ISSN 0711-6659

# canadian acoustics
# acoustique canadienne

DECEMBER 1991 DÉCEMBRE 1991
Volume 19 — Number 5 Volume 19 — Numéro 5

Editorial 1

Technical papers / Articles de recherche

Noise in rural recreational environments
Herbert G. Kariel 3

Bottom loss in areas with ice-rafted sediments
Francine Desharnais 11

Attenuations from hearing protectors and the ABC classification system
Alberto Behar 17

Acoustics Week in Canada 1992 - Call for papers / Semaine de l'Acoustique Canadienne 1992 - Appel de communications 28

Other features / Autres rubriques

Book review / Revue de livre 23

Regulation of sound levels in the federal jurisdiction / Réglement sur les niveaux acoustiques dans les établissements de compétence fédérale 25

Acoustics Week in Canada 1991 / Semaine de l'Acoustique Canadienne 1991 34

Note from the President / Mot du président 36

Minutes of CAA meetings / Procès verbaux de réunions de l'ACA 40

News / Information 44

Employment / Emplois 47

Membership Directory 1991 / Annuaire des membres 1991 48

CAA Prizes / Prix de l'ACA 61

Simon Tuckett ©1991

# canadian acoustics / acoustique canadienne

**THE CANADIAN ACOUSTICAL ASSOCIATION**
**P.O. BOX 1351, STATION "F"**
**TORONTO, ONTARIO M4Y 2V9**

**L'ASSOCIATION CANADIENNE D'ACOUSTIQUE**
**C.P. 1351, SUCCURSALE "F"**
**TORONTO, ONTARIO M4Y 2V9**

**CANADIAN ACOUSTICS** publishes refereed articles and news items on all aspects of acoustics and vibration. Papers reporting new results or applications, as well as review or tutorial papers and shorter research notes are welcomed, in English or in French. Submissions should be sent directly to the Editor-in-Chief. Complete instructions to authors concerning the required camera-ready copy are presented on the last page of this issue.

**CANADIAN ACOUSTICS** is published four times a year - in March, June, September and December. Publications Mail Registration No. 4692. Return postage guaranteed. Annual subscription: $10 (student); $35 (individual, corporation); $150 (sustaining - see back cover). Back issues (when available) may be obtained from the Associate Editor (Advertising) - price $10.00 including postage.

**ACOUSTIQUE CANADIENNE** publie des articles arbitrés et des informations sur tous les domaines de l'acoustique et des vibrations. On invite les auteurs à proposer des manuscrits rédigés en français ou en anglais concernant des travaux inédits, des états de question ou des notes techniques. Les soumissions doivent être envoyées au rédacteur en chef. Les instructions pour la présentation des textes sont exposées à la dernière page de cette publication.

**ACOUSTIQUE CANADIENNE** est publiée quatre fois par année - en mars, juin, septembre et decembre. Poste publications - enregistrement n$^{o}$ 4692. Port de retour garanti. Abonnement annuel: $10 (étudiant); $35 (individuel, société); $150 (soutien - voir la couverture arrière). D'anciens numéros (non-épuisés) peuvent être obtenus du rédacteur associé (publicité) - prix: $10,00 (affranchissement inclus).

---

# EDITORIAL

Acoustics Week in Canada 1991 has come and gone. As you can read in the feature in this edition, it was a great success with excellent courses and papers.

I was delighted to learn from those attending the Edmonton meeting that (almost) everyone thought the first Proceedings Issue was a great success. May I emphasize that the two-page summaries were *not* reviewed; I encourage all of you to submit full-length versions for review and publication as technical articles.

Hot on the heels of Acoustics Week in Canada 1991 comes Acoustics Week in Canada 1992, which will be held in Vancouver. Many thanks to Doug Whicker for coming to the rescue and agreeing to coordinate the meeting. The call for papers appears in this issue.

We have had several complaints, from authors who submitted papers for publication, about the long delays involved in the review process. It is true that this process has taken six months in some recent cases. The reason is simple; reviewers agree to review a paper and then hold on to it for months. There is no reason for the review of *Canadian Acoustics* papers to take more than two or three months. We all know that reviewing papers is unrewarding and time-consuming, but necessary. To all reviewers: please do not unnecessarily delay your colleagues publications; you know how you hate it when your publications are held up! Let us know as soon as possible if you won't be able to review a paper.

On page 61 of this issue you will find a new feature. This is an announcement of all of the prizes awarded by the Canadian Acoustical Association. Brief details, and the names of past prize recipients, are included. Full prize details and application forms are available from the Secretary of the CAA. This announcement will appear in all issues of the journal from now on. It will replace the publication of full prize details and application forms once a year, as was done in the past. We hope, above all, that this new format will lead to more people applying for these prizes.

I leave you with perhaps the ultimate response to all those (including myself) who at one time or other have stated that they cannot 'afford' to publish in *Canadian Acoustics* because such publications are not 'recognized' by the scientific community. Here is article 225 of the 1991 NSERC awards guide:

*Grantees are encouraged, whenever appropriate, to publish the results of their NSERC-supported research in Canadian journals, including not only the Canadian Journals of Research published by the National Research Council, but also other Canadian scientific and technical publications as well.*

La Semaine de l'Acoustique Canadienne 1991 est maintenant chose du passé. Tel que vous le lirez dans ce numéro, ce fut un grand succès compte tenu des excellents cours et conférences, du haut taux de participation et de la superbe température.

J'ai été enchanté d'apprendre de la bouche des participants qui assistaient au congrès d'Edmonton que tous (ou presque) ont souligné le grand succès du premier numéro des Actes du Congrès. Puis-je insister sur le fait que les deux pages résumés n'ont pas été révisées; je vous encourage donc à soumettre une version complète pour révision et publication comme article technique.

Sur les traces encore chaudes de la Semaine Canadienne de l'Acoustique 1991 se dessine la Semaine Canadienne de l'Acoustique 1992, qui se tiendra à Vancouver. Nous remercions Doug Whicker d'être venu à la rescousse et d'avoir accepté de coordonner le congrès. L'appel des communications apparaît dans ce numéro.

Nous avons reçu plusieurs plaintes, de la part des auteurs qui soumettent des articles pour publicaton, concernant les longs délais relatifs au processus de révision. Il est vrai que dans certains cas récents ce processus a nécessité six mois. La raison est simple: les réviseurs acceptent de réviser un article mais le gardent en leur possession plusieurs mois. Il n'y a pas de raison pour que la révision des articles soumis à l'*Acoustique Canadienne* nécessite plus de deux our trois mois. Nous savons tous que la révision d'articles n'est pas gratifiante et demande beaucoup de temps mais est nécessaire. A tous les réviseurs: s'il vous plaît, ne retarder pas inutilement les publications de vos collèges; vous n'aimez pas cela lorsque votre publication est retardé! Informez nous le plus rapidement possible si vous êtes incapable de reviser le'article qui vous a été envoyé.

A la page 61 de ce numéro, vous trouverez une nouveauté. Il s'agit de l'annonce des prix décernés par l'Association Canadienne d'Acoustique. Un court détail ainsi que le nom des récipiendaires antérieurs de chacun des prix sont présenteés. Les instructions détaillées de chacun des prix ainsi que les formulaires d'inscription sont disponibles au Secrétariat de l'ACA. A partir de maintenant, cette annonce paraîtra dans tous les numéros du journal. Celle-ci remplacera la publication des instructions détaillées et des formulaires une fois l'an, tel que fait antérieurement. Nous espérons que ce nouveau format incitera davantage les gens à soumettre leur candidature pour ces prix.

Nous aimerions solliciter votre aide à l'égard de la traduction de textes pour l'*Acoustique Canadienne*. Les francophones qui peuvent consacrer une heure ou deux par période de trois mois à la traduction de textes sont invités à communiquer avec le rédacteur en chef.

Je vous laisse probablement avec la réponse ulitme à tous ceux (incluant moi-même) qui à un moment ou un autre ont mentionné qu'ils ne pouvaient 'se permettre' de publier dans l'*Acoustique Canadienne* parce que ces publications ne sont pas 'reconnues' par la communauté scientifique. Voici l'article 225 du guide des prix du CRSNG 1991:

*On encourage les béneficiaires des subventions à publier les résultats de leur recherche subventionnées par le CRSNG dans le journaux canadiens, si possible. Il peut s'agir non seulement des journaux canadiens de recherche publiés par le CNRC, mais aussi d'autres publications scientifiques et techniques canadiennes.*

# ACOUSTICAL INTERFACE™ SYSTEM

**precision acoustical measurements with your FFT, scope or meter**

## PS9200 POWER SUPPLY

■ Dual Channel ■ 9V "Radio" Battery
■ Portable ■ 50 Hours Operation
■ Low Noise ■ LED Status Indicator

## 7000 SERIES MICROPHONES

■ Type 1 Performance ■ ¼, ½ and 1 Inch Models

## 4000 SERIES PREAMPLIFIERS

■ 2Hz to 200kHz ± 0.5db ■ Removable Cable ■ PS9200 and 7000 Series Compatible

# NEW LOW COST PRECISION MEASUREMENTS

■ **SINGLE CHANNEL SYSTEM UNDER $1,200**
■ **DUAL CHANNEL SYSTEM UNDER $2,000**
(½ or 1 inch microphones)

ACO

**ACO Pacific, Inc.**
2604 Read Avenue
Belmont, CA 94002
(415) 595-8588



ACOUSTICS BEGINS WITH ACO

*Canadian Acoustics / Acoustique Canadienne 19(5) 3-10 (1991)* *Research article / Article de recherche*

# NOISE IN RURAL RECREATIONAL ENVIRONMENTS

**Herbert G. Kariel**
Department of Geography
University of Calgary, Calgary, Alberta, T2N 1N4

## ABSTRACT

This study describes and analyses the relationship between people's evaluation of various sounds commonly heard in rural outdoor recreational environments and their measured dB(A) or sound pressure levels. The findings indicate that sound pressure level alone is not a good predictor of annoyance. Rather several complexly interrelated factors relating to the harmonic content of the sounds themselves and those concerning their socio-psychological aspects influence the way in which people evaluate different sounds. Factors relating to the perception and evaluation of sounds in rural recreational environments are discussed and implications for other rural settings are presented.

## SOMMAIRE

La présente étude se propose d'analyser le rapport entre l'impression que se font les gens des bruits qui les entourent dans les aires de loisirs en plein air et leur niveau de pression sonore réelle mesurée en décibels (dB(A)). Les résultats indiquent que le niveau de pression sonore, pris tout seul, ne suffit pas à prédire le désagrément qui en résulte. Au contraire, les gens font une évaluation des bruits perçus selon plusieurs facteurs se reliant entre eux de manière complexe et qui ont trait au contenu harmonique de ces bruits eux-mêmes, aussi bien que selon des facteurs ayant trait aux aspects socio-psychologiques de ces bruits. Cette étude examine également les facteurs relatifs à la manière dont les gens perçoivent ces bruits et ce qu'on peut en conclure pour le milieu rural dans un sens plus large.

## 1. INTRODUCTION

For the many who visit forests, parks, wilderness areas, and similar types of rural or outdoor recreational environments, escaping noise and crowds is one of the significant benefits obtained (Driver, Nash, and Haas 1987). While in these environments individuals are exposed to a variety of natural sounds such as those of birds and streams, the sounds of people talking or setting up camp, and technological sounds, such as those of chain saws or aircraft overflights. Some of these sounds are considered pleasing and satisfying, while others are deemed annoying and distract from the quality of the recreational experience which people seek.

This paper summarizes research on the relationship between individual's evaluation of sounds commonly heard in rural or outdoor recreational environments and their measured sound pressure level (dB(A)) and discusses factors which relate to the perception and evaluation of these sounds. Planning implications for recreational and other rural areas are also presented.

## 2. PREVIOUS STUDIES

In contrast to the many studies of noise and its annoyance in urban areas, there are relatively few studies about noise in rural or outdoor recreational environments. Harrison (1974b) summarized investigations carried out by the U.S. Forest Service on the effects of noise from off-road vehicles (snowmobiles, motorcycles, dune buggies, and all-terrain vehicles) on operators, bystanders, and forest recreationists. Kariel (1978, 1980) studied campers' evaluation of natural, person-related, and technological sounds commonly experienced at campgrounds. Harrison, Clark, and Stankey (1980), using the Outdoor Recreation Opportunity Spectrum, discussed the unacceptability of noise in Forest

Service recreation areas in general terms. Dailey and Redman (1975), in suggesting guidelines for campsite spacing, described physical and psychological properties of a number of human-related noises often associated with recreation in roadless areas. Dellora, Martin, and Saunders (1984) synthesized their laboratory studies of conflicts between four-wheel-drive users, bushwalkers, picnickers, and other recreationists in Victoria, Australia.

## 3. METHOD

Data for the reaction of people to sounds are from two studies by Kariel (1978; 1980) in which evaluations were measured by attitude surveys. In the first study, visitors (n=713) to highway-oriented campgrounds in three of Canada's mountain national parks (Banff, Yoho, and Kootenay) were asked to rate a number of nature-, person-, and technology-related sounds commonly heard in these settings, on a five-point, bipolar, pleasantness-annoyance scale, even if they had not experienced them all. Mean values of these ratings were computed and ranked, from the most pleasing (water, campfires, and wind) to the most annoying (car noise, motor or trail bikes, and chain saws) (Table 1 and Figure 1). Questions about such items as trip purpose, type of sleeping accommodation used, ownership of noise-producing items, and experience with particularly annoying sounds were also asked. Additional information, such as time of day effect, was gained in conversation with interviewees following completion of the questionnaire.

Results showed that sounds which are considered most annoying are technology-related, those as acceptable or neutral were usually person-related, and nature-related ones were deemed most pleasing. If a sound was considered annoying, the degree of annoyance was greater in the evening than during the day and greatest at night. The evaluation of pleasing sounds was constant regardless of time of day. Agreement among respondents was greatest with respects to sounds considered pleasant, next greatest for annoying sounds, and least for acceptable ones.

Additional information was provided by analyzing the relationship between the evaluations of sounds and other questions asked of respondents.

– *Purpose of the trip*: Sounds which represent possible conflicts or which might interfere with enjoyment of the trip purpose were considered annoying. Those persons whose major purpose was hiking were more annoyed by person- and technology-related sounds than those who had other trip purposes. Individuals whose primary purpose was camping were less bothered by persons talking, but found sounds from horses and mules annoying; those picnicking were not as bothered by all sounds. Fishermen disliked sounds of pets, which they felt would interfere with fishing and swimmers found the sound of wind unpleasant.

– *Sleeping accommodation*: People who slept in tents were more pleased with natural sounds and more annoyed by person– and technology–related ones, and generally preferred a quieter environment than those in other accommodations.

Table 1. Mean rating of sound sources, from Pleasing (1) to Annoying (5) for persons staying at highway-oriented campgrounds and mountaineers at a mountaineering camp.

| Source | Campers | Mountaineers |
|---|---|---|
| Water | 1.20 | 1.30* |
| Campfire | 1.32 | 1.76 |
| Wind | 1.40 | 1.21* |
| Birds, insects, or other native animals | 1.44 | 1.42 |
| Horses or mules | 2.34 | 2.42 |
| Chopping wood | 2.39 | 2.65 |
| Persons' activities | 2.67 | 3.09* |
| Persons talking | 2.81 | 3.11 |
| Radio | 3.28 | 4.56* |
| Pets | 3.31 | 3.84* |
| Trains | 3.53 | 4.04* |
| Motorboats | 3.75 | 4.83* |
| Aircraft | 3.78 | 4.20* |
| Road or highway traffic | 4.00 | 4.61* |
| Snowmobiles | 4.27 | 4.61* |
| Car noise (door slamming, horn blowing, engine running, etc.) | 4.29 | 4.76* |
| Motor or trail bikes | 4.36 | 4.98* |
| Chainsaws | 4.37 | 4.48 |

*Difference between the two groups is statistically significant at $P<0.05$

– *Previous camping experience*: More experienced campers found sounds from radios, trains, motor boats, and cars more annoying than did those who had taken fewer trips.
– *Trip duration*: Length of trip, whether overnight or of several weeks' duration made no difference.
– *Value attached to camping experience*: Those who placed a greater value on camping experience tended to be more pleased with nature-related sounds as well as those associated with camping than were other individuals. They were also more annoyed with sounds from highways and motor or trail bikes.
– *Ownership of noise-producing items*: Those persons who owned a noise-producing item were less annoyed by its sound than were others: pet owners liked the sound of pets, chain saw owners were less annoyed than non-owners by their sound.

Of those respondents who had experienced particularly annoying sounds (N = 487), the most frequently mentioned sounds were person-related (people being raucous or noisy, playing the radio or tape deck); sound of motorbikes, trail bikes, and similar equipment; that of trains; dogs barking; and automobile and traffic noise. Forty six per cent of all respondents had discussed annoying sounds with fellow campers. As was also found in other studies (TRACOR 1969), only a minority, 13%, had discussed annoyances with officials.

Additional data are from Kariel (1980) in which the same procedure for obtaining sound ratings was used in a backcountry area. Participants (n=46) of the Alpine Club of Canada were interviewed at a general mountaineering camp held near Glacier Lake, in Banff National Park. The sound ratings were treated in the same way as in the first study and the ordering was similar for both groups ($r_S$ =0.91, z =3.74) (Table 1 and Figure 1). While mountaineers differed little from highway-oriented campers in their evaluation of nature-related sounds, they rated person-related ones as somewhat less acceptable, and technology-related sounds considerably more annoying. This difference, although not as strong, also showed up when the small

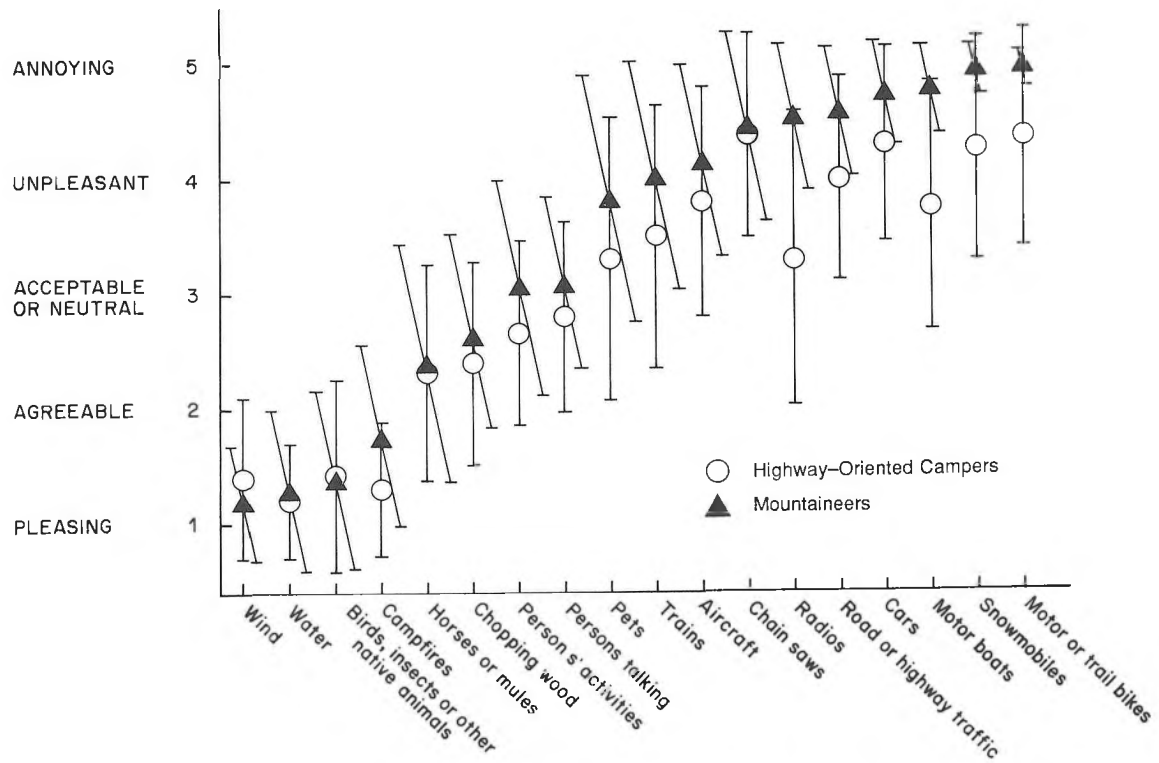



Figure 1. Comparison between highway–oriented campers and mountaineers in their rating of sound sources.

group of highway-oriented campers who had given mountaineering as a trip purpose (n=17) was analyzed. Hence, these differences probably relate to the fact that mountaineers are generally more wilderness purist in their viewpoints and characteristics than highway-oriented campers.

Sound pressure level data were obtained in the field and were supplemented by those reported in other studies (for example: U.S. EPA 1971; Dailey and Redman 1975; Harrison 1974a and Ohlson 1976). Sound pressure level measurements collected specifically for this study were made and recorded using a single channel version with a of 40 dB range for each setting or more than a total range of 140 dB, of the data acquisition system described in Jones and Babott (1977). This system consists of a microphone which picks up the sound, a box containing circuitry which converts the sound into digital form, and a cassette tape recorder for storing the digitized data. The recorded data are then played back via an interface into a computer for analysis and printed out. The printout includes various $L_x$ values, all in dB(A), but only $L_{eq}$ values are reported since $L_{eq}$, $L_{10}$, and $L_{dn}$ are all equally good predictors of subjective response and is the accepted current practice (Hall and Taylor 1977; Fidell, Barber and Schultz 1991). A few measurements were made by observing the sound pressure level, as measured by a sound level meter, over a period of time and calculating $L_{eq}$. Some impact sounds, such as chopping wood were read off a sound level meter, recorded and averaged, a procedure which provides an approximation of $L_{50}$. The microphone and measuring instrument used was a standard GENRAD 1565-B sound level meter. All readings were taken on the dB(A) scale. Those readers who wish to convert sound pressure level to Sones can apply the appropriate equation.

The microphone or sound level meter was either positioned or, in a few instances, hand-held approximately 1.5m above the ground. The distance from the sound varied with the source, but approximated that of the nearest camper, since it was reasonable to believe that those persons nearest the source and therefore exposed to the higher sound pressure level would evaluate the sound as more annoying.than those at a greater distance. All recordings were taken at campgrounds or in similar settings except for those for a helicopter, which were taken on a mountain slope at an elevation roughly similar to that of the helicopter (2450m, 8,500 ft.) and at a distance of about 3km.

Weather and other environmental conditions were generally good at times of recording. There was no rain, and wind varied from calm to light breeze, except when the sound of wind through trees was specifically recorded. Cloud cover ranged from overcast and scattered clouds to clear. Vegetation varied from grassy areas with shrubbery to open forest, and topography was reasonably level.

## 4. RESULTS

The sound pressure level of the sources varied considerably, ranging from a low of 22 to 27 dB(A) for those of insects to a high of 83 dB(A) for chainsaws (Table 2). This variation is not only due to the sounds themselves, but also to the distance to the sound source as well as environmental factors. When these sound pressure levels were related to their ranking on the pleasantness-annoyance scale, using the broader categories of the questionnaire, there was no apparent relationship (r=0.20); that is, the level of annoyance appeared to be independent of dB(A) level. Examination of the particularly annoying sounds reported as having been experienced also showed that there was little relationship to sound pressure levels alone.

## 5. CAUTIONARY COMMENTS

Before discussing findings, some cautionary comments regarding the data on noise levels and the responses given on the questionnaires should be made.

– All sound level values are not directly comparable, since different ones were used in different studies. For example, peak levels were reported in U.S. EPA, Dailey and Redman used $L_{50}$, and the author used $L_{eq}$ as well as direct readings of peak values.

– Different methods were used to record data, ranging in sophistication from reading a sound level meter directly by eye to a complex system involving analysis of the statistics of the sound levels.

– The duration of the sound samples varied, being quite short for direct sound level meter readings, especially for impact type sounds and longer for continuous ones.

– Distances from sound sources varied among and within studies. Dailey and Redman, for example,used 15.2m (50 ft.), while I tried to use the distance from the sound source to the nearest campsite.

– The sound pressure level of a source may have quite a range, depending upon various factors, such as whether a radio is turned on especially high (full blast), the number of persons in a group and how loudly they sing, whether a helicopter is taking off or flying, a trail bike is being accelerated, or if a wild animal is charging, or merely ambling along.

Table 2. Range of sound pressure level at the observer in dB(A) of various sound sources in rural recreational environments: at different distances, under various environmental conditions, and by different researchers.

| | | | |
|---|---|---|---|
| 83 | Chainsaw[a] 15.2m | 50-62 | Birds, terns and gulls call notes[f] |
| 78 | Person yelling[b] 15.2m | 50 | Crickets[e] |
| 76 | Safety whistle[b] 15.2m | 49.9 | Chopping wood 5m |
| 74 | Trail bike[c] 15.2m | 48 | Wind blowing through trees |
| 73.6 | Aircraft, small 100m | 48 | Conversation[b] 15.2m |
| 73 | Snowmobile[d] 15.2m | 48 | Birds[e] |
| 73 | Dogs howling[e] | 47.8 | Persons talking, taking pictures, etc. 15m |
| 72 | Harmonica[b] 15.2m | | |
| >70 | Aircraft, small[f] 300-400m | 47-48 | Creek, small, with rapids 15m |
| 70 | Aircraft sight-seeing, Grand Canyon[e] | 46.6 | Automobile, warming up 30m |
| 68 | Helicopter 150m | 45.1-55.5 | Helicopter, ca. 3km |
| 66-71 | Chopping wood 5m | 45 | Background, lm opposite small rapids of ca.5m wide brook[b] |
| 66 | Pounding tent stakes[b] 15.2m | | |
| 66 | Clattering pans[b] 15.2m | 44.9 | Birds, crows, call notes 20m |
| 65.1 | Motor boat trolling 75m | 44.3 | Campfire with persons talking 25m |
| 65-68 | Persons talking 20m | | |
| 64.8 | Car door being slammed 10m | 44 | Radio, playing music 25m |
| 64 | Chopping wood[b] 15.2m | 43.4 | Garbage container being opened and closed 40m |
| 62.0 | Wind, fresh breeze blowing through trees | | |
| 61.2 | Creek, small with rapids 5m | 43 | Camp stove 5m |
| 60 | Singing[b] 15.2m | 42.8 | Aircraft, small at high altitude |
| 60 | Dogs barking[e] | 42-52 | Road traffic 100m |
| 59.8 | Campfire 2m | 40-46 | Chipmunks 10m |
| 57.5 | Diesel generator 50m | 39 | Squirrel[e] |
| 57 | Trail bikes 100m | 36.1 | Road traffic 100m |
| 55-68 | Persons washing dishes, doing camp chores 15m | 35.5 | Automobile, engine idling 30m |
| | | 35 | Background, coniferous forest, low wind[b] |
| 54.8 | Wind, gusty, with rustling of tree foilage | | |
| 53.8 | Birds, woodpeckers, call notes 5m | 34-41 | Birds, chaffinch song notes[f] 30-100m |
| 53.6 | Train in distance 1km | | |
| 53.0 | Persons setting up camp 15m | 30.7 | Bird flying along lakeshore 15m |
| 52.9 | Campfire 5m | 30 | Background, meadow, low wind conditions[b]. |
| 52.9 | Birds, woodpeckers, call notes 5m | | |
| 52 | Radio playing music[e] | 30 | Wind, rustling of grass and brush |
| 52 | Guitar[b] 15.2m | 23.4 | Background, open mountain slope |
| 51.9 | Persons eating and talking 15m | 22-27 | Insects[f] |
| 50.2 | Creek, medium size 15m | 16 | Background, rim of Grand Canyon[e] |

Unless footnoted, sound pressure levels are the author's measurements; $L_{eq}$ in decimals, $L_{50}$ and peak values in whole numbers, and distances are estimates. More than one value for a source indicates measurements were made by different researchers or under different conditions. Distances, where shown, are the author's or as given in the sources.

a) Myles, Hirvonen, Embleton, and Toole (1971) $L_{50}$.
b) Dailey and Redman (1975) peak values.
c) Harrison (1974a) peak value.
d) Sound rating tag on Bombardier Nordic Safari 503R, at 15.2m (50') and 78dB(A) at wide-open throttle, in accordance with Society of Automotive Engineers regulations J1161 and J192A.
e) U.S.EPA (1971) peak values.
f) Ohlson (1976) $L_{50}$ values.

– There were some differences between the sounds measured and those which were identified on the questionnaire in the attitude survey. Those on the attitude survey included both specific and generalized ones, while the measured sounds were nearly all specific. For purposes of analysis, specific sounds, such as persons talking, were grouped under the generalized sound, persons' activities.
– Questions regarding the duration of sounds were not included in the survey.
– Respondents probably generalized sounds to averages on the basis of past experiences or anticipations of them in the future, and hence did not include consideration of persistence in terms of duration or frequency, or particularly loud ones.

## 6. DISCUSSION

Despite the limitations and biases which may have been introduced by the items pointed out above, the overall finding that annoyance is independent of dB(A), within the range of sound pressure levels studied, appears to be reasonable in light of the data available and our present understanding of annoyance from noise in outdoor recreational environments.

If sound pressure level alone is not a good predictor of annoyance, how is it related to annoyance and how else can persons' evaluations of noise in rural or outdoor recreational environments be accounted for? It would appear that several complexly interrelated factors relating to the physical characteristics of the sounds themselves and those concerning their socio-psychological aspects influence the way in which people evaluate different sounds.

Regarding the physical characteristics of sounds, transportation and community noise studies have found that sound pressure level is related to annoyance, i.e. higher sound pressure levels are more annoying than lower sound pressure levels (Galloway and Jones, 1974; Kryter, 1985). Although this finding was not born out in this study, I suspect that person- and technology-related sounds would also be deemed more annoying at higher levels.

Sounds of higher-pitch or frequency tend to be more annoying than lower-pitched ones. Also, rhythmic sounds, such as those from engines, as well as those which are irregular or intermittent, are judged to be more annoying than continuous ones, even when other properties are the same (Dailey and Redman, 1975). On the other hand, noises which have a random component, such as those from wind, flowing water, and other nature-related sources, tend to be considered more pleasing.

A number of researchers have pointed to the importance of the socio-psychological or perceived meaning or connotation of a noise (Parry and Parry, 1972; Harrison, 1974b; Dailey and Redman, 1975; Schultz, 1978). When a sound is heard, people interpret, evaluate, and attach meaning and significance to it and also judge its appropriateness for the setting, whether it is potentially harmful or helpful, how it relates to past experience, and the like.

The total experience in the setting is important in judging a sound's appropriateness. If we consider only the source of a sound, a stream for example, we take it out of context. We then ignore the larger scene as well as the activity in which the person evaluating the sound may be engaged.

Sounds which are interpreted as aiding or benefiting an activity are evaluated positively, while those deemed as interfering with or being detrimental to an activity or as being harmful are considered to be displeasing or annoying. Sounds may include noises which interfere with conversation, sleeping, relaxing, or other activity. The thresholds interfering with conversation and sleep seem to be approximately 45 and 35 dB(A) respectively (Kryter, 1985).

As the primary reasons for visiting rural or outdoor recreational environments are to escape the noise of urban areas, enjoy the natural scene, reduce tension, and obtain tranquility or solitude (Driver, Nash, and Haas, 1987), sounds which are felt to interfere with these experiences will be considered as annoying. In this connection it should be mentioned that, since sounds are detectable, and hence identifiable, from great distances and at very low levels, even without registering on a sound level meter, they can be intrusive and provoke reactions.

Expectations and ideas about which sounds are appropriate in a specific environment and at a particular time are also important in determining their annoyance. This helps to explain why people who stay at campgrounds only overnight are more tolerant of noises than those who use them as a destination or for a longer period of time. Although off-road vehicles are not ordinarily heard at campgrounds, it is noteworthy that, where their presence is considered inevitable, as with dune buggies at the Oregon Dunes National Recreation Area, sound pressure levels of 85 dB at 15.2m (50ft.) were considered acceptable (Harrison 1974b). Also, the sound of chain saws, for example, might be considered less annoying in Finland or Sweden where they are seen as a natural part of forested environments.

Instances of preventability or misfeasance, such as when persons have their radio turned on loudly, or are joy-riding a trail bike around a campground, are considered annoying. This reaction is similar to what has been found in transportation noise studies (Galloway and Jones, 1974; Leonard and Borsky, 1974, for example). In transportation studies,instances of misfeasance are considered extra annoying, at the same sound pressure level compared with normally anticipated operation of vehicles, while sounds which have a presumed utility and are infrequent are deemed sub-annoying. In addition, sounds over which persons feel they have no control or which are unpredictable, are considered annoying (Glass and Singer, 1974).

At the same time people will be tolerant of or even pleased with a disturbing sound, at least for a short time period , if they believe that it will aid or benefit an experience or activity, such as the sound of a chain saw used for cutting wood or the sound of a snowmobile or helicopter when it signifies that rescue is on the way.

A number of other items contribute to the annoyance of a sound. Sounds which engender fear, such as those from wild animals, and prior experiences with sounds are also important in determining their degree of annoyance. Persons who have had pleasant experiences with horses find the sound made by them pleasing, while others with less pleasant memories, such as hiking on trails disturbed by them, dislike their sound. The same holds true of sounds made by native mammals, especially bears and by insects, such as mosquitos. Time of day and type of sleeping accommodation also relate to annoyance. For sounds which are considered annoying, the degree of annoyance is greater in the evening than during the day and greatest at night, whereas the evaluation of pleasing sounds is constant regardless of time of day. In addition, I suspect that some sounds will become annoying if they continue for long time periods.

## 7. IMPLICATIONS

The results of this study as well as others can be used for planning purposes in rural or outdoor recreational environments to enhance the recreational experience of users. It appears to be important to keep the level of human– and technology–related sounds generally low; if possible below the background level of about 15–20 dB(A). In discussing guidelines for planning campsite locations so as to minimize annoyance from noise, Dailey and Redman (1975) suggested that they be located laterally along streams and so as to take advantage of environmental features, such as natural relief and vegetation, but not near lake shores or in meadows. Disturbance from noise may also be minimized by designating different areas for different types of accommodations, such as recreational vehicles, trailers, and tents. Special sections might also be set aside for late arrivals. It would also be desirable to restrict or regulate the use of sound-producing items, such as aircraft overflights, snowmobiles, generators in motor homes, motor boats, and radios, in order to safeguard a recreational milieu. This could be done by legally designating recreational areas as noise-sensitive, limiting noise levels, and making quietness a condition of use. Patrolling campsites and equitable enforcement of regulations is obviously tricky and managers are often hesitant to do so. It would appear, however, that the preponderance of campers would be willing to accept regulations as long as they were reasonable and fairly and impartially administered (Hendee *et al.* 1968). Education concerning the need for low sound levels is probably the most effective way to preserve a quiet atmosphere. Signs such as the ones used in many European cities showing an automobile horn with a red slash through it, might be effective reminders.

If the findings of this study also apply to other rural areas where ambient sound pressure levels are generally low and natural sounds predominate, then nature- and person-related sounds would also be considered pleasing or acceptable. On the other hand, continuous or intermittent technological or mechanical sounds, such as those emitted by compressors and other equipment at gas processing plants, would be deemed annoying even at quite low sound pressure levels or at levels falling within the Alberta ERCB (Energy Resources Conservation Board) directive of between 40 and 56 dB(A) $L_{eq}$. Such sounds have been considered annoying by persons living near such a plant (Dects, pers. comm.). Annoyance would be aggravated at higher sound pressure levels which occasionally occur. Such exotic sounds are urban-type intrusions into rural settings and interfere with the serenity experienced in them. Since affected individuals would likely express their displeasure and possible frustration more vociferously if little or nothing is done to alleviate annoyance, it would appear wise to restrict such sounds to the immediate vicinity of the source. Other technology-related sounds, such as those of road traffic, farm machinery, or even road construction, would likely be tolerated because they are of relatively short duration or interpreted as benefiting rural residents.

## ACKNOWLEDGEMENT

I would like to express my appreciation to the following for their contribution to the research and this paper: F. Babott for designing and constructing the

data acquisition system, writing the computer program and for making suggestions regarding recording and analyzing sounds; the Canada Council and the University of Calgary for research grants; and staff members of the Department of Geography for contributing to the final product.

## REFERENCES

Fidell, S., Barber, D.S., and Schultz, T.J. 1991 "Updating a dosage-effect relationship for the prevalence of annoyance due to general transportation noise," *Journal of the Acoustical Society of America,* 89(1):221-233.

Dailey, T. and Redman, D. 1975 *Guidelines for Roadless Area Campsite Spacing to Minimize Impact of Human-Related Noises,* USDA Forest Service General Technical Report PNW-35.

Deets, V., Plant supervisor, Esso Quirk Creek Gas Plant, personal communication.

Dellora, G.B., Martin, B.V., and Saunders, R.E. 1984 *Motorised Recreational Vehicles: Perception and Recreational Conflict,* Environmental Report No. 17, Monash University, Graduate School of Environmental Science.

Driver, B.L., Nash, R. and Haas, G. 1987 "Wilderness Benefits: A State-of-Knowledge Review," in R. C. Lucas, compiler, *Proceedings-National Wilderness Research Conference: Issues, State of Knowledge, Future Directions,* Fort Collins, CO, July 23-26, 1985, USDA Forest Service General Technical Report INT-220, 294-319.

Galloway, W. J. and Jones, G. 1974 "Motor Vehicle Noise: Identification and Analysis of Situations Contributing to Annoyance," in U.S. Environmental Protection Agency, Office of Noise Abatement and Control, *International Congress on Noise as a Public Health Problem,* Dubrovnik, Yugoslavia 1973, Proceedings, 785-803.

Glass, D. C. and Singer, J.E. 1974 "Behavioral Effects and Aftereffects of Noise," in U.S. Environmental Protection Agency, Office of Noise Abatement and Control, *International Congress on Noise as a Public Health Problem,* Dubrovnik, Yugoslavia 1973, Proceedings, 409-416.

Hall, F.L. and Taylor, S.M. 1977 "Predicting community response to road traffic noise," *Journal of Sound and Vibration* , 52:387-399.

Harrison, R.T. 1974a *Motorcycle Noise,* USDA, Forest Service, Equipment Development and Test Report 2428, San Dimas Equipment Development Center, San Dimas, CA.

—1974b *Sound Propagation and Annoyance under Forest Conditions,* USDA, Forest Service, Equipment Development and Test Report 7120-6, San Dimas Equipment Development Center, San Dimas, CA.

Harrison, R. T., Clark, R.N. and Stankey, G.H. 1980 *Predicting Impact of Noise on Recreationists,* USDA, Forest Service, San Dimas Equipment Development Center, San Dimas, CA.

Hendee, J.C., et al. 1968 *Wilderness users in the Pacific Northwest – Their characteristics, values and management preferences,* USDA Forest Service Research Paper PNW-61, Portland: Pacific Northwest Forest and Range Experiment Station.

Jones, H.W., and Babott, F. 1977 *Internoise 77,* "A Multi-Channel Digital Noise Measuring Apparatus for the Measurement of Noise Propagation," Proceedings, B148-154.

Kariel, H. G. 1978 "Evaluation of Campground Sounds in Canadian Rocky Mountain National Parks," revised version of a paper presented at the Annual Meeting, Association of American Geographers, Salt Lake City, UT. April 14-17, 1977.

— 1980 "Mountaineers and the General Public: A Comparison of Their Evaluation of Sounds in a Recreational Environment," *Leisure Sciences,* 3:155-167.

Kryter, K. D. 1985 *The Effects of Noise on Man,* New York: Academic Press.

Leonard, S. and Borsky, P. N. 1974 "A Causal Model for Relating Noise Exposure, Psycho-social Variables and Aircraft Noise Annoyance," in U.S. Environmental Protection Agency, Office of Noise Abatement and Control, *International Congress on Noise as a Public Health Problem,* Dubrovnik, Yugoslavia 1973, Proceedings, 691-705.

Myles, D.V., Hirvonen, R., Embleton, T.F.W. and Toole, F.E. 1971 *An Acoustical Study of Machinery on Logging Operations in Eastern Canada,* Ottawa:Canadian Forestry Service, Department of Fisheries and Forestry.

Ohlson, B. 1976 "Sound fields and sonic landscapes in rural environments," *Fennia,* 148:33-43.

Parry, H.J. and Parry, J.K. 1972 "The Interpretation and Meaning of Laboratory Determinations of the Effects of Duration on the Judged Acceptability of Noise," *Journal of Sound and Vibration,* 20:51-57.

Schultz, T.J. 1978 "Synthesis of social surveys on noise annoyance," *The Journal of the Acoustical Society of America,* 64:377-405.

TRACOR, 1969 *Public Reaction to Sonic Booms,* TRACOR Document T-70-AU-7136-U, Austin: Tracor.

U.S. EPA (ENVIRONMENTAL PROTECTION AGENCY) 1971 *Community Noise,* Washington, D.C.:Office of Noise Abatement and Control, NTID300.3.

*Canadian Acoustics / Acoustique Canadienne 19(5) 11-15 (1991)* ***Research article / Article de recherche***

# BOTTOM LOSS IN AREAS WITH ICE-RAFTED SEDIMENTS

**Francine Desharnais**
Defence Research Establishment Atlantic (DREA)
P.O. Box 1012, Dartmouth, Nova Scotia B2Y 3Z7

## ABSTRACT

Bottom loss vs grazing angle data was obtained for a location in Baffin Bay. The analysis showed bottom losses decreasing with frequency, for frequencies from 20 to 630 Hz. This feature fits the hypothesis of the presence of ice-rafted sediments, which could be modelled by adding a thin layer of high-impedance material at the sediment surface. Other areas of the North Atlantic Ocean have shown similar features in their bottom loss curves and sediment configuration. The thin-layer approximation appears to be valid for areas where ice-rafting is dominant. Turbidity currents may possibly create the same phenomenon.

## SOMMAIRE

Des analyses de pertes acoustiques en fonction de l'angle d'incidence rasante ont été produites pour une région dans la baie de Baffin. L'analyse a démontré que les pertes acoustiques dues au fond marin diminuent avec la fréquence, pour des fréquences allant de 20 Hz à 630 Hz. Cette caractéristique soutient l'hypothèse de la présence de sédiments déposés par les glaciers (floes), ce qui peut être modelé en ajoutant une mince couche de matériel de grande impédance à la surface des sédiments. D'autres régions de l'océan Atlantique Nord ont montré des caractéristiques semblables dans leurs courbes de pertes acoustiques dues au fond marin et dans leur configuration de sédiments. L'approximation faite avec la couche mince semble être valide pour les régions où les floes sont dominants. Les courants de turbidité peuvent vraisemblablement créer le même phénomène.

## 1. INTRODUCTION

Sound propagation in Arctic regions has recently taken on a new importance, and an effort has been made over the past few years to collect and analyze acoustic data from several Northern areas. DREA produced an analysis of bottom losses vs grazing angle for one station in Baffin Bay which presents an interesting case of what could be a thin layering at the sediment surface. The hypothesis was made that the particular sediment configuration was due to ice-rafted sediments, which are a main characteristic of this northern area.

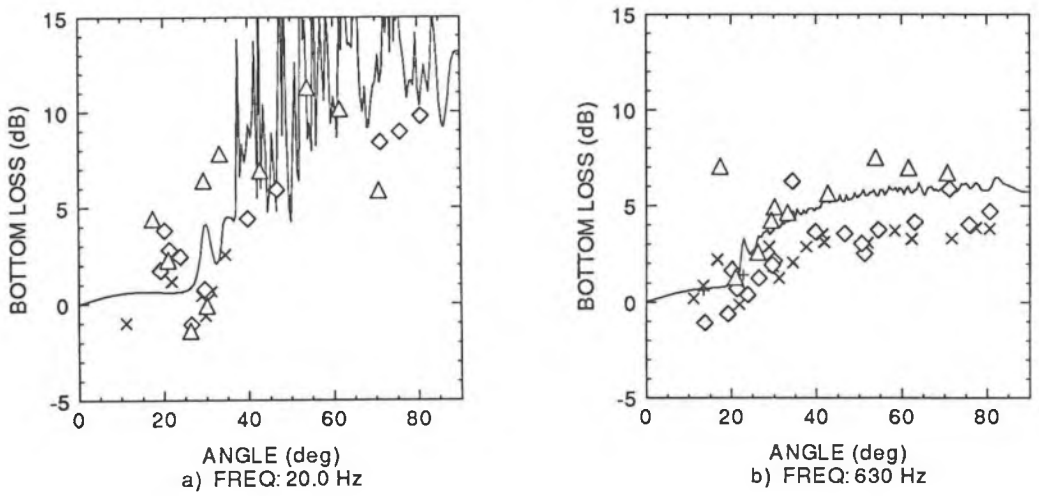
The experiment is described and the bottom loss vs grazing angle data are presented. Extensive modelling was done to support the thin layer hypothesis. This hypothesis seems to be valid for areas where either ice-rafting and/or turbidity currents are the main sediment transportation agents.

## 2. EXPERIMENT AND DATA ANALYSIS

The experiment was conducted by DREA at an unspecified site in Baffin Bay (the site will be referred to as station 1). The research vessel CFAV QUEST deployed and monitored an experimental dipole array of hydrophones (EDA), and HMCS CORMORANT dropped charges along two radial tracks approximately 70 km long, each ending at the station (with approximately 60° between the tracks). 1.8 lb explosive sound sources were used, with a detonation depth around 200 m. The omnidirectional hydrophone depths were set at approximately 300 m. The water depth was relatively constant along the two tracks.

The analysis of the data was done using a set of shot analysis programs available at DREA (Desharnais and Peters, 1989). The programs divide the transients into their diverse components (according to the number of bottom interactions for each component). The energy levels of each component are calculated for several frequency bands of one-third of an octave. Six centre frequencies were chosen, from 20 to 630 Hz. The results, ie. data points of bottom loss vs grazing angle, are shown in Figures 1a and b for 20 and 630 Hz respectively. The grazing angle is the angle between an acoustic propagation vector and the seabed.

The symbols indicate the different number of bottom interactions. The reader is reminded that the lower the number, the more reliable are the data. The data with higher




Figures 1a,b. Bottom loss vs grazing angle, for 20 and 630 Hz, data and SAFARI modelling.
Symbols: ▲ = 1 bottom bounce; ◇= 2 bb; ✱= 3 bb; + = 4 bb; —— = SAFARI.

orders of bottom bounces are consistently lower than the one bottom bounce data at high grazing angles. This problem occurs when the different energy arrivals are too close in time to accurately estimate independently the separate energy levels. The bottom loss is not well defined at very low grazing angles, for any frequency. This problem is due to the low number of charges at long distances. At higher grazing angles, we observe bottom losses decreasing with increasing frequency. Effectively, the bottom losses cluster around 10 dB for the low frequencies (20, 40 Hz), and gradually decrease for higher frequencies (315, 630 Hz), where the values reach 5-6 dB (one bottom bounce data.

## 3. DATA MODELLING

The model used was SAFARI (Seismo-Acoustic Fast field Algorithm for Range-Independent environments; see Schmidt, **1988**). This normal-mode based model can include shear waves for a multi-layered stratified medium. It has the capability to calculate plane-wave reflection coefficients, from which the reflection losses are obtained. In this case, due to the particular geometry of the experiment, these reflection losses are taken to be a good approximation of the observed bottom losses. The geology of the site and the modelling parameters that we used are presented next, followed by the modelling results.

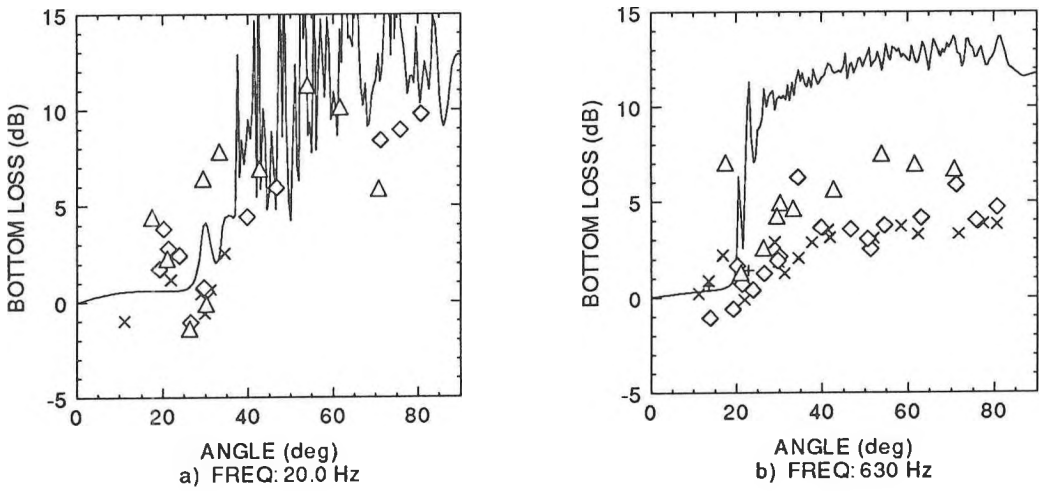
### 3.1 Geology

Jackson, Keen and Barrett (**1977**) as well as Keen and Barrett (**1972**) published seismic refraction and reflection measurements taken in Baffin Bay. These two references thus supply compressional sound speeds and densities for the main bottom layers, down to the mantle. Because of the nature of these measurements, the layers are crudely defined and do not provide a sufficiently refined description of the surface layer.

Several authors though reported core analysis for the area of Baffin Bay where ice-rafting prevails [Aksu and Hiscott (**1989**), Aksu and Piper (**1979**), A. Grant (**1971**) and J. Marlowe (**1968**)]. The first few centimetres are predominantly composed of a yellow-brown to brown gravelly, sandy mud. Scattered pebbles and gravel are present, because of the ice-rafting. Mud aggregates beds (from submarine slumping, and further transportation by suspended flows) were also found in thin layers, in the first few meters. These aggregates might contain as much as 80% of sand-size grains.

A compressional sound speed profile associated with the above bottom description is insufficient to model the data realistically. Even though it represents well the high losses at low frequencies, an additional feature, like the presence of a thin reflector near the surface, is required to explain the low losses at higher frequencies (630 Hz). A high-impedance thin layer would reflect the high frequency energy, but would be transparent to longer wavelengths, ie lower frequencies, which would be absorbed by the soft material underneath the reflector.

Such a thin layer in fact is not unusual since it has been reported in many other areas of the North Atlantic Ocean where core analyses are available. It has been observed in certain areas of Labrador Sea (Gallagher, **1973**), Hatteras Abyssal Plains (Tucholke, **1980**), Sohm Abyssal Plains (Horn et al., **1969**), etc.




Figures 2a,b. As figures 1a,b without the thin layer at the sediment surface.
Symbols: ▲ = 1 bottom bounce; ◆ = 2 bb; ✖ = 3 bb; + = 4 bb; —— = SAFARI.

A thin layer was therefore added to the bottom parameters to obtain a better modelling of the data. An improvement was indeed observed. The best fit was obtained with the addition of a high-impedance layer slightly below the sediment-water interface, between the depths of approximately 0.1 and 0.75 m. The compressional sound speed varies from 1600 to 1830 m/s within the layer, and the density is from 1.6 to 2 g/cm$^3$. The final compressional sound speed profile used to model the sediment and bottom is shown in Figure 3; the top 11 m of sediment is detailled on the inset of Figure 3. Other parameters necessary to model the data, and not found in the previously mentioned literature, were derived from Hamilton (1987).

## 3.2 Modelling Results

Figures 1a and b show, along with the data, the modelling results averaged in one-third octave bands (solid curves), using realistic geo-acoustic parameters (including the thin high-impedance layer at the sediment-water interface). For a comparison, the modelling results obtained with the same parameters, but without the surficial thin layer, are shown in Figures 2a and b, also with the data. The addition of the thin layer yields highly improved results at higher frequencies, as seen at 630 Hz. The oscillations produced by the model at low frequencies are due to the multiple interactions between the acoustic energy and the different bottom layers (resonance effect). The effect is less obvious at high frequencies since the wavelengths are much shorter. At all frequencies, the agreement is within 2-3 dB (except for a few data points) between the modelled and the experimental results, and the difference is even less if we consider only the one-bottom-bounce data points. This good agreement seems to indicate that the geo-acoustical parameters used to model the station 1 data are realistic if the thin layer is included. The small amount of data at low grazing angles makes it hard to conclude anything about the validity of the model at these angles, and on the real shear speeds for station 1. The negative bottom losses seem to indicate that a fair amount of energy is refracted within the sediments. Since SAFARI produces reflection loss data, and not bottom loss data, it cannot effectively model the negative bottom losses due to this phenomenon, even though it handles bottom-refracted waves very well.

There is also some scatter in the data arising from different numbers of bottom interactions. This could be due partly to the lower reliability of the data for higher bottom bounce arrivals, since at this point the signal to noise ratios can be fairly low. Discrepancies at angles above 30° can also be related to the time spreading of the signal. As explained by Vidmar and Oakley (1987), the energy of the first bottom bounce arrival can persist into the two-bottom bounce arrival and so on. This overlapping was found to be negligible for the first bottom bounce arrival, though it could lower the bottom loss of the two and three bottom bounce arrivals by 2-3 dB, as we can observe in Figure 1b. Vidmar and Oakley correlated these discrepancies with scattering from the sea surface; this effect would be mainly observed at wind speeds above 10 kt. Winds of 10 kt and over were effectively recorded for one of our runs, and such a phenomenon could therefore have affected about half the data points.

# 4. DISCUSSION

The bottom-loss data have been successfully modelled using geophysical parameters that are realistic for the area, and the

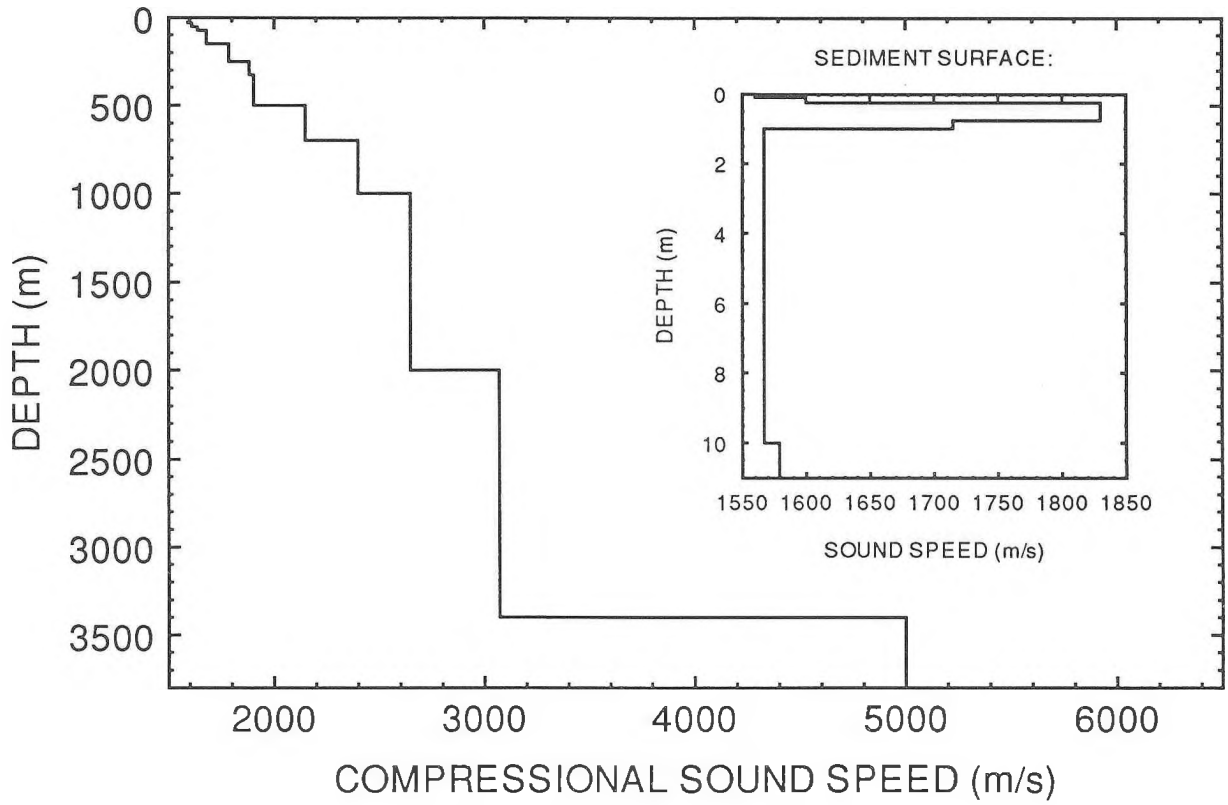



Figure 3. Compressional sound speed profile of the sediments and bottom, used to produce the results of Figure 1. Depth 0 is the water-sediment interface.

addition to the model of a thin layer with a high impedance near the sediment-water interface. Gallagher (1973) has presented the following hypothesis to explain a similar thin layer found at one site in the Labrador Sea. For this particular location, the thin layer has two components: one upper section composed of coarse material overlying a lower section of finer material. Turbidity currents and, to a lesser extent, ice-rafting, are to be held accountable for the presence of coarse material at the sediment surface (upper section of the thin layer), since the material is of the same type as the adjacent continental shelf and land masses. This coarse material is of higher density and sound speed than the sediments that would otherwise be found in the Labrador Sea. The underlying fine material has a higher percent clay size component than other typical cores of the North Atlantic, and it has a lower water content and a higher strength than the coarse layer. The overburden load caused by the coarse layer would have decreased the water content of the underlying material, and increased its sound speed and density. This mechanism would account for the high impedance of the lower section of the thin layer. Care must be taken, however, when considering this mechanism, since it was observed that the fine, high-speed material of the thin layer contained a high percentage of sand. The measurements performed on the core samples to determine water content may therefore be unreliable, since there is a possibility that water escaped during the core sampling, and that the high impedance of the layer was solely due to the high sand content within the layer, and not to the low water content.

It is possible that a similar "coarse layer overload" could explain the data collected at station 1. Ice-rafting is the main sediment transportation agent for at least the first several metres of sediments, in addition to the less important effect of turbidity currents and debris-flow deposits (which could be more important for different layers of the bottom, or different areas). Because of the ice-rafting, there are mud aggregates with high percentages of sand, and a certain amount of sand-mud mixtures, with a high variability in the porosity.

The sediment type at station 1 therefore appears to have a different origin than that shown in Gallagher's data, though

both areas present sandy types of material close to the surface, and coarse material right at the sediment surface. On a first analysis, the same arguments could be used to explain the similar sound speed profiles at the sediment surface for these two areas. Unfortunately, these mixtures are not pure sand, and may not justify an impedance for the thin layer as high as found necessary to model the data. One explanation for this problem might be some water drainage from the sand layers interbedded with the mud layers. This drainage would explain the porosity reduction and the high impedance of the layer. It should also be added that it is possible that the thin layer that was added to the model could also be found at greater depths. Since the high-frequency energy is reflected mostly by the first thin layer, deeper layers cannot be acoustically seen. The model as it stands is still valid, however, since it fits the data very well.

Other processes could also explain the presence of a thin layer at the sediment surface at station 1. The theory of a permafrost layer could possibly explain this peculiar layer. It may also be that the layer is some type of crust due to evaporation of chemicals, although the core analysis did not indicate the presence of any such consolidated material right at the surface. Neither is erosion a satisfactory answer, since it would not explain the thinness of the layer. However, gas hydrates have a similarly high impedance (Max, 1990), and it is possible that they could appear at a relatively small depth within the sediment, although why solid hydrates would form near the sediment surface only could not be explained.

It can therefore be concluded that the most satisfactory explanation for the observed bottom loss phenomenon is that a singular sediment configuration appears when ice-rafting or turbidity currents are mainly responsible for sediment transportation. This type of sediment seems to incorporate a near surface layer probably consisting of coarse grains and low water content; this structure has the effect of increasing the speed and thus the impedance of that layer.

There are methods to determine the sound speed and the thickness of a thin layer using relative arrival time differences from separate energy arrivals (see for example Herstein, Dullea and Santaniello, 1979). Such a method will be tested in the near future as an attempt to confirm the presence of a thin layer at the sediment surface of station 1.

Assuming that we confirm the presence of the layer, it would be interesting to analyze other North Atlantic Ocean sites, and see if the presence of a thin layer is a fairly common phenomenon, extended to more areas where we can have either ice-rafting and/or turbidity currents.

## REFERENCES


Aksu, A.E. and Hiscott, R.N. (**1989**). "Slides and debris flows on the high-latitude continental slopes of Baffin Bay", *Geology*, v. 17, pp. 885-888.

Aksu, A.E. and Piper, D.J.W. (**1979**). "Baffin Bay in the past 100,000 yr", *Geology*, v. 7, pp. 245-248.

Desharnais, F. and Peters, S.D. (**1989**). "Charge analysis at DREA, for water environments", DREA Technical Communication **89/310**.

Gallagher, J. (**1973**). Private communication.

Grant, A.C. (**1971**). "Distributional trends in the recent marine sediments of northern Baffin Bay", *Maritime Sediments*, v. 7, no. 2, pp. 41-63.

Hamilton, E.L. (**1987**). "Acoustic properties of sediments", in: *Acoustics and ocean bottom*, A. Lara-Sáenz, C. Ranz-Guerra, C. Carbó-Fité, eds., C.S.I.C., Madrid.

Herstein, P.D., Dullea, R.K. and Santaniello, S.R. (**1979**). "Hattaras Abyssal Plain low frequency bottom loss measurements", NUSC Technical Report **TR-5781**.

Horn, D.R., Ewing, M., Delach, M.N., Horn, B.M. (**1969**). "A prediction of sonic properties of deep-sea cores, Sohm Abyssal Plain and environs", Lamont Geological Observatory, Palisades, New York, Tech. Rept. No. 2, CU-2-69 NAVSHIPS N00024-69-C-1184.

Jackson, H.R., Keen, C.E. and Barrett, D.L. (**1977**). "Geophysical studies on the eastern continental margin of Baffin Bay and in Lancaster Sound", *Can. J. Earth Sci.*, v. 14, pp. 1991-2001.

Keen, C.E. and Barrett, D.L. (**1972**). "Seismic Refraction Studies in Baffin Bay: An example of a developing ocean basin", *Geophys. J. R. astr. Soc.*, v.30, pp. 253-271.

Marlowe, J.I. (**1968**). "Unconsolidated marine sediments in Baffin Bay", *Jour. Sedimentary Petrology*, v. 37, pp. 1065-1078.

Max, M.D. (**1990**). "Gas hydrates and acoustically laminated sediments: potential environmental cause of anomalously low acoustic bottom loss in deep-ocean sediments", NRL Report **9235**.

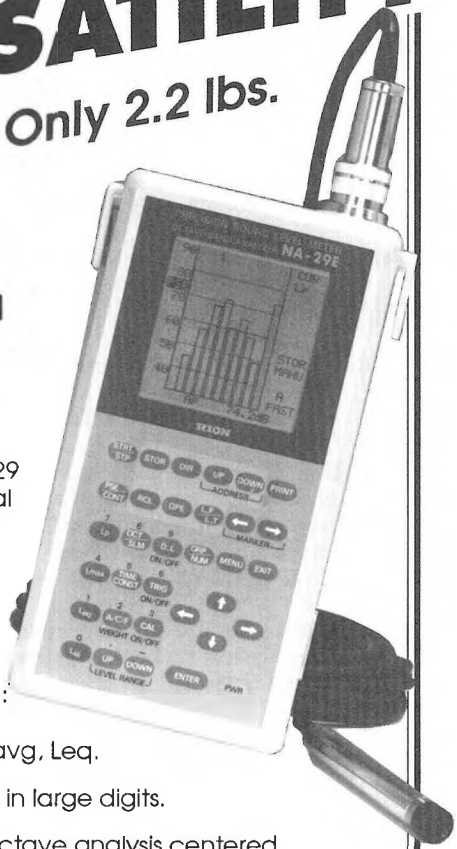
Schmidt, H. (**1988**). "SAFARI - Seismo-Acoustic Fast field Algorithm for Range-Independent environments - User's guide", SACLANTCEN Report **SR-113**.

Tucholke, B.E. (**1980**). "Acoustic environment of the Hatteras and Nares Abyssal Plains, western North Atlantic Ocean, determined from velocities and physical properties of sediment cores", *J. Acoust. Soc. Am.*, v.68, pp. 1376-1390.

Vidmar, P.J. and Oakley, D.W. (**1987**). "NAVOCEANO Bottom loss upgrade support - Difference between first, second, and third bounce bottom loss", Applied Research Laboratories University of Texas at Austin, ARL Technical Report **87-31**.

# INCREDIBLE VERSATILITY

## At Only 2.2 lbs.




Rion's new NA-29 provides unusual capabilities for a pocket-size acoustical analyzer weighing only 2.2 lbs. It's displays include:

- ❑ Lmax, Ln, Lavg, Leq.
- ❑ Sound level in large digits.
- ❑ Real-time octave analysis centered 31.5 Hz. through 8000 Hz.
- ❑ Level vs. time, each frequency band.
- ❑ 1500 stored levels or spectra.
- ❑ Spectrum comparisons.

It also features external triggering, AC/DC outputs, and RS-232C I/O port. A preset processor adds additional versatility for room acoustics and HVAC applications. To minimize external note taking, users can input pertinent comments for each data address. Specify the NA-29E for Type 1 performance or the NA-29 for Type 2.

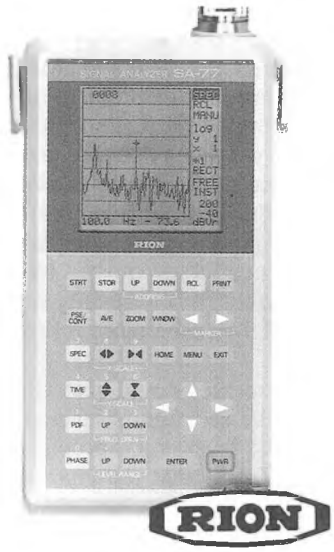
Our combined distribution of Norwegian Electronics and Rion Company enables us to serve you with the broadest line of microphones, sound and vibration meters, RTAs, FFTs, graphic recorders, sound sources, spectrum shapers, multiplexers, and room acoustics analyzers, plus specialized software for architectural, industrial and environmental acoustics. You'll also receive *full* service, warranty and application engineering support. Prepare for the '90s.

***Call today.*** (301) 495-7738

**SCANTEK INC.**
*Norwegian Electronics • Rion*

916 Gist Avenue • Silver Spring, MD 20910

# PALM SIZE FFT




***Amazingly smaller and lighter than a lap-top***

Our new SA-77 FFT Analyzer is a true miniature. Yet it is very big in capability.

- 0 – 1 Hz to 0 – 50 kHz.
- Zooms to 800 lines.
- FFT, phase and PDF analysis and time waveform.
- External sampling for order analysis.
- Stores 150 screen displays plus 30K samples of time data.
- Single/double integration or differentiation.
- Arithmetic/exponential averaging or peak-hold.
- Built-in RS-232C.
- $8\frac{1}{4}$ X $4\frac{3}{8}$ X $1\frac{1}{2}$ inches.
- 23 ounces.

Call today. Discover how much noise, vibration and general signal analysis capability you can hold in the palm of your hand. And at how reasonable a cost.

**SCANTEK INC.**
*Norwegian Electronics • Rion*

916 Gist Avenue, Silver Spring, MD, USA 20910 • (301) 495-7738

# ATTENUATIONS FROM HEARING PROTECTORS AND THE ABC CLASSIFICATION SYSTEM

**Alberto Behar, P.Eng.**
Ontario Hydro, 757 McKay Road
Pickering, Ontario L1W 3C8

## SUMMARY

This paper evaluates the accuracy of the CSA ABC class system for rating hearing protectors. The noise level of the protected ear of twelve protectors (six Class A and six Class B) subjected to twelve noises were calculated. It was shown that there is large variation among sound levels from both protector classes as well as overlaps, resulting mostly in overprotection. It is recommended that the ABC system be changed to some other rating system used by the international community.

## SOMMAIRE

Cet article s'intéresse â l'adéquacité de la classification ABC dans l'ACNOR pour l'évaluation des protecteurs auditifs. Le niveau de pression acoustique atteignant l'oreille protégée par douze protecteurs différents (six de classe A et six de classe B) soumis à douze bruits différents est calculé. Les résultats démontrent une dispersion importante des niveaux de pression acoustique ainsi que des chevauchements pour les deux classes de protecteurs, résultent principalement en une "sur-protection". Il est recommandé que le système ABC soit écarté au profit d'un autre système d'évaluation utilisée par la communauté internationale.

## 1.0 OBJECTIVE

The ABC Classification system in the CSA Standard for hearing protectors[1] has been under discussion for many years within the CSA Committee as well as among the Canadian scientific community, manufacturers and users. The fact that Canada is the only place in the world where this system is used has been often pointed out. Also, the ease and simplicity in using the NRR[2] as a simplified substitute to the NIOSH "long" method[3] has been debated.

This paper intends to bring a different approach to this discussion by examining the intrinsic value of the ABC system. To this effect, sound level of the protected ear, resulting from the use of twelve protectors (six Class A and six Class B) in twelve different noises was calculated. Accuracy of the system was examined by analyzing overlaps and spreads of sound levels of the protected ear when using Class A and B protectors. The adequacy of using a particular class of protector for a given noise was also tested for the noises used in the study.

## 2.0 INTRODUCTION

### 2.1 Background

Protectors are intended to reduce the sound level that reaches the tympanic membrane of the ear of a person exposed to noise ("sound level of the protected ear"). Consequently, the sound attenuation is one of the most important parameters of a protector. The almost universally accepted ANSI method[5] (similar to the ISO one[6]) allows for the measurement of the protector's sound attenuation at each one of the measurement frequencies, 125 Hz through 8000 Hz. It also provides a mean for assessing the variability between and within test subjects using the standard deviation of the measured attenuations.

Results from the measurement of the attenuation of protectors are used to:

(a) determine if a protector is appropriate for a given noise by calculating the sound level of the protected ear, and

(b) compare protectors.

A variety of methods allow for the calculation of the sound level of the protected ear, using attenuation values measured in laboratories around the world. It is well known that those attenuations are higher than these obtained in real world situations. Because all classification methods use the same source of information, (laboratory measured attenuations), the same criticism regarding non-realistic results applies to all and everyone of the prediction methods.

## 2.2 The ABC Classification System

The CSA Standard on hearing protectors provides details on how to classify a protector into Class A, B or C according to the attenuation measured as per the ANSI Standard. No provisions are made for using the standard deviation of the measurements.

The CSA classification system was originated as an attempt to set performance requirements for plugs and muffs. It was incorporated in the CSA Standard Z94.2-1965[4]. Later, the system was modified following a proposal by Berger[8]. The attenuation of the hearing protectors was reduced to reflect their performance in real life situations. To that effect, Class A protectors were derated by 4 dB, Class B by ten and Class C by eight. To simpligy the derating and in a somehow arbitrary manner, no difference was made between derating of plugs and muffs.

## 2.3 Use of the Measured Attenuation

Attenuation results are used in one of the following ways:

(a) To calculate the sound level of the protected ear. This is the approach taken by the international community using the NIOSH "long" method[3], the NRR[4] and the HML[7] Method.

This approach has the advantage of allowing for the calculations of the sound level of the protected ear. In some instances it takes into account the entire spectrum of the ambient noise (NIOSH "long" method). In some others (NRR) it only uses the C-Weighted sound level of the noise. Finally, the HML method uses both A and C-weighted sound levels.

(b) To divide protectors in classes according to the mean attenuation at the measured frequencies. Use of a given class of protector depends on the time weighted average sound level the person is exposed to. This method is only used in Canada in the CSA Standard.

One advantage of this method is of being procedural: no calculations are needed to determine the class of the protector to be used.

## 3.0 MATERIAL

Twelve different noises (No. 1 through No. 12) and twelve protectors (A through L) were used in this study. Some of the noises are real (measured in real life situations), while other are shaped artificially. Details of the noises are presented in Table 1, Figure 1 and Figure 2. They were chosen so that to cover a wide variety of spectra. Details of the twelve protectors (six Class A and six Class B), their attenuations and CSA classes are presented in Table 2. All data are those supplied by manufacturers.

TABLE 1

NOISES USED IN THE STUDY

| No. | Type of Noise | Sound Levels, dB* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Octave Band Centre Frequencies, Hz | | | | | | |
| | | A | Lin | C | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
| 1 | Air chisel chipping | 109.4 | 110.1 | 109.4 | 90 | 98 | 104 | 102 | 100 | 103 | 104 |
| 2 | -4 dB/oct | 99.3 | 107.2 | 107.1 | 105 | 101 | 97 | 93 | 89 | 85 | 81 |
| 3 | Air compressor | 100.2 | 102.7 | 102.5 | 65 | 100 | 91 | 93 | 93 | 94 | 89 |
| 4 | Chemical reactor | 92.9 | 94.4 | 94.3 | 82 | 87 | 88 | 90 | 86 | 76 | 66 |
| 5 | +4 dB/oct | 111.9 | 112.2 | 110.4 | 86 | 90 | 94 | 98 | 102 | 106 | 110 |
| 6 | Bell shape | 95.4 | 96.1 | 95.9 | 82 | 86 | 90 | 90 | 90 | 86 | 82 |
| 7 | Blower | 94.8 | 95.8 | 95.7 | 86 | 87 | 88 | 90 | 90 | 84 | 72 |
| 8 | Feeding pump | 92.8 | 94.9 | 94.8 | 82 | 89 | 90 | 87 | 86 | 83 | 75 |
| 9 | Wood chipper | 102.8 | 106.5 | 106.4 | 97 | 102 | 102 | 95 | 95 | 91 | 85 |
| 10 | Clarifier | 94.4 | 94.5 | 94.3 | 78 | 82 | 87 | 88 | 90 | 86 | 78 |
| 11 | Compressor | 99.5 | 100.1 | 99.9 | 81 | 90 | 93 | 96 | 93 | 88 | 86 |
| 12 | Grinder | 103.5 | 102.5 | 102.0 | 64 | 72 | 81 | 85 | 101 | 95 | 92 |

* Octave band levels were rounded to the nearest dB; A, C and Lin levels were obtained by calculation and were rounded to the nearest tenth of dB.

Since the objective of this paper is to compare treatment of laboratory data, no allowance is made here to compensate for the difference between laboratory and real life attenuation results.

TABLE 2

LIST OF HEARING PROTECTORS USED IN THIS STUDY

| Letter | Manufacturer | Model | Type | Attenuation - 2 Standard Deviations, dB | | | | | | | CSA Class |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | |
| A | Willson Prod. Division | Sound Band | Semi-insert | 16.4 | 12.8 | 12.4 | 12.8 | 23.4 | 25.6 | 36.8 | B |
| B | Bilsom International Inc | Prop-O-Plast | Plug | 15.4 | 17.8 | 18.2 | 18.0 | 26.2 | 33.0 | 27.6 | B |
| C | Mine Safety Appliances Company | Noise-foe Mark IV | Muff | 7.2 | 12.2 | 18.6 | 31.0 | 29.6 | 36.4 | 29.6 | A |
| D | American Optical Company | 1720 | Muff | 12.0 | 17.0 | 26.6 | 39.3 | 39.1 | 43.4 | 32.3 | A |
| E | Cabot S.C. Safety Corp. | E-A-R | Plug | 23.6 | 26.0 | 26.2 | 32.2 | 34.4 | 39.6 | 36.4 | A |
| F | Mine Safety Appliances Company | Ear De-fender | Plug | 10.4 | 8.2 | 11.0 | 15.2 | 18.8 | 15.2 | 7.6 | B |
| G | Safety Supply Canada | 204 | Muff | 7.2 | 13.2 | 20.5 | 31.2 | 33.4 | 35.8 | 32.5 | B |
| H | Glendale Optical Company | GN901 | Muff | 8.8 | 14.8 | 25.6 | 31.2 | 33.8 | 37.0 | 27.6 | A |
| I | Peltor | H9A | Muff | 10.6 | 11.0 | 20.3 | 28.4 | 32.9 | 35.9 | 29.3 | B |
| J | North | Com-Fit | Plug | 15.1 | 20.5 | 25.1 | 27.4 | 33.8 | 42.1 | 40.8 | A |
| K | Cabot S.C. Safety Corp. | Ultra Fit | Plug | 27.5 | 28.7 | 32.1 | 28.9 | 26.5 | 29.6 | 39.4 | A |
| L | Peltor | H9P3e | Cap. Muff | 9.9 | 12.5 | 20.9 | 25.4 | 32.5 | 33.6 | 30.5 | B |

## 4.0 METHOD AND RESULTS

Sound levels of the protected ear, in dBA, were calculated for each of the one hundred and forty-four combination protector/noise, using the NIOSH "long" method. They are presented in Table 3. The Table also shows the CSA class of each protector and the sound level in dBA of each noise. As an example, when wearing Protector I (Class B) while exposed to the Noise 9 (SL=102.8 dBA), the noise level of the protected ear will be 84.2 dBA, while it will be 70.9 dBA, when exposed to Noise 12 (103.5 dBA).

TABLE 3

SOUND LEVELS OF THE PROTECTED EAR

| Protectors | | Noises (3) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Letter (1) | Class (2) | SL dBA | 109.4 | 99.3 | 100.2 | 92.9 | 111.9 | 95.4 | 94.8 | 92.8 | 102.8 | 94.4 | 99.5 | 103.5 |
| C | A | | 84.4 | 84.6 | 79.9 | 70.2 | 81.8 | 71.2 | 61.6 | 69.2 | 84.3 | 68.5 | 74.6 | 73.4 |
| D | A | | 77.9 | 79.5 | 74.8 | 63.9 | 77.6 | 64.4 | 63.1 | 62.0 | 78.4 | 61.3 | 67.8 | 65.0 |
| E | A | | 77.2 | 71.8 | 68.8 | 62.3 | 75.8 | 63.9 | 62.4 | 62.8 | 74.5 | 61.9 | 67.9 | 68.5 |
| H | A | | 80.8 | 82.3 | 77.1 | 66.7 | 82.2 | 67.2 | 66.1 | 65.0 | 80.6 | 64.5 | 70.9 | 70.1 |
| J | A | | 79.2 | 77.1 | 72.8 | 65.7 | 75.4 | 66.5 | 64.8 | 65.5 | 77.4 | 64.3 | 71.0 | 69.1 |
| K | A | | 79.4 | 70.2 | 71.5 | 64.4 | 80.8 | 67.1 | 66.9 | 64.0 | 73.5 | 66.5 | 71.0 | 76.2 |
| A | B | | 92.3 | 85.5 | 83.7 | 78.8 | 88.2 | 79.6 | 77.7 | 79.0 | 88.7 | 77.4 | 84.6 | 80.3 |
| B | B | | 87.2 | 80.9 | 78.6 | 73.6 | 85.2 | 74.4 | 72.7 | 73.8 | 83.3 | 72.4 | 79.4 | 77.0 |
| F | B | | 97.7 | 88.0 | 87.4 | 78.7 | 101.9 | 81.2 | 81.3 | 80.6 | 90.7 | 79.2 | 85.2 | 87.5 |
| G | B | | 82.8 | 84.1 | 78.8 | 68.9 | 79.6 | 69.6 | 68.0 | 67.6 | 83.0 | 66.7 | 73.1 | 70.1 |
| I | B | | 83.8 | 83.6 | 80.8 | 70.2 | 81.7 | 70.6 | 69.4 | 68.7 | 84.2 | 67.7 | 74.4 | 70.9 |
| L | B | | 83.6 | 83.1 | 87.6 | 70.0 | 81.4 | 70.5 | 69.2 | 69.0 | 83.2 | 67.9 | 74.7 | 71.4 |

Note: Sound levels were calculated using the NIOSH "long" method

(1) From Table 2
(2) As per CSA Standard
(3) From Table 1

Protectors were further divided into two groups according to their CSA class: one group contains six Class A protectors and the other six Class B protectors. For each noise and class of protectors, the maximum and minimum sound levels of the protected ear, as well as their ranges were calculated. Maximums, minimums and ranges are shown in Table 4. The graph in Figure 3 shows the maximum and minimum values, while the graph in Figure 4 shows their ranges. Figure 5 shows the overlap existing between the maximum SL using a protector Class A and the minimum SL using a Class B.

## 5.0 DISCUSSION

It is accepted that the best prediction of the sound level of the protected ear is obtained by using the NIOSH "long" method. It has also been shown, that no large differences appear between results from using the above method or anyone of the NRR and the HML methods. [9] [10]

As mentioned at the beginning, the ABC is a procedural method. As such, it implies that the use of a given type of protector, ensures a "safe" sound level of the protected ear, without having to confirm it through calculation of the noise level of the protected ear. As per the CSA Standard, a Class A protector is to be used in sound levels up to 105 dBA and a Class B up to 95 dBA. There is an implicit assumption that a Class A protector has a 10 dBA higher attenuation than a Class B.

Data in Table 4, Figure 3 and Figure 4 show that there is a wide variation among the sound levels of the protected ear among protectors of the same class. Depending of the noise involved, their range varies between 5.3 and 14.4 dBA for Class A protectors and between 7.1 dBA and 22.3 dBA for Class B protectors.

The examination of Table 3 and Figure 3 shows that there is also a large overlap between sound levels of the protected ear using Classes A and B protectors. In almost all cases, the maximum sound level of the protected ear using a Class A protectors results in a higher sound level than the lower sound level using a Class B protector, meaning that a Class A protector is not always better than a Class B. Differences ranging between -1 dBA and +6 dBA are shown in the graph of Figure 5.

The wide variation of sound levels of the protected ear and their overlap leads us to the conclusion that there is no clear difference between sound levels of the protected ear using protectors of Class A and Class B. Therefore, there cannot be a safe guideline as to when to wear what.

TABLE 4

SOUND LEVELS OF THE PROTECTED EAR

(maximum, minimum and ranges)

| Protectors Class | SL | Noises | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | | SL, dBA | 109.4 | 99.3 | 100.2 | 92.9 | 111.9 | 95.4 | 94.8 | 92.8 | 102.8 | 94.4 | 99.5 | 103.5 |
| A | Min | | 77.2 | 70.2 | 68.8 | 62.3 | 75.4 | 63.9 | 61.6 | 62.0 | 73.5 | 61.3 | 67.8 | 65.0 |
| | Max | | 84.4 | 84.6 | 79.9 | 70.2 | 82.2 | 71.2 | 66.9 | 69.2 | 84.3 | 68.5 | 74.6 | 76.2 |
| | Range | | 7.2 | 14.4 | 11.1 | 7.9 | 6.8 | 7.3 | 5.3 | 7.2 | 10.8 | 7.2 | 6.8 | 11.2 |
| B | Min | | 82.8 | 80.9 | 78.6 | 68.9 | 79.6 | 69.6 | 68.0 | 67.6 | 83.2 | 66.7 | 73.1 | 70.1 |
| | Max | | 97.7 | 88.0 | 87.6 | 78.8 | 101.9 | 81.2 | 81.3 | 80.6 | 90.7 | 79.2 | 85.2 | 87.5 |
| | Range | | 14.9 | 7.1 | 9.0 | 9.9 | 22.3 | 11.6 | 13.3 | 13.0 | 7.5 | 12.5 | 12.1 | 17.4 |

Finally, the validity of Table 1.A of the Standard was tested against the sound levels of the protected ear calculated in Table 3. To account for the derating of 4 dB (Class A protectors) and 10 dB (Class B protectors), Table 5 was developed, where those levels were added to the levels in Table 3. Next step was to see how many protectors of each Class reduce the sound level of the protected ear to 85 dB for each one of the twelve noises. Table 6 shows the result. In this table, the first row lists noise numbers and the second their levels in dBA. Next row contains the Class of protector to be used for that noise as per Table 1.A of the Standard. The following two rows show the number of protectors from this study that will satisfy the requirement of reducing the noise level of the protected ear to the required 85 dBA (or less).

Table 6 shows that, for instance, for noise No. 1 (SL=109.4 dBA), the CSA requirement is for a combination of a plug and a muff. However five of the six Class A protectors will be sufficient by themselves without being used in combination. Therefore the CSA recommendation will result in overprotection.

In the case of noise No. 2 only four of the six Class A protectors will provide the required reduction.

The last row of the table summarizes the findings:

(a) in only one case (noise No. 3) all six Class A are adequate and none of the Class B could be used. Therefore, the Class system works.

(b) in six cases (noises No. 2, 4, 7, 8, 9 and 10) not all protectors of the assigned classes are adequate, and

(c) in five cases (noises No. 1, 5, 6, 11 and 12) protectors of a lower class will also be sufficient.

Therefore, in one out of twelve cases, the Class system works correctly.

## 6.0 CONCLUSIONS

As stated before, the conclusions of this study apply only to:

(a) protectors and noises studies here, and
(b) to attenuations provided by manufacturers. No derating for real life situations has been done.

The CSA Standard ABC classification and selection method is supposed to insure a proper protection of wearer's hearing by dividing protectors into Classes A, B and C and indicating the maximum sound level the person should be exposed to. Those maximum levels are:

105 dBA for protectors Class A
95 dBA for protectors Class B, and
89 dBA for protectors Class C.

The obvious implication is that the attenuations from protectors Class A are at least 10 dBA higher than those of Class B and 16 dB than those of Class C.

Results from this study show that this is not the case and that there are large variations and overlaps between sound levels of the protected ear when wearing either Class A or Class B protectors. There is a basic inconsistency in the results of assigning a particular Class of protector for a given noise, as hown in Table 6.

The conclusion is that the Class ABC system is not a reliable one and should be replaced by other method (or methods, as done by the ISO), developed on a more scientific basis and recognized by the scientific community.
The conclusion is that the Class ABC system is not a reliable one and should be replaced by other method (or methods, as done by the ISO), developed on a more scientific basis and recognized by the scientific community.

## REFERENCES


(1) CSA Z94.2-M1984: Hearing Protectors

(2) "Noise Labelling Requirements for Hearing Protectors" Fed. Register 42:190 (September 1979) p.p. 56139-147

(3) HEW Publication No. (NIOSH) 76-120: List of Personal Hearing Protectors and Attenuation Data (1975)

(4) Shaw, E.: The Canadian Standard Association Classification of Hearing Protectors in P.W. Albert: Editor: Personal Hearing Protection in Industry, Raven Press, NY, 1982 (91-99)

(5) ANSI Standard S12.6-1984: Method for the Measurement of the REal-Ear Attenuation of Hearing Protectors

(6) ISO 4869-1 Acoustics - Hearing Protectors - Part 1: Subjective Method for the Measurement of Sound Attenuation (1990)

(7) Lundin, R.: Three Methods for Calculating the Attenuation Index of a Hearing Protector S-260 50. Billesholm, Sweden: Bilsom, A.B., 1987

(8) Berger, E.H.: Letter to Dr. S. Forshaw, April 1983

(9) Behar, A.: Attenuation of Hearing Protectors and the NRR Factor, Am.Ind.Hyg.Assoc.J.42:904-908 (1981)

(10) Behar, A.: The High, Medium and Low Method - A Better Noise Reduction Rating? Am.Ind.Hyg.Assoc.J.51:659-662 (1990)


**TABLE 5**

**SOUND LEVELS OF THE PROTECTED EAR**

| Protectors | | Noises | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Letter | Class | SL dBA | 109.4 | 99.3 | 100.2 | 92.9 | 111.9 | 95.4 | 94.8 | 92.8 | 102.8 | 94.4 | 99.5 | 103.5 |
| C | A | | 88.4 | 88.6 | 83.9 | 74.2 | 85.8 | 75.2 | 65.6 | 73.2 | 88.3 | 72.5 | 78.6 | 77.4 |
| D | A | | 81.9 | 83.5 | 78.8 | 67.9 | 81.6 | 68.4 | 67.1 | 66.0 | 82.4 | 65.3 | 71.8 | 69.0 |
| E | A | | 81.2 | 75.8 | 72.8 | 66.3 | 79.8 | 67.9 | 66.4 | 66.8 | 78.5 | 65.9 | 71.9 | 72.5 |
| H | A | | 84.8 | 86.3 | 81.1 | 70.7 | 86.2 | 71.2 | 70.1 | 69.0 | 84.6 | 69.4 | 74.9 | 74.1 |
| J | A | | 83.2 | 81.1 | 76.8 | 69.7 | 79.4 | 70.5 | 68.8 | 69.5 | 81.4 | 68.3 | 75.0 | 73.1 |
| K | A | | 83.4 | 74.2 | 75.5 | 68.4 | 84.8 | 71.1 | 70.9 | 68.0 | 77.5 | 70.5 | 75.0 | 80.2 |
| A | B | | 102.3 | 95.5 | 93.7 | 88.8 | 98.2 | 89.6 | 87.7 | 89.0 | 98.7 | 87.4 | 94.6 | 90.3 |
| B | B | | 97.2 | 90.9 | 88.6 | 83.6 | 95.2 | 84.4 | 82.7 | 83.8 | 93.3 | 82.4 | 89.4 | 87.0 |
| F | B | | 107.7 | 98.0 | 97.4 | 88.7 | 111.9 | 91.2 | 91.3 | 90.6 | 100.7 | 89.2 | 95.2 | 97.5 |
| G | B | | 92.8 | 94.1 | 88.8 | 78.9 | 89.6 | 79.6 | 78.0 | 77.6 | 93.0 | 76.7 | 83.1 | 80.1 |
| I | B | | 93.8 | 93.6 | 90.8 | 80.2 | 91.7 | 80.6 | 79.4 | 78.7 | 94.2 | 77.7 | 84.4 | 80.9 |
| L | B | | 93.6 | 93.1 | 97.6 | 80.0 | 91.4 | 80.5 | 79.2 | 79.0 | 93.2 | 77.9 | 84.7 | 81.4 |

Note: Sound levels were calculated following the procedure in the NIOSH "long" method and then 4 dB were added to all Class A protectors and 10 dB to all Class B protectors.

**TABLE 6**

**PROTECTOR'S CLASS AS PER THE CSA STANDARD**

| NOISE NUMBER | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SL, dBA | | 109.4 | 99.3 | 100.2 | 92.9 | 111.9 | 95.4 | 94.8 | 92.8 | 102.8 | 94.4 | 99.5 | 103.5 |
| CLASS AS PER THE CSA STANDARD | | A plug + A or B muff | A | A | B | A plug + A or B muff | A | B | B | A | B | A | A |
| NUMBER OF PROTEC-TORS | Class A | 5 | 4 | 6 | N/A | 4 | 6 | N/A | N/A | 5 | N/A | 6 | 6 |
| | Class B | 0 | 0 | 0 | 4 | 0 | 4 | 4 | 4 | 0 | 4 | 3 | 3 |
| CORRECT CLASS ASSIGNED | | NO | | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |

Figure 1

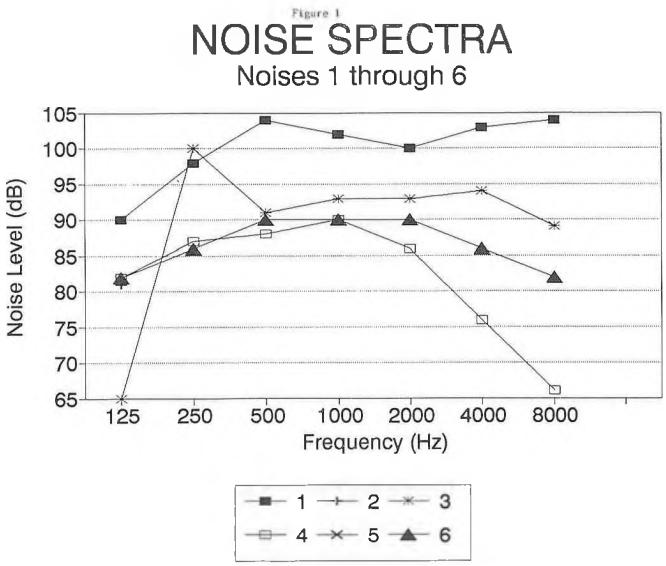



Figure 2

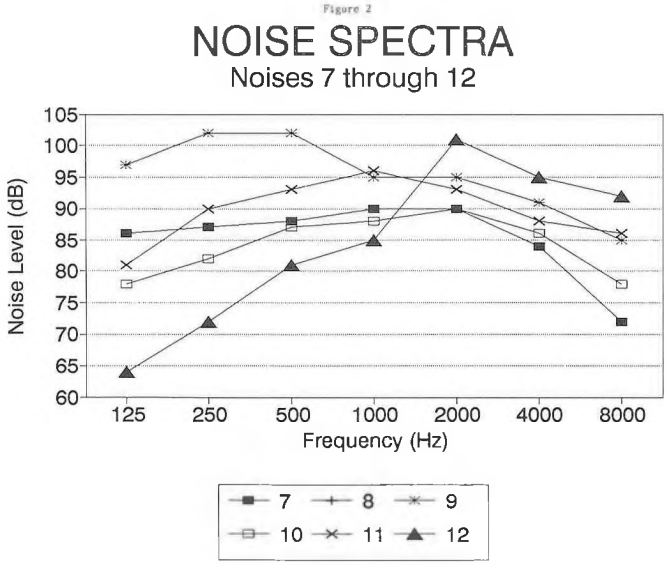



Figure 3

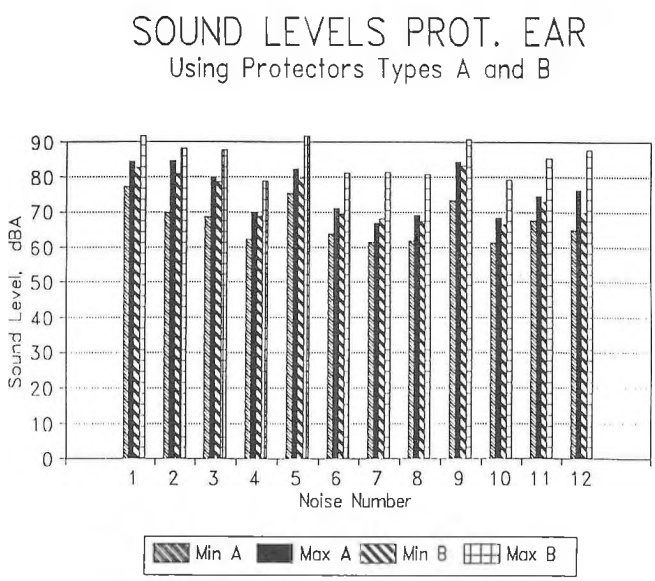



Figure 4

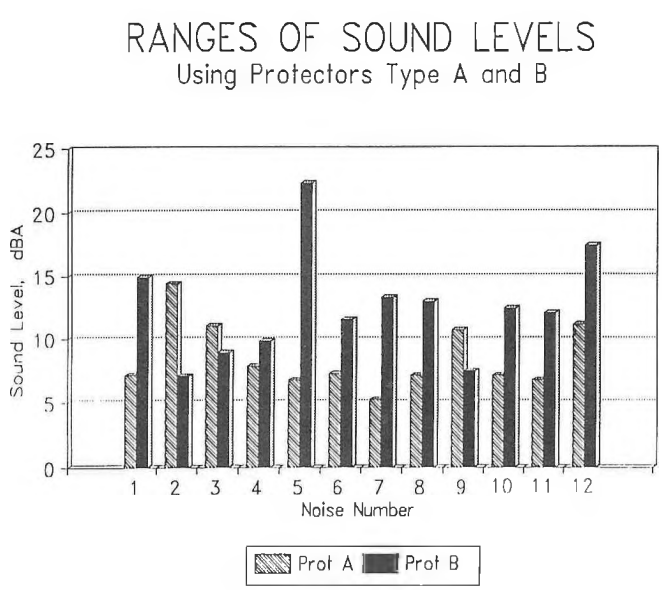
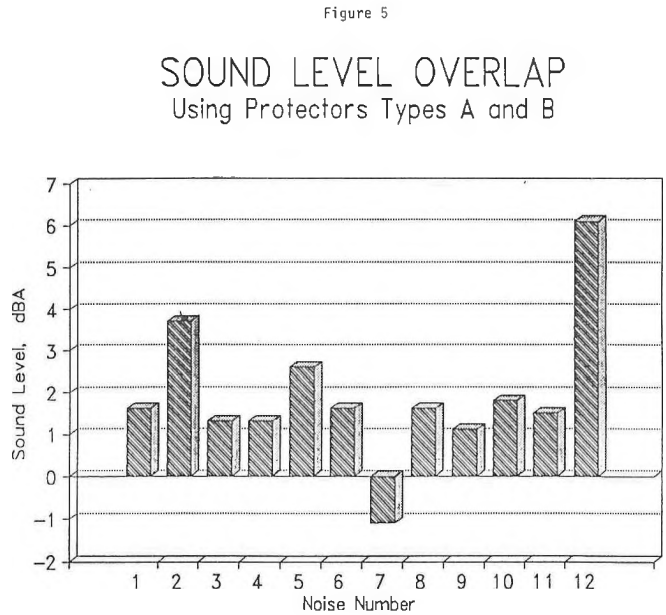



Figure 5



# FLOW-INDUCED VIBRATIONS, 2nd ed.

## by Robert D. Blevins

This is the Second Edition of Dr. Blevins' book. It is an expanded and up-dated version of the original which was published in 1977. The book has a pronounced applied orientation and is designed to provide students and practising engineers with the tools required to deal with a broad range of fluid-structure interaction problems. These include the dynamic response of tall buildings, long span bridges and electric power cables under wind action, the vibration problems of tube arrays and other parallel structures, the dynamic response of off-shore platforms to wave action, the fluid-elastic instability of towed cables, other marine applications, and aeroacoustic excitation and sound generation. Entirely new in this edition are a review of aircraft flutter and sonic fatigue and a chapter devoted to "ideal fluid flow".

The book begins with a brief presentation of the principal dimensional parameters that are encountered in later chapters. This is followed by the new chapter on Ideal Fluid Flows. Useful material is provided in this chapter for determining "added mass"; otherwise the presentation is academic in style and of little value to the practising engineer.

The next several chapters deal, in turn, with the fluid-structure interaction phenomena responsible for dynamic response; vortex-induced vibration, galloping and flutter, aeroelastic instabilities of tube and cylinder arrays, vibrations induced by oscillatory flows and vibrations induced by turbulence and sound. The engineering problems caused by these phenomena are described. Experimental data and analytical procedures are provided to help the engineer design around the problems. Attention is also directed towards approaches to the reduction of vibration. In most sections, example problems are analyzed and additional exercises are provided to make the book more suitable for student use.

These chapters are followed by a chapter on structural damping and devices for augmenting damping. A useful review is provided of field and laboratory measurements of damping values. Finally there is a chapter on sound generated by vortex shedding and a chapter on the vibrations of pipes that are induced by internal flow and axial external flow.

The book leaves the impression of being well-edited but is not without some editorial errors. It might be faulted for not including some of the more recent developments; for example, the measurement and use of "Scanlan" coefficients for analysis of bridge motion, the dynamic force balance technique for wind tunnel investigation of buildings, the development of tuned liquid or liquid sloshing dampers and the recently identified wind-rain induced instability of the sloping stays of cable-stayed bridges.

The scope of the book is enormously broad. It encompasses much of the fields of fluid dynamics and structural dynamics. The complex interaction between the two has been admirably dealt with in this book. The breadth of the subject and the number of problems addressed has made it difficult in many cases to cover the individual topics with the depth required by the engineer. However, the book will alert him to the potential, flow-induced vibration problems and for those wishing to probe a particular topic in more depth, they will find that excellent referencing has been provided.

The new material in the Second Edition, the reorganization of much of the content and a generally more attractive presentation has resulted in a significant improvement over the earlier version. As a "basically introductory" book it provides much useful data and analytical methodology and a good basic understanding of the fluid-elastic phenomena. Good books that deal with the destructive forces of wind and waves that can lead to the failure of long span bridges and overturning off-shore platforms are always welcome. This book would enhance the libraries of many engineers and academics.

*[This book (ISBN 0-442-20651-8) is available from Van Nostrand Reinhold at a price of $59.95].*

**Reviewed by Robert L. Wardlaw, Guest Worker, Applied Aerodynamics Laboratory, National Research Council, Ottawa.**

ECKEL

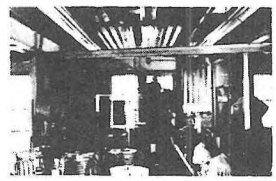
# Noise Control Products & Systems

## for the protection of personnel... for the proper acoustic environment...

### engineered to meet the requirements of Government regulations

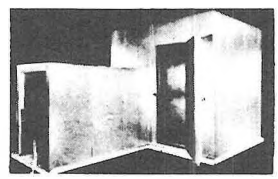
**Eckoustic® Functional Panels**

Durable, attractive panels having outstanding sound absorption properties. Easy to install. Require little maintenance. EFPs reduce background noise, reverberation, and speech interference; increase efficiency, production, and comfort. Effective sound control in factories, machine shops, computer rooms, laboratories, and wherever people gather to work, play, or relax.



**Eckoustic® Enclosures**

Modular panels are used to meet numerous acoustic requirements. Typical uses include: machinery enclosures, in-plant offices, partial acoustic enclosures, sound laboratories, production testing areas, environmental test rooms. Eckoustic panels with solid facings on both sides are suitable for constructing reverberation rooms for testing of sound power levels.



**Eckoustic® Noise Barrier**

● **Noise Reduction Curtain Enclosures** ● **Machinery & Equipment Noise Dampening**

The Eckoustic Noise Barrier provides a unique, efficient method for controlling occupational noise. This Eckoustic sound absorbing-sound attenuating material combination provides excellent noise reduction. The material can be readily mounted on any fixed or movable framework of metal or wood, and used as either a stationary or mobile noise control curtain.

**Acoustic Materials & Products** for dampening and reducing equipment noise

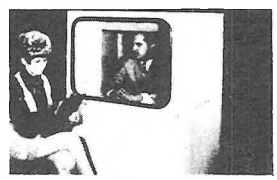
**Multi-Purpose Rooms**

Rugged, soundproof enclosures that can be conveniently moved by fork-lift to any area in an industrial or commercial facility. Factory assembled with ventilation and lighting systems. Ideal where a quiet "haven" is desired in a noisy environment: foreman and supervisory offices, Q.C. and product test area, control rooms, construction offices, guard and gate houses, etc.

**Audiometric Rooms: Survey Booths & Diagnostic Rooms**

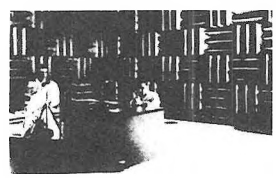
Eckoustic Audiometric Survey Booths provide proper environment for on-the-spot basic hearing testing. Economical. Portable, with unitized construction.

Diagnostic Rooms offer effective noise reduction for all areas of testing. Designed to meet, within ±3 dB, the requirements of MIL Spec C-81016 (Weps). Nine standard models. Also custom designed facilities.



**An-Eck-Oic® Chambers**

Echo-free enclosures for acoustic testing and research. Dependable, economical, high performance operation. Both full-size rooms and portable models. Cutoff frequencies up to 300 Hz. Uses include: sound testing of mechanical and electrical machinery, communications equipment, aircraft and automotive equipment, and business machines; noise studies of small electronic equipment, etc.



For more information, contact

**ECKEL INDUSTRIES OF CANADA, LTD.,** Allison Ave., Morrisburg, Ontario • 613-543-2967

**ECKEL INDUSTRIES, INC.**

# REGULATION OF SOUND LEVELS IN THE FEDERAL JURISDICTION

**Baily Seshagiri, Labour Canada / Travail Canada**

A comprehensive set of revisions to Part VII ("Levels of Sound") of the Canada Occupational Safety and Health Regulations was published in the Canada Gazette, Part II, on July 31, 1991, and became law as of that date. This is the culmination of nearly 3 years of discussions between the employers and employees under the federal jurisdiction, with Labour Canada acting as the facilitator, and providing technical, legal and administrative support. The revisions are extensive and the new regulation appears to be one of the most progressive in Canada. It applies only to some of the establishments that come under the jurisdiction of Part II of the Canada Labour Code, such as the federal public service, banks, the Post Office, airports, radio broadcasting stations, etc.

Some of the highlights are given below.

- The criterion level at which engineering controls become mandatory has been reduced to 87 dB(A) from 90 dB(A). Hearing protection is to be utilized only when engineering controls are not "reasonably practicable", and a report has been submitted to Labour Canada. The same report is to be given to the Joint Safety and Health Committee or the Safety and Health Representative where either exists.
- The exchange rate has been changed to 3 dB from the previous value of 5 dB.
- The threshold level is now at least 74 dB(A), with an option open to the employer of choosing a lower level to suit his instrument requirements.
- The employer has to conduct an investigation if any employee is likely to be exposed to sound levels equal to or greater than 84 dB(A), for a duration "that is likely to endanger the employee's hearing". The Joint Safety and Health Committee or the Safety and Health Representative must be consulted in this matter.
- Employees exposed to noise exposure levels ($L_{ex,8}$) equal to or greater than 84 dB(A) must be provided with written information describing the hazards associated with exposure to high levels of sound".
- Warning signs must be posted where employees could be exposed to sound levels in excess of 87 dB(A).
- Where the use of hearing protection becomes unavoidable, the employer, in consultation with the Joint Safety and Health Committee or Safety and

# RÉGLEMENT SUR LES NIVEAUX ACOUSTIQUES DANS LES ÉTABLISSEMENTS DE COMPÉTENCE FÉDÉRALE

Une modification globale de la partie VII ("Niveaux acoustiques") du Règlement du Canada sur l'hygiène et la sécurité au travail a été publiée, le 31 juillet 1991, dans la partie II de la Gazette du Canada et est entrée en vigueur la même date. il s'agit du résultat de presque trois ans de purparlers entre les employeurs et les employés relevant de la compétence fédérale, Travail Canada ayant fait fonction de coordonnateur et fourni un soutien technique, juridique et administratif. Les révisions sont nombreuses et le nouveau règlement est vraisemblablement l'un des plus sévères au Canada. Il ne s'applique cependant qu'aux établissements qui sont assujettis à la partie II du Code canadien du travail, comme la fonction publique fédérale, les banques, les bureaux de poste, les aéroports, les stations de radiodiffusion, etc.

Voici certains points marquants de la modification:

- Le seuil pour l'utilisation obligatoire de dispositifs techniques a été ramené de 90 à 87 dBA. Les protecteurs auditifs ne doivent être utilisés que lorsque le recours à des dispositifs techniques est "impossible", qu'un rapport a été présenté à cet égard à Travail Canada et qu'un exemplaire en a été fourni au comité de sécurité et de santé ou au représentant en matière de sécurité et de santé, le cas échéant.
- Le facteur de bissection a été ramené de 5 à 3 dB.
- Le seuil pour ce qui est des mesures se situe maintenant à 74 dBA, et les employeurs peuvent choisir un niveau inférieur, selon l'instrument utilisé.
- L'employeur doit effectuer une enquête si un employé risque d'être exposé à des niveaux acoustiques de 84 dBA ou plus, "Pour une période susceptible de juire à son oue". Il faut alors consulter le comité de sécurité et de santé ou le représentant en matière de sécurité et de santé.
- L'employeur doit fournir par écrit aux employés exposés à des niveaux de bruit ($L_{ex,8}$) de 84 dBA ou plus des renseignements écrits "sur les risques que présente l'exposition à des niveaux acoustiques élevés".
- L'employeur doit afficher des panneaux avertisseurs là o sont susceptibles d'être exposés les employés à un niveau acoustique supérieur à 87 dBA.
- Lorsqu'il devient inévitable d'utiliser un protecteur auditif, l'employeur doit, en consultation avec le comité de sécurité et de santé ou le représentant en matière de sécurité et de santé, établir un programme de formation

Health Representative, must institute a training programme in the fit, care and use of the protectors.

- The CSA Standard CAN/CSA-Z107.56-M86 (Procedures for the Measurement of Occupational Noise Exposure) has been referenced and forms the basis of assessing noise exposure.
- There is no separate limit on impact or impulsive sounds.
- Audiometric testing is not mandatory.
- Large trucks (trucks with a gross vehicle weight of more than 4,500 kg, designed primarily for transport of goods and operated primarily on public roads) are exempt from most of the revisions to the Regulation. They continue to operate under the previous limits: criterion level of 90 dB(A), and an exchange rate of 5 dB.

For details, please consult the text of the revised regulation. The title of the document is: Canada Occupational Safety and Health Regulations, amendment - SOR/91-448. Copies can be purchased from:

Canada Communications Group
Publishing
Ottawa, Ontario K1A 0S9
Tel: (819) 956-4802
Fax: (819) 994-1498

To discuss any technical details, please contact me at (819) 953-0219.

de l'employé sur l'ajustement, l'entretien et l'utilisation du protecteur auditif.

- La norme CAN/CSA-Z107.56-M86 (Méthode de mesure de l'exposition au bruit en milieu de travail) a été utilisée comme référence pour l'évaluation de l'exposition au bruit et elle en constitue le fondement.
- Il n'existe pas de limite distincte applicable aux bruits d'impact.
- L'examen audiométrique n'est pas obligatoire.
- Les poids lourds (camions d'une masse totale en charge de plus de 4500 kg qui sont conçus principalement pour le transport des marchandises et qui sont utilisés essentiellement sur les chemins publics) ne sont pas visés par la plupart des modifications apportées au règlement. Ils sont toujours régis par les dispositions antérieures (c'est-à-dire seuil de 90 dBA et facteur de bissection de 5 dB).

Pour plus de précisions, veuillez consulter le règlement révisé, dont le titre est: Règlement du Canada sur l'hygiène et la sécurité au travail - Modification - DORS/91-448. Vous pouvez en acheter des exemplaires auprès de:

Groupe Communication Canada
Edition
Ottawa (Ontario) K1A 0S9
Téléphone: (819) 956-4802
Télécopieur: (819) 994-1498.

Pour tout renseignement d'ordre technique à cet égard, veuillez me téléphoner, au (819) 953-0219.

# HALIFAX CHAPTER MEETING REPORT

**David Chapman, Dartmouth**

On 29 October 1991, the halifax Chapter of the Canadian Acoustical Association held yet another meeting and public lecture. As the meeting was held in the Earl of Dalhousie Pub in the Dalhousie University Club, a social hour and light supper were held before the meeting started. The business issues of the meeting were few and were dispensed with rapidly. Two speakers were arranged for the evening. This is a new procedure that we are introducing to help us to know each other better. The first speaker is to be a local member of the acoustics community who will take 10-15 minutes to give an overview of their area of expertise. (They will at the same time work up the audience to a fevered pitch in anticipation of the main speaker...). The first speaker of that evening was John Gillis ofg Simrad Marine's Dartmouth office. Using some excellent colour graphics, John gave a thorough but rapid overview of Simrad and its role in local projects. The main event of the evening was a presentation by Blake Noon and Tom Walton of Eckel Industries, who were down from Morrisburg, Ontario to speak to Dalhousie University about installing an anechoic chamber. They gave a very interesting talk about a massive anechoic chamber (largest in Canada) being built in the Ottawa area for Health and Welfare Canada. The talk was well received and stimulated much discussion.

# Blachford

H.L. BLACHFORD, LTD.

The ABC's of noise control:

Aquaplas: Vibration Damping
Baryfol: Noise Barriers
Conaflex: Absorption Media

Blachford manufactures barriers, absorption and vibration damping materials in Mississauga and Montréal. Blachford also provides standard and custom-made products in liquid, sheet, roll or die-cut parts specially designed to suit your needs.

"YOUR CANADIAN SOURCE OF NOISE CONTROL MATERIALS FOR OVER 25 YEARS."

Blachford

made in CANADA
fabriqué au CANADA

MISSISSAUGA 416-823-3200
MONTREAL 514-866-9775
VANCOUVER 604-263-1561

# CALL FOR PAPERS

## Acoustics Week in Canada
## October 6 - 9, 1992

Acoustics Week in Canada 1992, will be held at the Sheraton Plaza 500 Hotel in Vancouver, British Columbia. The week will begin with two days of technical seminars with proposed topics being underwater acoustics, architectural acoustics, and occupational noise and vibration evaluation and control. Specific details and registration for these courses will be published in the June issue of *Canadian Acoustics*. The symposium of the Canadian Acoustical Association will take place on October 8th and 9th following the seminars. The annual meeting and banquet of the CAA will be held on Thursday, October 8th.

### SYMPOSIA
October 8 & 9, 1992

The symposia programme will include keynote speakers in special plenary sessions which will be followed by parallel general sessions. Authors are invited to submit abstracts for presentation in these general sessions on all aspects of acoustics, however, papers in specific areas are especially encouraged. These include:

* Underwater Acoustics
* Speech, Hearing and Communications
* Architectural Acoustics
* Acoustic Measurements
* Electroacoustics
* Acoustic Sources
* Performance Acoustics
* Occupational Noise and Vibration

The organizers intend to develop several structured sessions around a particular theme and invite ideas from potential authors. Group submissions will be reviewed as a complete package. Papers submitted independently will be placed into appropriate categories for presentation.

All submissions will be reviewed to ensure suitability, and accepted abstracts will be published in a booklet available at the conference as well as in *Canadian Acoustics*. Abstracts should be limited to 300 words and must be received by April 15th, 1992. Submitted abstracts must be prepared in accordance with the Instructions for the Preparation of Abstracts as directed in this issue of *Canadian Acoustics*. Completed abstracts and information on technical sessions should be directed to:

Dr. Pierre Zakarauskas
DREP FMO Victoria
Victoria, B.C., V0S 1B0
Tel: (604) 363-2879
FAX: (604) 363-2856

### STUDENT AWARDS

Students are particularly invited to participate. Students must apply for these awards with their abstract submission using the enclosed application form. In addition to the student awards for papers available from the CAA, a limited number of assistance grants for student travel and housing will be available. Further details on the travel grants will be carried in the March issue of *Canadian Acoustics*.

**Host City: Vancouver, Spectacular by Nature**

# APPEL DE COMMUNICATIONS

## Semaine Canadienne de l'Acoustique
## 6 - 9 octobre 1992

La Semaine Canadienne de l'Acoustique 1992 aura lieu à l'hôtel Sheraton Plaza 500 de Vancouver, Colombie-Britannique. La semaine débutera avec deux jours de séminaires techniques, les thêmes proposés étant l'acoustique sous-marine, l'acoustique architecturale, et l'évaluation et le contrôle du bruit et des vibrations en milieu de travail. Les détails spécifiques et les modalités d'inscription à ces cours seront publiés dans le numéro de juin de l'*Acoustique Canadienne*. Le congrès de l'Association Canadienne d'Acoustique se tiendra les 8 et 9 octobre, suite aux séminaires. L'Assemblée générale annuelle et le banquet de l'ACA auront lieu mardi, le 8 octobre.

### CONGRES

8 - 9 octobre 1992

Le programme du congrès sera composé des conférences d'invités spéciaux regroupés à l'intérieur des sessions plénières qui seront suivies par des sessions génèrales parallèles. Les auteurs sont invités à soumettre leur résumés pour ces sessions générales qui porteront sur tous les aspects de l'acoustique. Cependant, les communications relatives à des thêmes spécifiques sont fortement encouragés. Il s'agit de:

* Acoustique sous-marine
* Parole, Audition et Communication
* Acoustique Architecturale
* Mesures acoustiques
* Electro-acoustique
* Sources acoustiques
* Acoustique des salles de spectacle
* Bruit et vibration en milieu de travail

Les organisateurs désirent planifier plusieurs sessions structurées autour d'un thème particulier et invitent les auteurs potentiels à soumettre leurs idées. Les soumissions de groupe seront révisées en tant qu'ensemble complet. Les papiers soumis individuellement seront classés dans une catégorie appropriée.

Tous les résumés seront révisés afin de vérifier leur pertinence et les résumés acceptés seront publiés dans un document qui sera disponible au congrés ainsi que dans l'*Acoustique Canadienne*. Les résumés doivent être limités à 300 mots et doivent être reçus avant le 15 avril 1992. Les résumés soumis doivent être préparés selon les instructions contenues dans la préparation des résumés inclus dans ce numéro de l'*Acoustique Canadienne*. Les résumés complets et les informations concernant les sessions techniques doivent être envoyés à:

Dr. Pierre Zakarauskas
DREP FMO Victoria
Victoria, B.C., V0S 1B0
Tel: (604) 363-2879
FAX: (604) 363-2856

### PRIX AUX ETUDIANTS

Les étudiants sont particulièrement invités à participer. Les étudiants doivent s'inscrire au concours et envoyer leur résumés en utilisant le formulaire joint à ce numéro. En plus des prix aux étudiants décernés par l'ACA, il y aura un nombre limité de bourses pour couvrir les frais de déplacement et de logement. Des détails supplémentaires concernant ces bourses seront fournis dans le numéro du mois de mars de l'*Acoustique Canadienne*.

**Ville hôte: Vancouver, Nature Spectaculaire**

## INSTRUCTIONS FOR THE PREPARATION OF ABSTRACTS

1) Quadruplicate copies of an abstract are required for each meeting paper; one copy should be an original. Send the four copies to the Technical Program Chairperson, in time to be received by April 15th, 1992. Either English or French may be used. A cover letter is not necessary.

2) Limit the abstract to 300 words, including title and first author's name and address; names and addresses of coauthors are not counted. Display formulas set apart from the text are counted as 40 words. Do not use the forms "I" and "we"; use passive voice instead.

3) Title of abstract and names and addresses of authors should be set apart from the abstract. Text of abstract should be one single, indented paragraph. The entire abstract should be typed double spaced on one side of 8 1/2 x 11 in. or A4 paper.

4) Be sure that the mailing address of the author to receive the acceptance notice is complete on the abstract, to insure timely deliveries.

5) Do not use footnotes. Use square brackets to cite references or acknowledgements.

6) Underline nothing except what you wish to be italicized.

7) If the letter l is used as a symbol in a formula, loop the letter l by hand and write "lc ell" in the margin of the abstract. Do not intersperse the capital letter O with numbers where it might be confused with zero, but if unavoidable, write "capital oh" in the margin. Identify phonetic symbols by appropriate marginal remarks.

8) At the bottom of an abstract give the following information:

   a) If the paper is part of a special session, indicate the session;
   b) Name the area of acoustics most appropriate to the subject matter;
   c) Telephone Number, including area code, of the author to be contacted for information. Non-Canadian Authors should include country;
   d) If more than one author, name the one to receive the acceptance notice;
   e) Overhead projectors and 35mm slide projectors will be available at all sessions. Describe on the abstract itself any special equipment needed.

## INSTRUCTIONS POUR LA PRÉPARATION DES RÉSUMÉS DE CONFÉRENCES

1) Quatre copies du résumé sont requises pour chaque papier soumis; une des copies doit être un original. Envoyer les quatre copies au Président du Comité technique, suffisamment à l'avance pour qu'elles soient reçues avant le 15 avril 1992. L'anglais ou le français peut être utilisé. Une lettre de présentation n'est pas requise.

2) Limiter le résumé à 300 mots, incluant le titre, le nom et l'adresse du premier auteur; les noms et les adresses des co-auteurs ne sont pas comptabilisés. Les formules en retrait du texte comptent pour 40 mots. Ne pas utiliser la forme "je" ou "nous"; utiliser plutôt la forme passive.

3) Le titre du résumé, les noms et les adresses des auteurs doivent être séparés du texte. Le texte du résumé doit être présenté en un seul paragraphe. Le résumé entier doit être dactylographié à double interlignes sur une face d'une page 8 1/2 x 11 pouce ou du papier A4.

4) S'assurer que l'adresse postale complète de l'auteur qui doit recevoir l'avis d'acceptation est inscrite sur le résumé afin d'assurer une livraison rapide.

5) Ne pas utiliser les notes de bas de page. Utiliser les crochets pour les références et les rermerciements.

6) Ne souligner que ce qui doit être en italique.

7) Si la lettre l est utilisée comme symbole dans une formule, encercler la lettre l à la main et écrire "lc ell" dans la marge du résumé. Ne pas introduire la lettre majuscule O dans les chiffres lorsqu'elle peut être confondue avec zéro, mais se cela n'est pas possible, écrire "O majuscule" dans la marge. Identifier les symboles phonétiques à l'aide de remarques appropriées dans la marge.

8) A la fin du résumé, fournir les informations suivantes:

   a) Si la communication fait partie d'une session spéciale, indiquer laquelle;
   b) Identifier le domaine de l'acoustique le plus appropié à votre sujet;
   c) Le numéro de téléphone, incluant le code régional, de l'auteur avec qui l'on doit communiquer pour information. Les auteurs étrangers doivent indiquer leur pays;
   d) S'il y a plus d'un auteur, mentionner le nom de celui qui doit recevoir l'avis d'acceptation;
   e) Des projecteurs à acétates et à diapositives seront disponibles dans chaque session. Indiquer les besoins spéciaux, si nécessaire.

# The Canadian Acoustical Association
# l'Association Canadienne d'Acoustique

## ANNUAL STUDENT PRESENTATION AWARDS

The Canadian Acoustical Association makes awards to students whose papers are presented at the CAA Annual Symposium. Students contemplating papers for the 1992 Symposium should apply for consideration for these awards with the submission of their abstract.

### RULES

1. These awards are presented annually to authors of outstanding student papers that are presented during the technical sessions at Acoustics Week in Canada.

2. In total, three awards of $500.00 are presented. An award can be divided in case of a tie.

3. Presentations are judged on the following merits:
   i) The way the subject is presented;
   ii) The explanation of the relevance of the subject;
   iii) The explanation of the methodology/theory;
   iv) The presentation and analysis of results;
   v) The consistency of the conclusions with theory and results.

4. Each presentation is judged independently by at least three judges.

5. The applicant must be:
   i) a full-time post-secondary student at the time of application (undergraduate or graduate);
   ii) the first author of the paper;
   iii) a member of the Canadian Acoustical Association.

6. To apply for the award, the student must send the application simultaneously with the abstract of his or her paper. Multiple authors are permitted, but only the first author may receive an award.

## PRIX ANNUELS RELATIFS AUX COMMUNICATIONS ÉTUDIANTES

L'Association Canadienne d'Acoustique décernent des prix aux étudiants qui présenteront une communication au congrès annuel de l'ACA. Les étudiants qui considèrent présenter un papier au congrès doivent s'inscrire à ce concours au moment où ils soummettent leur résumé,

### REGLEMENTS

1. Ces prix sont décernés annuellement aux auteurs de communications exceptionnelles présentées par des étudiants lors des sessions techniques de la Semaine Canadienne de l'Acoustique.

2. Au total, trois prix de 500$ sont remis. Un prix peut être partagé en cas d'égalité.

3. Les présentations sont jugées selon les critères suivants:
   i) La façon dont le sujet est présenté;
   ii) Les explications relatives à l'importance du sujet;
   iii) L'explication de la méthodologie;
   iv) La présentation et l'analyse des résultats;
   v) La consistence des conclusions avec la théorie et les résultats.

4. Chaque présentation est évaluée séparément par au moins trois juges.

5. Le candidat doit être:
   i) un étudiant à temps plein de niveau post-secondaire au moment de l'inscription (de niveau sous-gradué ou gradué);
   ii) le premier auteur du papier;
   iii) un member de l'Association Canadienne d'Acoustique.

6. Afin de s'inscrire au concours, l'étudiant doit envoyer le formulaire d'inscription en même temps que son résumé. Plusieurs auteurs sont permis, mais seul le premier auteur peut recevoir le prix.

### APPLICATION FOR STUDENT PRESENTATION AWARD AT ACOUSTICS WEEK IN CANADA

### FORMULAIRE D'INSCRIPTION POUR LES PRIX DECERNES AUX ETUDIANTS LORS DE LA SEMAINE CANADIENNE DE L'ACOUSTIQUE

NAME OF THE STUDENT/NOM DE L'ÉTUDIANT:_____

TITLE OF PAPER/TITRE DU PAPIER:_____

UNIVERSITY/COLLEGE//UNIVERSITÉ/COLLEGE:_____

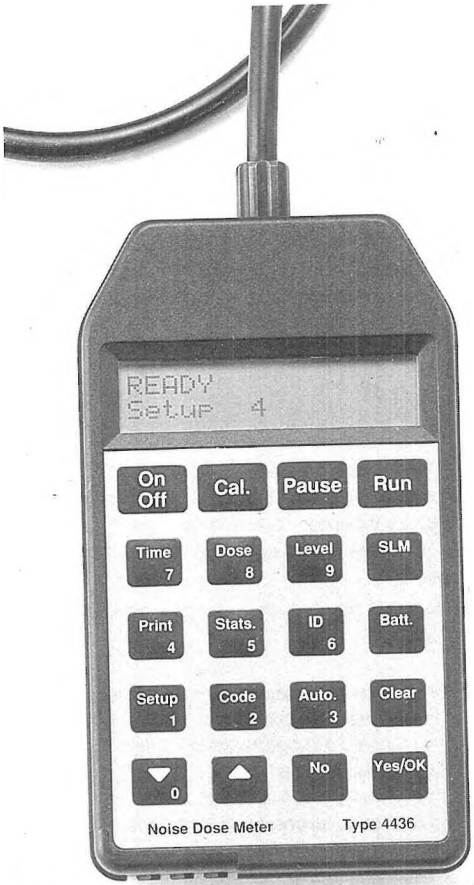
NAME, TITLE OF SUPERVISOR/NOM ET TITRE DU SUPERVISEUR:_____

STATEMENT BY THE SUPERVISOR/DÉCLARATION DU SUPERVISEUR:

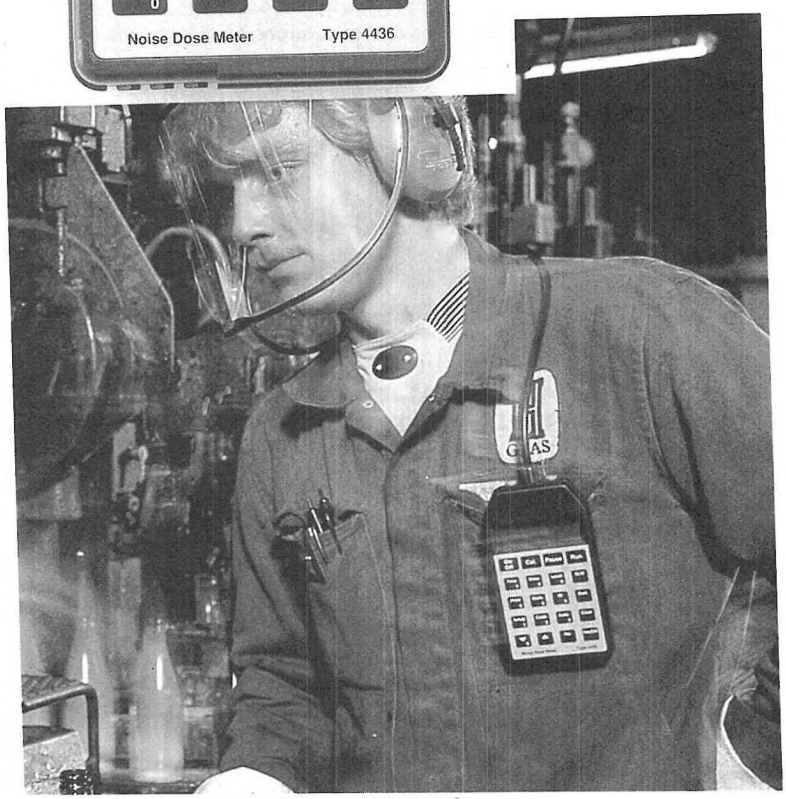
The undersigned affirms that the student mentioned above is a full-time student and the paper to be presented is the student's original work.
Le sous-signé affirme que l'étudiant mentionné ci-haut inscrit à temps plein et que la communication qui'il présentera est le fruit de son propre travail.

Signed/Signature:_____Date:_____

# A SOUND DECISION!




## This dose meter withstands the rigors of the modern industrial environment, yet provides accurate and dependable readings.



*The Type 4436 dose meter can be used as a Type 2 integrating sound level meter.*

Put the latest sound technology in your pocket and protect your employees from damaging noise exposure with a dose meter. The Type 4436 incorporates the latest technology and yet is rugged enough to withstand the most hostile industrial environments.

Bruel & Kjaers's Type 4436 microphone is protected inside the instrument casing where the hazards of the workplace cannot reach it. A strong, flexible rubber tube attached to the instrument, guides sounds to the microphone.

Specially-created software, known as the BZ 7028, allows information to be downloaded into a PC for analysis or data logging.

**BRUEL & KJAER CANADA LTD.**

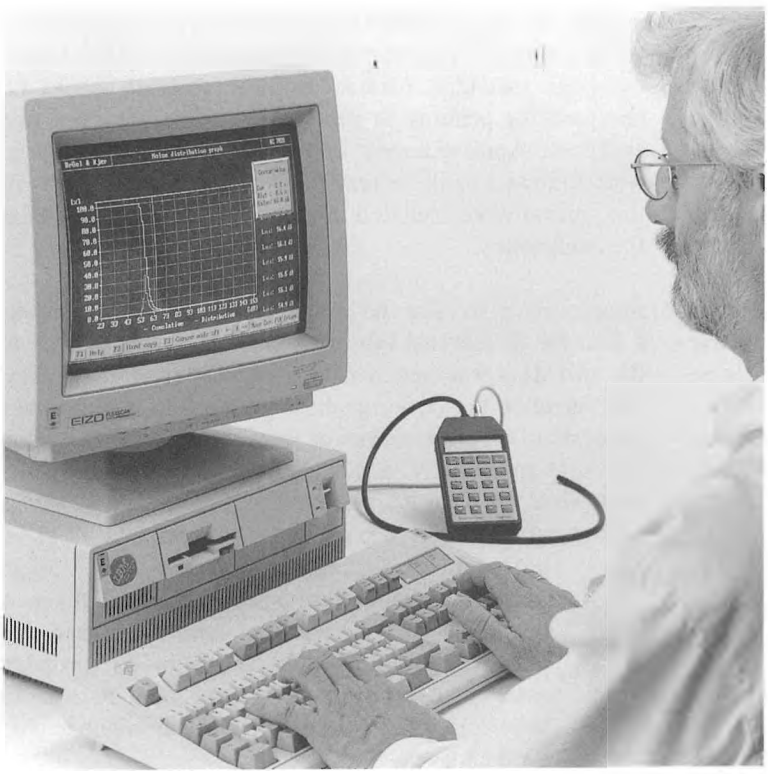
90 Leacock Road, Pointe Claire, Quebec H9R 1H1
Tel.: (514) 695-8225 Fax: (514) 695-4808 Telex: 05-821691 b k pcir

# THE BEST SOFTWARE FOR THE BEST DOSE METER.

## Permanent records in two minutes.

Application software BZ 7028 supporting the

Type 4436
Noise Dose Meter
makes for an unbeatable combination.



**This dynamic new product provides:**

- permanent records in two minutes or less.
- color graphs and tables
- time history
- statistical analysis
- cumulative distribution
- level distribution

In short, these are the tools with which you can quickly pinpoint problem noise exposures and provide full documentation.


**BRUEL & KJAER CANADA LTD.**

90 Leacock Road, Pointe Claire, Quebec H9R 1H1
Tel.: (514) 695-8225 Fax: (514) 695-4808 Telex: 05-821691 b k pcir

# CANADIAN ACOUSTICS WEEK 1991

**The Ramada Renaissance Hotel, Edmonton, October 7 to 10, 1991.**

The 1991 Acoustics Week in Canada Convention was marked by several success stories - marvelous weather in Edmonton (and why not?), a larger than anticipated registration, a full complement of strong technical papers, two well-received plenary session speakers, two well-attended preconference seminars, an enjoyable banquet with a unique entertainment group, and finally, one of the greatest after-conference bus tours that any of the participants could remember.

Registrations, always a bit of a problem at conventions, did not disappoint this year either. To encourage early registrations, a fee of $75 was charged if paid before August 31, $85 if paid after. It appears the $10 differential made little impact. Registrations continued to come in up to and including the opening day. Fifty-three persons, including students, registered before Aug. 31. Thirty more registered prior to opening. Fifteen more showed up at the door. There were 83 full registrations, 15 students, 10 seminar registrants who did not attend the conference, and 13 "freebies", including seminar speakers, exhibitors, guest speakers, and press.

The Technical Program, organized by Dr. Gary Faulkner and his committee of seven, drew a total of 76 submitted abstracts in a wide variety of subjects. Initially, the committee chose to play an active role in promoting CAA'91 instead of simply dealing with submissions that responded to the advertising. The result was a significant number of invited speakers whose contributions made the sessions both interesting and useful. Coupled with the invited speakers, the general papers submitted were used to develop the final programme which consisted of three parallel sessions, with 20 minute time allocations. The printed program was formatted to have the three simultaneous sessions for each time period on one sheet, allowing delegates to easily understand their options.

The Annual General Meeting is serious business

Bruce Dunn turns over the reigns of office to Dave Chapman

The Conference Proceedings took a new twist this year, which promises to be a pattern for the future. In co-operation with the Editor, Dr. Murray Hodgson, the October issue of Canadian Acoustics was advanced one month, so that it would be available at the conference. All the abstract contributors were notified in May that a two-page extended format of their abstract would be accepted for printing in the journal. The response was excellent. Approximately 2/3 of the accepted abstracts were followed by the extended-format version. Copies of the journal were included in all of the registration kits at the conference.

In an attempt to raise the image level of the conference as a host for the several sub-disciplines in acoustics, each of the two days was begun with a plenary-session speaker. The speaker topics were chosen to reflect the broader interests of all acousticians as opposed to a select group. The first speaker, W. J. Cavanaugh, an architect, opined that, while we have learned how to measure many things with great accuracy, we still have a long way to go in determining acceptable criteria that affect people. The second speaker, John Ohala, a distinguished researcher and lecturer in phonetics, cautioned researchers to broaden their field of vision to discover what persons in other disciplines were doing which might impact on their own work.

Consistent with previous years, the convention was used as the backdrop to presentation of Tutorial Seminars for people interested in the practical application of acoustic principles. These are not necessarily directed to CAA members, but can act to attract others to join the

Alberto Behar presents Katherine Ward with her prize

CAA. The two seminars presented were on Active Noise Control and Noise and Vibration Control in Buildings. With last minute registrations coming in as late as October 4th, the Building Noise course attracted 18 people and the Active Noise course drew 12 registrations. Both courses were well received and many compliments were expressed regarding their value.

The Social Aspects of the convention were not overlooked. The wine and cheese reception on Tuesday evening, sponsored by generous donations from exhibitors and other corporations, was attended by over 60 people.

The Awards Banquet was attended by 74 persons, who were entertained by an unusual trio of musicians dressed as medieval minstrels playing ancient instruments. While their numbers were small, six ladies enjoyed a conducted bus tour of the City and an afternoon at West Edmonton Mall, followed the next day by a visit to the city center and luncheon at the Macdonald Hotel.

Commercial Exhibitors again made a significant contribution to the success of the convention. Seven firms filled the two exhibition spaces, and provided complimentary coffee service throughout the two days.

Financially, we are not sure if the convention was a success or failure. At the Montreal convention in 1990 a motion was passed directing this committee to lose up to $3000 by subsidizing student participation and inviting outstanding speakers to enhance the conference image. While the final tally has not yet been made, it appears that a small profit will be realized! The good turnout at the conference, the printing of the Proceedings in the Journal, and the substantial contributions from exhibitors and other companies made the difference. In addition to the reduced registration fee of $10 levied to all students, six of them were granted travel subsidies of $250 each. Finally, four students received awards for student paper presentations, two at $500 and two at $250 each.

## ROCKY MOUNTAIN BUS TOUR

If you weren't there, you missed out on three great days ! Eleven people plus the driver enjoyed fantastic weather, incredible scenery, a rare avalanche experience, great accommodation and food, and marvellous fellowship.

Brilliant sunshine and a temperature of 27$^{o}$C greeted the group as they arrived in Jasper ! The Park animals were everywhere, and the visit to Maligne Lake and Rose Marie Rock in the Maligne River gave the group an indicator of what was to come.

A trail hike to the base of Mt. Edith Cavell glacier put several members of the group in position to witness first hand (in safety) two successive ice avalanches as huge chunks of the Angel Glacier high up on the side of the mountain broke loose in the warm weather. This was followed by more spectacular scenic visits to Athabasca Falls, Sunwapta Falls, the Columbia Icefield, Peyto Lake with it's incredible color, and Lake Louise.

Saturday evening was spent in Banff, enjoying great food and the usual "tourist" activities of riding the Sulphur Mountain Gondola and shopping.

Sunday, October 13 the group travelled to Drumheller and the world renowned Royal Tyrrell Museum of Paeleontology located in the Red Deer River Badlands. The trip ended that evening with a farewell dinner in Red Deer and home to Edmonton.

Oh yes, there was a convention held that week also !

Entering Jasper Park: Krish Krishnappa, Gene Bolstad, Bill Cavanaugh, George Wong, Agnes Bolstad, Betty Behar, Steve Elliott

[Photographs by Gene Bolstad and Marek Roland-Wieszkowski]

## MESSAGE DU PRÉSIDENT

Même si j'ai été formellement élu Président de l'ACA au congrès d'Edmonton, j'ai pris environ un mois et demi avant de m'y plonger pour vrai. Cette révélation coincide avec l'arrivée des archives envoyés par Bruce Dunn, président sortant; une pile de documents et de chemises empaquetés dans une boîte de carton. Dans une vie antérieure, cette boîte contenait un électroménager nommé "The Canadian/le canadien"; sur la boîte, il y avait quelques étiquettes indiquant que le contenu était "100% CANADIAN/100% CANADIEN" et deux grandes feuilles d'érable rouges. Mystérieusement, les deux feuilles d'érable et les étiquettes ainsi que les instructions "PLEASE READ AND FOLLOW INSTRUCTIONS CAREFULLY/LIRE ET SUIVRE LES INSTRUCTIONS" ont été rayées avec un marqueur noir. Je n'ai pas encore compris si Bruce m'envoyait un message codé. De toute façon, je suis assuré que Bruce sera d'un précieux support comme Président sortant, me pilotant à travers les eaux un peu agitées de l'ACA.

On attend probablement d'un nouveau président élu qu'il écrive un message enlevant à ces membres, qu'il présente sa vision future de l'organisation et qu'il annonce des changements radicaux à structure. J'espère que je ne décevrai pas personne en ne le faisant pas. Je pense que nous avons une association en bonne santé avec des membres engagés, un conseil d'administration et un exécutif. Notre journal *l'Acoustique Canadienne* s'améliore toujours du point de vue apparence visuelle et contenu. Notre rencontre annuelle continue d'être stimulante et de remporter un grand succès (techniquement et financièrement). Pourquoi changer quoi que ce soit?

Ceci ne veut pas dire qu'il n'y a pas de place pour l'amélioration. Il y a certaines choses que nous pouvons améliorer et je propose de concentrer mes efforts sur l'augmentation de l'efficacité de l'organisation, de m'occuper des choses qui ont pris du retard, et peut-être de regarder vers l'avant. Je reviens tout juste d'une session portant sur la "planification stratégique" offerte par mon établissement, même si je ne suis pas un fervent défenseur de ce processus, il peut être utile à l'ACA afin de regarder vers l'avant et et de s'imaginer dans 5, 10 ou 15 ans d'ice. Qui sont nos membres actuels et futurs? Aurons-nous toujours besoin d'une association strictement canadienne? Comment la question québécoise affectera-t-elle l'association?

## PRESIDENT'S MESSAGE

Although I was formally elected President of the CAA at the Edmonton meeting, it took about a month and a half for the awesome truth to sink in. This revelation coincided with the arrival of the CAA "archives" from Past President Bruce Dunn: a stack of documents and file folders packed in a cardboard box. In a former life, the box contained an electrical applicance dubbed "The Canadian/le canadien"; on the box were a couple of labels indicating that the contents were "100% CANADIAN/100% CANADIEN" and two large red maple leaves - or is it leafs? Mysteriously, both of the maple leaves and all of the labelling on the box were scratched out with thick black marks, including the instructions "PLEASE READ AND FOLLOW INSTRUCTIONS CAREFULLY/LIRE ET SUIVRE LES INSTRUCTIONS". I have not yet determined if Bruce was sending me a coded message. In any case, I am sure that Bruce will prove invaluable as Past President, piloting me through the choppy CAA waters.

A newly-elected president is probably expected to write a stirring message to the membership, charting out the future course of the organization and heralding sweeping changes to its structure. I hope I won't disappoint anyone by not doing this. My feeling is that we have a healthy association with a committed membership, Board of Directors, and Executive. Our journal *Canadian Acoustics* is steadily improving in both visual appearance and content. Our annual meetings continue to be stimulating and successful (both technically and financially). Why change anything?

That is not to say that there is no room for improvement. There are a few things we could probably do better, and I propose to devote my efforts to tightening up the running of the organization, tying up loose ends, and perhaps looking ahead a little. I have just returned from a "strategic planning" session run by my establishment; although I have not become a strong advocate of this process, it may be useful for the CAA to try to look ahead and imagine itself 5, 10, or 20 years from now. Who are our present and future members? Will there still be a need for a strictly Canadian association? How will the Québec question affect the association?

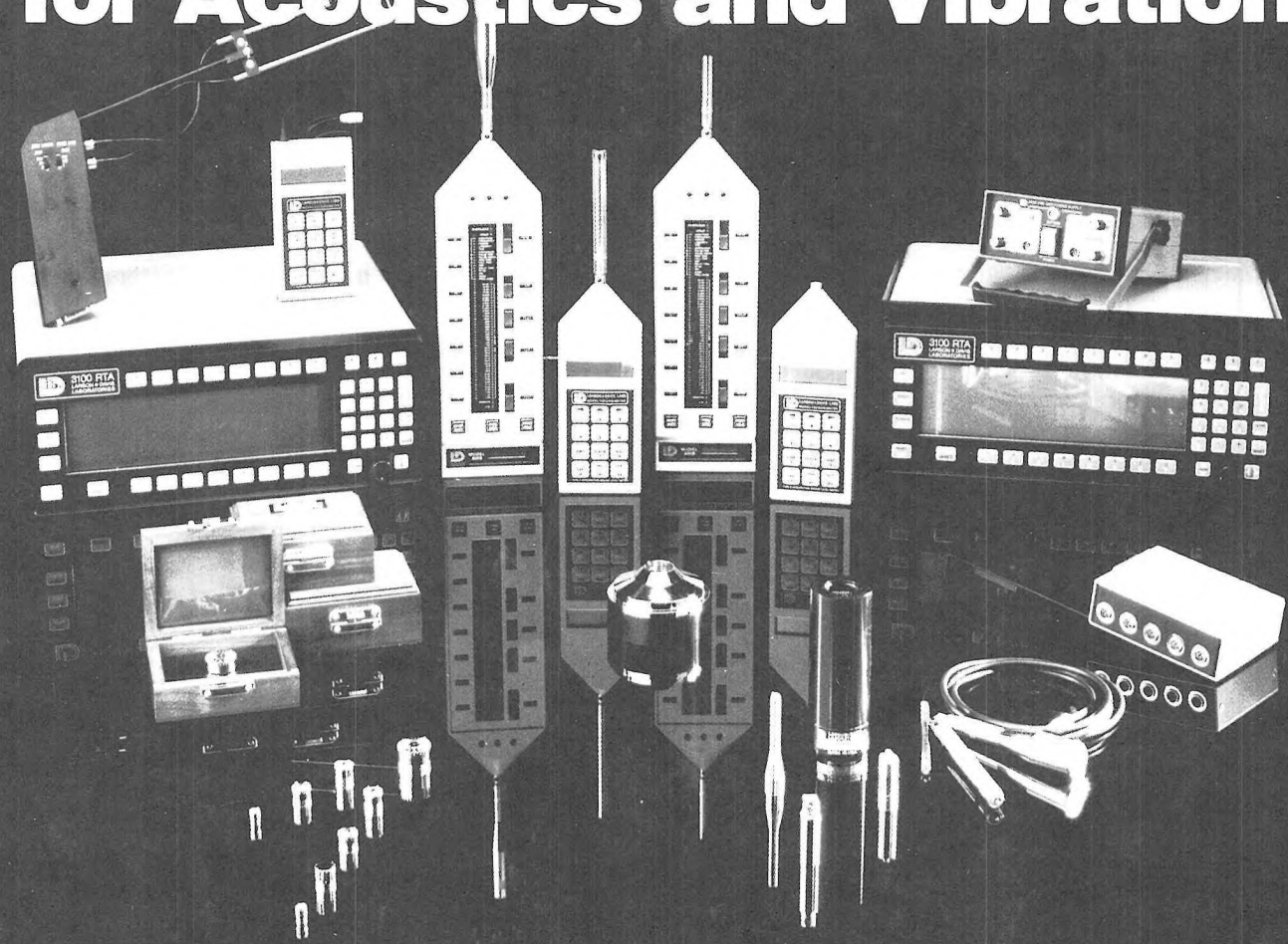
A la recherche d'une plus grande efficacité, quelques modifications ont déjà été apportées. Une certaine insatisfaction a été exprimée à l'égard de l'organisation des prix étudiants de la Semaine Canadienne d'Acoustique; une de mes premières tâches de Président a été de créer un comité chargé d'améliorer les règlements et le formulaire d'inscription pour ces prix. Je vous invite à prendre connaissance dans ce numéro du réultat de cette démarche qui a été révisée et approuvée par le conseil d'administration.

Enfin, j'exhorte les membres de l'ACA à contribuer à l'association en soumettant du matériel à l'*Acoustique Canadienne.* non seulement le journale est un forum de publications scientifiques et de notes techniques mais il est aussi le principal médium de communication. Pourquoi ne pas envoyer des nouvelles des activités de votre communauté dans le domaine de l'acoustique? S'il y a quelque chose quie vous tracasse à propos de l'ACA ou de la façon dont elle est dirigée, pourquoi ne pas écrire un court texte exposant votre point de vue? (Nous acceptons aussi les compliments!)

In the pursuit of improved efficiency, some alterations have already been made. There has been some dissatisfaciton with the way student presentation awards have been organized at Acoustics Week in Canada; one of my first duties as President was to create a committee to design an improved set of rules and an application from for these awards. Please see elsewhere in this issue for the result, which has been reviewed and approved by the Board of Directors.

In closing, I urge the CAA members to contribute to the association by submitting material for *Canadian Acoustics*. Not only is the journal a forum for research papers and technical notes, but it is also our principal means of communication. Why not send in newsy bits of acoustical activities in your community? If something about the CAA or the way it conducts itself bothers you, why not write a short piece expressing your point of view? (We also accept compliments, by the way!)

# Superior Instrumentation for Acoustics and Vibration



## LARSON-DAVIS LABORATORIES

We have become a new technology leader in acoustics and vibration measuring instruments. Our goal is to provide advanced, precise, high-quality products at very reasonable prices. As the result of a substantial ongoing research program, Larson-Davis products provide versatility and automation untouched by *any* competitive offerings. Our growing product family includes:

- Portable multichannel Real-Time analyzers delivering 1/1, 1/3 and 1/12 octave bands to 125 KHz with future plug-in modules for FFT, acoustic intensity, memory expansion, etc.
- Underwater acoustic analysis equipment.
- Precision sound level meters with computer interfaces and automated control of 1/1 and 1/3 octave filters.
- Data logging noise dosimeters and hand-held sound level meters.
- Environmental and industrial noise monitoring systems.
- Building and architectural acoustics analyzers.
- Vibration measuring and monitoring instruments.
- Audiometric calibration instruments for speech and hearing.
- Network airport noise monitoring systems, with management planning software.
- Precision measuring microphones, preamplifiers, power supplies, instrumentation amplifiers, acoustic intensity probes, calibrators and accessories.

For more information contact the factory.

**Dalimar Instruments Inc.**

89, boul. Don Quichotte
Suite No. 7
Ile Perrot, Qc
J7V 6X2
Tel.: (514) 453-0033
Fax: (514) 453-0554

The Canadian Acoustical Association
l'Association Canadienne d'Acoustique

# 1991 PRIZE WINNERS / RÉCIPIENDAIRES 1991

### EDGAR AND MILLICENT SHAW POSTDOCTORAL PRIZE (RENEWAL / RENOUVELLEMENT)

**Li Cheng, Université de Sherbrooke**

*"Acoustic quietening of plates: Vibro-acoustic modelling of a circular stiffened shell ended by a panel and coupled to an acoustic cavity"*

### ALEXANDER GRAHAM BELL PRIZE IN SPEECH COMMUNICATION AND BEHAVIOURAL ACOUSTICS

**Steven Donald Turnbull, University of New Brunswick**

*"The influence of possible anti-masking strategies in pinniped vocalizations of signal detection"*

**Fangxin Chen, University of Alberta**

*"Computer simulation of a Mandarin tone perception"*

**Leonard E. Cornelisse, University of Western Ontario**

*"The spatial perception of a sound's location in three dimensions"*

### DIRECTORS' AWARDS / PRIX DES DIRECTEURS

Professional / Professionel: **Annabel J. Cohen, Dalhousie University**

*"Scale and serial order information in melodic perception: independence or interdependence"*

### STUDENT AWARDS / PRIX ETUDIANT

**Daryl Caswell, University of Calgary**

*"Symphonic bells of 'fantastic' proportion"*

**Stephen Keith, Carleton University**

*"Rock-drill handle vibration: measurement and hazard assessment"*

**Jane MacNeil, University of Calgary**

*"Discrimination of static and dynamic frequency changes by children and young adults"*

**Katherine Ward, University of Alberta**

*"An acoustical and perceptual study of changes in dysphoria with voice therapy"*

# CONGRATULATIONS / FÉLICITATIONS

# The Canadian Acoustical Association
# L'Association Canadienne d'Acoustique

## MINUTES OF THE BOARD OF DIRECTORS MEETING

October 8, 1991, 10:00 a.m.
Ramada Renaissance, Edmonton, Alberta

Present: B.F. Dunn, S. Abel, W. Sydenborgh, E. Bolstad, L. Brewster, C. Laroche, D. Chapman, A. Behar, T. Embleton

1. Report of the President

Bruce Dunn welcomed the members of the board present. He announced that due to his retirement and extensive travel, he would not be able to stand for re-election as President. The minutes of the Board of Directors' meeting held May 26, 1991 in Ottawa were discussed and adopted. Motion made by A. Behar, seconded by G. Bolstad.

2. Report of the Secretary

Discussion of the changes in the Postal Services whereby mail has to be picked up at the Post Office Box rather than forwarded to the Secretary as in previous years. It is decided that no changes be made at this time. Paid membership as of August 31, 1991 is as follows: Members 277, Student Members 33, Corporate Subscriptions 75, and Sustaining Subscribers 23.

3. Treasurer's Report - (See Appendix A)

Four motions by the Treasurer (See Appendix B). Moved by E. Bolstad, seconded by A. Behar. All in favour, none against.

4. Editor's Report

Due to the absence of the Chief Editor, Murray Hodgson, a brief report was presented by the Editor, Chantai Laroche. Moved by E. Bolstad and seconded by S. Abel that provision be made to cover the attendance of the editor at an editors' workshop. The president made special mention of the high quality of the Journal and special mention of the Proceedings Issue for the work done by Murray Hodgson and Gary Faulkner.

5. A Membership Report was sent in by Mike Zagorski with some suggestions which may be of value to the next membership chairperson.

6. Convention Chairman's Report. E. Bolstad was very pleased with the advance registration of 80 people for the symposium and 30 for the seminar. The symposium is held this year over 2 days with 3 parallel sessions.

7. Prizes and Awards Committee - Presentation by A. Behar on the inner workings of such a committee and the need for universal guidelines. Reports are presented in the following order:

| | |
|---|---|
| Post Doctoral - E. and M. Shaw Award | Chairperson: S. Abel |
| Bell Speech Prize | Chairperson: L. Brewster |
| Fessenden Award | Chairperson: D. Chapman |
| Eckel Award | Chairperson: M. Hodgson |
| Directors' Award | Chairperson: C. Laroche |
| Student Prizes | Chairperson: A. Behar |
| Youth Science Fair Prize | Chairperson: A. Cohen |

Motion by C. Laroche to have 3 Directors Awards:

$500.00 to a student author
$250.00 to a professional author under 30 years of age
$250.00 to a professional author over 30 years of age or over

It was agreed that any paper reviewed and published in Canadian Acoustics would be eligible for a Directors' Award and that the author need not be a CAA member. Also, only graduate students are currently eligible for the Student category; that is students pursuing an M.Sc., Ph.D. or some other professional degree. The CAA will investigate including undergraduate students in future.

8. Student Awards - A. Behar

Three prizes are available. Guidelines are: advance identification of the student together with the name of the supervisor, on a board provided at the registration desk.

9. Post Doctoral Award 1992

Applications and submissions for the award should be made before the end of February 1992. Forms are available from S. Abel and the Secretary.

10. Directors' Award

Winners for 1991 will be announced at the Symposium Banquet.

11. Science Fair

Our sponsorship of the Science Fair to continue. We should have a representative of the CAA at the Science Fair to present the award for an acoustics project and report back to the Committee. B. Dunn and A. Cohen to function as contact persons.

12. Bell Speech Prize

L. Brewster announced that this prize was a three-way split among Steven Turnbull, Fangxin Chen, and Leonard Cornelisse.

13. Fessenden Award

D. Chapman noted that no applications were received and no award presented in 1991.

14. Eckel Prize

No report is available at this time from M. Hodgson.

15. Education Committee: S. Abel, A. Cohen, M. Hodgson

Information is being gathered on a continuous basis for a published report at some point in time.

16. Internoise - Toronto 1992: Tony Embleton

Report tabled. Tony Embleton is also willing to report to the CAA on Internoise 1991 in Australia.

17. Nominating Committee

S. Abel, as Chairperson for the committee and Past-President, proposes David Chapman for President for 1992. Nominations will also be solicited from the floor at the AGM. Two new Directors are to be elected, one from Nova Scotia and one from Quebec.

18. Status Reports: B. Dunn

On the 1994 International Congress on Audiology and the International Conference on Spoken Language Processing: it is recommended that no official participation nor financial assistance be provided.

19. Halifax Chapter

D. Chapman reports that meetings are held three to four times per year. A recent speaker was a representative from Eckel Industries on anechoic chambers.

20. Directors' Meeting Spring 1992

Travel allowance total to be budgeted at $3,000.00, with the provision that no reimbursement can exceed the economy airfare. Motion by S. Abel, seconded by L. Brewster. Passed.

21. Acoustics Week 1992

No report is tabled by Winnipeg; nor is a representative available from the Winnipeg committee. B. Dunn will report to the AGM after consultation with Winnipeg.

22. New Business

a) CAA will have logo pins available at a cost of about $1.50 each. E. Bolstad had hoped to have them available at this convention.

b) Observation: If Winnipeg 1992 is not ready, investigate the possibility of Vancouver hosting the 1992 meeting. B. Dunn will investigate.

c) Observation: T. Embleton asks whether a Nominations committee should not be independent from the Board of Directors.

23. Adjournment of the meeting at 4:15 p.m. Moved by B. Dunn, seconded by A. Behar.

Prepared by W.V. Sydenborgh

# APPENDIX A

**TREASURER'S REPORT**

To the President and Members of the Board of Directors of the Canadian Acoustical Association:

I am pleased to present the accompanying Financial Statement prepared by our auditor, Mr. G.A. Tipping, CGA, for the year ending August 31, 1991.

Firstly, as noted in the interim report of May 26, 1991, for practical administrative purposes, the previous treasurer, Chris Andrew, continued to carry out his duties until the end of December and then turned over all accounts and transferred all funds to the new accounts which I had established in Edmonton. I am pleased to report that all funds appear to have been tracked satisfactorily.

As recommended by our previous treasurer and the auditor, a distinct division of assets has now been effected. We now have a separate Trust Account for the Capital Fund which requires two signatures to withdraw or transfer any funds. It has a substantial amount of cash on deposit, bearing interest, from which it is intended to pay for all prizes and awards that have been established to date. It also has a sufficiently large portfolio of Guaranteed Investment Certificates (GIC's) to generate income to support those awards.

For simple administrative reasons, the actual issuance of cheques to award recipients must be made from the General Operating fund chequing account, with occasional transfer of funds from the Trust Account as needed.

The General Operating Fund is now essentially a chequing account, requiring only the Treasurer's signature. The amount of cash held in this account has been arbitrarily established to reasonably handle all budgeted cash flow.

As the accompanying statements indicate, both accounts have been showing income in excess of expenditures, which is fortunate, but which does deserve comment. Perhaps the principal reason for the excess has been the success of the last two conventions, in Halifax and Montreal. The latter has contributed $7,632.00 to the General Operating Fund, due probably to relatively high registration fees and good attendance.

As directed by the membership at the last Annual General Meeting, the 1991 Convention Committee was budgeted to lose approximately $3,000.00 in the interest of increasing support to student attendees and improving the quality of the program. As will be reported on separately, it is now anticipated that due to excellent attendance at both the seminars and the conference, this loss may not occur.

The Operating Fund Balance of over $31,000.00 is more than is needed to handle the budgeted expense for the coming year, and since there is no reason to expect any significant deficit in income vs expense, I propose that approximately $20,000.00 of the balance be transferred to the Capital Fund at once. Keep in mind, however, that once the money is transferred, it is in trust for our society purposes and cannot be transferred out for operating expenses.

The Capital fund cash account is also in excess of that needed to pay for currently budgeted awards and scholarships, and I propose that a substantial portion of the cash be invested in additional GIC's to bear better interest. As a matter of fact, one of the listed certificates for $8,500.00 matured on October 1, with interest of $913.75. In light of the currently falling interest rates, I took the liberty, on September 19, of taking out a replacement certificate in the amount of $10,000.00 at 9.5% for five years. I will be requesting confirmation of this action at this meeting.

Since the current and future investment income is expected to be in excess of $11,000.00 per year for the next 3 to 5 years, with a budgeted list of awards currently at $7,800.00, the Board and the Association should give consideration to the matter of whether or not the award list should be augmented or adjusted. I am not advocating change, merely suggesting discussion.

With respect to this matter, it should be pointed out that most institutions such as Universities generally limit their grants and bursaries to approximately 75% of the investment income, with the balance being reinvested to cover inflation and possible lowering of interest rates.

## APPENDIX B

**NOTICE OF MOTION**

Whereas the Operating Fund balance of $31,360.00 shown at the end of August, 1991, is in excess of the amount needed for budgeted expenditures in the 1991/92 fiscal year and no interest is earned on this Fund, be it moved that the Treasurer be empowered to transfer the amount of $20,000.00 from the Operating Fund to the Capital Fund. The amount shall be made up of a credit of $5,587.00 in the inter-fund balance and $14,413.00 cash.

**NOTICE OF MOTION**

Whereas the Guaranteed Investment Certificate No. 1134024 in the amount of $8,500.00 plus interest of $913.75 matured on October 1, 1991 and was deposited to the Capital Fund cash account, be it moved that the Treasurer be empowered to reinvest the amount of $10,000.00 in a Guaranteed Investment Certificate from Canada Trust for a period of five (5) years, at an annual interest rate of 9.5%, paid annually to the Capital Fund cash account.

**NOTICE OF MOTION**

Whereas the Capital Fund cash account, after transfer of funds from the General Operating Fund of $14,413.00, will be standing in excess of $32,000.00, and whereas awards and prizes scheduled to be given within the next fiscal year will not exceed $7,800.00, be it moved that the Treasurer be empowered to invest an additional $20,000.00 in Guaranteed Investment Certificates for a period of five (5) years, with the provision that this investment be placed in a separate Trust Company account covered by Canada Deposit Insurance Corporation apart from the coverage already provided.

**NOTICE OF MOTION**

Be it moved that the present Auditor, G.A. Tipping, Certified General Accountant, be appointed as Auditor of the Association until the next General Meeting, to audit the accounts of the Association, except for the accounts specifically related to the annual conference held in Edmonton in 1991.

This constitutes my report.

Eugene H. Bolstad, P.Eng.,

Treasurer

## MINUTES OF THE C.A.A. ANNUAL GENERAL MEETING

October 10, 1991, 3:30 p.m.
Ramada Renaissance, Edmonton, Alberta

1) Opening of the Meeting and Welcome by Bruce Dunn.

2) Minutes of the 1990 Annual Meeting, Montreal, Quebec accepted as published in the Journal. Moved by A. Behar. Seconded by R. Peppin.

3) President's report, B. Dunn. Announcement by the President that he will be stepping down after two years due to his impending retirement and subsequent extensive travel.

4) Secretary's Report, W.V. Sydenborgh. The paid membership status is as follows:

| | |
|---|---|
| Members | 277 |
| Student Members | 33 |
| Sustaining Subscribers | 23 |
| Corporate Subscribers | 75 |

This shows very little change from previous years, with a continuing shift of about 10% in the membership category. A loss as far as student members are concerned is observed. Sustaining subscribers have increased, as have subscriptions.

5) Treasurer's Report, E. Bolstad. The Treasurer presented the Financial Report and Auditors' Report by Mr. Tipping. The Financial Report is adopted. So moved by G. Wong and seconded by T. Embleton. Re-investment of funds plus surplus of the Operating Fund to be added to the Capital Fund for future expansion and hedge against inflation. Motion by J. Nicolas and seconded by B. Dunn.

6) Report of the Editor of "Canadian Acoustics". Chantal Laroche presented the report on behalf of M. Hodgson. We are always looking for papers to be published in the Journal. With the move of the Chief Editor to Vancouver, a new printer will have to be found. Also, expenses will be higher due to more pages in the Journal and the increased cost of mailing. Motion presented to increase the budget of the Chief Editor by up to $2000.00. Moved by C. Laroche. Seconded by A. Behar. Motion of congratulations to M. Hodgson and G. Faulkner for the quality of the "Proceedings" issue, September 1991. Moved by A. Behar. Seconded by E. Bolstad. The membership list will be published in the next issue.

7) Report by the Membership Chairman is received in the absence of M. Zagorski and will be passed on to the incoming Chairperson for Membership.

8) Report of the Convener of Acoustics Week 1991 Edmonton, E. Bolstad.

The $3,000.00 seed money (loss) has helped to keep costs down for people wanting to attend the Symposium. Early hopes were for 60-70 attendees. Result to date is 83. Student attendance is also very good. Summary of the Symposium will be published in the Journal. Including exhibitors and those attending seminars, a total of 144 tags were issued.

9) Prizes. Announcement is postponed to the banquet after the AGM.

10) Cameron Sherry reports as Chairman of the C.S.A. Main Committee on Acoustics about rapid development of standards adapted by the I.S.O. (International Standards Organization).

Due to input and co-operation of the members of the European Common Market, the danger exists that these standards could become trade barriers to North American manufacturers. A letter on behalf of the C.S.A. Main Committee will be addressed to the President of the Canadian Manufacturers' Association, outlining these dangers. Especially machinery exported to the ECM may be affected.

11) Report by Chairperson Education Committee, S. Abel. The request for input via the Journal generated only one response. Urgent appeal for input to S. Abel, especially from the academic sector.

12) Fessenden Underwater Prize, D. Chapman. No applications received in 1991.

13) Report - International INCE and Inter-Noise 1992 in Toronto by T. Embleton. International INCE is in its 21st year. This will be the first conference held in Canada. Dates are July 20 - 22, 1992 at the Inn-On-The-Park in Toronto. All committees are in place. Requests for papers are out. Deadline for abstracts is January 10, 1992.

14) Review of the Prize Committee by A. Behar is outlined. Some shortcomings to be rectified. It is moved by D. Chapman and seconded by M. Roland-Mieszkowski that: Regarding the Student Awards Presentation at Acoustics Week in Canada, the CAA Board of Directors review the existing rules and:

a) Establish and publicize a revised set of rules acceptable to a majority of CAA Directors and Executive.
b) Make the changes necessary to admit undergraduate students into the awards scheme, provided that their work is certified to be original.
c) Ensure that a copy of the rules and an application form be included in the call for papers.

The above to be in place starting with Acoustics Week in Canada, 1992.

All present are in favour.

15) Science Fair Report by B. Dunn and A. Cohen. B. Dunn announced that $250.00 was presented to the winner of the Project in Acoustics. The winner was an 8th grade student from Beaconsfield, Que., Maria Gazelle-Holm. Motion by T. Embleton and seconded by C. Lunis that our participation in the Science Fair continue with an amendment by C. Sherry that a one year free subscription to the Journal be provided to the winner.

Accepted unanimously.

16) Status Report on the 1994 International Congress of Audiology and the International Conference on Spoken Language, by B. Dunn. The above will not have official participation by the CAA, nor financial support.

17) Vancouver will be the host city for Acoustics Week 1992. Convener is D. Wicker. Toronto will be the host city in 1993. Motion to accept is made by A. Behar. Seconded by G. Wong. Unanimous. The original proposal from the Winnipeg group was withdrawn.

18) Fees and Budget for 1992. Motion by E. Bolstad, seconded by T. Embleton that the fees for 1992 remain the same as for 1991. Carried.

That the Auditor, G.A. Tipping, be retained for 1992 at $1500.00 per year and the yearly secretarial budget remain at $1500.00. Moved by E. Bolstad and seconded by A. Behar. Carried.

19) Elections. For President, Membership Chairperson, 2 Directors. The proposed slate is:

| | |
|---|---|
| President: | D. Chapman (1 yr) |
| Membership: | J. Bradley (1 yr) |
| Directors: | M. Roland-Mieszkowski, Nova Scotia; F. Laville, Quebec (4 yrs) |

No other nominations received either in writing or from the floor. All declared elected. All accepted. Past President will be B. Dunn.

20) B. Dunn thanked all those that have fulfilled their terms and congratulated those newly-elected and wished them well.

21) D. Chapman thanked B. Dunn for all the work he has done for the CAA.

22) Adjournment by B. Dunn. Seconded by A. Behar.

Prepared by W.V. Sydenborgh

# NEWS/INFORMATIONS

## CONFERENCES

**2nd International Congress on Recent Developments in Air- & Structure-Borne Sound and Vibration**: Acoustical Society of America/Institute of Noise Control Engineering, March 4-6, 1992. For further information call (205) 844-4820.

**2nd French Congress on Acoustics**: Arcachon, France, April 14-17, 1992. Contact: Congrès français d'acoustique, Mécanique physique-Université de Bordeaux I, 33405 Talence Cedex, France. Telephone: (33) 56 84 62 26 - Telefax: (33) 56 84 69 64.

**DGLR/AIAA 14th Aeroacoustics Conference**: Aachen, Germany, May 11-14, 1992. Contact: Dr. John Seiner, Acoustics Division, NASA Langley Research Center, Mail Code 166, Hampton, Virginia 23665-5225, U.S.A. Phone (804) 864-6276, Fax: (804) 864-7687.

**Eurosymposium, "The Mitigation of Traffic Noise in Urban Areas"**: Palais des Congrès Nantes - France, May 12-15, 1992. Contact: Y. Delanne, L.C.P.C., Centre de Nantes 8 P 19, 44340 Bouguenais, France. Phone 33.40.84.59.01 or Fax 33.40.84.59.86.

**6th International Conference on Hand-Arm Vibration**: Bonn, Gerrmany, May 19-22, 1992. Contact: 6th HAV - Berufsgenossenschaftliches Institute für Arbeitssicherheit - BIA, Alte Heerstrasse 111, D-5205 Sankt Augustin 2. Telex: 49/2241/23102 or Telefax: 49/2241/231234.

**Acoustical Society of America**: Salt Lake City, Utah, May 11-15, 1992. Contact: Murray Strasberg, Acoustical Society of America, 500 Sunnyside Blvd., Woodbury, NY 11797, USA

**14th International Congress on Acoustics**: Beijing, China, September 3 - 10, 1992. Contact ICA Secretariat, Institute of Acoustics, P.O. Box 2712, Beijing 100080, China or Fax at 256 - 1457.

## COURSES

**Vibration Testing**: San Diego, CA, February 25-28, 1992. Contact: Spectral Dynamics, 13112 Evening Creek Drve, South, San Diego, CA 92128-4149. Telephone: (619) 679-6000 or FAX: (619) 679-6400 or, better yet, phone seminar registration at (619) 679-6351 between the hours of 08:00 - 16:00 Pacific Time.

**Clinical Audiology**: Southampton, UK, March 30 - April 3, 1992. Contact: ISVR Conference Secrtetary, Institute of Sound & Vibration Research, The University, Southampton SO9 5NH, UK. Telephone: (0703) 592310 or FAX: (0703) 593033.

**Instrumentation and Measurement Techniques for Noise Control (run in association with Bruel & Kjaer)**: Southampton UK. April 6 - 8, 1992. Contact: ISVR Conference Secretary, Institute of Sound & Vibration Research, The University, Southampton SO9 5NH Telephone: (0703) 592310 or FAX: (0703) 593033.

**Active Control of Sound and Vibration**: Southampton, UK, April 13-15, 1992. Contact: ISVR Conference Secretary, Institute of Sound & Vibration Research, The University, Southampton SO9 5NH, UK. Telephone: (0703) 592310 or FAX: (0703)

**Acoustics & Noise Control**: Cheswick, PA, May 18-22, 1992. Contact: AVNC, Continuing Education Division, 250 Shagbark Drive, R.D. #1, Cheswick, PA 16094.

## CONFERENCES

**2e Congrès international sur les derniers progrès dans le domaine des vibrations et des sons aériens et des corps:** Acoustical Society of America/Institute of Noise Control Engineering, du 4 au 6 mars 1992. Renseignements: (205) 844-4820.

**2e Congrès français d'acoustique**: Arcachon, France, du 14 au 17 avril 1992. Contacter: Congrès français d'acoustique, Mécanique physique, Université de Bordeaux I, 33405 Talence Cedex, France. Téléphone: (33) 56 51 62 26. Télécopieur: (33) 56 84 69 64.

**14e Conférence DGLR/AAIAA sur l'aéroacoustique**: Aachen, Allemagne, du 11 au 14 mai 1992. Contacter: Dr. John Seiner, Acoustics Division, NASA Langley Research Center, Mail Code 166, Hampton, Virginie 23665-5225, E-U. Téléphone: (804) 864-6274. Télécopieur: (804) 864-7687.

**Eurosymposium su la maîtrise du bruit routier en milieu urbain**: Palais des congrès, Nantes, France, du 12 au 15 mai 1992. Contacter: Y. Delanne, L.C.P.C., Centre de Nantes 8 P 19, 44340, Bouguenais, France. Téléphone: (33) 40 84 59 01. Télécopieur: (33) 40 84 59 96.

**6e Conférence internationale sur les vibrations dans les bras et les mains**: Bonn, Allemagne, du 19 au 22 mai 1992. Contacter: 6th HAV - Berufsgenossenschaftliches Institute für Arbeitssicherheit - BIA, Alte Heerstrasse 111, D-5205, Sankt Augustin 2. Télex: 49-2241-23102. Télécopieur: (49) 2241-231234.

**Conférence de l'Acoustical Society of America**: Salt Lake City, Utah, du 11 au 15 mai 1992. Contacter: Murray Strasberg, Acoustical Society of America, 500 Sunnyside Blvd, Woodbury, NY 11797, E-U.

**14e Congrès international sur l'acoustique**: Beijing, Chine, du 3 au 10 septembre 1992. Contacter: ICA Secretariat, Institute of Acoustics, P.O. Box 2712, Beijing 100080, Chine, Télécopieur: 246-1457.

## COURS

**Vibration Testing**: San Diego, California, du 25 au 28 février 1992. Contacter: Spectral Dynamics, 13112 Evening Creek Drive, South San Diego, CA 92128-4199. Téléphone: (619) 679-6000, Télécopieur (619). Ou s'inscrire directement en composant le (619) 679-6351 entre 8 h et 16 h (heure du Pacifique).

**Clinical Audiology**: Southampton, Grande-Bretagne, du 30 mars au 3 avril 1992. Contacter: ISVR Conference Secretary, Institute of Sound and Vibration Research, The University, Southampton SO9 5NH, Grande-Bretagne. Téléphone: (0703) 592310, télécopieur (0703) 593033.

**Instrumentation and Measurement Techniques for Noise Control (donné en collaboration avec Bruel & Kjaer)**: Southampton, Grande-Bretagne, du 6 au 8 avril 1992. Contacter: ISVR Secretary, Institute of Sound and Vibration Research, The University, Southampton S09 5NH, Grande-Bretagne. Téléphone (0703) 592310, télécopieur (0703) 593033.

**Active Control of Sound and Vibration**: Southampton, Grande-Bretagne, du 13 au 15 avril 1992. Contacter ISVR Conference Secretary, Institute of Sound and Vibration Research, The University of Southampton S09 5NH, Grande-Bretagne, Téléphone (0703) 592310, télécopieur (0703) 593033.

**Acoustics & Noise Control**: Cheswick, Pennsylvanie, du 18 au 22 mai 1992. Contacter: AVNC, Continuing Education Division, 250 Shagbark Drive, R.D. #1, Cheswick, PA 16094.

**Signal Processing**: Cheswick, PA, May 18-22, 1992. Contact: AVNC, Continuing Education Division, 250 Shagbark Drive, R.D. #1, Cheswick, PA 16094.

**Program in Acoustics and Signal Processing**: State College, PA, June 1992. A unique four-week program, comprised of ten accredited graduate level courses in acoustics and signal processing, will be offered in June, 1992 by Penn State's Graduate Program in Acoustics in cooperation with the University's Applied Research Laboratory (ARL). Contact: Dr. Alan D. Stuart, Summer Program Coordinator, the Penn State Graduate Program in Acoustics, P.O. Box 30, State College, PA, 16804. Telephone (814) 863-4128 or FAX (814) 865-3119.

## NEW PRODUCTS

A new **Draft American National Standard**: "Evaluating the Effectiveness of Hearing Conservation Programs" is shortly to appear as Draft ANSI S12.13-1991 (ASA Catalogue No. 97-1991). It is the result of the work of the ANSI S12 WG12, that has two Canadian members. The Standard made use of the Audiometric Data Base Analysis, originally developed by Larry and Julie Royster from the North Carolina State University. For more information, contact Alberto Behar, Ontario Hydro, Telephone: (416) 683-7516.

**Institute of Noise Control Engineering**: NOISE-CON 91 was the occasion for the celebration of the 20th anniversary of the founding of the Institute of Noise Control Engineering. The Proceedings of NOISE-CON 91 are now available. Eighty-seven papers on a wide variety of topics on noise control engineering appear in the Proceedings. Copies of the NOISE-CON 91 Proceedings are available for $75.00 each from Noise Control Foundation, P.O. Box 2499 Arlington Branch, Poughkeepsie, NY 12603, USA.

**Occupational Noise-induced Hearing Loss - Prevention and Rehabilitation**: During November 1990 a series of one-day seminars was presented in various centres throughout Australia on the above topic. The Proceedings of the seminars are now available. The Proceedings are priced at $35.00 (Australian), which includes handling and postage, and may be obtained by sending an international bank draft to the Finance Subsection, Worksafe Australia, GPO Box 58, Sydney 2001, Australia.

**Dalimar Newsletter 1991**. In order to better serve all itscustomers in the Ontario market, Dalimar has opened an office near Toronto. Mr. Harvey Bauhs joins the sales team to service this territory. Harvey brings with him nine years of experience in acoustics and vibration, having worked for a major consultant in these fields. Harvey can be reached at:

Dalimar Instruments Inc.
225 Major Mackenzie Drive, East
Suite 611
Richmond Hill, Ontario
L4C 8T4D
Telephone: (416) 508-8345
Facsimile: (416) 508-8344
Mr. Bauhs will be pleased to discuss your instrumentation requirements with you. Please feel free to contact him.

## PEOPLE IN THE NEWS

**Murray Hodgson** has left the NRC to take up a joint appointment at the University of British Columbia. He will be the "engineer" for the Occupational Hygiene Programme, a new graduate programme funded by the Workers' Compensation Board of BC. He will also have a cross appointment in Mechanical Engineering. In both cases he will teach acoustics and vibration and undertake research into the acoustical environment in workrooms.

**Signal Processing**: Cheswick, Pennsylvanie, du 18 au 22 mai 1992. Contacter: AVNC, Continuing Education Division, 250 Shagbark Drive, R.D. #1, Cheswick, PA 16094.

**Program in Acoustics and Signal Processing**: State College, Pennsylvanie, juin 1992. Programme de quatre semaines offert par le programme de troisième cycle en acoustique de la Pennsylvania State University en collaboration avec le laboratoire de recherche appliquée (ARL) de la même université, et comprenant dix cours de troisième cycle dans les domaines de l'acoustique et du traitement des signaux. Contacter: Dr. Alan D. Stuart, Summer Program Coordinator, the Penn State Graduate Program in Acoustics, P.O. Box 30, State College, PA, 16804. Téléphone (814) 863-4128, télécopieur (814) 865-3119.

## NOUVEAUX PRODUITS

Nouveau projet de norme de l'ANSI sur l'évaluation des programmes de protection de l'ouïe à paraître sous la désignation Draft ANSI S12.13-1991 (no 97-1991 dans le catalogue ASA). Le projet est le fruit des travaux du groupe de travail ANSI S12 WG12, qui compte deux canadiens. Le norme fait usage de l'analyse de la base de données audiométrique, mise au point par Larry et Julie Royster de la North Carolina State University. Contacter: Alberto Behar, Ontario Hydro, téléphone (416) 683-7516.

**Institute of Noise Control Engineering**: Au cours de la conférence NOISE-CON 91, qui coïncidait avec les festivités du 20e anniversaire de l'Institute of Noise Control Engineering, quelques 87 mémoires ont été présentés sur une grande variété de sujets liés au génie de la maîtise du bruit. Ces mémoires sont contenus dans les actes de la conférence disponible au coût de 75 $ l'unité. Contacter: Noise Control Foundation, P.O. Box 2499 Arlington Branch, Poughkeepsie, NY 12603, USA.

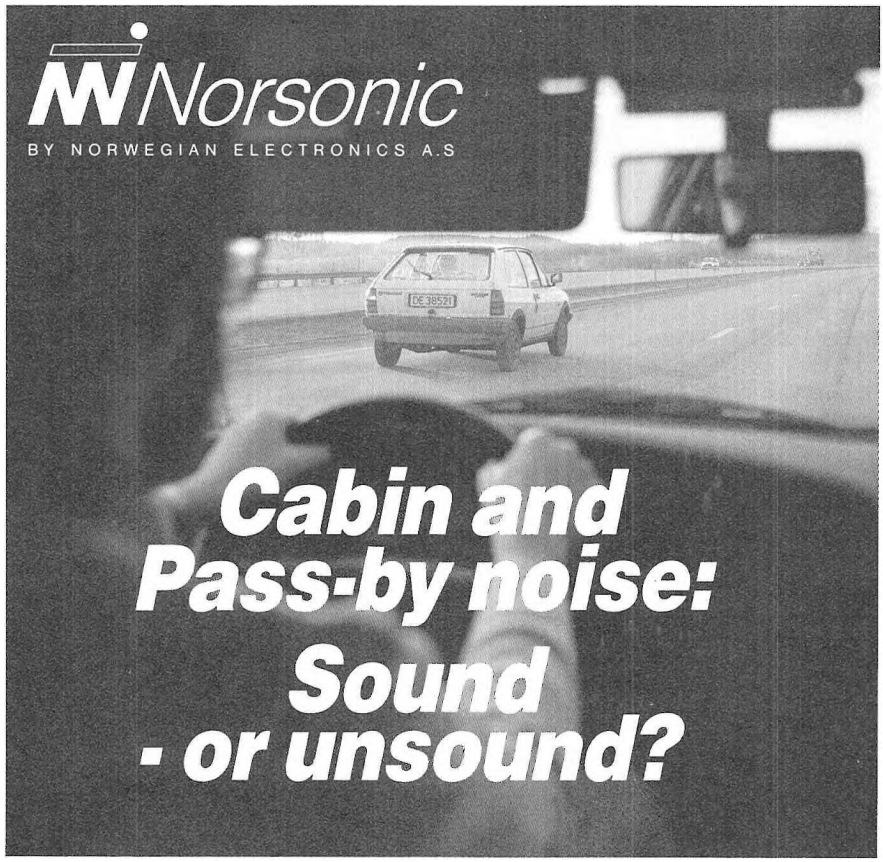
**Occupational Noise-induced Hearing Loss - Prevention and Rehabilitation**: Ce sujet a été traité lors d'une série de séminaires d'une journée tenus en novembre 1990 dans diverses villes australiennes. Les actes de ces séminaires sont maintenant disponible au coût de 35 $ (AUS) l'unité, (frais de poste compris). On peur se les procurer en faisant parvenir une traite bancaire internationale à: Finance Subsection, Worksafe Australia, GPO Box 58, Sydney 2001, Australia.

**Nouvelle tirée du Dalimar Newsletter 1991**: Afin de mieux servir l'ensemble de son clientèle ontarienne, la compagnie Dalimar vient d'ouvrir un bureau dans la région de Toronto. Le représentant commercial pour cette région sera Harvey Bauhs. M. Bauhs possède neuf ans d'expérience dans les domaines de l'acoustique et de la vibration.. Ses coordonnées sont les suivantes:

Dalimar Instruments Inc.
225, Major Mackenzie Drive est
Bureau 611
Richmond Hill, Ontario
L4C 8T4
Téléphone: (416) 508-8345
Télécopieur: (416) 508-8344
M. Bauhs se fera un plaisir de discuter de vos besoins avec vous. N'hésitez pas à communiquer avec lui.

## LES GENS QUI FONT PARLER D'EUX

**Murray Hodgson** vient de quitter son poste au CNR pour occuper un poste double à l'université de la Colombie-Britannique. Il travaillera en effet au sein de deux programmes: le nouveau programme d'hygiène industrielle fondé par la Commission des accidents du travail de la Colmibia-Britannique, et le programme de génie mécanique. Dans les deux cas, son enseignment portera sur l'acoustique et les vibrations; il fera aussi des recherches dans le domaine de l'environnement acoustique en milieu de travail.

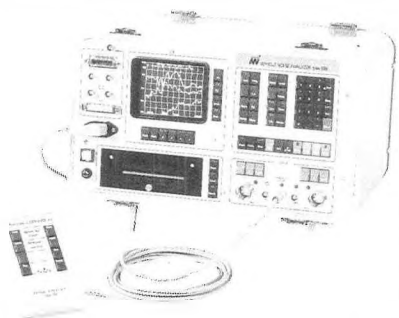



Norsonic introduces the ideal cost-effective high quality vehicle noise and vibration analyzer for car manufacturers and suppliers of tires and car parts.

The new Vehicle Noise Analyzer VNA 836 is designed for easy reliable in-car operation by single test drivers. It offers separate registration of pass-by noise from the right and left-hand side of the car, as well as separate registration of all cabin noise.

Norsonic offers a complete solution, with optical rpm pick-up, light barriers, and vehicle position radar.

The entire VNA 836 system is set up in a few minutes, and it can supply all information necessary to satisfy the most demanding engineering staff. Instant calculation and presentation of all relevant data makes the Norsonic Vehicle Noise Analyzer 836 the ideal cost-effective light-weight test tool for the world's automotive industry.



**SCANTEK, INC.**
916 Gist Avenue
Silver Spring MD 20910
(301) 495-7738
Fax (301) 495-7739

## EMPLOYMENT

**As a service to readers we will publish, at no charge, advertisements from employers looking for staff, and from individuals seeking employment. To take advantage of this service, simply send your advertisement to the Editor-in-Chief. Individuals wishing to remain anonymous may request the use of a file number, to be managed by the Editor.**

**Acoustical Consultant Sought**

We are seeking an Acoustical Consultant, to work mostly with industrial noise control in the Canadian oil and gas industry. The job functions include data acquisition and analysis, formulation of noise-control recommendations, and preparation of reports. The applicant should have prior experience with noise measurement and noise control. Previous experience in acoustical consulting would be beneficial. The applicant should preferably be a registered Professional Engineer.

HFP is a well-established acoustical-consulting firm, located in Calgary, Alberta. The majority of our clients are oil and gas companies. Our work involves conducting environmental-noise assessments and diagnostic assessment for existing facilities, and providing noise-control design for existing and proposed facilities. Other work occasionally includes architectural acoustics, HVAC noise control and transportation-noise assessment.

Qualified individuals should send their resumés, in strict confidence, to:

**HFP Acoustical Consultants Ltd.**
**#1140, 10201 Southport Road S.W.**
**Calgary, Alberta T2W 4X9**

**Employment Sought**

Well-trained graduate with M.Eng. in acoustics seeks a professional career as an acoustical engineer. Experienced in architectural acoustics and occupational noise assessment. Familiar with acoustic theory, instrumentation, noise control design, as well as computers and software routines. Please contact:

**Mr. Li Junping**
**Centre for Building Studies**
**Concordia University**
**1455 de Maisonneuve Blvd. W.**
**Montreal, Quebec H3G 1M8**
**(514) 848-7919 (office)**
**(514) 342-2263 (residence)**

**Representatives Wanted**

Scantek, Inc., the exclusive North American distributor of Norsonic (formerly Norwegian Electronics), RION, Castle Associates, RTA Technology, Braunstein & Berndt and others is searching for one or more representatives in Canada to handle its entire line. We offer a strong and diverse line, a strong customer base, and unsurpassed support and service. For further information call or write:

**Richard J. Peppin, P.Eng.,President**
**Scantek, Inc., 916 Gist Avenue**
**Silver Spring, MD, USA 20910**
**Tel: (301) 495-7738**
**Fax: (301) 495-7739**

## EMPLOIS

**A titre de service aux lecteurs nous publierons, sans frais, les annonces d'employeurs qui cherchent du personnel, et d'individus qui sont à la recherche d'un emploi. Pour bénéficier de ce service, envoyez simplement votre annonce au rédacteur en chef. Les individus désirant demeurer anonymes peuvent demander un numéro de dossier, géré par le rédacteur.**

**Wanted: Career**

**Acoustical Engineer Solicits Challenging Career**

Knowledgable in highway noise control techniques and analysis. Practical experience using transducers and instrumentation measuring techniques, such as sound intensity, for analyzing acoustical and vibration phenomena. University education in engineering. Member of:

Association of Professional Engineers of Ontario (APEO)
Canadian Acoustical Association
Institute of Noise Control Engineering
Acoustical Society of America

Reply with confidence and confidentiality to:
**Acoustical Engineer**
**4 Ludlow Avenue**
**Toronto, Ontario M8Z 3S8**

**Manager**

A well-established, well-equipped western-Canadian acoustical consultant is seeking a Manager to assume full responsibility for operating the company. Eligibility for membership in APEGGA and at least 3 years experience in acoustical consulting are required. Management and market experience are a definite asset. Partnership and eventual full ownership are open to negotation. Contact:

**Bolstad Engineering Associates Ltd.**
**9249 - 48th Street**
**Edmonton, Alberta T6B 2R9**
**Tel: (403) 465-5317**
**Fax: (403) 465-5318**

**Research Students and Assistants Sought**

A new research group, concentrating on subjective and physical aspects of the (mainly acoustical) work environment, is starting up at the University of British Columbia. Current research projects include: prediction of sound fields in large offices; measurement and prediction of the acoustic properties of room surfaces; propagation and design of industrial acoustic warning signals; prediction of the performance of baffle arrays in non-diffuse sound fields.

Expressions of interest are invited from persons interested in working as research assistants or in pursuing post-graduate degrees in Occupational Hygiene or Mechanical Engineering. Contact:

**Dr. Murray Hodgson**
**Department of Mechanical Engineering**
**University of British Columbia**
**2324 Main Mall**
**Vancouver, BC V6T 1Z4**

# The Canadian Acoustical Association
# l'Association Canadienne d'Acoustique

## MEMBERSHIP DIRECTORY 1991 / ANNUAIRE DES MEMBRES 1991

The number that follows each entry refers to the areas of interest as coded below.

Le nombre juxtaposé à chaque inscription réfère aux champs d'intérêt tels que codifiés ci-dessous.

| Areas of interest | | Champs d'intérêt |
|---|---|---|
| Architectural acoustics | 1 | Acoustique architecturale |
| Electroacoustics | 2 | Electroacoustique |
| Ultrasonics | 3 | Ultrasons |
| Musical acoustics | 4 | Acoustique musicale |
| Noise | 5 | Bruit |
| Psycho and physio-acoustics | 6 | Psycho et physio-acoustique |
| Shock and vibration | 7 | Chocs et vibrations |
| Speech communication | 8 | Communication parlée |
| Underwater acoustics | 9 | Acoustique sous-marine |
| Other | 10 | Autre |

Dr. Sharon M. Abel
Mount Sinai Hospital
600 University Ave., Suite 843
Toronto, Ontario
M5G 1X5
(416) 586-8278 FAX: (416) 586-8588
Member 5,6,8

ACOUSTEC INC.
Dr. J.G. Migneron
925 rue Newton, Ste 103
Quebec, Quebec
G1P 4M2
(418) 877-6351 FAX: (418) 877-6353
Sustaining 1,6

Acoutherm Insulation Ltd.
19 Passmore Ave., Unit 18
Scarborough, Ontario
M1V 4T5
(416) 299-7852 FAX: (416) 299-7783
Corp. Subscription 1,5,7

Ms. M.P.B. Adams
Safety Dept.
INCO Ltd.
Thompson, Manitoba
R8N 0W9
(204) 778-2605 FAX: (204) 778-2179
Member 5,7,8

Dr.P.W.Alberti,
200 Elizabeth St.,
7th Floor North,
Toronto, Ontario
M5G 2C4
Member 5

Dr. D.L. Allen
Vibron Limited
1720 Meyerside Drive
Mississauga, Ontario
L5T 1A3
(416) 670-4922 FAX: (416) 670-1698
Member 1,5,7

Mr. Maurice Amram
Ecole Polytechnique
de Montreal
Departement de Genie Physique
C.P. 6079, Succursale A
Montreal, Quebec
H3C 3A7
(514) 340-4572 FAX: (514) 340-4026
Member 1,5

Mr. Chris Andrew
DPW, Noise Control Office
433 Eastern Avenue,
Toronto Ontario
M4M 1B7
(416) 392-0791 FAX: (416) 392-0816
Member 1,5

Mr. Graham Andrews
Boeing Canada, Dehavilland
Flight Test Building
Garratt Blvd.
Mailstop N70-01,
Downsview, Ontario
M3K 1Y5
(519) 650-2056 Home; (416) 375-3812 Bus
Member 2,5

Mr. Horst Arndt
Unitron Industries Ltd.
20 Beasley Drive
P.O. Box 9017
Kitchener, Ontario
N2G 4J3
(519) 895-0100 FAX: (519) 895-0108
Member 2,6,8

Mr. A.F.Atamanchuk
Health Environmentalist
City of Winnipeg, Health Dept.
280 William Avenue
Winnipeg, Manitoba
R3B 0R1
(204) 986-2388 FAX: (204) 947-3957
Member 1,5,7

Ian Atkinson
Nordco Ltd.
P.O. Box 8833
St. John's, Newfoundland
A1B 3T2

Mr. B.W. Bailey
c/o Bruel & Kjaer Canada Ltd.
116 Russ Rd.
Grimbsby, Ontario
L3M 4E7
(416) 945-1900 FAX: (416) 945-8411
Member 2,5,6

Ms. Denise Barbiero
Audiology
Mount Sinai Hospital
600 University Ave., #201
Toronto, Ontario
M5G 1X5
(416) 586-5018
Member 2,5,

Mr. Simon Bargetzi
Bargmes Ent. Canada Ltd.
P.O.Box 704
Golden, British Columbia
V0A 1H0
(604) 344-5344
Member 1,5,7

Barman Swallow Associates
1 Greensboro Dr., Suite 401
Rexdale, Ontario
M9W 1C8
(416) 245-7501
Sustaining 1,3,5,7

Barron Kennedy Lyzun & Associates Ltd.
Att: Mr. Kenneth E. Barron, P.Eng.
#250-145 West 17th Street
North Vancouver, British Columbia
V7M 3G4
(604) 988-2508
Sustaining 1,2,5,

Dr. W.E.Baylis
Dept.of Physics
University of Windsor
Windsor, Ontario
N9B 3P4
(519) 253-4232, ext 2653, FAX: (519) 973-7075
Member 1,4

B.C. Inst. of Technology
Library - Serial Dept.
3700 Willingdon Avenue
Burnaby, British Columbia
V5G 3H2
Subscription

Mr. Tom Beardall, Manager
Occupational Hygiene Services
Occupational Health Centre
Abramsky Hall - 2nd Floor
Queen's University
Kingston, Ontario
K7L 3N6
(613) 545-2909 FAX: (613) 545-6686
Member 5,7

Mr. Alberto Behar
Safety Services Dept.
Ontario Hydro
757 McKay Road
Pickering, Ontario
L1W 3C8
(416) 683-7516
Member 1,2,5

Mr. S. Benner
Ministry of the Environment
250 Davisville Ave., 3rd Floor
Toronto, Ontario
M4S 1H2
(416) 440-3549 FAX: (416) 440-6973
Member 1,5

Ms. Barbara Bentley
14 Archer Cres.
London, Ontario
N6E 2A5
(519) 668-0635
Student 5,8

Mr. Alain Berry
GAUS - Génie Mécanique
Université de Sherbrooke
Sherbrooke, Quebec
J1K 2R1
(819) 821-7102 FAX: (819) 821-7163
Student 5,7,9

Mr. Ugis Bickis
Occupational Health Ctr.
Abramsky Hall, Queen's University
Kingston, Ontario
K7l 3N6
(613) 545-2909 FAX: (613) 545-6686
Member 1,5,7

Mr. David G. Billard
NFLD. & LABRADOR HYDRO
P.O. Box 12400
St. John's, Newfoundland
A1B 4K7
(709) 737-1404 FAX: (709) 737-1790
Member 1,3,5,7

Bilsom International Ltd.
60 St. Clair Ave. E.
Suite 1002
Toronto, Ontario
M4T 1N5
(416) 922-7807
Corp. Subscription

Mr. Kenneth G. Bilyk
Bilyk Technologies
27 Park Terrace Drive
Winnipeg, Manitoba
R2J 3C6
(204) 255-0620 FAX: (204) 255-0619
Member 1,2,5

Mr. John Binek
SPL CONTROL
1400 Bishop St.
P.O. Box 2252
Cambridge, Ontario
N1R 6V8
(519) 623-6100 FAX: (519) 623-7500
Member 1,5

H.L. Blachford, Ltd.
c/o Mr. D.E. Watson
2323 Royal Windsor Dr.
Mississauga, Ontario
L5J 1K5
(416) 823-3200 FAX: (416) 823-9290
Sustaining 5

Mr. J. Blachford
H.L. Blachford Ltee
977 Lucien l'Allier
Montreal, Quebec
H3G 2C3
(514) 866-9775
Member

Bolstad Eng. Assoc.Ltd.
c/o Mr. E.H. Bolstad
9249-48 Street
Edmonton, Alberta
T6B 2R9
(403) 465-5317 FAX: (403) 465-5318
Sustaining 1,5

Jean-Pierre Bouchard
Acoustico
2575 rue Watt
Ste-Foy, Quebec
G1P 3T2

Raymond Bouchard
Production Hollophonique Inc.
5880, boul. Martel
St. Honore, Quebec
G0V 1L0

Mr. J.W. Boutilier
1143 Upper Paradise Road
R.R. 1
Ancaster, Ontario
L9G 3K9
Member 1,2

Mrs. Denise M. Bowman
806 Harris Place N.W.
Calgary, Alberta
T3B 2V4
(403) 282-2742
Student, 6

Mr. Paul G. Bowman
Union Gas Ltd.
50 Keil Dr. N.
Chatham, Ontario
N7M 5M1
(519) 352-3100, ext. 2873, FAX: (519) 436-5210
Member 5

J.S. Bradley
Inst. for Research in Construction
National Research Council Canada
Bldge M-27
Montreal Road
Ottawa, Ontario
K1A 0R6
(613) 993-9747
Member 1,2,4

C. William Bradley
Consulting Engineer
3600 Ridgewood Ave., Ste. 106
Montreal, Quebec
H3V 1C2

Mr. Scott J. Bradley, P.Eng.
Boeing Canada Technology Ltd.
Baskin Drive East
Arnprior, Ontario
K7S 3M1
(819) 685-9094
Member 2,5,7

A.J. Brammer
Inst. for Microstructural Sciences
National Research Council Canada
Montreal Road
Ottawa, Ontario
K1A 0R6
(613) 993-6160 FAX: (613) 952-1394
Member 3,5,7

Mr. Dave Brennan
Martec Limited
5670 Spring Garden Rd.
Suite 805
Halifax, Nova Scotia
B3J 1H6
(902) 425-5101
Member 6,7,9

Ms. Lynne C. Brewster
S.P.A.R.C.
Room 15, Ellis Hall
University Hospital
Saskatoon, Saskatchewan
S7N 0X0
(306) 966-1320 FAX: (306) 966-8716
Member 1,2,6,8

British Library
Document Supply Centre
Accessions Dept.
Boston, Spa
Yorks LS237BQ
United Kingdom
Subscription

Mr. David W. Brown
Brown Strachan Associates
1290 Homer Street
Vancouver, British Columbia
V6B 2Y5
(604) 689-0514 FAX: (604) 689-2703
Member 1,6

Mr. David G. Browning
139 Old North Road
Kingston, RI
USA 02881
(401) 783-4362
Member 3,9

Bruel & Kjaer Canada Ltd.
c/o Mr. Andrew McKee
90 Leacock Road
Pointe Claire, Quebec
H9R 1H1
(514) 695-8225 FAX: (514) 695-4808
Sustaining 5,7,10

Mr. Claudio Bulfone
12686-93 A Avenue
Surrey, British Columbia
V3V 1L3
(604) 589-0587 FAX: (604) 666-1175
Member 5,7

C.J. Burna
10408 - 36 Avenue
Edmonton, Alberta
T6J 2H4
(403) 435-9172 (Home); (403) 465-5317 (Bus)
Member 1,4,5,

Ms. P. Burnett-Phillips
Box 158
Dept. of Psychology
University of Georgia
Athens, GA
USA 30602

Mr. Steve Burrell
Martec Limited
5670 Spring Garden Road, Ste. 805
Halifax, Nova Scotia
B3J 1H6
(902) 425-5101
Member 5,7,9

Jack Butler, Ph.D.
Image Acoustics Inc.
P.O. Box 6
North Marshfield, MA
USA 02059

Mr. Richard Cabot
145 S.W. 102nd
Portland, OR
USA 97225-6954
(503) 627-0832 FAX: (503) 641-8906
Member 1,2,6

Mr.Angelo J. Campanella
Campanella Assoc.
3201 Ridgewood Drive
Columbus, OH
USA 43026
(614) 876-5108 FAX: (614) 771-8740
Member 1,5,7

Canadian Astronautics Ltd.
Information Resources Ctr.
1050 Morrison Drive
Ottawa, Ontario
K2H 8K7
Subscription

Canadian Institute for STI
Library Serial Acquisitions
National Research Council Canada
Ottawa, Ontario
K1A 0S2
Subscription

M. Pierre-U. Careau
Hotel-Dieu de Levis
90 des Buissons, Est
Levis, Quebec
G6V 5B4
(418) 833-4644 FAX: (418) 833-1681
Member 5,6,7

William J. Cavanaugh
Cavanaugh Tocci Assoc. Inc.
3 Merifield Lane
Natick, MA
USA 01760

Centralnaja Nauchno
Techn Bibliotheka
198188 Leningrad
USSR
Subscription

Ctr. Hospitalier Honore-Mercier Inc.
c/o Mme. Pauline Fortier
2750 Boul. Laframboise
St.-Hyacinthe, Quebec
J2S 4Y8
(514) 773-3152 FAX: (514) 773-4979
Subscription 1,5,6

Alain Chamard
A.P.C.H.Q.
5930 boul. Louis-H. Lafontaine
Anjou, Quebec
H1M IS7

Mr.Yvan Champoux
Département de Génie Mécanique
Faculté des Sciences Appliquées
Université de Sherbrooke
Sherbrooke, Quebec
J1K 2R1
(819) 821-7146
Member 1,5,7

Mr. David M.F. Chapman
Defence Research Establishment Atlantic
P.O. Box 1012
Dartmouth, Nova Scotia
B2Y 3Z7
(902) 426-3100 Ext 228
Member 9

Mr. Marshall Chasin
216 McMorran Cresc.
Thornhill, Ontario
L4J 3P3
(416) 731-1785
Member 2,5,6,8

Dr. Margaret F. Cheesman
The University of Western Ontario
Faculty of Appplied Health Sciences
Department of Communicative Disorders
Elborn College
London, Ontario
N6G 1H1
(519) 661-2001 FAX: (519) 586-8739
Member 5,6,8

Fangxin Chen
Dept. of Linguistics
University of Alberta
Edmonton, Alberta
T6G 2E7
(403) 492-4189
Student 6,8

Mr. Li Cheng
G.A.U.S., Génie Mécanique
Université de Sherbrooke
Sherbrooke, Quebec
J4K 2R1
(819)824-7184 FAX: (819) 821-7163
Member 1,5,7

Dr. W. T. Chu
Institue for Research in Construction
National Research Council Canada
Montreal Road, Bldg. M-27
Ottawa, Ontario
K1A 0R6
(613) 993-9742 FAX: (613) 954-5984
Member 1,5

Mr. Jozef Cipin
Acoutherm Insulation Ltd.
19 Passmore Ave., Unit 18
Scarborough, Ontario
M1V 4T5
(416) 299-7852 FAX: (416) 299-7783
Member 1,5,7

Cirrus Research Ltd.
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire Y014 OPH
England

Steven D. Clements
2907 - 5599 Fenwick St.
Halifax, Nova Scotia
B3H 1R2
(902) 429-5024

Mr. Gregory E. Clunis, Eng.
907 Admiral Avenue
Ottawa, Ontario
K1Z 6L6
(613) 736-2151 FAX: (613) 998-9603
Member 1,7,9

Mr. Dean R. Coates
R.R. # 6
Cobourg, Ontario
K9A 4J9
(416) 372-1905
Member 1,5,7

Mr. John B. Codrington
Acres International Ltd.
5259 Dorchester Road
P.O. Box 1001
Niagara Falls, Ontario
L2E 6W1
(416) 374-5200
Member 5,7

Dr. Annabel J. Cohen
Department of Psychology
Dalhousie University
Halifax, Nova Scotia
B3H 4J1
(902)494-8888 FAX: (902) 494-6585
Member 4,6,8

Arthur J. Collier
c/o DREA
Box 1012
Dartmouth, Nova Scotia
B2Y 3Z7
(902) 426-3100
Member 7,9

Gervais Comtois
Prevost Car Inc.
35 boul. Gagnon
Ste Claire, Quebec
G0R 2V0

USACERL Library
P.O.Box 9005
Champaign, IL
USA 61826
Subscription

Mr. Joseph L. Corcoran
4622 Caulfield Dr.
W. Vancouver, British Columbia
V7W 1E8
(604) 926-8668
Member 1,5,7

Mr. Leonard Cornelisse
565 Talbot Street, Apt. 602
London, Ontario
N6A 2T1
(519) 438-3887
Member 1,6,8

F.D. Cotaras
c/o DREA
P.O. Box 1012
Dartmouth, Nova Scotia
B2Y 3Z7
Member 3,9

Andre Cote
Département de Génie Mécanique
Université de Sherbrooke
Sherbrooke, Quebec
J1K 2R1
Student

Mr.Jacques Cote
Soc. d'electrolyse et chimie
Alcan Ltee
C.P. 1500 (Edifice 270A)
Jonquiere, Quebec
G7S 4L2
(418) 699-2640 FAX: (418) 699-3078
Member 1,5,6,7

J.E. Coulter Associates Engineering
Suite 201
200 Finch Ave. W.
North York, Ontario
M2R 3W4
(416) 250-6565
Sustaining 1,5,7

Dr. A. Craggs
Dept. of Mech. Engineering
University of Alberta
Edmonton, Alberta
T6G 2G8
(403) 474-6316
Member 1,5

Mr. Don Craw
University of Manitoba
Occupational Health & Safety Office
Room 191, Frank Kennedy Centre
Winnipeg, Manitoba
R3T 2N2
(204) 474-6316 FAX: (204) 275-5863
Member 5,6,7,8

Ms. Anna M. Crawford
Dept. of Physics
Memorial University
St. Johns, Newfoundland
A1B 3X7
(709) 737-4408
Student 4,9

CSI Mediatheque
Phys.
Boite Postale 30
75927 Paris 19
France
Subscription

C.S.T.B
Monsieur Josse
24, rue Joseph Fourier
38401 Saint Martin d'Heres
France
Subscription

Dr. Lola Cuddy
Department of Psychology
Queen's University
Kingston, Ontario
K7L 3N6
(613) 545-6013 FAX: (613) 545-2499
Member 4,6,8

Mr. J.C. Robert Cyr
Nova Scotia Power Corp.
P.O. Box 910
Halifax, Nova Scotia
B3J 2W5
(902) 428-6589
Subscription

DSE Production Services Ltd.
539 Cleveland Cres., S.E.
Calgary, Alberta
T2G 4R8
(403) 287-2496
Subscription 1,2,8

Dr. Gilles Daigle
Division of Physics
National Reasearch Council Canada
Ottawa, Ontario
K1A 0R6
(613) 993-6188 FAX: (613) 952-1394
Member 3,5

Dalimar Instruments Inc.
89 boul. Don Quichotte, Ste. 7
Ile Perrot, Quebec
J7V 6X2
(514) 453-0033 FAX: (514) 453-0554
Sustaining 1,5,7

Mr. Edward A. Daly
Daly Engineering Company
P.O. Box 129
Beaverton, OR
USA 97075-0129
(503) 626-5735
Member 1,5,7

Davidson & Associates Ltd.
1456 Kelly
St. Sauveur, Quebec
JOR 1R1
(514) 227-4248 FAX: (514) 438-9079
C. Subscription 1,5,7

Dr. Huw G. Davies
Dept.of Mechanical Eng.
University of New Brunswick
Box 4400
Fredricton, New Brunswick
E3B 5A3
(506) 453-4513
Member 5,7

D.C.A.N. (1-20 DAW)
G.E.R.D.S.M.
Le Brusc
F 83140 Six Fours Les Plages
France
1990
Subscription

Ms.Ann de Mey
2 Kennedy Ave, Apt. 205
Toronto, Ontario
M6S 2X5
(416) 769-4077
Member 1,5,7

Defence Research Establishment
Atlantic - Library
P.O. Box 1012
Dartmouth, Nova Scotia
B2Y 3Z7
C.Subscription

Defence Research Establishment
Pacific - Library
Forces Mail Office
Victoria, BC
VOS 1B0
Subscription

Mr. W. C. DeGagne, P.Eng.
208 Brock Street
Winnipeg, Manitoba
R3N 0Y6
(204) 489-7545
Member 4,5

F. Desharnais
Defense Nationale
P.O. Box 1012
Dartmouth, Nova Scotia
B2Y 3Z7

Mr. J. Desormeaux
Ontario Hydro, Safety Service Dept.
757 McKay Road
Pickering, Ontario
L1W 3C8
(416) 683-7516
Member

Mr. S.M. Dickinson
Dept. of Mechanical Eng.
Univ. of Western Ontario
London, Ontario
N6A 5B9
(519) 661-3120 FAX: (519) 661-3808
Member 5,7

Mr. Leslie L. Doelle
5 Kenneth Ave., Ste. 608
North York, Ontario
M2N 6M7
(416) 730-9524
Member 1,4,5

Dr. A.G. Doige
Dept. of Mech. Engineering
University of Victoria
P.O. Box 3055
Victoria, British Columbia
V8W 3P6
(604) 721-8916 FAX: (604) 721-6051
Member 5,7,9,10

Mr. G. Doswell
26 Maplewood Dr.
Whitby, Ontario
L1N 7C4
(416) 668-4003
Member 2,4,7

Dr. Bruce E. Dunn
Dept. of Psychology
University of Calgary
2500 University Drive, N.W.
Calgary, Alberta
T2N 1N4
(403) 220-5564
Member 4,5,6

Dr. Stephen J. Eady
Speech Technology Research Ltd.
Ste. D, 1623 McKenzie Ave.
Victoria, British Columbia
V8N 1A6
(604) 477-0544 FAX: (604) 477-2540
Member 4,6,8

Eckel Industries Inc.
155 Fawcett St.
Cambridge, MA
USA 02138
(617) 491-3221
Corp. Subs. 1,5

Eckel Industries of Canada Ltd.
c/o Mr. Blake Noon
P.O. Box 776
Morrisburg, Ontario
K0C 1X0
(613) 543-2967
Sustaining 5

Mr. A.T. Edwards
328 Gloucester Ave.
Oakville, Ontario
L6J 3X1
(416) 845-1840
Member 1,5,6

Dr. J. Edworthy
Dept. of Psychology
Plymouth Polytechnic
Drake Circus, Plymouth
Devon PL4 8AA
England
44 0752 264647
Member 4,5,6

Prof. M. David Egan
P.O. Box 365
Anderson, SC
USA 29622
(803) 226-3832
Member 1,2,5

Dr. Jos J. Eggermont
Dept. of Psychology
University of Calgary
2500 University Drive, N.W.
Calgary, Alberta
T2N 1N4
(403) 220-7747 FAX: (403) 282-8249
Member 6

Milton S. Eisenhower Library
Serials Dept.
Johns Hopkins Unviersity
Baltimore, MD
USA 21218

Electricite de France
Direction des Etudes et Recherches
c/o P. Leclerc
1, ave du General de Gaulle
BP 408
92141 Clamart Cedex
France
Subscription

Electro Medical Instrument Co.
349 Davis Road
Oakville, Ontario
L6J 5E8
(416) 845-8900
Sustaining 5,6,8

Elektrotehnicki Fakultet
365257/321125
Centralna Knjiznica
PP 170
41000 Zagreb
Yugoslavia
Subscription Canebsco

Gilles Elhadad, physicien
5765 Westminster
Cote-St-Luc, Quebec
H4W 2J6
(514) 489-6262
Member 1,5,7

Mr. C. Elliott
Ontario Hydro
700 University Ave.
Toronto, Ontario
M5G 1X6
(416) 592-8648
Member

Dr. Dale D. Ellis
SACLANTCEN
APO New York, NY
USA 09019-5000
Tel +39187540111 FAX: +39 187 524600
Member 3,9

Tony F.W. Embleton
80 Sheardown Rd.
P.O. Box 786
Nobleton, Ontario
L0G 1N0
(416) 859-1136
Member 2,5,10

Energy Resources Conserv. Board
Library, 2nd Level
640-5 Avenue, S.W.
Calgary, Alberta
T2P 3G4
Subscription

Engineer of Materials
CP Rail, Mechanical Dept.
Box 6042, Stn."A"
Montreal, Quebec
H3C 3E4
Subscription

Environmental Health
North Shore Health Dept.
253 East 14th Street
North Vancouver, British Columbia
V7L 2N5
(604) 988-5231
C.Subscription 1,5

Environmental Health Ctr. Libr.
Rm. B20 EHC Building, HPB
Health and Welfare Canada
Ottawa, Ontario
K1A 0L2
Subscription

Mr. James B. Farmer
RBW Graphics
1749 Twentieth Street East
Owen Sound, Ontario
N4K 5R2
(519) 376-8330 Ext. 339 FAX: 519 371-2379
Member 1,5,7

Mr. James Farquharson
10201 Southport Road S.W., #1140
Calgary, Alberta
T2W 4X9
(403) 259-3600 FAX: (403) 259-4190
Member 1,5

Mr. Clifford Faszer
HFP Acoustical Consul. Ltd.
10201 Southport Rd. S.W., Ste. 1140
Calgary, Alberta
T2W 4X9
(403) 259-3600 FAX: (403) 259-4190
Member 1,6,7

Dr. M.G. Faulkner
Dept. of Mechanical Eng.
University of Alberta
Edmonton, Alberta
T6G 2G8
(403) 492-3446
Member 1,5,7

Mr.James L. Feilders
545 North Rivermede Rd., Ste. 203
Concord, Ontario
L2N 3Z7
(416) 660-2444 FAX: (416) 660-4110
Member 1,5,10

Dr. A. Finley
Dept. of Anaesthesia
I.W.K. Children's Hospital
P.O. Box 3070
Halifax, Nova Scotia
B3J 3G9
(902) 428-8311
Member 6,10

Laurie K. Fitzgerald
Dept. of Psychology
University of Calgary
2500 University Dr. N.W.
Calgary, Alberta
T2N 1N4
Student 6,8,9

Peter J. Flipsen, Jr.
Box 2096
Fort Nelson, British Columbia
V0C 1R0
(604) 774 3066
Member

Mlle Renee Fontaine
6747 19e Ave.
Montreal, Quebec
H1X 2L9
(514) 725-4559
Student 1,2,5,6,8

Foothills Hospital
1403 - 29 St. N.W.
Calgary, Alberta
T2N 2T9
Subscription

John E.K. Foreman
RR #3
Denfield, Ontario
N0M 1P0
Member

Mr. Harold Forester
Paramax Electronics Inc.
6111 Royalmount Ave.
Montreal, Quebec
H4P 1K6
(514) 340-8392
Member 1,5,7

Mr.Stanley Forshaw
DREP
FMO Victoria, Bldg. 199
Victoria, British Columbia
V0S 1B0
(604) 380-2868
Member 5,6,8

Jeanne-C. Fortin
Hydro-Quebec
800 boul. de Maisonneuve Est
Montreal, Quebec
H2L 4M8

Mr. Leslie Frank
HFP Acoustical Consul. Ltd.
10201 Southport Rd. S.W., Ste. 1140
Calgary, Alberta
T2W 4X9
(403) 259-3600 FAX: (403) 254-0993
Member 1,5,10

Mr. Bradley W. Frankland
Dept. of Psychology
Dalhousie University
Halifax, Nova Scotia
B3H 4J1
(902) 455-1237
Student 4,6,8

Mr. Ian A. Fraser
13 Slayter Street
Dartmouth, Nova Scotia
B3A 1Z6
(902) 466-2831
Member 5,7,9,

M. K. Fuller
4223 West 15th Ave.
Vancouver, British Columbia
V6R 3A7
(604) 822 5591 (604) 822-6569
Member 6,8

Mr. W.R.J. Funnell
Dept. of Biomedical Eng.
c/o MEDCOR
McGill University
3775 rue University
Montreal, Quebec
H3A 2B4
(514) 398-6739 FAX: (514) 398-7461
Member 6

Ken Fyfe
Mechanical Eng.
University of Alberta
4-9 Mech.Eng.Bldg.
Edmonton, Alberta
T6E 6C6

Gamache Line
Ministere des Transports
255 Cremazie est
Montreal, Quebec
H2M 1L5

Mr. V. Gambino
3329 Beaurivage Cres.
Mississauga, Ontario
L5L 5H2
(416) 569-1294 FAX: (416) 245-9616
Member 1,2,5,7

Mr. N. Gans
7761 Ostell Cresc.
Montreal, Quebec
H4P 1Y7
(514) 365-3111
Member 1

Mr. Ralph Garcea
190 Grace St.
Toronto, Ontario
M6G 3A6
(416) 534-3604
Member 5,7,10

Dr. Robert Gaspar
822 Lounsborough Street
Windsor, Ontario
N9G 1G3
(519) 972-0677 FAX: (519) 972-0677
Member 1,5,7

Mr. Wm. Gastmeier
12 Roslin Ave. South
Waterloo, Ontario
N2L 2G5
(519) 885-4633
Member 1,2,5

Dr. R.W. Gatehouse
Department of Psychology
University of Guelph
Guelph, Ontario
N1G 2W1
(519) 824-4120, ext. 3518
Member 5,6

Mme Louise Getty
G.A.U.M.
Université de Montreal
C.P. 6128, Succursale A
Montreal, Quebec
H3C 3J7
(514) 343-7672 FAX: (514) 343-5740
Member 5,8,10

Mr. Philip Giddings
16 Wilkins Ave.
Toronto, Ontario
M5A 3C3
(416) 867-3978 FAX: (416) 864-1031
Member 1,2,6

Mr. Christian Giguere
Dept. of Engineering
University of Cambridge
Trumpington St.
Cambridge CB2 1PZ
United Kingdom
Tel (011 44) 223-332800 FAX: (011 44)
221-332662
Student 2,6,8

Dalila C. Guisti
545 North Rivermede Rd.
Ste. 203
Concord, Ontario
L4J 5Y9
(416) 660-2444 FAX: (416) 660-4110
Member 1,5,7

Mr. K.H. Gough
4904 - 124 St.
Edmonton, Alberta
T6H 3T9
(403) 454-5310
Member 6,8

Mr. Gary Gould
3079 The Credit Woodlands
Mississauga, Ontario
L5C 2J2
(416) 592-4773 FAX: (416) 592-2009
Member 1,5,7

Mr. Walter Griba
Instructional Media Centre
Simon Fraser University
Burnaby, British Columbia
V5A 1S6
(604) 291-3190
Member 1,4,5

Mr. Manfred W. Grote
ARCOS Acoustical Consulting Ltd.
L400, 1400 Kensington Rd. N.W.
Calgary, Alberta
T2N 3P9
(403) 283-1191 FAX: (403) 270-3525
Member 1,5,7

Group One Acoustics Inc.
c/o Mr. T. Medwedyk
1538 Sherway Dr.
Mississauga, Ontario
L4X 1C4
(416)896-0988 FAX: (416) 897-7794
C.Subscription 1,2,4

Mr. F. Guptill
Box 93, Site 16A
R.R. 2
Armadale, Nova Scotia
B3L 4J2
(902) 852-3872 FAX: (902) 852-3872
Member 9

Dr. A.T. Haines, M.D.
Assistant Professor
Occupational Health Program
Room 3H50 - HSC
McMaster University
1200 Main St. W.
Hamilton, Ontario
L8N 3Z5
(416) 525-9140 Ext. 2333
Member 7

Linda Hall Library
5109 Cherry
Kansas City, MO
USA 64110
C.Sub.

Mr. Robin E. Halliwell
Inst. for Research in Construction
Acoustics Section, Bldg. M-27
National Research Council Canada
Montreal Road
Ottawa, Ontario
K1A 0R6
(613) 993-9749 FAX: (613) 954-5984
Member 1,5

Mr. C.A. Hamm
Memorial University of Newfoundland
St. John's, Newfoundland
A1B 3X7
(709) 838 24-8
Student 3,5,9

Hatch Assoc. Ltd.
Att: Mr. Tim Kelsall
21 St. Clair Ave. E.
Toronto, Ontario
M4T 1L9
(416) 962-6350
Sustaining, 1,5

Mr. L.E. Hawker
#204 975 Brock St.
Windsor, Ontario
N9C 2T6
(519) 258-7967
Student 5,7,8

Mr. T.E. Hayman
Hugh W. Jones & Associates
374 Viewmount Dr.
Allen Heights
Tantallon, Nova Scotia
B0J 3J0
(902) 826-7922 FAX: (902) 826-7602
Member 1,3,5

Elizabeth Hellier
Dept. of Psychology
Polytechnic South West
Drake Circus, Devon, England
PL4 8AA
PH: 0752 233147
Student 5

Mr. J.R. Hemingway
15106 Rio Terrace Drive
Edmonton, Alberta
T5R 5M5
(403) 487-5665
Member 1,2,5

M. Salem Hertil
S.S. Wilson Assoc.
305 Renfrew Dr., #101
Markham, Ontario
L3R 9S7
(416)940-4664 FAX: (416) 940-4670
Member 1,5,7

Dr. Raymond Hetu
G.A.U.M.
Université de Montreal
CP 6128, Succursale A
Montreal, Quebec
H3L 3J7
(514) 343-7559
Member 5,6

Mr. T. Hewlings
178 Dieppe Ave.
Pointe Claire, Quebec
H9R 1X7
(514) 697-1964
1990
Member 1,2,7

Mr. Ralph K. Hillquist
RKH Consults, Inc.
P.O. Box 113
Milford, MI
USA 48381
(313) 685-2754 FAX: (313) 684-6057
Member 1,5,6

Mr. Thomas T.K. Ho
Bruel & Kjaer Asia Ltd.
3006-8 Shun Tak Centre
200 Connaught Road Central
Hong Kong
(852) 548-7486 FAX: 858-1168
Corp. Subs. 1 thru 9

Dr. Murray Hodgson
Department of Mechanical Engineering
University of British Columbia
2324 Main Mall
Vancouver, British Columbia
V6T 1Z4
(604) 822-3073 FAX: (604) 822-2403
Member 1,5

Mr. J.T. Hogan
Dept. of Linguistics
4-20 Assiniboia Hall
University of Alberta
Edmonton, Alberta
T6G 2E7
(403) 492-3480
Member 6,8

Cheng Honwai Honry
Scientific Services Branch
Tsing Yi Power Station
69-79 Tsing Yi Road
Tsing Yi, Hong Kong

Dr. Donald Hood
135 North Syndicate Ave.
Suite 200
Thunder Bay, Ontario
P7C 3V3
(807) 623-0322 FAX: (807) 623-8609
Member 5,6

Hopital Saint-Luc
Bibliotheque
1058 Rue Saint-Denis
Montreal, Quebec
H2X 3J4
Subscription

Mr. Brian Howe
Vibron Ltd.
1720 Meyerside Drive
Mississauga, Ontario
L5T 1A3
(416) 670-4922 FAX: (416) 670-1698
Member 1,5,7

Mr. Christopher A. Hugh
Sound & Vibration Services
6593 Edenwood Drive
Mississauga, Ontario
L5N 3E9
(416) 824-2016 FAX: (416) 592-2009
Member 1,5,7

Hughes Aircraft of Canada Ltd.
Acoustic Technology Div.
260 Salteaux Cres.
Winnipeg, Manitoba
R3J 3T2
(204) 949-2400 FAX: (204) 889-1268
Subscription

Mr. Steven Hughes
Defence Research Institute Atlantic
P.O. Box 1012
Dartmouth, Nova Scotia
B2Y 3Z7
(902) 426-3100
Member 9

L'Hotel-Dieu de Saint-Jerome
290 Rue Montigny
Saint-Jerome, Quebec
J7Z 5T3
(514) 432-9711
Subscription

IBM Canada Ltd.
Department 361
844 Don Mills Rd.
North York, Ontario
M3C 1V7
Sustaining

IRSST-SALLE DE DOCUMENTATION
505 boul. de Maisonneuve Ouest
11e Etage
Montreal, Quebec
H3A 3C2
(514) 288-1551
Subscription 5,7

The Library
Institute of Ocean Sciences
P.O. Box 6000
Sidney, British Columbia
V8L 4B2
Subscription

Inst. of Sound & Vib. Research
c/o Mrs. A. Dove, Librarian
The University
Southampton SO9 5NH
England
(0703) 592301 FAX: (0703) 593033
Subscription 2,7,9

J.P. Environmental Products Inc.
P.O. Box 816, Stn. C
Kitchener, Ontario
N2G 4C5
(519) 662-3220 FAX: (519) 662-3223
Subscription 1,5,7

Dr. Donald G. Jamieson
Communication Disorders
Elborn College
University of Western Ontario
London, Ontario
N6G 1R8
(519) 661-3901 FAX: (519) 661-3866
Member 2,6,8

Mr. T.M. Johansen
c/o F.J. Reinders & Assoc. Canada Ltd.
201 County Court Blvd., Ste. 500
Brampton, Ontario
L6W 4L2
(416) 457-1618 FAX: (416) 457-8852
Member 1,5,7

Dr. H.W. Jones
Hugh W. Jones & Associates
374 Viewmount Dr.
Allen Heights
Tantallon, Nova Scotia
B0J 3J0
(902) 826-7922 FAX: (902) 826-7602
Member 1,3,5

Li Junping
Center For Building Studies
Concordia University
1455 de Maisonneuve Blvd. W.
Montreal, Quebec
H3G 1M8
Student

Michael N. Kealey
Trans Canada Pipelines
TCP Tower
111-5th Ave. S.W.
P.O. Box 1000, Stn. M
Calgary, Alberta
T2P 4K5
(403) 267 8696 FAX: (403) 267-8992
Member 1,5,9

Mr. John S. Keeler, P.Eng.
R.R. #8
Owen Sound, Ontario
N4K 5W4
(519) 371-4411
Member 1,4,5

Mr. Thomas Kelly
174 D'Auvergne
Gatineau, Quebec
J8T 1J7
(613) 991-9979 FAX: (613) 998-7416
Member 5,6,10

Mr. Leslie G. Kende
105 Clifton Road
Toronto, Ontario
M4T 2G3
(416) 440-3588
Member 1,5,7

Thom Kennedy
Safe For Life Inc.
1701 - 2050 Nelson St.
Vancouver British Columbia
V6G 1N6

Mr.Archie Kerr
Occupational Hygiene
DOFASCO Inc.
Box 2460
Hamilton, Ontario
L8N 3J5
(416) 544-3761, ext. 3820 FAX: (416) 548-4263
Member 5

Norm Knoflach
4490 Henderson Rd.
Milton ON
L9T 2X5
(416) 564-5472
Member

Mr. Donald C. Knudsen
Knudsen Engineering Ltd.
77 Gore St. E.
Perth, Ontario
K7H 1H8
(613) 267-1165 FAX: (613) 267-7085
Member 3,9

Mr. Charles Konzelman
Calder Square
P.O. Box 10251
State College, PA
USA 16805
(814) 863-3214, (814) 234-2232 (home)
Student 1,3,9,

Mr. John W. Kopec
Riverbank Acoustical Labs
1512 S. Batavia Avenue
Geneva, IL
USA 60134
(708) 232-0104 FAX: (708) 232-0138
Member 1,5

Mr. John J. Kowalewski, P.Eng.
Mechanical Research Dept.
Ontario Hydro
800 Kipling Avenue, KR-275
Toronto, Ontario
M8Z 5S4
(416) 231-4111, ext. 6178
Member 1,5,7

Dr.Steven Kraemer
T.U.V. Rheinland
2901 Bayview Ave., #208
North York, Ontario
M2K 1E6
(416) 733-3677 FAX: (416) 733-7781
Member 1,5,7

Mr. C.A. Krajewski
95 Southill Drive
Don Mills, Ontario
M3C 2H9
(416) 440-3590 FAX: (416) 440-6973
Member 1,5,7

Dr. G. Krishnappa
Engine Laboratory
Institute of Mechanical Engineering
National Research Council Canada
Montreal Road
Ottawa Ontario
K1A 0R6

Mr. K. Kruger
Albta Pub. Wks, Supply & Services
Tech. Resources Div.
8215 - 112 Street, 12th Floor
Edmonton, Alberta
T6G 5A9
(403) 427-7667
Member 1,5,7

Mr. Verne Kucy
The Corporation of Delta
4450 Clarence Taylor Crescent
Delta, British Columbia
V4K 3E2
(604) 946-3281 FAX: (604) 946-3706
Member 5,6

Ms. Joann Kudritz
87 McKenzie St. Lower
Orillia, Ontario
L3V 6A6
(705) 327-1665
Member 2,5,8

Dr. Hans Kunov
Institute of Biomedical Eng.
Rosebrugh Building
University of Toronto
Toronto, Ontario
M5S 1A4
(416) 978-6712 FAX: (416) 978-4317
Member 2,6,8

Laboratoire Acoustique Architectural 3D
Pres: Robert Ducharme
Dept. technique: Gilles Elhadad, physicien
63 Rang St.Claire
Ste-Anne-des-Plaines, Quebec
J0N 1H0
(514) 478-8828
Sustaining 1,5,7

Laboratoire Centrale
De La Prefecture De Police
39, bis rue de Danzig
75015, Paris
France
Subscription 2,6,9

M. Michel A. Lafreniere
805 de l'Esperanto, App. 8
Trois-Rivieres, Quebec
G8Y 2R3
(819) 371-6041 FAX: (819) 371-6987
Member 5,6,7

Dr. Nicole M. Lalande
Service d'Audiologie
Ctr. Hospitalier de Valleyfield
150 rue St. Thomas
Valleyfield, Quebec
J6T 6C1
(514) 371-9920, ext. 2053 FAX: (514) 371-7454
Member 5,6

Mr. A.K.K. Lam
P.O. Box 246, Station K
Toronto, Ontario
M4P 2G5
416-229-0945
Member 1,5,7

Gilbert Landry
SNC Inc.
2 Place Felix Martin
Montreal, Quebec
H2Z 1Z3

Sylvain Lariviere
Lariviere, Mackear & Assoc.
775 Marlatt
St. Laurent, Quebec
H4M 2H6
Student

Dr. Chantal Laroche
Groupe d'Acoustique de l'Université de Montreal
C.P. 6128, Succursale A
Montreal, Quebec
H3C 3J7
(514) 343-7301 FAX: (514) 343-5740
Member 5,6,8

M. Yvon J.B. Larose
Dalimar Instruments Inc.
89 Boul. Don Quichotte, Ste. 7
Ile Perrot, Quebec
J7V 6X2
(514) 453-0033 FAX: (514) 453-0554
Member 1,2,7

Larson Davis Laboratories
1681 West 820 North
Provo, Utah
USA 84601
(801) 375-0177 FAX: (801) 375-0182
Sustaining 1,5,7

Ville de Laval
Service d l'environement
A/S Louis Plamondon
3 Place Laval, Bureau 430
Laval, Quebec
H7N 1A2
(514) 662-4545
Member 1,5,7

Le Centre D'Expertise Acoustique BGL Inc.
Att: M. Rene Benoit, Pres.
1558 Montarville, Bureau 205
St. Bruno, Quebec
J3V 3T7
(514) 441-5690 FAX: (514) 441-5692
Member 1,5,7

Frederic Laville
Université de Sherbrooke
Groupe d'Acoustique, Génie Mécanique
Sherbrooke, Quebec
J1K 2R1
(819) 821-7157 FAX: (819) 821-7163
Member 5,7,9

Dr. Hie K. Lee
14 Beaufort Drive
Kanata, Ontario
K2L 1Z4
(613) 957-8460
Member 1,3,5

Dr. L.J. Leggat
Director General R&D Operations
National Defence Headquarters
Ottawa, Ontario
K1A 0K2
(613) 992-5947 FAX: (613) 996-5177
Member 5,7,9

Mr. John F. Lewis
376 Prospect Bay Rd.
Box 93, Site 15, R.R.#4
Armdale, Nova Scotia
B3L 4J4
(902) 852-3442 FAX: (902) 852-4788
Member 9

Mr. A.D. Lightstone
Valcoustics Canada Ltd.
30 Wertheim Court, Unit 25
Richmond Hill, Ontario
L4B 1B9
(416) 764-5223 FAX: (416) 764-6813
Member 1,5,7

Linda Hall Library
Serials Department
5109 Cherry Street
Kansas City, Missouri
USA 64110
Subscription

Mr. Stanley P. Lipshitz
Dept. of Appl. Mathematics
University of Waterloo
Waterloo, Ontario
N2L 3G1
(519) 885-1211 ext. 3755 FAX: (519) 746-6592
Member 2,3,6

Mr. John Logan
Dept. of Psychology
Indiana University
Bloomington, Indiana
USA 47405
(812) 855-4267
Student 4,6,8

Mr. David Lubman
14301 Middletown Lane
Westminster, CA
USA 92683
(714) 898-9099 FAX: (714) 373-3050 +*
Member 1,5,6

MFL Occupational Health Ctr. Inc.
102-275 Broadway Ave.
Winnipeg, Manitoba
R3C 4M6
(204) 949-0811
Subscription 5,7

MJM Conseillers en Acoustique
c/o M. Michel Morin
6555 Cote des Neiges
Bureau 440
Montreal, Quebec
H3S 2A6
(514) 737-9811 FAX: (514) 737-9816
Sustaining 1,5,7

MacMillan Bloedel Research
Information Serv.Library
4225 Kincaid St.
Burnaby, British Columbia
V5G 4P5
C.Subscription

Mr. Norbert H. Maertins
Health Sciences Centre
732 McDermot Ave.
Winnipeg, Manitoba
R3E OT3
(204) 787-3538 FAX: (204) 787 4865
Member 1,5,7

Mr. G.C. Maling (Jr.)
Editor, Noise/News
P.O. Box 2469, Arlington Br.
Poughkeepsie, New York
USA 12603
Subscription

Director
Manitoba Health, Hearing Conservation
800 Portage Ave., 2nd Floor
Winnipeg, Manitoba
R3G 0N4
(204) 945-6848
Subscription 5,6,8

Manitoba Hydro, Library
P.O. Box 815
Winnipeg, Manitoba
R3C 2P4
(204) 474-3019
Corp. Subs. 5,7,10

Mr. J. Mariconda
11 Wincott Dr., Ste. 1014
Weston, Ontario
M9R 2R9
(416) 247-0553
Member 2,5,7
Patrice Masson
Etudiant-Polytechnique
C.P. 6079, Succ. A
Montreal, Quebec
H3C 3A7
Student

Mr. Nigel Maybee
56 Foreht Cres.
Aurora, Ontario
L4G 3E8
(416) 841-0708
Member 5

Mr. Wade McGregor
619-15th Street N.W.
Calgary, Alberta
T2N 2B1
(403) 287-2496
Member 2,4,8

Mr. Donald H. McKay
2110 23 Avenue, S.W.
Calgary, Alberta
T2T 0W1
(403) 244-5395
Member 3,5

Dr. Wm. P.S. McKay
1162 South Park St.
Halifax, Nova Scotia
B3H 2W8
(902) 429-5617 FAX: (902) 428-3044
Member 6

Mr. A. McKee
Bruel & Kjaer Canada Ltd.
90 Leacock Road
Pointe Claire, Quebec
H9R 1H1
(514) 695-8225 FAX: (514) 695-4808
Member 5,7

Sheila F. McMahon, M.A.
Audiology & Hearing Aid Assoc.
Kachina Plaza, Suite 7
2451 South Avenue A
Yuma, AZ
USA 85364
(602) 341-1330
Member

Dr. John A. McNulty
P.O. Box 5144, Armdale
Halifax, Nova Scotia
B3L 4M7
(902) 494-3429
Member 6,8,9

Mecart Inc.
Att: Denis Lamonde, P.Eng.
110 rue de Rotterdam
Parc Industriel Metropolitain de Quebec
Saint-Augustin-de-Desmaures, Quebec
G3A 1T3
(418) 878-3584 FAX: 418 878-4877
C.Sub. 1,4,5

Mechanical Engineering Acoustics and
Noise Unit
Dept. of Mechanical Eng.
University of Alberta
6720-30 Street
Edmonton, Alberta
T6P 1J6
(403) 466-6465
Sustaining 1,2,6

George Mencher
N.S. Hearing and Speech Clinic
5599 Fenwick St.
Halifax, Nova Scotia
B3H 1R2
(902) 423-7354 FAX: (902) 423-0981
Member 5,8

Mr. Jorge Menyhart
3060 Blenheim Street
Vancouver, British Columbia
V6K 4J6
(604) 738-3382
Member 2,3,8

Mr. C.A. Mihalj, P.Eng.
Project Manager, Transportation Planning
Marshall Macklin Monaghan Limited
275 Duncan Mill Road
Don Mills, Ontario
M3B 2Y1
(416) 882-1100 FAX: (416) 882-0055
Member 1,5

Luc Milette
2500 boul. Université
Dept. Génie Mécanique
Université de Sherbrooke
Sherbrooke, Quebec
J1K 2R1
(819) 821-7184
Student

Martin Meunier
Decibel Consultants
265 boul. Hymus, Ste 2500
Pte-Claire, Quebec
H9R 1G6

MinistEre de l'Environment
Direction Régionale Mauricie Bois-France
100 Laviolette, local 102
Trois-RiviEres, Quebec
G9A 5S9
Subscription 5,6,7

R. Marek Mieszkowski
Dalhousie University
5599 Fenwick Street
Halifax, Nova Scotia
B3H 1R2

Kathryn L. Momtahan
72 Ontario Street
Ottawa, Ontario
K1K 1K9
(613) 788-2707
Student 5,6,8

Dr. Thomas Moore
Dept. of Mechanical Eng.
Queen's University
Kingston, Ontario
K7L 3N6
(613) 545-2582 FAX: (613) 545-6489
Member 5,7

Mrs. Deirdre A. Morison
Chief, Product Safety Division
Health & Welfare Canada
Rm. 138, Environmental Health Ctr.
Tunney's Pasture
Ottawa, Ontario
K1A 0L2
(613) 957-7910 FAX: (613) 954-2486
Member 3,5,10

National Acoustic Laboratories
Att: The Librarian, The Library
126 Greville St.
Chatswood, N.S.W.
Australia 2067
Subscription

Terrance M. Neary
4-32 Assiniboia Hall
University of Alberta
Edmonton, Alberta
T6G 2E7
(403) 492-5240 FAX: (403) 492-6145
1991 Member

Nelson Industries Inc.
Corporate Research Department
P.O. Box 600
Stoughton, WI
USA 53589-0600
(608) 873-4370
Sustaining 2,5,7

Mr. P. Nguyen
Decibel Consultants, Inc.
265 Hymus, Ste. 2500
Point-Claire, Quebec
H9R 1G6
(514) 630-4855 FAX: (514) 630-4595
Member 1,5,7

M. Jean Nicolas
Professeur titulaire
G.A.U.S.
Dept. Génie mécanique
Université de Sherbrooke
Sherbrooke, Quebec
J1K 2R1
(819) 821-7157 FAX: (819) 821-7903
Member 5,7

Guy Nollet
Decibel Consultants
265 Boul. Hymus, #2500
Pointe Claire, Quebec
H9R 1G6

Norhammer Ltd.
Box 2042
Gravenhurst, Ontario
P0C 1G0
(705) 689-2374 FAX: (705) 689-6968
C.Sub. 5,8

Northern Illinois Univ.
Periodical Dept.
Univ. Libraries
Dekalb, IL
USA 60115
Subscription

Dr. Tom Northwood
140 Blenheim Dr.
Ottawa, Ontario
K1L 5B5
Member

Nova Scotia Dept of the Environment
Library
P.O. Box 2107
Halifax, Nova Scotia
B3J 3B7
Subscription

Mr. J.P.M. O'Keefe
10 Ridley Gardens
Toronto, Ontario
M6R 2T8
(416) 532-9673
Member 1,5

Mr. Donald Olynyk
8403-87 Street, #201
Edmonton, Alberta
T6C 3G8
(403) 465-4125
Member 1,2,5

Ontario Hydro
Corporate Library Serv.
700 University Ave., H-1
Toronto, Ontario
M5G 1X6
C.Subscription

Ont. Ministry of Labour Library
400 University Ave., 10th Fl.
Toronto, Ontario
M7A 1T7
Subscription

Mr. Douglas O'Shaughnessy
INRS Telecommunications
3 Place du Commerce
Ile des Soeurs, Quebec
H3E 1H6
(514) 765-7824 FAX: (514) 765-8785
Member 1,6,8

Dr. M.M. Osman
MEED, H13 A13
Ontario Hydro
700 University Avenue
Toronto, Ontario
M5G 1X6
(416) 592-4988 FAX: (416) 592-2009
Member 1,5,7

M. Pierre M. Ouimet
7925 Cote St.-Luc Rd.
Montreal, Quebec
H4W 1R5
(514) 485-5423
Member 1,4,5

OZA Inspections Ltd.
P.O. Box 271
Grimsby, Ontario
L3M 4G5
(416) 945-5471
Sustaining 5,7,10

Mr. John M. Ozard
DREP
FMO Victoria, British Columbia
VOS 1B0
(604) 479-2853
Member 10

Pacific Biological Station
Library, Dept.of Fisheries and Oceans
Namaimo, British Columbia
V9R 5K6
Subscription

Mr. Thomas Paige
Vibron Ltd.
1720 Meyerside Drive
Mississauga, Ontario
L5T 1A3
(416) 677-4922 FAX: (416) 670-1698
Member 1,2,5

Bruno Paillard
C.R.C.S. Genie Electrique
Fac. des Sc. Appliquées
Université de Sherbrooke
Sherbrooke, Quebec
J1K 2R1
Student

Maurice Painchaud
Hydro Quebec
340 rue St. Maurice
Trois Rivieres, Quebec
G9A 5J5

Raymond Panneton
Université de Sherbrooke
Dept. Génie Mécanique
Sherbrooke Quebec
J1K 2R1
Student

Louise Pare
Audiologiste
966 Neufchatel
Repentigny, Quebec
J5Y 2A5
(514) 654-0532
Member 5,6

Dr. Robin F. Patchett
Psychology Dept.
Laurentian University
Sudbury, Ontario
P3E 2C6
(705) 522-0115
Member 5,6

Mr. Richard Patching, P.Eng.
6815 8th Street N.E., Ste. 105
Calgary, Alberta
T2E 7H7
(403) 274-5882 FAX: (403) 295-0732
Member 1,5,7

Mr. Bhawani Pathak
Canadian Centre for Occupational Health and Safety
250 Main St. E.
Hamilton, Ontario
L8N 1H6
(416) 572 4533 FAX: (416) 572-2206
Member 5,7

Mr. Howard Patlik
551 Steeles Ave. West, Tnhse 35
Willowdale, Ontario
M2M 3Y1
(416) 395-0716 (Bus: 416-250-6565)
Member 1,5,7

Marie Pelletier
QIT Fer & Titane Inc.
Dept. Hygiene Ind.
B.P. 560
Sorel, Quebec
J3P 5P6

Penn State University
Applied Research Lab
Library
P.O. Box 30
State College, PA
USA 16804
Subscription

Mr. Richard J. Peppin
5012 Macon Rd.
Rockville, MD
USA 20852
(301) 984-3375
Member 1,5,7

Ms. Louise Perrault
979 Monique
St. Thomas, Quebec
J0K 3L0
(514) 756-2174
Student 2,6,8

Dr. J.E. Piercy
Physics Division
National Research Council Canada
Montreal Road
Ottawa, Ontario
K1A 0R6
(613) 749-8929 FAX: (613) 952-1394
Member 3,5,6

Prof. John R. Platt
Dept. of Psychology
McMaster University
Hamilton, Ontario
L8S 4K1
(416) 525-9140, Ext. 3011 FAX: (416) 529-6225
Member 4,6

Mr. Peter Poling
1879 Altona Road
Pickering, Ontario
L1V 1M6
(416) 286-2499
Member 2,4,6

Dr. N.Popplewell
Dept. of Mech.Engineering
University of Manitoba
Winnipeg, Manitoba
R3T 2N2
(204) 474-9888 FAX: (204) 275-3773
Member 5,7,8

Mr. Richard C. Potter
Hygeia Inc.
303 Bear Hill Road
Waltham, MA
USA 02154
(617) 890-4999 FAX: (617) 890-1058
Member 5,7,10

Dr. S.E. Prasad
B.M. Hi-Tech Inc.
P.O. Box 97
Collingwood, Ontario
L9Y 3Z4
(705) 444-1440 FAX: 705 444-6787
Member 2,3,8

Dr. J.D. Quirt
Institute for Research in Construction
Acoustics Section, Bldg M-27
National Research Council Canada
Montreal Road
Ottawa, Ontario
K1A 0R6
(613) 993-2305 FAX: (613) 9545984
Member 1,2,5

Dr. Ramani Ramakrishnan
41 Watson Avenue
Toronto, Ontario
M6S 4C9
(416) 762-6093
Member 1,5,7

Ms. L. Rammage
c/o Voice Clinic
4th Floor, Willow Pavillion
805 West 12th Ave.
Vancouver, British Columbia
V5Z 1M9
Student 5,6,8

Dr. L.A. Read
Dean, Arts & Science
Wilfrid Laurier University
75 University Ave., W.
Waterloo, Ontario
N2L 3C5
(519) 884-1970, Ext. 2220
Member 1,4,

Mr. E. Rebke
Alberta Public Works
Property Tech. Planning Div.
8215 - 112 St.
12th Flr. College Plaza
Edmonton, Alberta
T6G 5A9
(403) 427-7667
C.Subs.

H.J. Rerup Consulting Inc.
Att: Mr. Hans J. Rerup
22 Homewood Avenue
Hamilton, Ontario
L8P 2M2
(416) 521-0999 FAX: (416) 525-4894
C.Sub. 1,5,10

Dr. H.S. Ribner
1035 Willow Green Drive
Newport News, VA
USA 23602
(416) 667-7000 UTIAS (804) 864-7618
NASA
Member 3,5,10

J.L. Richards & Assoc. Ltd.
864 Lady Ellen Place
Ottawa, Ontario
K1Z 5M2
(613) 728-3571
C.Subscription 1,5,7

Werner G. Richarz, Ph.D, P.Eng.
Dept. of Mechanical & Aerospace
Engineering
Carleton University
Ottawa, Ontario
K1S 5B6
(613) 788-5689
Member 2,5,10

Krista Riko
Suite 201
600 University Ave.
Toronto, Ontario
M5G 1X5
(416) 586-5018
Member 2,5,6

Mr. Matias Ringheim
Kilde Akustikk A/S
P.O. Box 229
N-5701 Voss
Norway
01147-5-513500 FAX: 011 10344
Member 1,5,7

Mme. Myriam Robillard
SNC Inc.
2 Place Felix Martin
Montreal, Quebec
H2Z 1Z3
Member 1,4,5

Dr. R.J. Rogers
Dept. of Mech. Engineering
University of New Brunswick
P.O. Box 4400
Fredericton, New Brunswick
E3B 5A3
(506) 453-4513 FAX: (506) 453-5025
Member 5,7

Jean Rouat
Dept. Sciences Appliquées
Université. du Québec à Chicoutimi
Chicoutimi, Quebec
G7H 2B1
(418) 545-5042
Member 8

Dr. Anton J. Rozsypal
Dept. of Linguistics
University of Alberta
Edmonton, Alberta
T6G 2E7
(403) 432-4952
Member 4,6,8

Dr. Leslie T. Russell
11 Laurentide Drive
Halifax, Nova Scotia
B3M 2M9
(902) 420-7566 FAX: (902) 423-6711
Member 1,5

Mr. Wm. D. Ruth, CRSP, CSS
Hearing Measurements Co. Ltd.
27 Strathearn Ave., Unit 2
Bramalea, Ontario
L6T 4V5
(416) 791-1428
Member 5

Dr. M.P. Sacks
Tacet Engineering Ltd.
111 Ava Road
Toronto, Ontario
M6C 1W2
(416) 782-0298 FAX: (416) 785-9880
Sustaining 1,5,7

Daniel St. Georges
Service du Batiment
7925 Chemin Cote St.-Luc
Montreal, Quebec
H4W 1R5
(514) 485-5361 FAX: (514) 485-5802
Member 1,5,6

Mr. Claude Sauvageau
CRIQ
8475 Ave. Christophe-Colomb
B.P. 2000, Succ. Youville
Montreal, Quebec
H2P 2X1
(514) 383-1550 FAX: (514) 383-3250
Member 5,7

Mr. Miron Savich
58 Hirshhorn Avenue
Elliot Lake, Ontario
P5A 1N9
(705) 848-3263
Member 5

Jacques Savard
Hydro Quebec
800 est de Maisonneuve
16ieme etage
Montreal, Quebec
H2L 4M8

SCANTEK, Inc.
916 91st Ave.
Silver Spring, MD
USA 20910
(301) 495-7738 FAX: (301) 495-7739
Sustaining 1,5,7

Mr. D.A. Scheirer, President
Comtec Associates Ltd.
#203 - 2 Athabascan Ave.
Sherwood Park, Alberta
T8A 4E3
(403) 467-7840 FAX: (403) 467-9263
Member 2,4

Ryan Schott
PAMI
P.O. Box 1060
Portage La Prairie, Manitoba
R1N 3C5
(204) 239-5445
Member 2,4,6

Mr. Henry Scory
IRSST
505 ouest Maisonneuve
Montreal, Quebec
H3A 3C2
(514) 288-1551 FAX: (514) 288-9632
Member 3,5,7

Richard C. Seewald, Ph.D.
Communicative Disorders
Elborn College
University of Western Ontario
London, Ontario
N6G 1H1
(519) 661-2001
Member 2,6,8

Dr. Edgar A.G. Shaw
Researcher Emeritus
Institute for Microstructural Sciences
National Research Council Canada
Ottawa, Ontario
K1A 0R6
(613) 993-6157 FAX: (613) 952-1394
Member 2,5,6

Mr. Neil A. Shaw
P.O. Box 619
Topanga, CA
USA 90290
(213) 455-2702
C.Sub. 1,2,4

Mr.Cameron Sherry
445 Bellevue Ave.
Dorion, Quebec
J7V 2B1
(514) 455-3450
Member 1,5

Mr. Ken Simpson
5850-50th St. N.W.
Salmon Arm, British Columbia
V1E 4M2
(604) 832-3481
Member 3,5,7

Ms. Elzbieta B. Slawinski
Psych. Dept.
University of Calgary
2500 University Drive
Calgary, Alberta
T2N 1N4
(403) 220-5205
Member 4,6,8

Francis W. Slingerland
25 Eisenhower Cres.
Nepean, Ontario
K2C 3H1
(613) 998-4532 FAX: (613) 990-3617
Member 5,7,10

Sono Wall Inc.
103 Minerva Ave.
Scarborough, Ontario
M1M 1V8
(416) 267-2996
Member 1,4,5,7,8

Spaarg Engineering Limited
Noise and Vibration Analysis
822 Lounsborough Street
Windsor, Ontario
N9G 1G3
(519) 972-0677 FAX: (519) 972-0677
Sustaining 1,5,7

Dr. Philip R. Staal
Defence Research Establishment Atlantic
P.O. Box 1012
Dartmouth, Nova Scotia
B2Y 3Z7
(902) 426-3100
Member 9

Mr. John Stevenson
Workers' Compensation Board of B.C.
6951 Westminster Highway
Richmond, British Columbia
V7C 1C6
(604) 228-9210 FAX: (604) 276-3247
Member 1,2,5

Mr. John McG Stewart
P.O. Box 1604, Stn. M
Halifax, Nova Scotia
B3J 2Y3
(902) 420-0313 FAX: (902) 429-7186
Member 9,10

Ms. Uta Deppe Stewart
503 Russel Road
Saskatoon, Saskatchewan
S7K 7K6
(306) 933-5694
Member 5,8

Dr. Michael R. Stinson
Division of Physics
National Research Council of Canada
Ottawa, Ontario
K1A 0R6
(613) 993-3729 FAX: (613) 952-1394
Member 3,6

Ms. Dana Storms
Mount Sinai Hospital
Suite 201
600 University Ave.
Toronto, Ontario
M5G 1X5
(416) 586-5018
Member 5,8

Robert W. Storey
Manson Insulation Inc.
195 The West Mall, #1120,
Etobicoke, Ontario
M9C 5K1

Mr. Robert A. Strachan
Two Yaletown Sq.
1290 Homer St.
Vancouver, British Columbia
V6B 2Y5
(604) 689-0514 FAX: (604) 689-2703
Member 1,5,7

Mr. D.C. Stredulinsky
32 John Cross Drive
Dartmouth, Nova Scotia
B2W 1X3
(902) 434-5605
Member 5,7,9

Mr. John Swallow
206 -35 Ormskirk Ave.
Toronto, Ontario
M6S 1A8
Member 1,5,7

Mr. Winston V.Sydenborgh
1243 Redbank Crescent
Oakville, Ontario
L6H 1Y4
(416) 844-7113 FAX: (416) 823-9290
Member 1,5,7

Mr. R.H. Tanner, P.E.
P.O. Box 533
Naples, FL
USA 33939
(813) 261-5840
Member 1,2,4,5

Dr. John M. Terhune
Dept. of Biology
University of New Brunswick
P.O. Box 5050
Saint John, New Brunswick
E2L 4L5
(506) 648-5633 FAX: (506) 648-5528
Member 6,8,9

Mr. Peter Terroux
Consultant in Acoustics
P.O. Box 96, Station M
Halifax, Nova Scotia
B3J 2L4
(902) 425-3096
Subsc. 1,2,5

Dr. David J. Thomson
DREP
FMO Victoria
Victoria, British Columbia
V0S 1B0
(604) 363-2880 FAX: (604) 363-2856
Member 3,9,10

Floyd Toole
National Research Council Canada
Inst. for Microstructural Sciences
Ottawa, Ontario
K1A 0R6

Mr. Edwin H. Toothman
Bethlehem Steel Corp.
Room 169, SGO
Bethlehem, PA
USA 18016-7699
(215) 694-6705 FAX: (215) 694-1377
Member 5,6,8

Transport Canada Library and Information Centre (GSL)
Place De Ville
Ottawa, Ontario
K1A 0N5
Subscription

B.A. Trenholm
P.O. Box 2572
Dartmouth, Nova Scotia
B2W 4B7
(902)426-3100 Ext. 136
Member 9

Dominique Trentin
Génie Mécanique, G.A.U.S.
Sciences Appliquées
Université de Sherbrooke
Sherbrooke, Quebec
J1K 2R1
(819) 821-7102
Student 4,6,8

Robert Trepanier
6155 Tomken Road
Mississauga, Ontario
L5T 1X3
(416) 564-5472
Member 5,7,10

Prof. B. Truax
Dept. of Communication
Simon Fraser University
Burnaby, British Columbia
V5A 1S6
(604) 291-3687
Member 2,4,5

Mr. M. Tunnicliffe
16 Montebello Dr.
Dartmouth, Nova Scotia
B2X 3A6
(902) 427-2408
Member 9

Stephen Donald Turnbull
197 Douglas Ave.
Saint John, New Brunswick
32K 135
(506) 693-7196
Student 6,8,9

Dr. Muniyandy S. Ulagaraj
Research & Development
AGT Ltd.
Ste. 500, Capitol Square Bldg.
10065 Jasper Ave.
Edmonton, Alberta
T5J 3B1
(403) 493-3042 FAX: (403) 493-4277
Member 2,5,8

J. Ulicki
77-1313 Border St.
Winnipeg, Manitoba
R3H 0X9
(204) 694-2884 FAX: (204) 694-5025
Member 1,5,7

Universitaesbibliothek &
Tech. Informations-Bibliothek/TIB
Welfengarten 1 B
3000 Hannover 1
West Germany
Subscription

Universitatsbibliothek Munster
Postfach 8029
4400 Munster - Westfalen
Germany
Subscription

University of Alberta Library
Acquisition Division Serials
Edmonton, Alberta
T6G 2J8
Corp. Sub.

Univ. College of Cape Breton
Library
P.O. Box 5300
Sydney, Nova Scotia
B1P 6L2
Subscription

Univ. de Montreal-18A Dept.
Biblio Acq. Periodques
C.P. 6128, Succ. A
Montreal, Quebec
H3C 3J7
Subscription

University of Manitoba
Occ. Health and Safety
519 University Centre
Winnipeg, Manitoba R3T 2N2
(204) 474-6316
Subscription 1,5,8

University of New Brunswick
Harriet Irving Lib Serials
P.O. Box 7500
Fredericton, New Brunswick
E3B 5H5
Subscription

University of Toronto Library
Serials Department
Toronto, Ontario
M5S 1A5
C.Subscription

University of Windsor
Library, Serials Section
Windsor, Ontario
N9B 3P4
Subscription

Valcoustics Canada Ltd.
30 Wertheim Court, Unit 25
Richmond Hill, Ontario
L4B 1B9
(416) 764-5223 FAX: (416) 764-6813
Sustaining 1,5,7

City of Vancouver
Health Department
1060 West 8th Avenue
Vancouver, British Columbia
V6H 1C4
Subscription

Mr. Frank Van Oirschot
Industrial Metal Fabricators Ltd.
288 Inshes Ave.
Box 834
Chatham, Ontario
N7M 5L1
(519) 354-4270
Sustaining Subs. 5

Dr. P.J. Vermeulen
Dept. of Mechanical Eng.
University of Calgary
2500 University Dr., N.W.
Calgary, Alberta
T2N 1N4
(403) 220-5776 FAX: (403) 282-8406
Member 3,5,10

Chantal Vignault
2171 Edouard Monpetit, App 307
Montreal, Quebec
H3T 1J3
(514) 731-3971
Student 5,6,8

Mr. Keith W.A. Walker
39832 Crabapple Dr.
Antioch, IL
USA 60002
(708) 395-2106 Home; (708) 546-8288
Bus./FAX: (708) 546-9699
Member 1,5

Dr. A.C.C. Warnock
Institute for Research in Construction
Bldg. M-27
National Research Council Canada
Montreal Road
Ottawa, Ontario
K1A 0R6
(613) 993-9370 FAX: (613) 954-5984
Member 1,5,7

Mr. D.E. Watson
c/o H.L. Blachford Ltd.
2323 Royal Windsor Drive
Mississauga, Ontario
L5J 1K5
(416) 823-3200
Member 5

Wayne State University
Science Library
Detroit, Michigan
USA 48202
Subscription

D. K. Webb,
13 Weybridge Trail,
Brampton ON
L6V 3S3

Dr. Margaret Weiser
345 Laurier East, #201
Ottawa, Ontario
K1N 6R5
(613) 739 5317
Member 4, 6, 8

Mr. G. Westerberg
Akustik-Konsult AB
Surbrunnsgatan 6
S-11421 Stockholm
Sweden (468)
Tel: 150165 FAX: 152643
Member 1, 4, 5

Mr. L.A. Westlake
126 Essex Court,
THUNDER BAY, ON
P7A 7P1
(807) 475 1691
Member 1, 5, 7

Mr. E. A. Wetherill
28 Cove Road
Alameda, CA
U.S.A. 94501
(415) 769-1622
Member 1, 2, 5

Mr. Ronald G. White
7 Amberglen Court
Holland Landing, Ontario
L0G 1H0
(416) 675-3983 FAX: (416) 675 5546
Member 1, 5

Wilrep Ltd.,
1515 Matheson Blvd. E., Unit C-8,
Mississauga, Ont.
L4W 2P5
(416) 625-8944, FAX:: (416) 625-7142
Sustaining

Mr. Keith Wilson,
Fiberglas Canada Inc.,
4100 Yonge St.,
Willowdale, ON
M2P 2B6
(416) 730-7939 FAX: (416) 733 8613
Member 1,5,7

Mr. W. H. Winchell,
Imax Systems Corporation,
2525 Speakman Dr.
Sheridan Park,
Mississauga, Ont.
L5K 1B1
(416) 855-1379 FAX: (416) 855-2606
Member 1,2,6

Mr. Chris N. Wolfe
Vibra-Sonic Control & Materials Handling Ltd.,
4004 Gravely Street
Burnaby, British Columbia
V5C 3T6
(604) 294-9495 FAX: (604) 294 8033
Member 1, 5, 7

Dr. G.S.K. Wong
Inst. for National Measurements Standards,
National Research Council
Montreal Road
Ottawa, Ontario
K1A 0R6
(613) 993-6159 FAX: (613) 952 1394
Member 2, 3, 5,

Roland Woodcock
Dept. de Génie Mécanique
G.A.U.S.
Université de Sherbrooke
2500 boul. Université
Sherbrooke, Quebec
J1K 2R1
(819) 821-7184 FAX: (819) 821-7903
Member 1,3

Mr. Wayne R. Young
Apt. 706, 5599 Fenwick St.
Halifax, Nova Scotia
B3H 1R2
(902) 423-2428
Student 2,6,8

M. Manell E. Zakharia
I.C.P.I. Lyon
Labatoir d'Acoustique et Signaux Sonar
25 rue du Plat
69288 Lyon Cedex 02
France
(33) 72325074 FAX: 33-78-378034
Member 3,9,10

Mr. Steven Zigelstein
3890 Bathurst St., Apt. 303
North York, Ontario
M3H 3N5
(416) 398-2304
Member 1,4,5

# The Canadian Acoustical Association
# l'Association Canadienne d'Acoustique

## PRIZE ANNOUNCEMENT

A number of prizes, whose general objectives are described below, are offered by the Canadian Acoustical Association. As to the first four prizes, applicants must submit an application form and supporting documentation before the end of February of the year the award is to be made. Applications are reviewed by subcommittees named by the President and Board of Directors of the Association. Decisions are final and cannot be appealed. The Association reserves the right not to make the awards in any year. For some awards applicants must be members of the Canadian Acoustical Association. Preference will be given to citizens and permanent residents of Canada. Potential applicants can obtain full details of the prizes and their eligibility conditions, as well as application forms and procedures from: The Secretary, Canadian Acoustical Association, P.O. Box 1351, Station F, Toronto, Ontario M4Y 2V9.

### EDGAR AND MILLICENT SHAW POSTDOCTORAL PRIZE IN ACOUSTICS

This prize is made to a highly qualified candidate holding a Ph.D. degree or the equivalent, who has completed all formal academic and research training and who wishes to acquire up to two years supervised research training in an established setting. The proposed research must be related to some area of acoustics, psychoacoustics, speech communication or noise. The research must be carried out in a setting other than the one in which the Ph.D. degree was earned. The prize is for $3000 for full-time research for twelve months, and may be renewed for a second year. Coordinator: Sharon Abel. Past recipients are:

*1990 Dr. Li Cheng, Université de Sherbrooke*

### ALEXANDER GRAHAM BELL GRADUATE STUDENT PRIZE IN SPEECH COMMUNICATION AND BEHAVIOURAL ACOUSTICS

The prize is made to a graduate student enrolled at a Canadian academic institution and conducting research in the field of speech communication or behavioural acoustics. It consists of an $800 cash prize to be awarded annually. Coordinator: Lynne Brewster. Past recipients are:

*1990 Bradley Frankland, Dalhousie University*
*1991 Steven Donald Turnbull, University of New Brunswick*
*Fangxin Chen, University of Alberta*
*Leonard E. Cornelisse, University of Western Ontario*

### FESSENDEN STUDENT PRIZE IN UNDERWATER ACOUSTICS

The prize is made to a graduate student enrolled at a Canadian university and conducting research in underwater acoustics or in a branch of science closely connected to underwater acoustics. It consists of an approximately $400 cash prize to be awarded every two years. The prize was inaugurated in 1991. Coordinator: David Chapman.

### ECKEL STUDENT PRIZE IN NOISE CONTROL

The prize is made to a graduate student enrolled at a Canadian academic institution pursuing studies in any discipline of acoustics and conducting research related to the advancement of the practice of noise control. It consists of a $500 cash prize to be awarded annually. The prize was inaugurated in 1991. Coordinator: Murray Hodgson.

### DIRECTORS' AWARDS

Three awards are made annually to the authors of the best papers published in *Canadian Acoustics*. The first author must study or work in Canada. All papers reporting new results as well as review and tutorial papers are eligible; technical notes are not. The first award, for $500, is made to a graduate student author. The second and third awards, each for $250, are made to professional authors under 30 years of age and 30 years of age or older, respectively. Coordinator: Chantal Laroche.

### STUDENT PRESENTATION AWARDS

Three awards of $500 each are made annually to the undergraduate or graduate students making the best presentations during the technical sessions of the Canadian Acoustics Week. Application must be made at the time of submission of the abstract. Coordinator: Alberto Behar.

# The Canadian Acoustical Association
# l'Association Canadienne d'Acoustique

## ANNONCE DE PRIX

Quatre prix, dont les objectifs généraux sont décrits ci-dessous, sont décernés par l'Association Canadienne d'Acoustique. Quant aux quatre premiers prix, les candidats doivent soumettre une formule de demande ainsi que la documentation associée avant le dernier jour de février de l'année durant laquelle le prix sera décerné. Toutes les applications seront analysées par des sous-comités nommés par le président et la chambre des directeurs de l'Association. Les décisions seront finales et sans appel. L'Association se réserve le droit de ne pas décerner les prix une année donnée. Pour certains des prix, les candidats doivent être des membres de l'Association. La préférence sera donnée aux citoyens et aux résidents permanents du Canada. Les candidats potentiels peuvent se procurer de plus amples détails sur les prix, leurs conditions d'éligibilité, ainsi que des formules de demande auprès de: Le Secrétaire, Association Canadienne d'Acoustique, C.P. 1351, Station F, Toronto, Ontario M4Y 2V9.

### Prix Post-Doctoral Edgar et Millicent Shaw en Acoustique

Ce prix est attribué à un(e) candidat(e) hautement qualifié(e) et détenteur(rice) d'un doctorat ou l'équivalent qui a complèté(e) ses études et sa formation de chercheur et qui désire acquérir jusqu'à deux années de formation supervisée de recherche dans un établissement reconnu. Le thème de recherche proposée doit être relié à un domaine de l'acoustique, de la psycho-acoustique, de la communication verbale ou du bruit. La recherche doit être menée dans un autre milieu que celui où le candidat a obtenu son doctorat. Le prix est de $3000 pour une recherche plein temps de 12 mois avec possibilité de renouvellement pour une deuxième année. Coordinatrice: Sharon Abel. Les récipiendaires antérieur(e)s sont:

*1990 Dr. Li Cheng, Université de Sherbrooke*

### Prix Etudiant Alexander Graham Bell en Communication Verbale et Acoustique Comportementale

Ce prix sera décerné à un(e) étudiant(e) inscrit(e) à une institution académique canadienne et menant un projet de recherche en communication verbale ou acoustique comportementale. Il consiste en un montant en argent comptant de $800 qui sera décerné à tous les ans. Coordinatrice: Lynne Brewster. Les récipiendaires antérieur(e)s sont:

*1990 Bradley Frankland, Dalhousie University*
*1991 Steven Donald Turnbull, University of new Brunswick*
*Fangxin Chen, University of Alberta*
*Leonard E. Cornelisse, University of Western Ontario*

### Prix Etudiant Fessenden en Acoustique Sous-marine

Ce prix sera décerné à un(e) étudiant(e) inscrit(e) à une institution académique canadienne et menant un projet de recherche en acoustique sous-marine ou dans une discipline scientifique reliée à l'acoustique sous-marine. Il consiste en un montant en argent comptant d'environ $400 qui sera décerné à tous les deux ans. Ce prix a été inauguré en 1991. Coordinateur: David Chapman.

### Prix Etudiant Eckel en Controle du Bruit

Ce prix sera décerné à un(e) étudiant(e) inscrit(e) à une institution académique canadienne dans n'importe quelle discipline de l'acoustique et menant un projet de recherche relié à l'avancement de la pratique en contrôle du bruit. Il consiste en un montant en argent comptant de $500 qui sera décerné à tous les ans. Ce prix a été inauguré en 1991. Coordinateur: Murray Hodgson.

### Prix des Directeurs

Trois prix sont décernés, à tous les ans, aux auteurs des trois meilleurs articles publiés dans l'*Acoustique Canadienne*. Le premier auteur doit étudier ou travailler au Canada. Tout manuscrit rapportant des résultats originaux ou faisant le point sur l'état des connaissances dans un domaine particulier sont éligibles; les notes techniques ne le sont pas. Le premier prix, de $500, est décerné à un(e) étudiant(e) gradué(e). Le deuxième et le troisième prix, de $250 chaque, sont décernés à des auteurs professionnels âgés de moins de 30 ans et de 30 ans et plus, respectivement. Coordinatrice: Chantal Laroche.

### Prix de Presentation Etudiant

Trois prix, de $500 chaque, sont décernés à tous les ans aux étudiant(e)s sous-gradué(e)s ou gradué(e)s présentant les meilleurs communications lors de la Semaine Canadienne d'Acoustique. La demande doit se faire lors de la soumission de l'abstract. Coordinatrice: Chantal Laroche.

The Canadian Acoustical Association


l'Association Canadienne d'Acoustique

## SUBSCRIPTION INVOICE

Subscription for the current calendar year is due January 31. Subscriptions received before July 1 will be applied to the current year and include that year's back issues of Canadian Acoustics, if available. Subscriptions received from July 1 will be applied to the next year.

Check ONE Item Only:

| | |
|---|---|
| CAA Membership | $35 |
| CAA Student membership | $10 |
| Corporate Subscription | $35 |
| Sustaining Subscription | $150 |

Total Remitted $_____

INFORMATION FOR MEMBERSHIP DIRECTORY

Check areas of interest (max 3):

1. Architectural Acoustics _____
2. Electroacoustics _____
3. Ultrasonics & Physical Acoustics _____
4. Musical Acoustics _____
5. Noise _____
6. Psycho/Physiological Acoustics _____
7. Shock & Vibration _____
8. Speech Communication _____
9. Underwater Communication _____
10. Other _____

## FACTURE D'ABONNEMENT

L'abonnement pour la présente année est dû le 31 janvier. Les abonnements reçus avant le 1 juillet s'appliquent à l'année courante et incluent les ancient numéros (non-épuisés) de l'Acoustique Canadienne de cette année. Les abonnements reçus à partir du 1 juillet s'appliquent à l'année suivante.

Cocher la case appropriée :

| | |
|---|---|
| Membre individuel | |
| Membre étudiant(e) | |
| Membre de société | |
| Abonnement de soutien | |

Versement total

RENSEIGNEMENT POUR L'ANNUAIRE DES MEMBRES

Cocher vos champs d'intérêt (max. 3):

1. Acoustique architecturale
2. Electroacoustique
3. Ultrasons, acoustique physique
4. Acoustique musicale
5. Bruit
6. Physio/psychoacoustique
7. Chocs et vibrations
8. Communication parlée
9. Acoustique sous-marine
10. Autre

Telephone number (_____) _____ Numéro de téléphone
Facsimile number (_____) _____ Numéro de télécopieur
E-Mail number _____ Numéro de courier électronique

PLEASE TYPE NAME AND ADDRESS BELOW:

VEUILLEZ ECRIRE VOTRE NOM ET VOTRE ADRESSE CI-DESSOUS:

Faites parvenir ce formulaire à l'adresse suivante en prenant soin d'y joindre un chèque fait au nom de L'ASSOCIATION CANADIENNE D'ACOUSTIQUE:

Make cheques payable to THE CANADIAN ACOUSTICAL ASSOCIATION. Mail this form with payment to:

W.V. Sydenborgh
H.L. Blachford Ltd.
2323 Royal Windsor Drive
Mississauga, Ontario L5J 1K5

## INSTRUCTIONS TO AUTHORS
## PREPARATION OF MANUSCRIPT

**Submissions**: The original manuscript and two copies should be sent to the Editor-in-Chief.

**General Presentation**: Papers should be submitted in camera-ready format. Paper size 8.5" x 11". If you have access to a word processor, copy as closely as possible the format of the articles in Canadian Acoustics 18(4) 1990. All text in Times-Roman 10 pt font, with single (12 pt) spacing. Main body of text in two columns separated by 0.25". One line space between paragraphs.

**Margins**: Top - title page: 1.25"; other pages, 0.75"; bottom, 1" minimum; sides, 0.75".

**Title**: Bold, 14 pt with 14 pt spacing, upper case, centered.

**Authors/addresses**: Names and full mailing addresses, 10 pt with single (12 pt) spacing, upper and lower case, centered. Names in bold text.

**Abstracts**: English and French versions. Headings, 12 pt bold, upper case, centered. Indent text 0.5" on both sides.

**Headings**: Headings to be in 12 pt bold, Times-Roman font. Number at the left margin and indent text 0.5". Main headings, numbered as 1, 2, 3, ... to be in upper case. Sub-headings numbered as 1.1, 1.2, 1.3, ... in upper and lower case. Sub-sub-headings not numbered, in upper and lower case, underlined.

**Equations**: Minimize. Place in text if short. Numbered.

**Figures/Tables**: Keep small. Insert in text at top or bottom of page. Name as "Figure 1, 2, ..." Caption in 9 pt with single (12 pt) spacing. Leave 0.5" between text.

**Photographs**: Submit original glossy, black and white photograph.

**References**: Cite in text and list at end in any consistent format, 9 pt with single (12 pt) spacing.

**Page numbers**: In light pencil at the bottom of each page.

**Reprints**: Can be ordered at time of acceptance of paper.

## DIRECTIVES A L'INTENTION DES AUTEURS
## PREPARATION DES MANUSCRITS

**Soumissions**: Le manuscrit original ainsi que deux copies doivent être soumis au rédacteur-en-chef.

**Présentation générale**: Le manuscript doit comprendre le collage. Dimensions des pages, 8.5" x 11". Si vous avez accès à un système de traitement de texte, dans la mesure du possible, suivre le format des articles dans l'Acoustique Canadienne 18(4) 1990. Tout le texte doit être en caractères Times-Roman, 10 pt et à simple (12 pt) interligne. Le texte principal doit être en deux colonnes séparées d'un espace de 0.25". Les paragraphes sont séparés d'un espace d'une ligne.

**Marges**: Dans le haut - page titre, 1.25"; autres pages, 0.75"; dans le bas, 1" minimum; aux côtés, 0.75".

**Titre du manuscrit**: 14 pt à 14 pt interligne, lettres majuscules, caractères gras. Centré.

**Auteurs/adresses**: Noms et adresses postales. Lettres majuscules et minuscules, 10 pt à simple (12 pt) interligne. Centré. Les noms doivent être en caractères gras.

**Sommaire**: En versions anglaise et française. Titre en 12 pt, lettres majuscules, caractères gras, centré. Paragraphe 0.5" en alinéa de la marge, des 2 cotés.

**Titres des sections**: Tous en caractères gras, 12 pt, Times-Roman. Premiers titres: numéroter 1, 2, 3, ..., en lettres majuscules; sous-titres: numéroter 1.1, 1.2, 1.3, ..., en lettres majuscules et minuscules; sous-sous-titres: ne pas numéroter, en lettres majuscules et minuscules et soulignés.

**Equations**: Les minimizer. Les insérer dans le texte si elles sont courtes. Les numéroter.

**Figures/Tableaux**: De petites tailles. Les insérer dans le texte dans le haut ou dans le bas de la page. Les nommer "Figure 1, 2, 3,..." Légende en 9 pt à simple (12 pt) interligne. Laisser un espace de 0.5" entre le texte.

**Photographies**: Soumettre la photographie originale sur paper glacé, noir et blanc.

**Références**: Les citer dans le texte et en faire la liste à la fin du document, en format uniforme, 9 pt à simple (12 pt) interligne.

**Pagination:** Au crayon pâle, au bas de chaque page.

**Tirés-à-part**: Ils peuvent être commandés au moment de l'acceptation du manuscrit.

## WHAT'S NEW ??

| | |
|---|---|
| Moves | Retirements |
| Deaths | Degrees awarded |
| New jobs | Distinctions |
| Promotions | Other news |

Do you have any news that you would like to share with *Canadian Acoustics* readers? If so, fill in and send this form to:

## QUOI DE NEUF ??

| | |
|---|---|
| Déménagements | Retraites |
| Décès | Obtention de diplômes |
| Offre d'emploi | Distinctions |
| Promotions | Autres nouvelles |

Avez-vous des nouvelles que vous aimeriez partager avec les lecteurs de l'*Acoustique Canadienne*? Si oui, écrivez-les et envoyer le formulaire à:

Jim Desormeaux, Ontario Hydro, 757 McKay Road, Pickering, Ontario L1W 3C8

_____

_____

_____

_____

# The Canadian Acoustical Association
# l'Association Canadienne d'Acoustique

## SUSTAINING SUBSCRIBERS / ABONNES DE SOUTIEN

The Canadian Acoustical Association gratefully acknowledges the financial assistance of the Sustaining Subscribers listed below. Annual donations (of $150.00 or more) enable the journal to be distributed to all at a reasonable cost. Sustaining Subscribers receive the journal free of charge. Please address donation (made payable to the Canadian Acoustical Association) to the Associate Editor (Advertising).

L'Association Canadienne d'Acoustique tient à témoigner sa reconnaissance à l'égard de ses Abonnés de Soutien en publiant ci-dessous leur nom et leur adresse. En amortissant les coûts de publication et de distribution, les dons annuels (de $150.00 et plus) rendent le journal accessible à tous nos membres. Les Abonnés de Soutien reçoivent le journal gratuitement. Pour devenir un Abonné de Soutien, faites parvenir vos dons (chèque ou mandat-poste fait ou nom de l'Association Canadienne d'Acoustique) au rédacteur associé (publicité).

**Acoustec Inc**
935 rue Newton, suite 103
Québec, Québec G1P 4M2
Tél: (418) 877-6351

**Barman Swallow Associates**
1 Greenboro Dr., Suite 401
Rexdale, Ontario M9W 1C8
Tel: (416) 245-7501

**Barron Kennedy Lyzun & Assoc.**
#250-145 West 17th Street
North Vancouver, BC V7M 3G4
Tel: (604) 988-2508

**Bilsom International Ltd.**
60 St. Clair Ave. E., Suite 1002
Toronto, Ontario M4T 1N5
Tel: (416) 922-7807

**H.L. Blachford Ltd.**
Noise Control Products
Engineering / Manufacturing
Mississauga: Tel.: (416) 823-3200
Montreal: Tel: (514) 866-9775
Vancouver: Tel: (604) 263-1561

**Bolstad Engineering Associates**
9249 - 48 Street
Edmonton, Alberta T6B 2R9
Tel: (403) 465-5317

**Bruel & Kjaer Canada Limited**
90 Leacock Road
Pointe Claire, Québec H9R 1H1
Tel: (514) 695-8225

**BVA Systems Ltd.**
2215 Midland Avenue
Scarborough, Ontario M1P 3E7
Tel: (416) 291-7371

**J.E. Coulter Associates Engineering**
200 Finch Ave. W., Suite 201
North York, Ontario M2R 3W4
Tel: (416) 250-6565

**Dalimar Instruments Inc.**
P.O. Box 110
Ste-Anne-de-Bellevue
Québec H9X 3L4
Tél: (514) 453-0033

**Eckel Industries of Canada Ltd.**
Noise Control Products, Audiometric
Rooms - Anechoic Chambers
P.O. Box 776
Morrisburg, Ontario K0C 1X0
Tel:(613) 543-2967

**Electro-Medical Instrument Ltd.**
Audiometric Rooms and Equipment
349 Davis Road
Oakville, Ontario L6J 5E8
Tel:(416) 845-8900

**Environmental Acoustics Inc.**
Unit 22, 5359 Timberlea Blvd.
Mississauga, Ontario L4W 4N5
Tel: (416) 238-1077

**Fabra-Wall**
Box 5117, Station E
Edmonton, Alberta T5P 4C5
Tel: (403) 987-4444

**Hatch Associates Ltd.**
Attn.: Tim Kelsall
21 St. Clair Ave. E.
Toronto, Ontario M4T 1L9
Tel: (416) 962-6350

**Hugh W. Jones & Associates**
374 Viewmount Drive
Allen Heights
Tantallon, Nova Scotia B0J 3J0
Tel: (902) 826-7922

**Industrial Metal Fabricators Ltd.**
Environmental Noise Control
288 Inshes Avenue
Chatham, Ontario N7M 5L1
Tel: (519) 354-4270

**Larson Davis Laboratories**
1681 West 820 North
Provo, Utah, USA 84601
Tel: (801) 375-0177

**Mechanical Engineering Acoustics and Noise Unit**
Dept. of Mechanical Engineering
6720 30th St.
Edmonton, Alberta T6P 1J3
Tel: (403) 466-6465

**MJM Conseillers en Acoustique Inc.**
**M.J.M. Acoustical Consultants Inc.**
Bureau 440, 6555 Côte des Neiges
Montréal, Québec H3S 2A6
Tél: (514) 737-9811

**Nelson Industries Inc.**
Corporate Research Department
P.O. Box 600
Stoughton, Wisconsin, USA 53589-0600
Tel: (608) 873-4373

**OZA Inspections Ltd.**
P.O. Box 271
Grimsby, Ontario L3M 4G5
Tel: (416) 945-5471

**Scantek Inc.**
Sound and Vibration Instrumentation
916 Gist Avenue
Silver Spring, Maryland, USA 20910
Tel: (301) 495-7738

**Spaarg Engineering Limited**
Noise and Vibration Analysis
822 Lounsborough Street
Windsor, Ontario N9G 1G3
Tel: (519) 972-0677

**Tacet Engineering Limited**
Consultants in Vibration & Acoustical Design
111 Ava Road
Toronto, Ontario M6C 1W2
Tel: (416) 782-0298

**Triad Acoustics**
Box 23006
Milton, Ontario L9T 5B4
Tel: (800) 265-2005

**Valcoustics Canada Ltd.**
30 Wertheim Court, Unit 25
Richmond Hill, Ontario L4B 1B9
Tel: (416) 764-5223

**Vibron Limited**
1720 Meyerside Drive
Mississauga, Ontario L5T 1A3
Tel:(416) 670-4922

**Wilrep Ltd.**
1515 Matheson Blvd. E.
Mississauga, Ontario L4W 2P5
Tel: (416) 625-8944