23-27
DAGA 98, German Acoustical Society Meeting, Zürich, Switzerland. Noise sessions will be presented in German. Contact: DEGA, German Acoustical Society, Carl von Ossietzky Universität, Dept. of Physics/Acoustics, D-26111 Oldenburg, Germany. Telephone: +49 441 798 3572; FAX: +49 441 798 3698; e-mail: *dega@aku.physik.uni-oldenburg.de*

1998 June 20-27
International Congress on Acoustics and Meeting of the Acoustical Society of America, Seattle, Washington, USA.* Contact: Elaine Moran, Acoustical Society of America, 500 Sunnyside Blvd., Woodbury, NY 11797, USA. Telephone: +1 516 576 2360; FAX: +1 516 576 2377.

1998 November 16-20
INTER-NOISE 98, the 1998 International Congress on Noise Control Engineering, Christchurch, New Zealand. Contact: New Zealand Acoustical Society, P.O. Box 1181, Auckland, NZ. FAX: +64 9 309 3540.
e-mail: *internoise98@auckland.ac.nz*

1998 November 20
Recreational Noise - Its Effects on Man and on the Environment, An International INCE and ICBEN Symposium, Queenstown, New Zealand. Contact: P. Dickinson, New Zealand Ministry of Health, P O Box 5013, Wellington, New Zealand. Telephone: +64 4 496 2268; FAX: +64 4 496 2340; e-mail:
philip.dickinson@mohwn.synet.net.nz

1998 November 22-27
7th International Congress on Noise as a Public Health Problem, Sydney, Australia. Contact: N. Carter, National Acoustic Laboratories, 126 Greville Street, Chatswood, NSW 2067, Australia. Telephone: +61 2 412 6800; FAX: +61 2 417 4709.

1999 March 15-19
Forum Acusticum and Meeting of the Acoustical Society of America, Berlin, Germany.* Contact: Elaine Moran, Acoustical Society of America, 500 Sunnyside Blvd. Woodbury, NY 11797, USA. Telephone: +1 516 576 2360; FAX: +1 516 576 2377.

***Sessions on noise are planned.**

Specialized Meetings Calendar

This calendar includes specialized meetings (seminars, short courses, workshops, etc.) with limited attendance which feature programs on noise and its control. Entries for this calendar are solicited from the I-INCE Member Societies and other organizations. In order for a listing to appear in this calendar, information *must* be provided by the organizers of a specialized meeting on the sessions planned for the technical program that will be devoted to noise and its control. This is particularly important if the word *noise* does not appear in the name or theme of the meeting. The registration fee for the event is also to be included for each listing. Send requests for listings of future events with required details to: Specialized Meetings Calendar, INCE/USA, P.O. Box 3206, Arlington Branch, Poughkeepsie, NY 12603, USA. FAX: +1 914 473 9325.

1996 October 01-03
Digital Signal Analysis for Application in Sound and Vibration Course, Livonia, Michigan, USA. Fee: USD 895. Contact: B&K Continuing Education Seminars, Spectris Technologies, Inc., 2634 Park Central Blvd., Decatur, GA 30035-3987, USA. Telephone: +1 313 522 8600; FAX: +1 313 522 4369.

1996 October 10
Noise Assessment and Control Course, Seattle, Washington, USA. Contact: University of Washington, 4225 Roosevelt Way N.E., Room 100, Seattle, WA 98105-6099, USA. FAX: +1 206 543 1069. e-mail: *ce@u.washington.edu*

1996 October 14-18
Vibration Control Short Course, State College, Pennsylvania, USA. Fee: USD 995. Course Chairman: E.E. Ungar. Contact: J. Hall, 225 Penn State Scanticon, University Park, PA 16802-7002, USA. Telephone: +1 814 863 5130; FAX: +1 814 863 5190. e-mail: *Conference-Info1@cde.psu.edu*

1996 October 14-18
Acoustics & Noise Control Course, Somerset, Pennsylvania, USA. Fee: USD 1,425. Principal instructor: W.R. Thornton. Contact: AVNC Continuing Education Division, 250 Shagbark Drive, R.D. #1, Cheswick, PA 15024, USA. Telephone: +1 412 265 4444; FAX: +1 412 367-9233.

1996 October 14-18
Highway Noise Analysis Seminar, Louisville, Kentucky, USA. Instructors: L. Cohn and A. Harris. Fee: USD 895. Contact: M. Baechle, Dept. of Civil Engineering, University of Louisville, Louisville, KY 40292, USA. Telephone +1 502 852 6590; FAX: +1 502 852 8851; e-mail: *lfcohn@llkyvx.louisville.edu*

1996 October 15-16
Introduction to Vehicle Noise and Vibration Control Course, Livonia, Michigan, USA. Fee: USD 495. Contact: B&K Continuing Education Seminars, Spectris Technologies, Inc., 2634 Park Central Blvd., Decatur, GA 30035-3987, USA. Telephone: +1 313 522 8600; FAX: +1 313 522 4369.

1996 October 17
Measuring Sound Intensity Correctly Course, Livonia, Michigan, USA. Fee: USD 295. Contact: B&K Continuing Education Seminars, Spectris Technologies, Inc., 2634 Park Central Blvd., Decatur, GA 30035-3987, USA. Telephone: +1 313

1996 October 27-28
ASTM Committee E-33 on Environmental Acoustics, New Orleans, Louisiana, USA. Contact: S. Mawn, ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA. Telephone: +1 610 832 9726; FAX: +1 610 832 9635. 522 8600; FAX: +1 313 522 4369.

1996 November 11-15
28th Training Course in Noise Control, Orlando, Florida, USA. Fee: USD 1200. Instructors: R. Hoover, L. Miller and R. Keith. Contact: N. King, Hoover & Keith, Inc., 11381 Meadowglen, Suite I, Houston, TX 77082, USA. Telephone: +1 713 496 9876; FAX: +1 713 496 0016.

1996 November 12-15
Machinery Vibration Analysis II Course, Brentwood, Tennessee, USA. Fee: USD 1050. Contact: The Vibration Institute, 6262 S. Kingery Highway - Suite 212, Willowbrook, IL 60514. Telephone: +1 708 654 2254; FAX: +1 708 654 2271.

1996 December 04-06
Community Noise Enforcement Certification Course, New Brunswick, New Jersey, USA. Fee: USD 480. Contact: Rutgers Noise Technical Assistance Center, Dept. of Environmental Sciences, Cook College, P.O. Box 231, New Brunswick, NJ 08903-8644, USA. Telephone: +1 908 932 8065; FAX: +1 908 932 8644.

1997 April 21-25
Measurements & Instrumentation Course, Somerset, Pennsylvania, USA. Fee: USD 1,425. Principal instructor: W.R. Thornton. Contact: AVNC Continuing Education Division, 250 Shagbark Drive, R.D. #1, Cheswick, PA 15024, USA. Telephone: +1 412 265 4444; FAX: +1 412 367-9233.

1997 May 19-23
Acoustics & Noise Control Course, Somerset, Pennsylvania, USA. Fee: USD 1,425. Principal instructor: W.R. Thornton. Contact: AVNC Continuing Education Division, 250 Shagbark Drive, R.D. #1, Cheswick, PA 15024, USA. Telephone: +1 412 265 4444; FAX: +1 412 367-9233.

1997 June 23-27
Sound Intensity Course, Somerset, Pennsylvania, USA. Fee: USD 1,425. Principal instructor: W.R. Thornton. Contact: AVNC Continuing Education Division, 250 Shagbark Drive, R.D. #1, Cheswick, PA 15024, USA. Telephone: +1 412 265 4444; FAX: +1 412 367-9233.

Standards News (USA)*

Avril Brenig, Standards Manager
ASA Standards Secretariat, Acoustical Society of America, 120 Wall Street, New York, NY 10005-3993. (Telephone: +1 212 248 0373; FAX: +1 212 248 0146)

George S.K. Wong
Acoustical Standards Group, Institute for National Standards, National Research Council, Ottawa, Ontario K1A 0R6, Canada. (Telephone: +1 613 993 6159; FAX: +1 613 990 8765)

American National Standards (ANSI Standards) developed by Accredited Standards Committees S1, S2, S3, and S12 in the areas of acoustics, mechanical vibration and shock, bioacoustics, and noise, respectively, are published by the Acoustical Society of America (ASA) through the American Institute of Physics (AIP). In addition to these standards, a Catalog of Acoustical Standards — ASA Catalog 13-1995 is available. For a copy, contact Avril Brenig.

Comments on all material in Standards News are welcome.

Standards news from the United States

(Partially derived from *ANSI Reporter*, and *ANSI Standards Action*, with appreciation)

Call for comment on American National Standards

This section lists proposed American National Standards that solicit public comments and review. The final dates for offering comments, listed in parentheses, are for information only. Copies of these documents are available from ANSI.

ACOUSTICS

BSR S1.13, Measurement of Sound Pressure Levels in Air [revision of ANSI S1.13-1971 (R1986)

Specifies requirements and describes procedures for the measurement of sound pressure levels in air at a single point in space. These requirements and procedures apply primarily to measurements performed indoors but may be utilized in outdoor measurements under certain specified conditions. This is a fundamental standard applicable to a wide range of measurements and to sounds which may differ widely in temporal and spectral characteristics; more specific American National Standards complement its requirements. A classification is given of the types of sound generally encountered, and the preferred descriptor for each type is identified. This standard is intended to be used by practitioners in the field, as well as by members of the general public who have little or no special technical training in areas relating to acoustics. This standard was originally listed for public review in the 15 April 1994 issue of *Standards Action*. It is being resubmitted, owing to substantive changes to the text. (1995 October 31)

BSR S3.44, Determination of Occupational Noise Exposure and Estimation of Noise-Induced Hearing Impairment (new standard)

Presents, in statistical terms, the relationship between noise exposures and changes in hearing threshold levels for a noise exposed population. This standard can also be applied to the calculation of the risk of incurring a hearing handicap from sustained daily exposure to noise. Guidance is provided as to the measurement of noise exposure. This standard is an adaption of the International standard ISO 1999: 1990 of the same name. Unlike the international standard, this standard allows assessment of noise exposure using a time/intensity trading relation other than a 3-decibel increase per halving of exposure time. (1995 October 31)

BIOACOUSTICS

BSR S3.6, Specification for Audiometers (revision of ANSI S3.6-1989)

Covers devices designed for use in determining the hearing threshold level of an individual in comparison with a chosen standard reference threshold level. Provides specifications and tolerances for pure tone, speech, and masking signals and describes the minimum test capabilities of different types of audiometers. (1995 December 12)

BSR S3.22, Specification of Hearing Aid Characteristics (revision of ANSI S3.22-1987)

Describes air-conduction hearing aid measurement methods that are particularly suitable for specification and tolerance purposes. (1995 December 12)

Standard submitted for withdrawal

Audiovisual systems

BSR PH7.305-1981 (R1986), Test Method for Headphones Used Primarily for Speech [withdrawal of ANSI PH7.305-1981 (R1986)\]

Covers measurement of the sensitivity and impedance of audiovisual headphones used in instructional institutions. This standard is being withdrawn because the information it includes is no longer relevant, useful, and valid. The standard will be replaced by an IEC standard.

Final actions on American National Standards

ANSI's Board of Standards Review has taken the final action indicated on the standard(s) listed below. When the approved standards are published, an announcement will be carried in

This is an edited version of the Standards News department published in the Journal of the Acoustical Society of America. Reprinted by permission. The full text appears in the Journal of the Acoustical Society of America,* ***99**(3), 1273-1275, 1996 March. — Ed.*

Standards Action, in ANSI's Supplements to the Catalog of American National Standards, and in trade publications.

ANSI S3.40-1989 (R1995), Guide for the Measurement and Evaluation of Gloves which are Used to Reduce Exposure to Vibration Transmitted by Hand (reaffirmation of ANSI S3.40-1989). Reaffirmation date: 1995 July 24

Noise labeling for products
The American National Standards Institute has developed and published a series of standards (ANSI Z535 series) containing guidelines for developing cautionary and warning markings for use on products. The Power Tool Institute Inc. has established a working group that is presently conducting a ballot between its members to standardize on pictographs to be used to inform the power tool users to read the instruction manual. Once the working group has selected three pictographs they plan to conduct public testing according to ANSI Z535.3 and eventually plan to seek global acceptance. The purpose of the above working group: Noise Labeling for Products, is to establish requirements for the use of measured noise emission values for the purpose of noise labeling products; and the scope is to describe the manner in which the sound power level and the sound pressure level of a product shall be expressed for labeling purposes.

Standards News from Abroad

(Partially derived from *ANSI Reporter* and *ANSI Standards Action*, with appreciation)

Newly published ISO and IEC Standards and Technical Reports
This section lists new and revised standards and technical reports recently approved and promulgated by ISO and IEC. These documents together with catalog listing several thousand current ISO and IEC standards are available from ANSI.

ISO Standards

ACOUSTICS (TC 43)
ISO 3746: 1995, Acoustics —Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane.

ISO 11691: 1995, Acoustics — Measurement of insertion loss of ducted silencers without flow — Laboratory survey method.
IEC Standards

ELECTROACOUSTICS (TC 29)
IEC 1260: 1995, Electroacoustics — Octave-band and fractional-octave-band filters

IEC Technical Report

ELECTROMAGNETIC COMPATIBILITY (TC 77)
IEC 1000-2-5: 1995, Electromagnetic compatibility (EMC) — Part 2: Environment — Section 5: Classification of electromagnetic environments — Basic EMC publication.

ISO and IEC Draft International Standards
This section lists proposed standards that the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) are considering for approval. The proposals have received substantial support within the technical committees or subcommittees that developed them and are now being circulated to ISO and IEC members for comment and vote. The final dates for offering comments, listed in parentheses, are for information only. Copies of these documents are available from ANSI.

ACOUSTICS (TC 43)
ISO/DIS 3822-3, Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations — Part 3: Mounting and operating conditions for in-line valves and appliances (revision of ISO 3822-3: 1984) (1996 January 28)

ISO/DIS 3822-4, Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations — Part 4: Mounting and operating conditions for special appliances (revision of ISO 3822-4: 1985) (1996 January 28)

ISO/DIS 13475-1, Acoustics — Determination of sound emission quantities for stationary audible warning devices used outdoors — Part 1: Field measurements (1996 January 14)

CEN/CENELEC
The following European drafts have been sent to members of the European Committee for Standardization (CEN), and/or the European Committee for Electrotechnical Standardization (CENELEC), for enquiry and comment. The final dates for offering comments, listed in parentheses, are for information only. Copies of these documents are available from ANSI.

Noise Emission
prEN 12076, Measurement of noise emission from compressors and vacuum pumps (engineering method) (1996 January 04).

International documents submitted to the U.S. for vote and/or comment
Some of the documents processed recently by the ASA Standards Secretariat. Dates in parentheses are deadlines for submission of comments and recommendation for vote, and they are for information only.

TAG	ISO Documents
S12	First ISO/CD Amendment 1 to 1996-2-1987 — Acoustics — Description and Measurement of Environmental Noise — *PART 2*: Acquisition of Data Pertinent to Land Use (1995 November 17) First ISO/CD 5129 — Acoustics — Measurement of Aircraft Interior Sound Pressure Levels In-flight (Revision of ISO 5129:1987) (1995 November 17)

First ISO/CD 1680 — Acoustics — Test Code for the Measurement of Airborne Noise Emitted by Rotating Electrical Machinery (Revision of ISO 1680-1:1986 and ISO 1680-2:1986) (1995 November 17)
First ISO/CD 14938 — Acoustics — Revision of B- and C-Weightings and Lin-response for Noise Measurement (1995 November 17)
ISO/DIS 13475-1 — Acoustics — Determination of Sound Emission Quantities for Stationary Audible Warning Devices Used Outdoors — *PART 1*: Field Measurements (1995 November 17)

TAG IEC Documents

S1 FIRST IEC/CD 1672 — Electroacoustics — Sound Level Meters (Revision of IEC 651:1979 and IEC 804:1985) (1995 November 22)
IEC/TC 29/313/CDV — Draft 2nd Ed. IEC 942: Electroacoustics — Sound Calibrators (1995 December 04)
ISO/CD 7096 — First Committee Draft for the Revision of ISO 7096: 1982 and 1994 — Earth-Moving Machinery — Laboratory Evaluation of Operator Seat Vibration (1995 November 30)

Standards News (USA)*

Avril Brenig, Standards Manager
ASA Standards Secretariat, Acoustical Society of America, 120 Wall Street, New York, NY 10005-3993. (Telephone: +1 212 248 0373; FAX: +1 212 248 0146)

George S.K. Wong
Acoustical Standards Group, Institute for National Standards, National Research Council, Ottawa, Ontario K1A 0R6, Canada. (Telephone: +1 613 993 6159; FAX: +1 613 990 8765)

American National Standards (ANSI Standards) developed by Accredited Standards Committees S1, S2, S3, and S12 in the areas of acoustics, mechanical vibration and shock, bioacoustics, and noise, respectively, are published by the Acoustical Society of America (ASA) through the American Institute of Physics (AIP). In addition to these standards, a Catalog of Acoustical Standards — ASA Catalog 13-1995 is available. For a copy, contact Avril Brenig.

Comments on all material in Standards News are welcome.

Standards News from the United States

(Partially derived from *ANSI Reporter*, and *ANSI Standards Action*, with appreciation)

Newly Published American National Standards

Acoustics
ANSI S12.2-1995, Criteria for Evaluating Room Noise

ANSI S12.42-1995, Microphone-in-Real-Ear and Acoustic Test Fixture Methods for the Measurement of Insertion Loss of Circumaural Hearing Protection Devices

Standards News from Abroad

(Partially derived from *ANSI Reporter* and *ANSI Standards Action*, with appreciation)

Newly published ISO and IEC Standards and Technical Reports

This section lists new and revised standards and technical reports recently approved and promulgated by ISO and IEC. These documents together with catalog listing several thousand current ISO and IEC standards are available from ANSI.

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ISO Standards

ACOUSTICS (TC 43)
ISO 9207:1995, Manually portable chain-saws with internal combustion engine Determination of sound power levels — Engineering method (grade 2).

MECHANICAL VIBRATION AND SHOCK (TC 108)
ISO 8608:1995, Mechanical vibration — Road surface profiles — Reporting of measured data.

IEC Standards

ELECTROACOUSTICS (TC 29)
IEC 1094-3: 1995, Measurement microphones — Part 3: Primary method for free-field calibration of laboratory standard microphones by the reciprocity technique.
IEC 1094-4: 1995, Measurement microphones — Part 4: Specifications for working standard microphones.

IEC Technical Reports

EQUIPMENT AND SYSTEMS IN THE FIELD OF AUDIO, VIDEO, AND AUDIOVISUAL ENGINEERING (TC 84)
IEC 268-18: 1995, Sound system equipment — Part 18: Peak programme level meters — Digital audio peak level meter

ISO and IEC Draft International Standards

This section lists proposed standards that the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) are considering for approval. The proposals have received substantial support within the technical committees or subcommittees that developed them and are now being circulated to ISO and IEC members for comment and vote. The final dates for offering comments, listed in parentheses, are for information only. Copies of these documents are available from ANSI.

ACOUSTICS (TC 43)
ISO/DIS 3382, Acoustics — Measurement of the reverberation time of rooms with reference to other acoustical parameters (revision of ISO 3382: 1975) (19 February 1996)

CEN/CENELEC
The following European drafts have been sent to members of the European Committee for Standardization (CEN), and/or the European Committee for Electrotechnical Standardization (CENELEC), for enquiry and comment. The final dates for offering comments, listed in parentheses, are for information only. Copies of these documents are available from ANSI.

Acoustics
prEN ISO 3822-3, Acoustics — Laboratory tests on noise

emission from appliances and equipment used in water supply installations — Part 3: Mounting and operating conditions for in-line valves and appliances (1996 February 27)

prEN ISO 3822-4, Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations — Part 4: Mounting and operating conditions for special appliances (1996 February 07)

International documents submitted to the U. S. for vote and/or comment

Some of the documents processed recently by the ASA Standards Secretariat. Dates in parentheses are deadlines for submission of comments and recommendation for vote, and they are for information only.

TAG ISO Documents

S12 ISO/DIS 5135 — Acoustics — Determination of sound power levels of noise from air-terminal devices, air-terminal units, dampers and valves by measurement in a reverberation room (Affirmative with comments)
ISO/DIS 6393 — Acoustics — Measurement of exterior noise emitted by earth-moving machinery — Stationary test conditions (Affirmative with comments)
ISO/DIS 6394 — Acoustics — Measurement at the operators position noise emitted by earth-moving machinery — Stationary test conditions (Affirmative with comments)
ISO/DIS 6926 — Acoustics Determination of Sound Power Levels of Noise Sources — Requirements for the Performance and Calibration of Reference Sound Sources (Negative w/comments)
ISO/DIS 8528-10.2 — Reciprocating internal combustion engine driven alternating current generating sets Part 10: Measurement of airborne noise by the enveloping surface method (1995 November 21)

S1 ISO/DIS 10845 — Acoustics — Frequency Weighting A for Noise Measurement (Negative w/comments)

S12 ISO/DIS 10847 — *In situ* Determination of Insertion Loss of Outdoor Noise Barriers of all Types (Negative w/comments)
ISO/DIS 11200.2 — Noise Emitted by Machinery and Equipment — Guidelines for the Use of Basic Standards for the Determination of Emission Sound Pressure Levels at a Work Station and at Other Specified Positions
ISO/DIS 11201.2 — Noise Emitted by Machinery and Equipment — Measurement of Emission Sound Pressure Levels at a Work Station and at Other Specified Positions — Engineering Method in an Essentially Free Field Over a Reflecting Plane
ISO/DIS 11202.2 — Noise Emitted by Machinery and Equipment — Measurement of Emission Sound Pressure Levels at a Work Station and at Other Specified Positions — Survey Method *in situ*
ISO/DIS 11203.2 — Noise Emitted by Machinery and Equipment — Determination of Emission Sound Pressure Levels at a Work Station and at Other Specified Positions
ISO/DIS 11204.2 — Noise Emitted by Machinery and Equipment — Measurement of Emission Sound Pressure Levels at a Work Station and at Other Specified Positions — Method Requiring Environmental Corrections
ISO/DIS 11819-1— Acoustics — Method for Measuring the Influence of Road Surfaces on Traffic Noise Part 1: Statistical Pass-By Method (1995 July 18)
ISO/DIS 13473-1 — Acoustics — Characterization of Pavement Texture Using Surface Profiles — Part 1: Determination of Mean Profile Depth (Affirmative)
ISO/DIS 13475-1 — Acoustics/Determination of Sound Emission Quantities for Stationary Audible Warning Devices Used Outdoors Part 1: Field Measurements (1995 October 13)
First ISO/CD 362 — Measurement of noise emitted by accelerating road vehicles — Engineering method (Revision of ISO 362:1981) (1995 November 21)
First ISO/CD 1680 — Acoustics/Test Code for the Measurement of Airborne Noise Emitted by Rotating Electrical Machinery (Revision of ISO 1680:1986 and ISO 1680-2:1986) (1995 October 13)
First IEC/CD 1672 — Electroacoustics/Sound Level Meters (Revision of IEC 651:1979 and IEC 804:1985) (1995 October 13)
First ISO/CD Amd. 1 to 1996-2-1987 — Acoustics/description and measurement of environmental noise — Part 2: Acquisition of data pertinent to land use (1995 October 13)
First ISO/CD 3741 — Determination of sound power levels of noise sources using sound pressure — Precision methods for reverberation rooms (Rev. of ISO 3741:1988 and ISO 3742:1988) (1995 November 21)
ISO/DTR 4869-4 — Acoustics — Hearing Protectors Part 4: Method for the Measurement of Effective Sound Pressure Levels for Sound Restoration Earmuffs (1995 November 15)
First ISO/CD 5129 — Acoustics/Measurement of Aircraft Interior Sound Pressure Levels in-Flight (Revision of ISO 5129:1987) (1995 October 13)

ISO/DIS 13332 — Reciprocating Internal Combustion Engines — Test Code for the Measurement of Structure-Borne Noise Emitted from High-Speed and Medium-Speed Reciprocating Internal Combustion Engines (1995 December 31)
First ISO/CD 14163 — ISO/TC 43/SC1 N 977 — Acoustics — Noise Control by Silencers (Affirmative without comments)
First ISO/CD 14938 — Acoustics/Revision of B-and C-Weighting and Lin-Response for Noise-Measurement (1995 October 13)

TAG IEC Documents

S1 First IEC/CD 1672: ELECTROACOUSTICS — SOUND LEVEL METERS (Revision of IEC 651: 1979 and IEC 804: 1985) (1995 November 22)
IEC/TC 29/313/CDV — DRAFT 2ND ED. IEC 942: ELECTROACOUSTICS — SOUND CALIBRATORS (1995 December 04)

http://asa.aip.org

The Acoustical Society of America established its home page in late 1995 as a service to its membership and others interested in all areas of acoustics. The page begins with a statement of the purpose of the Acoustical Society of America and then provides links to additional pages which describe various activities carried on within the Society and other aspects of acoustics. The page also provides links to some audio samples.

Purpose

The Acoustical Society of America was founded in 1929 to increase and diffuse the knowledge of acoustics and promote its practical applications. Any person or corporation interested in acoustics is eligible for membership in this Society. Further information concerning membership, together with application forms, may be obtained by addressing Elaine Moran, ASA Office Manager, 500 Sunnyside Blvd, Woodbury, NY 11797-2999, telephone: (516) 576-2360, FAX (516) 576-2377; email: asa@aip.org.

An Introduction to the Society

- A Brief History of the Society that includes the founding of the organization in 1929, the establishment and growth of the *Journal of the Acoustical Society of America*, the history of meetings, other Society publications, the standards program, and awards.
- Information on meetings held by ASA and links to meetings abstracts.
- A list of future meetings of the Society
- Information on membership, including qualifications for membership, information on sustaining membership, and benefits of membership.
- Information on technical committees and technical groups with further links to each technical area covered by the Society.
- Information on the Regional Chapters of the Society with further links to each chapter where a list of contacts and officers can be found.
- A list of Awards and Fellowships of the Society with internal links to a description of each award and names of persons who have received each award.
- A list of Sustaining Members of the Society.
- A list of officers, members of the Executive Council, and members of the Technical Council of the Society.
- A listing of the ASA office staff.
- A description of the *Journal of the Acoustical Society of America* including a list of Associate Editors and instructions for submitting papers to the *Journal*.
- A description of *Echoes*, a quarterly newsletter published by the Society with examples of cover pages of recent issues.
- Books published by the Society, including videotapes and compact discs
- A description of the acoustical standards program, including the standards committees established for standards development
- A description of the growth of the Society over the years.
- Statistics related to the technical interests of the members of ASA.
- A profile of society membership, including links to various ways of looking at the membership (age, degrees, professional affiliation, etc.)

An Introduction to Acoustics and Sound

- A link to a description of career opportunities in acoustics with a description of all of the technical areas in acoustics covered by the Society.
- A link to excerpts from chapter 1, "The Wave Theory of Sound" in Allan D. Pierce's *Acoustics: An Introduction to Its Physical Principles and Applications*.

Links to Other Sites of Interest to Acousticians

- Links to a number of other organizations, including
  - + The American Institute of Physics
  - + The MIT Media Laboratory Group
  - + The Laboratory of Seismics and Acoustics at TU Delft in The Netherlands
  - + The Penn State University acoustics home page
  - + Center for Acoustics and Vibrations at Penn State
  - + The National Science Foundation
  - + The WWW Virtual Library on Acoustics and Vibrations
  - + The *Yahoo* seach engine at http://www.yahoo.com/Science/Acoustics
  - + Other *Yahoo* sites related to artificial intelligence and natural language processing

International Advertising Contacts

Below is a list of international contacts for the advertisers in this issue. The telephone number is given first, and is followed by the FAX number where available. In cases where there are several telephone numbers per location, or several locations within a country, a colon (:) separates the telephone number(s) from its respective FAX number. Advertisers, please Fax updates to Brian Benbrook at (908) 981-1855.

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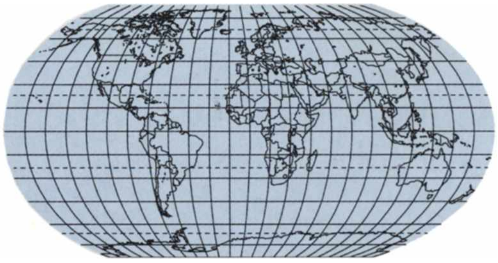

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