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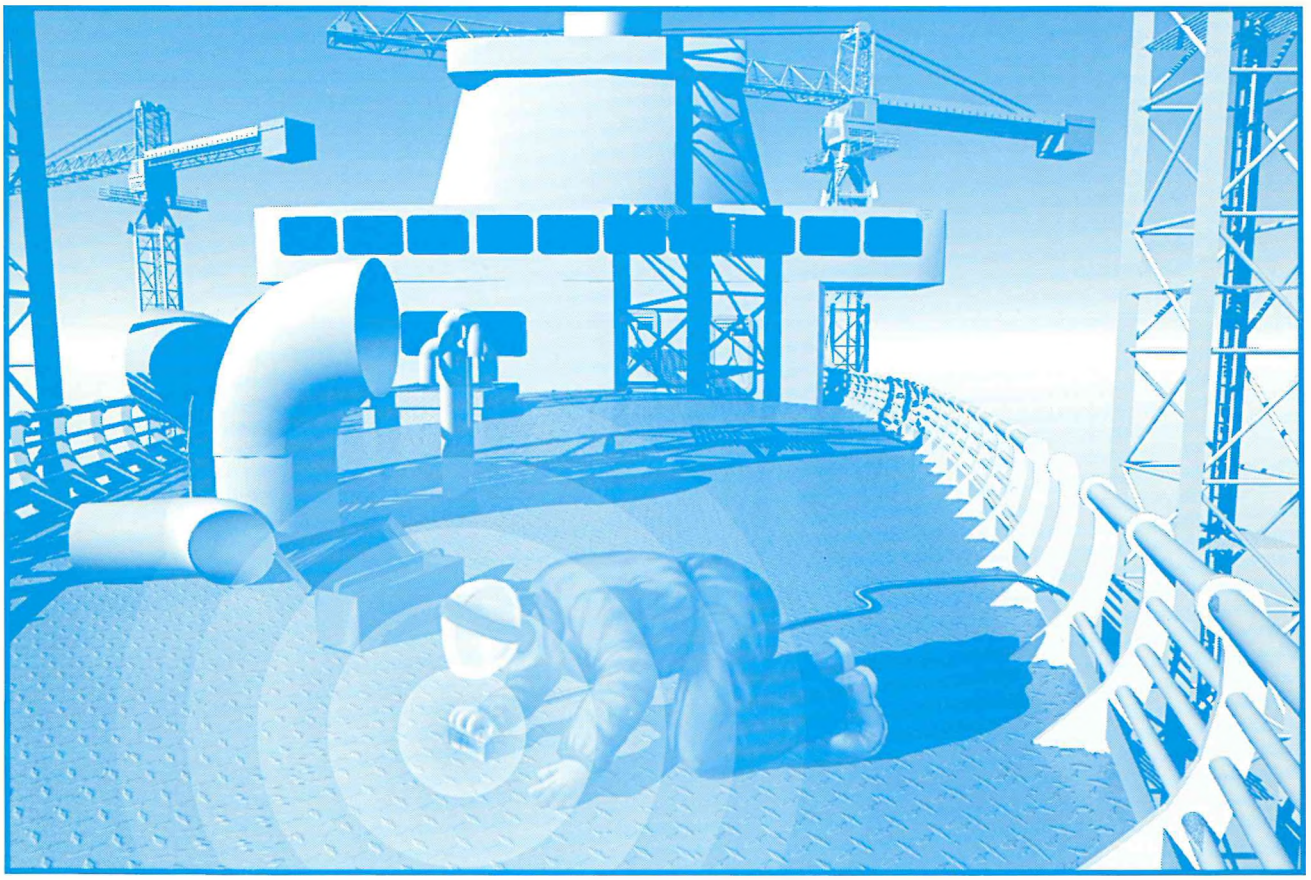

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CANADIAN ACOUSTICS publishes refereed articles and news items on all aspects of acoustics and vibration. Articles reporting new research or applications, as well as review or tutorial papers and shorter technical notes are welcomed, in English or in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

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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 fin de cette publication.

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EDITORIAL

C'est avec beaucoup de plaisir que je vous présente le nouveau Comité de rédaction de l'*Acoustique Canadienne*. Tel que présenté ci-dessous, le Comité est formé de scientifiques et praticiens dynamiques représentant divers champs d'intérêts propres à l'Association Canadienne d'Acoustique. Les membres de ce Comité ont accepté de relever le défi qui consiste à faire de l'*Acoustique Canadienne* une revue très lue et de haut calibre international dans le domaine de l'acoustique et des vibrations. En particulier, ils vont tenter de solliciter des soumissions d'articles à l'*Acoustique Canadienne* dans leurs propres champ d'intérêts. Prenez note de cette information et attendez-vous à ce qu'on vous approche pour solliciter votre contribution.

Je suis content de pouvoir enfin publier les commentaires des lecteurs sur l'article controversé de Raymond Hétu paru dans le numéro de mars 1994 ainsi que les réponses de l'auteur à ces commentaires. Les réactions très divergentes à cet article démontrent qu'il a suscité un intérêt et des discussions considérables, sans toutefois résoudre la controverse. Je crois que cet article, ainsi que les commentaires et les réponse publiés dans ce numéro, représentent une importante discussion de principes associés à la problématique de la conservation de l'audition et du controle du bruit. J'inviterais les lecteurs à distribuer ces textes à d'autres collègues dans le domaine, à les discuter entre vous et, comme je l'ai fait, avec les étudiants à qui vous enseignez.

Vous trouverez dans ce numéro l'appel des communications et les informations préliminaires relatives à la Semaine Canadienne d'Acoustique 1995 qui aura lieu à Québec. Les organisateurs préparent une excellente semaine de cours, de sessions techniques et d'activités sociales, qui se tiendront dans l'une des plus belles villes historiques canadiennes. Prenez bonne note des dates et des échéanciers pour les soumissions, préparez vos résumés et réservez vos billets d'avion.

It is with great satisfaction that I introduce to readers the newly formed *Canadian Acoustics* Editorial Board. As detailed below, the Board is made up of dynamic scientists and practitioners representing various areas of interest of the Canadian Acoustical Association. These Board members have accepted the following challenge: to work to make *Canadian Acoustics* a widely-read, high-quality international acoustical and vibration journal. In particular, they will endeavour to promote the submission of articles to *Canadian Acoustics* in their area of interest. So readers take note and expect to be approached to make your contribution!

I am also delighted to finally publish readers' comments on the controversial paper published by Raymond Hétu in the March 1994 issue - and the author's response to the comments. The widely divergent reactions to the paper prove that it has stimulated considerable interest and discussion, without resolving the controversy. I believe that this paper, and the comments and response published here, represent an important discussion of issues associated with hearing conservation and noise control. I would urge readers to circulate these texts to others in the field, and to discuss them among ourselves and - as have I - with students that they teach.

Published in this issue is the call for papers and preliminary information regarding Acoustics Week in Canada 1996, to be held in Quebec City. The organizers are preparing an excellent week of courses, technical sessions and social activities - to be held in Canada's most beautiful and historic city. Note the dates and the submission deadlines, prepare your abstracts and book your flights.

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Canadian Acoustics / Acoustique Canadienne 23(1) 3-9 (1995) ***Research article / Article de recherche***

A NEW VACUUM ACTIVATED DAMPING DEVICE TO REDUCE NOISE AND VIBRATION DURING RIVETING

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SUMMARY

An actual part of an airplane fuselage was mounted on a jig in an anechoic chamber in order to evaluate, among other things (see paper of P.E.boileau and Al. [1]), the performance of a vacuum-activated damping device called Vac Damps (damping material glued on aluminium back plate with a rubber seal all around that plate, in order to fix it on the fuselage by means of a partial vacuum underneath). Riveting with 4 mm diameter rivets requires two operators: a "riveter" , handling the rivet hammer and a "bucker",pushing on the reaction "bucking bar" to upset the rivet. The first goal of this study was to evaluate the noise attenuation provided by two Vac-Damp panels fixed one above and one below a row of rivets. The other goal was to assess the overall efficiency of such a device in lowering the exposure to hand-arm vibrations, mainly at the "bucker's" hand. Differences established on a LeqA basis between data with and without the two Vac-Damp have shown an attenuation of about 5 dBA on the global noise radiated at both "riveter's" and "bucker's" ears. Furthermore, the hand-arm vibrations on the handle of the rivets gun, and mainly on the "bucking bar" held by the " bucker" ,have also been reduced by approximately 2 to 3 dB through the use of the Vac-Damp panels. We should emphasize that for this particular study, only the radiated noise attenuation was considered. For more information on hand-arm vibration attenuation see ref. [1].

SOMMAIRE

Une partie de carlingue d'avion a été montée sur un banc d'essai dans une chambre anéchoique dans le but d'évaluer entre autre chose (voir publication de P.E.Boileau et Ass. [1]) la performance d'un système amortisseur appliqué par le vide appelé Vac Damp (matériau amortissant collé sur une plaque de fond d'aluminium avec un cordon d'étanchéité installé sur le contour de cette plaque, de façon à pouvoir le fixer sur la carlingue par un effet de vide partiel sous le tampon). Le rivetage de rivets de 4 mm de diamètre nécessite deux opérateurs: un riveteur qui manipule le marteau riveteur,et le porteur de bélier,qui appuie sur le bélier de réaction pour écraser le rivet. Le premier but de cette étude était d'évaluer l'atténuation produite par deux Vac Damp appliqués au dessus et au dessous de la rangée de rivets, affectant le bruit rayonné par le panneau d'avion riveté. L'autre but était d'estimer l'efficacité globale d'un tel sytème à diminuer l'exposition aux vibrations main-bras, particulièrement à la main du porteur de bélier. La différence évaluée sur une base de LeqA entre les données avec et sans les deux Vac Damp, a montré une atténuation d'environ 5 dBA sur le bruit global rayonné à la fois à l'oreille du riveteur et à celle du porteur de bélier. De plus, les vibrations main-bras sur le manche de la riveteuse, et principalement sur le bélier tenu par le porteur, ont aussi été diminuées de l'ordre de 2 à 3 dB en utilisant les Vac Damp. Il est à remarquer que dans cette étude nous n'avons consideré que les atténuations du bruit rayonné. Pour plus de renseignements sur l'atténuation des vibrations main-bras apportées par l'emploi des tampons Vac-Damp, consulter la référence [1].

INTRODUCTION

While riveting, two types of noise are generated by the blows of the riveting hammer on the impacted structure. One is the acceleration noise, directly related to the very fast change in momentum occurring during impacts, the other one is the ringing noise related to the two dimensional reverberation in the impacted structure and the possible structural resonances [2]. This second type of noise is generally predominant and generates intense vibration, which sometimes radiates as noise. A new type of vacuum activated device, called Vac Damp, has been developed, patented [3] and used primarily to attenuate the radiated noise by dampening the impacted panel by shear action. This investigation was combined with that of P.E. Boileau and al. who investigated hand-arm vibration exposure not only on the tool itself, but also on the wrist of the operator, using a special bracelet having three orthogonally oriented accelerometers. The intention was to evaluate the performance of the Vac Damp in lowering noise and hand arm vibration during the riveting process of an actual fuselage panel of a Boeing 767 installed on a jig in an anechoic chamber. With the Vac Damp installed it was noticed a correlation existed between an excess attenuation of the radiated noise of 4 dBA (ref. 2.10^{-5} Pascal) and the overall weighted hand-arm vibration level attenuation reaching 3 dB (ref. 1 μ m/s^2) with some riveting hammer/bucking bar combinations.

1. EXPERIMENTAL SETUP AND DESCRIPTION OF THE VAC DAMP

1.1 Experimental Set Up

The jig (scaffolding) was installed in an anechoic chamber and a fuselage panel was bolted on it as shown in figure 1. Stiffness of the curved panel was increased due to the presence of ribs and stringers. The bucking bar was hand-held along the channels formed by the U shaped longitudinal stringers (photo 1). The complete installation comprising the part of the fuselage panel is shown in photo 2. Photo 3 presents a view of the riveter holding the tool by the handle on which three accelerometers have been mounted at right angles to each other. The riveter was also wearing a special bracelet with three orthogonally oriented accelerometers to measure the vibration reaching his wrist. The same arrangement exists on the other side of the panel on the wrist of the bucking bar operator and on the bar. All twelve accelerometers are connected to charge amplifiers (shown on the anechoic chamber floor in photo 2), linked to a digital tape recorder. A vacuum pump was connected to two Vac Damp pads held against the fuselage panel by vacuum action, leaving a space for riveting along a row of rivets. Two microphones were installed on the stand shown in this same figure, one on each side at the top of the panel, to monitor the radiated noise on the riveter's and on the bucker's sides of this curved panel. These microphones were connected to a two channel FFT analyser (Bruel and Kjaer 2032) through two power amplifiers (Bruel and Kjaer 2610). The data was also recorded in parallel on a V.H.S tape recorder (Panasonic AG2400) through an analog/digital converter (Nakamichi DMP100) for further frequency analysis, and statistical study.

1.2 Description of the Vac Damp and of their Installation

Two Vac Damp pads are shown installed in photo 2. Their hidden face is made of polysulfide rubber molded on a rigid flat square aluminum (T6) plate .063" thick with its perimeter covered with a one inch wide gasket made of closed cell polyurethane. The polysulfide rubber contains some grooves to facilitate the creation of an almost complete vacuum (about 90%) with the vacuum pump shown in photo 2 along with its accumulator (which increases its capacity to about 8 c.f.m.). Each plate was tightly pushed against the curved panel surface.

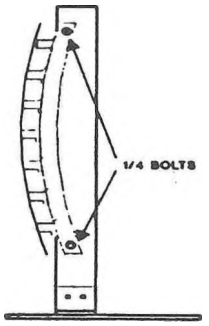

Figure 1. Scaffolding (or Bench) supporting an airplane panel

2. MEASUREMENTS AND DATA REDUCTION

2.1 Calibration

The Bruel and Kjaer model 4230 calibration source which gives 93.7 dB at 1000 Hz for the half inch microphone considered, was used to calibrate both the FFT analyzer and the video tape recorder. The calibration signal was amplified with a 10 dB gain and was recorded for a duration of 30 seconds on the videotape.

2.2 Description of the operations involved during measurement

Two half inch microphones were installed (photo 1) above the fuselage panel, one on each side of it, that is, one on the riveter's side and the other on the bucking bar operator's side. As shown in figure 2, the lines of rivets were numbered from one to nine. During riveting, the odd rows of rivets (1,3,5,7 and 9) were always used for the regular bucking bar (rectangular piece of steel having a mass of approximately 2 lbs). Rivets were driven in and taken out several times on each row. The even rows (2,4,6 and 8) were used to evaluate the performance of the Atlas Copco damped bucking bar (CL-4004). With the Vac Damp system applied, only the number 5 row was used for the regular bucking bar and the sixth row for the damped bucking bar. The excess attenuation was calculated using the data taken along, these two rows. For each riveting hammer/bucking bar combination, the data was recorded for at least twice for the same row of rivets (about 30 to 40 rivets). During riveting the setting of the measurement system was the following:

- signal attenuation -30 dB
- Hanning window for the FFT
- The data collection was triggered for 10% of the maximum level with a lag of 1 ms (figure 3).

The signal was recorded and stored on the VHS tape. The data analyzed in the frequency band 0-6400 Hz of the FFT lacks some precision at low frequency because of the weak resolution (8 Hz in the band 0-6400 Hz) of the spectrum analyser. This is the reason why the recordings were also analyzed in the frequency band 0-800 Hz where the resolution reaches 1 Hz, in order to obtain acceptable values below 500 Hz. Taking into account the difference in amplification between the calibration and the measurements themselves, the calibration value of the calibrator was taken as being 133.7 dB at 1000 Hz.

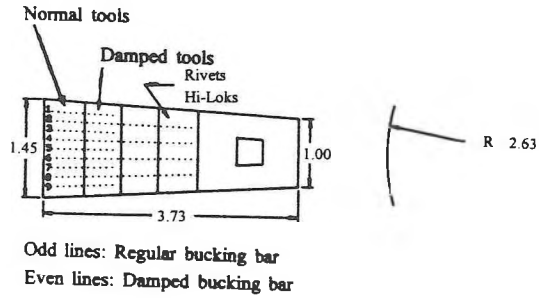

Figure 2. Fuselage panel where the experiment took place

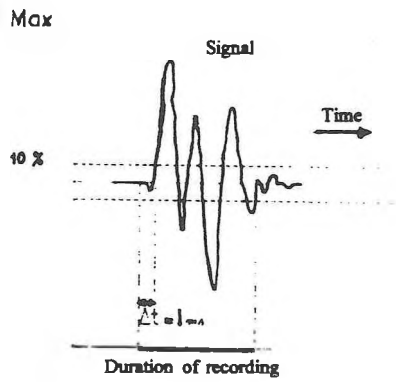

Figure 3. Time Duration of recording

2.3 Data Reduction and Validation using a Statistical Analysis

The error associated with the chain of instruments described in photo 4 has been evaluated in the following manner: first, by comparing the global sound pressure level obtained directly while riveting with that obtained from analysis of the recording;

consecutive analyses of the recording for the same rivet. In both cases, the discrepancy was within one dBA for sound pressure levels varying between 100 and 110 dBA. The analysis concentrated on a basis of rivet by rivet. For each rivet, the A weighted sound pressure level given by the analyzer adjusted as indicated previously, was noted in the frequency band 0-6400 Hz. These measurements were performed on the row of rivets 5 using the Chicago Pneumatic model 2X riveting hammer along with a regular bucking bar, successively with and without two vacuum pads being applied. The position of the rivets was identified on the videotape for comparison with and without pads, and for further statistical analysis. It was then possible to evaluate the total excess attenuation for each rivet and then with the FFT analyzer to calculate the mean and the standard deviation of the distribution obtained. For an ensemble of 36 rivets (twice the same row), the average noise attenuation (without pads minus with pads) was 4.1 dBA with a standard deviation of 2 dBA. This level of error is mainly due to the discrepancies associated with the handling of the tools by the operators. It is to be compared to the one (1 dBA) associated with the chain of instruments previously described. Furthermore, verification of negligeable influence of the distance of the rivets from the microphones was carried out at fixed position without consideration of directivity. Finally, with the use of a Hewlett Packard 9816 computer, it was possible to calculate the attenuation in each one third octave frequency band between 250 and 5000 Hz and between 0 and 800 Hz to obtain a better resolution of the FFT for the lower frequency bands. These results are presented in figures 4 to 7 for a small riveting hammer (model 2X) and in figure 8 to 11 for a larger tool (model 4X). A comparaison between the two tools is also presented in figure 12 to 15. The same operations were accomplished using a damped bucking bar and the results are presented in figure 16 to 19 for the two riveting hammers (2X and 4X).

3. ANALYSIS OF THE RESULTS AND DISCUSSION

When using the Vac Damp pads, and the conventional bucking bar it is clear by looking at figures 12 and 13 that the excess attenuation due to the pads is larger at low frequency for the larger, heavier riveting hammer (4X), than for the smaller, lighter one (2X). The comparison curves shown in these figures enhance this fact, and show also that a better control of the tool vibrations (mainly the bucking bar) should be accomplished with a heavier, larger riveting hammer while using the Vac Damp pads. Maybe this is because a larger, heavier tool reduces the acceleration noise which may become predominant, once the riveted panel is damped with an associated reduction of the ringing noise. Furthermore figures 14 and 15 show that the Vac Damp pads are more efficient at higher frequencies when we use the riveting hammer 2X instead of the 4X. Concerning the use of the damped bucking bar (Atlas Copco) the performance of the Vac Damp is very much dependent on the frequency mainly from 0 to 800 Hz where we can find attenuations and amplifications (figures 16 to 19). It seems to have a contradictory effect when the two damping devices (the Vac Damp panels and the damped bucking bar) are used simultaneously.

CONCLUSION

Attenuation due to the Vac Damp seems larger at low frequency for a larger heavier riveting hammer 4X than for a smaller lighter tool 2x. Then the tool vibration about 50 Hz should be best controlled with a large tool and with Vac Damp pads. This effect may be due to a better acceleration noise control which becomes predominant over the ringing noise, once this latter has been reduced with the Vac Damp, creating a damping effect.

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[1] P.E. Boileau, H. Scory, G. Brooks, M. Amram,"Hand arm vibration associated with the use of riveting hammers in the aerospace industry and efficiency of antivibration devices", Proceedings of the Canadian Acoustical Association Symposium, Vancouver B.C.,8-9 Oct. 92, p-15-16.

[2] J.Cushieri,F.J.Richards,"On the prediction of impact noise IV: estimation of noise energy radiated by impact excitation of a structure",Journal of Sound and Vibration,Vol.86,p319-342.

[3] G.Brooks,"Vac Damp for vibration and noise control".U.S.Patent No 446057, September 1990.

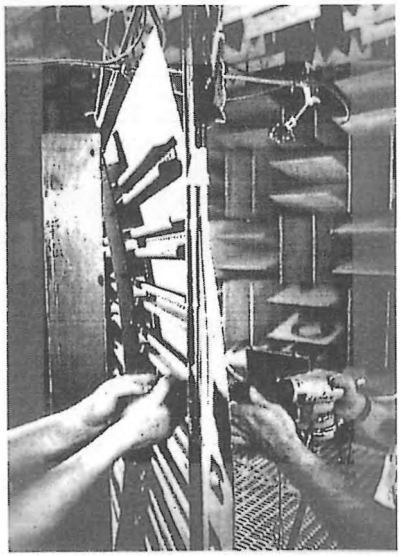


Photo 1. RIVETING OPERATION: on one side the riveter, and on the other side, the bucking bar holder

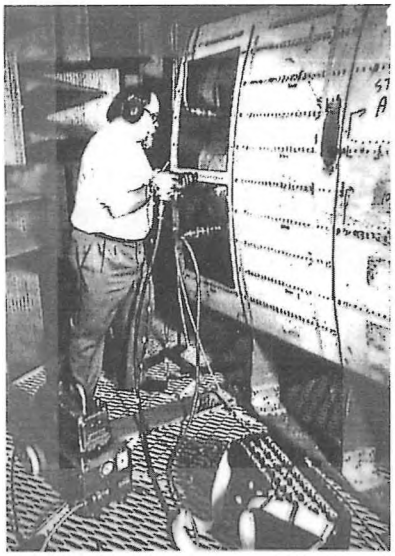


Photo 2. Riveting of an airplane panel with two dampers (Vac Damps) installed using a vacuum pump

Photo 3. View of the riveter and the accelerometers

Photo 4. Instrumentation for noise and vibration measurements and recording

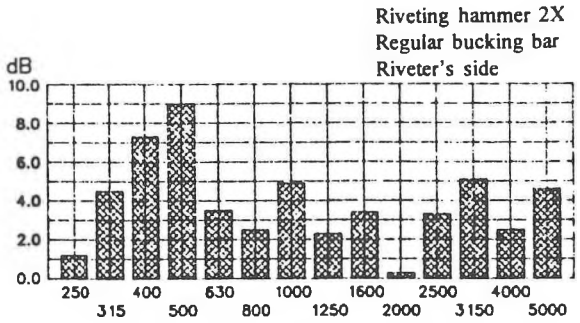
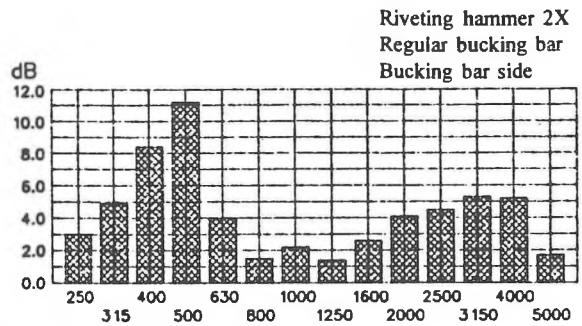


Figure 4.



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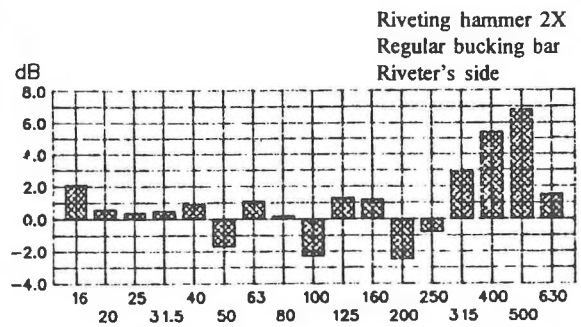

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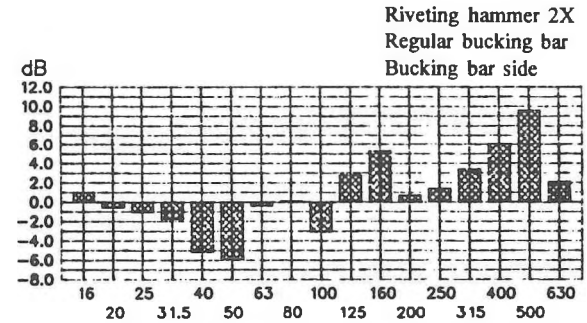

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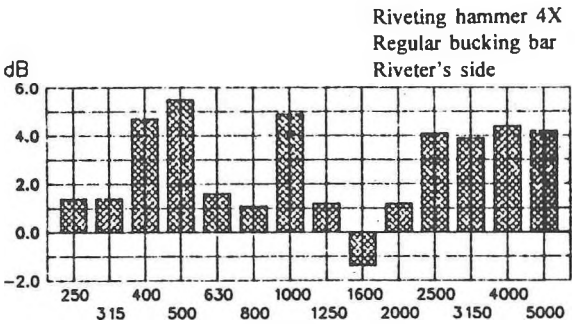


Figure 8.

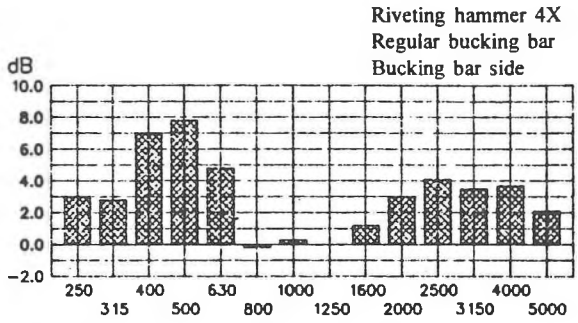


Figure 9.

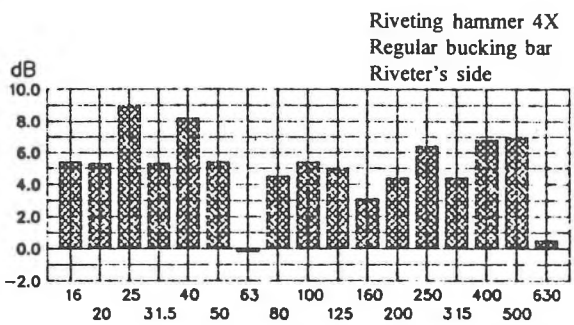


Figure 10.

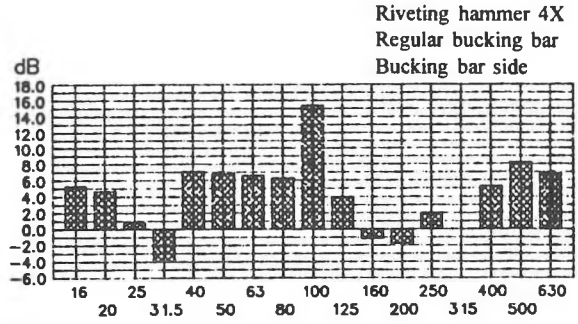
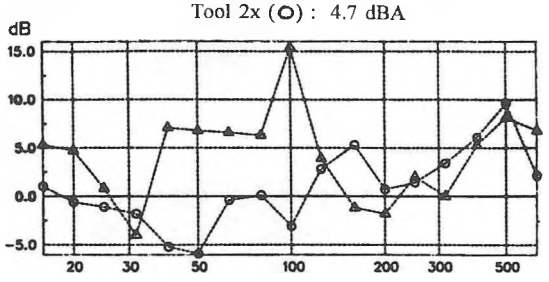


Figure 11.

Radiated noise attenuation

Radiated noise attenuation of vac damp with riveting tools 2x and 4x with regular bucking bar

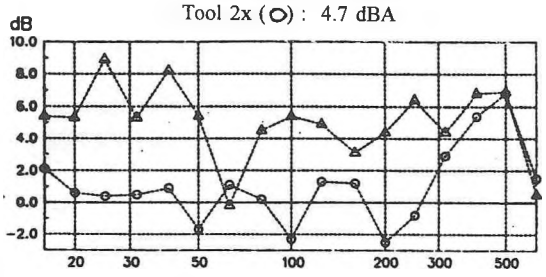
Overall attenuation on 3.2 KHz band (bucking bar side)
Tool 4x (△) : 4.7 dBA
Tool 2x (○) : 4.7 dBA



Central Frequency (Hz)

Figure 12.

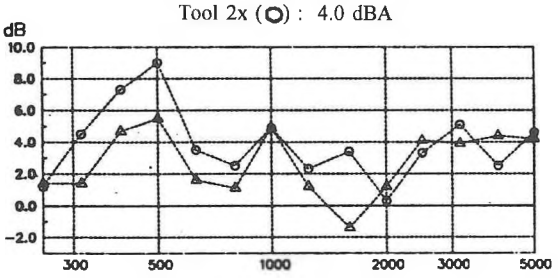
Overall attenuation on 3.2 KHz band (riveter's side)
Tool 4x (△) : 4.9 dBA
Tool 2x (○) : 4.7 dBA



Central Frequency (Hz)

Figure 13.

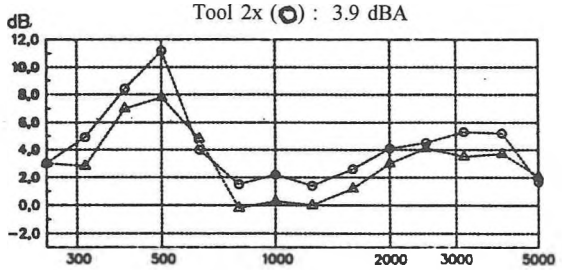
Overall attenuation on 3.2 KHz band (riveter's side)
Tool 4x (△) : 3.3 dBA
Tool 2x (○) : 4.0 dBA



Central Frequency (Hz)

Figure 14.

Overall attenuation on 3.2 KHz band (bucking bar side)
Tool 4x (△) : 2.7 dBA
Tool 2x (○) : 3.9 dBA

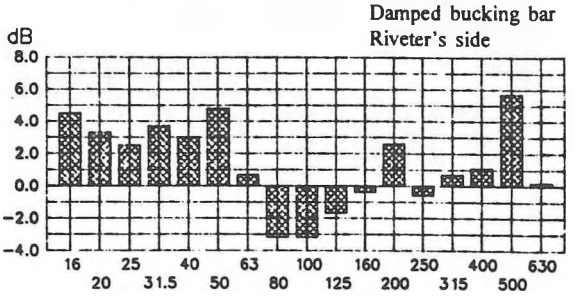


Central Frequency (Hz)

Figure 15.

Radiated noise attenuation of vac damp with riveting tools 2x and 4x with damped bucking bar

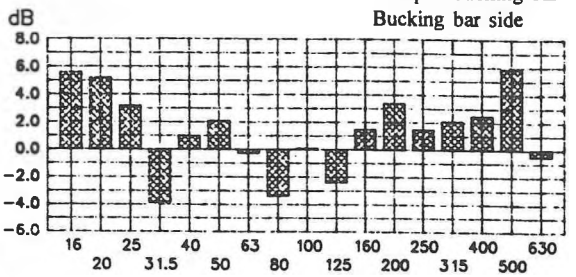
Riveting hammer 2X
Damped bucking bar
Riveter's side



Central Frequency (Hz)

Figure 16.

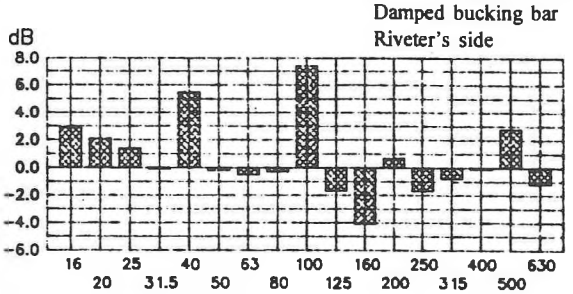
Riveting hammer 2X
Damped bucking bar
Bucking bar side



Central Frequency (Hz)

Figure 17.

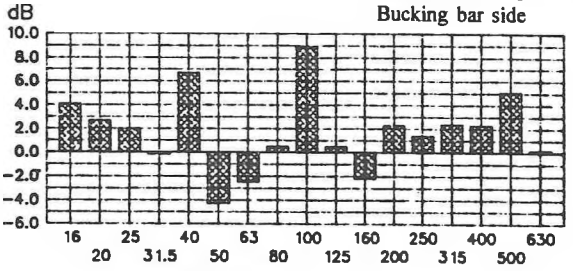
Riveting hammer 4X
Damped bucking bar
Riveter's side



Central Frequency (Hz)

Figure 18.

Riveting hammer 4X
Damped bucking bar
Bucking bar side



Central Frequency (Hz)

Figure 19.

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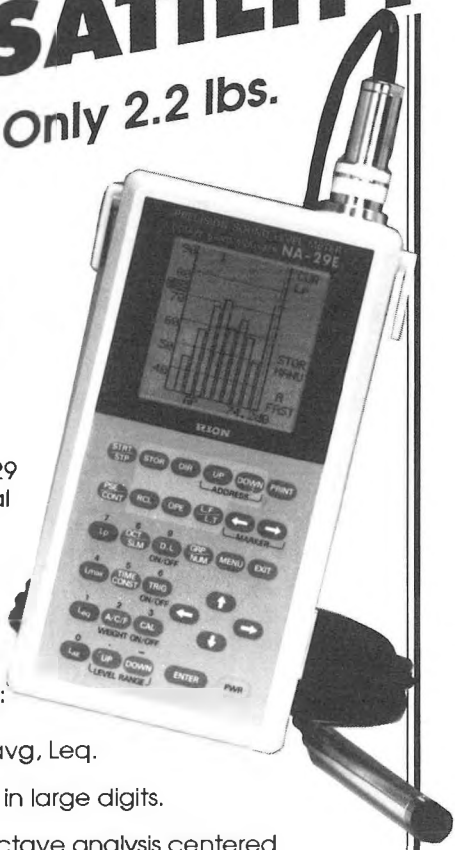

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Comments on: R. Hétu, "The Hearing Conservation Paradigm and the Experienced Effects of Occupational Noise Exposure", *Canadian Acoustics* 22(1) 3-19 (1994).

Sharon Abel, Ph.D., Mount Sinai Hospital, Toronto, Ontario

I very much enjoyed reading Dr. Raymond Hétu's article. In my view, it provides an excellent review and critical commentary of issues relating to research on noise-induced hearing loss. This is a theoretical paper and theory most certainly has a place in scientific journals. Hétu carefully describes the conceptual framework which is implicit to the way most researchers, clinicians and law-makers view noise-induced hearing loss and tests the postulates by recourse to published studies. A wide variety of research questions arise from his thought-provoking analysis. The paper has certainly given me some interesting new directions.

Comments on: R. Hétu, "The Hearing Conservation Paradigm and the Experienced Effects of Occupational Noise Exposure", *Canadian Acoustics* 22(1) 3-19 (1994).

Alberto Behar, Noise Control Management, Scarborough, Ontario

Jim Desormeaux OHST, Ontario Hydro, Whitby, Ontario

We have read with interest the above-mentioned article. It presents an historical perspective from which the author makes some deductions that we do not agree with. As practical hearing conservationists, we would like to address some of the concepts in the article (without getting into philosophical discussions and staying away from black boxes and similar theoretical approaches) and plainly state the philosophy and strategy used by present day hearing conservationists.

Every safety professional knows that if a hazard is present in the workplace and cannot be eliminated, it has to be managed. To do so, a hazard management program has to be designed and implemented. That is why we find in the workplace management programs for hazardous chemicals, asbestos, and confined space entry to quote just a few.

Noise in industry is just another workplace hazard. We, acousticians, like to point out the fact that "ears don't bleed" to underline the fact that effects from noise take long to manifest themselves and that they are not visible. Is that something unique? Not quite. Effects from many chemical agents are also late to show, and when they do, it is too late to react (does asbestos ring a bell? What about lead?).

As with other hazards, noise in the workplace is a fact of life, as are wars, crime, poverty, traffic accidents, etc. I would be great to be able to forbid wars or noisy workplaces by degree, but that just does not happen. On the other hand, we cannot and should not adopt a "do nothing" approach. This would obviously be unethical. Also, there is a strong workers/management consensus requesting that something be done. Finally, there are government regulations that prevent us from doing so. The question is what do we have to do about this hazard: if noise is here, how can we avoid workers being affected.

In our view, a hearing conservation program is the right strategy for the problem, since it is basically an organized effort to ensure that the hearing of a person that works in a noisy place is not affected (because of the noise) during his entire worklife. There may be disagreements among the professionals regarding the steps to be taken or on details of applications. But, in essence, there are no doubts that this is the way to go.

Before finishing, we would like to point out that the following two conclusions in article are wrong:

a) "scientists and occupational health practitioners should recognize that the concepts behind the hearing conservation programs justify high noise levels in the workplace". This statement besides being a highly personal opinion, is a little bit offensive to people who dedicate their life to health and safety.

b) ... difficult for noise-exposed workers to know the manifestations and consequences of occupational hearing loss". Well, we think that a statement like this could have been correct 50 years ago. Today, with the array of training courses done both at the management and labor levels, plus with the existing legislation,

there are not many noise-exposed people who do not know the effects from noise. Probably not familiar with the latest version of the ISO 1999, they are forced to comply with compulsory wearing of hearing protectors and/or hearing test, that should at least tell them something about the risk. Do they war protectors properly or all the time, that is a different question, but they know of noise, no doubt about it.

Comments on: R. Hétu, "The Hearing Conservation Paradigm and the Experienced Effects of Occupational Noise Exposure", *Canadian Acoustics* 22(1) 3-19 (1994).

Julia D. Royster, Ph.D. CCC-A, Environmental Noise Consultants, Inc.

and

Larry H. Royster, Ph.D., North Carolina State University

Raymond Hétu serves a useful function in stimulating those of us involved in occupational hearing conservation to re-evaluate the overall context of our efforts. The article deserves consideration. However, Hétu would actually be more effective in pursuing his agenda if he did not overstate his case. In his ardor to press his point, Hétu has presented a biased and highly selective compilation of statements, including many quotes taken out of context. His use of the term "black box" to describe hearing conservation seems to connote black in the sense of dark and evil, not simply the sense of paradigm. As two individuals whose lives are devoted to preventing noise-induced hearing loss, we are writing to point out inaccuracies of interpretation in Hétu's quotes of ourselves and others, and differences of opinion about hearing conservation.

Noise Control Is Part of Hearing Conservation

Hétu separates noise control and hearing conservation as mutually exclusive alternative approaches to the noise problem rather than as simultaneous aspects of a unified approach. This misconception is common, and was fostered in the USA by the historical progression from the original 1972 OSHA noise standard (which included a one-sentence mandate for hearing conservation programs (HCPs) as paragraph C) to the 1983 hearing conservation amendment (which set forth detailed requirements for HCP phases other than noise control). In our view (Royster & Royster, 1990) noise control is one of the five interdependent phases of a hearing conservation program, not a separate entity. That is, one does not have a complete hearing conservation program unless noise control is pursued.

If noise control can completely eliminate the hazard, then the phases of hearing protection and audiometric monitoring are not needed. However, periodic sound surveys are still needed to ensure that noise levels are maintained at safe values, and the education phase will be needed to enlist workers' participation in using and maintaining noise control treatments, and alerting engineers to new noise problems.

Complete elimination of noise hazards is unlikely. We are not familiar with situations where noise control is required by regulation to reduce employees' noise exposures down to daily equivalent levels below 85 dBA. If daily equivalent exposures equal or exceed 85 dBA, then some hazard remains, and all the phases of a hearing conservation program will be needed.

Moreover, if hazardous noise cannot be totally eliminated through noise control, that does NOT mean that noise control efforts should be dropped. Noise control is not an all-or-nothing proposition. Reducing noise is usually desirable even if hazard cannot be totally eliminated, because the potential hearing damage is reduced when daily exposures are lower, and because wearing hearing protection devices (HPDs) is more likely to succeed in preventing noise-induced permanent threshold shift (NIPTS) from lower noise exposures than from higher exposures.

In the USA, the 1972 noise standard requires feasible engineering or administrative noise controls when daily exposures exceed the equivalent of 8 hours at 90 dBA, using the 5-dB exchange rate with a 90 dBA measurement threshold. Unfortunately, federal OSHA stopped enforcing this requirement after a guideline known as "CPL 2-2.35 was issued to compliance officers in 1983, effectively gutting the requirement for noise controls unless daily equivalent exposures exceeded 100 dBA. Some state-controlled OSHA programs, such as the North Carolina OSHA program, did not adopt the federal guideline but continued to enforce the requirement for engineering noise controls at 90 dBA. Consequently, considerable noise control efforts are made by employers in North Carolina, our state. The National Hearing Conservation Association, American Speech-Language-Hearing Association, and other professional societies have urged federal OSHA to resume

full enforcement of the 1972 noise standard (Megerson, 1994; Schulz, 1994).

Hétu's Corollary A3: There are no environmental factors in the workplace other than noise that can adversely affect hearing.

Actually there is increasing interest and research into the potentiating effects of exposure to workplace chemicals on the development of noise-induced permanent threshold shifts in hearing. As evidence for such interactions is gathered, it needs to be publicized to all safety and health professions. If these problems have not yet been widely accounted for, it is because knowledge in this area is not yet well fleshed out or disseminated.

Hétu's Corollary A4: There are many non-occupational factors responsible for hearing loss among noise-exposed workers.

Hopefully Hétu would not deny that off-the-job noise exposure can cause hearing damage. Shooting guns, for example, is a well-documented cause of hearing loss, one which is robust enough to increase total NIPTS above what it might be from most occupational noise exposures alone. Hétu is correct that many employers wishfully believe that off-the-job noise is the primary contributor to NIPTS. Assuming unprotected exposure at work, this may be true if on-the-job exposures are low, but not if they are high. In many cases, however, the addition of off-the-job exposures to on-the-job exposures significantly increases the predicted total hearing damage. Johnson (1991) has suggested that the populations most at risk for noise-induced hearing loss (NIHL) today are persons with low on-the-job noise exposure who do not voluntarily wear HPDs at work, and who also have significant off-the-job noise exposures.

We have collected reference hearing data for non-industrial noise-exposed populations (NINEPs) composed of ordinary people whose hearing is affected by off-the-job noise (sociacusis) as well as health conditions and otological pathologies (nosoacusis), but who have never worked in a noisy job for more than two weeks (Royster & Thomas, 1979; Royster, Driscoll, Thomas & Royster, 1980). These unscreened populations show hearing levels which are much poorer than highly screened presbycusis data bases such as ISO Population A (ISO 1999(1990:E)). Passchier-Vermeer (1990) has found that the difference between otologically screened and unscreened populations is 2 dB at the median and 6 dB for the 0.1 fractile. If this is true, then all but 2 dB of the difference between median thresholds for NINEP and ISO-A is attributable to off-the-job noise exposure. For median white males age 40 and older, this assumed NIPTS from non-occupational sources is about 11 dB at 4 kHz and 15 dB at 6 kHz.

Hétu misconstrues the NIH (1990) consensus conference statement on NIHL by asserting that it "placed emphasis on such sources of noise as kitchen appliances, domestic lawn mowers, etc. as a serious threat to hearing" and gave "the impression that workplace noise is not a serious problem." In the consensus statement, noise levels of home products were discussed in two contexts: advocating product noise labelling to allow consumers to be able to identify and select quieter products for purchase, and educating schoolchildren and adults that noise can cause permanent hearing loss. (Many people who do not have access to the education provided in HCPs are unaware of this basic fact.) Occupational noise exposure was explicitly named in the consensus statement as the most common cause of NIHL, and the document advocated numerous ways in which occupational noise regulations should be toughened and broadened to cover more workers.

Occupationally noise-exposed employees need to know that their amount of potential hearing damage is governed by the total of all noise exposure from on-the- job and off-the-job sources, so that they can wear hearing protection devices every time they are needed. After all, one can't lose weight by eating a diet lunch at work if one indulges in double helpings and dessert at supper. Both calories and noise dose add from occupational and non-occupational sources, and it is the total that counts. Educating employees about off-the-job hearing hazards helps both them and the employer. At the same time, hearing conservationists need to educate employers that the potential NIPTS from unprotected on-the-job exposure is usually greater than that from off-the-job sources.

Hétu's Corollary A5: ENT surgeons are the hearing conservation experts.

Some physicians may make this assertion themselves, but few of our colleagues would agree. The key individual in any hearing conservation program is the on-site person who is in daily contact with employees in the noisy environment and who takes charge of making the program effective in preventing hearing loss. Neither a lot of training nor rocket-scientist abilities are necessary, but sincere interest is required. We (an audiologist and an engineer) both serve as consultants to industries concerning hearing conservation, and our aim is to help them help themselves. We have written (Royster & Royster, 1990) that no single profession has all the answers, and that common-sense decision making by those personnel at the plant site based on the site's unique needs is superior to relying on experts or publications. When ENT or occupational health physicians are involved in hearing conservation programs, they must assume an active front-line preventive role in the production environment, not the traditional reactive role behind the desk in a nice office. Most physicians need extra education

before they are qualified to play a role in hearing conservation programs or in diagnosing NIHL in medico-legal contexts, as evidenced by a recent text written to fill this need (Dobie, 1993).

Hétu's Postulate B: Noise is here to stay.

Hétu is correct that more incentives are needed for noise control, but wrong in believing that there are no jurisdictions where noise control is given more than lip service. Where regulatory agencies actually enforce noise control requirements (as in North Carolina) there is more noise control effort. It is short-sighted that regulatory agencies have not emphasized long-term noise reduction through planning to replace older equipment with quieter alternatives. Noise control consideration in the original design process is less expensive and longer-lasting than retrofit applied controls. Some industries have successfully pressured equipment manufacturers to design for quiet. For example, R. J. Reynolds Tobacco Company induced the manufacturer of cigarette making machines to achieve a quieter design by refusing to purchase any unless they met noise specs. By planning for noise control, the company built a new plant and brought it on line with all employees' daily equivalent noise exposures below 90 dBA, any many below 85 dBA.

Corollary C2: The susceptible individuals have to be identified.

Hétu objects to research efforts to establish relationships between various factors and susceptibility to noise-induced hearing loss because he assumes that the information would be misused to discriminate against employees or selectively assign less susceptible workers to higher noise exposures. Potential misuse of information does not justify dropping research to understand the processes involved in NIHL. Hétu insinuates that we meant harm by reporting our observation that "the percentage of an industrial population potentially compensable for on-the-job hearing loss is strongly dependent on the race and sex characteristics of the population" (Royster, Thomas, Royster & Lilley, 1978). He erroneously states that we claim that women are less susceptible to NIPTS than men, and blacks less susceptible than whites. Actually, we have reported finding different age-effect hearing losses for these populations, not differing susceptibility to NIPTS. We do not know whether the populations with less age-effect loss are less susceptible to noise damage. If this were found to be true, then perhaps physiological researchers (which we are not) could identify the underlying reason and use that knowledge to help prevent NIPTS. However, if we did not report our simple observation of differences in thresholds for these groups, then potentially useful research would not be conceived. Scientific observers must not hide part of the truth. We are amazed that Hétu would do otherwise.

Postulate D: Hearing protective devices can always be an effective and adequate means to prevent compensable hearing loss.

Hétu asserts that "the use of hearing protective devices is prescribed with little if any consideration given to the working conditions in which they are to be used" and "any mention of incompatibility between work requirements and the use of hearing protectors is being excluded." Hétu cites our writing (Royster & Royster, 1985) as describing employees who modify their hearing protectors as "abusing their protectors" without also mentioning that this discussion is part of a 6-page section concerning how to overcome problems in HPD use through intelligent selection based on compatibility with the work environment and task demands, as well as the comfort and preference of the individual wearer and consideration of the individual wearer's communication needs and hearing ability. A few paragraphs later he quotes our belief in the need for strict enforcement of HPD utilization in a pejorative way, without mentioning that we state that "a strict enforcement policy must be backed by genuine concern and a willingness to work with employees who have problems with their HPDs." Hétu also fails to mention the recent research concerning human factors aspects of HPD use, and the effort of Working Group 11 of Accredited Standards Committee S12, Noise, to develop a HPD attenuation test standard that will yield realistic estimates of the attenuation achievable by workers operating under all the constraints of their job demands. Today's hearing conservation community clearly recognizes that wearing HPDs is not as simple as wearing safety glasses. New HPD labeling recommendations being developed by a NHCA Task Force on HPD Effectiveness (chaired by Larry Royster) specifically indicate that human factors must be considered in selecting HPDs. However, these facts do not serve Hétu's purpose, so he omits them.

Corollary E1: Early detection of hearing loss by means of audiometric monitoring leads to prevention.

Corollary E2: Audiometric monitoring can effectively detect changes in the hearing sensitivity of noise-exposed employees before any hearing disability occurs.

In his discussion of these two assumptions, Hétu asserts that audiometric monitoring is actually conducted to oppose future compensation claims rather than to identify individuals who need extra attention to achieve better protection against noise. He argues that measurement

variability in audiometry is too great to detect incipient NIPTS because the annual rate of change from NIPTS is smaller than conventional values of significant threshold shift. This view ignores several factors. First, detection of cumulative change from baseline values is the goal of monitoring (not annual change from the most recent prior test). In an individual it may not be possible to detect a 10-dB threshold shift. However, a 15-dB shift can certainly be detected, and if we limit NIPTS to 15 dB at the most susceptible frequency, isn't that a lot better than letting it go unchecked? Second, if audiometry is performed during the workshift rather than prior to work, the detected 15-dB shift should include temporary threshold shift as well as permanent threshold shift. Therefore, less then 15 dB of permanent shift will be allowed to develop before follow-up attention is given. Third, if the procedures for audiometric data base analysis in Draft ANSI S12.13-1991 are employed, then ineffective HCPs will be detected through group data analysis before many workers suffer significant shifts in hearing. Hétu mentions this approach, but dismisses it. He criticizes the failure to use "an index of non-decrease in measured hearing sensitivity over time," although the draft standard explains that this approach was not used because of the difficulty of adjusting for inevitable age decline in hearing as well as unwillingness to wait for many years before being able to judge HCP effectiveness. The draft standard's procedures based on audiometric variability permit an earlier indication of HCP effectiveness, thereby permitting HCP personnel to improve the program if it is deficient before employees suffer the consequences. Hétu seems quick to pass judgment on approaches which he has not taken the time to understand.

General comments not related to specific sections of Hétu's paper:

Later in his article Hétu implies that there is collusion among otologists and scientists and occupational safety and health professionals to perpetuate a phony "hearing conservation black box" for their own profit and the protection of employers, all at the expense of the hearing of noise-exposed employees. As professionals whose careers are aimed at promoting effective hearing conservation programs (ones which prevent occupational NIHL) we resent being described as "recruits" of the otologists in a conspiracy of fraud.

Hétu states that the Acoustical Society of America "systematically holds special sessions on hearing conservation" as if this were a subversive activity. In fact, Hétu was invited by session organizers Julia Royster and Alice Suter to advocate his ideas in a session at ASA in 1991. He was unable to accept the invitation. When the session was held, his viewpoints doubting the usefulness of audiometric monitoring were summarized by Alice Suter in the interest of stimulating critical evaluation of current practices (Suter, 1991). A fall 1993 ASA session related to hearing conservation focused on the attenuation achieved by novice users of HPDs and development of a new testing standard to yield realistic data.

Hétu also implies that the National Hearing Conservation Association is a self-serving organization without self-critical ability. On the contrary, NHCA currently has ad hoc committees developing standards of good practice in the areas of mobile hearing test service guidelines, and audiometric baseline revision during the process of individual audiogram review, in addition to sponsoring the previously mentioned task force on HPD effectiveness. These facts contradict Hétu's description of professional societies as perpetuating the evil black box.

Maybe Hétu has never seen effective HCPs, but that does not mean that they don't exist. Our careers are devoted to increasing the number of effective HCPs -- ones which prevent NIPTS, thereby benefitting both the employee and the employer. The quality of the HCP is all-important: if its goal is mere OSHA compliance, then none of the phases will be implemented well enough to be of any value. On the other hand, if the goal is to provide a safe workplace and avoid occupational hearing loss, then that can be achieved. This is the reason we have developed procedures for audiometric data base analysis: to give employers and potentially regulatory compliance officers a tool for determining whether the HCP is working.

One way to improve program effectiveness is to educate employees in detail about their audiometric results and the effects of hearing loss on quality of life. As Hétu describes, the insidious nature of NIHL in combination with age-related hearing loss and the reluctance of affected individuals to reveal the problems they experience do make it more difficult to motivate employees to take NIHL seriously. However, we disagree with Hétu's statement that "the audiogram is not a convincing means to raise awareness." If employees are educated about the hearing thresholds needed for full audibility of conversational speech sounds and shown how the combination of inevitable aging plus unnecessary NIPTS can jeopardize speech perception, then their annual audiogram results will become more meaningful to them. If they receive detailed feedback about each annual audiogram in terms of their hearing status compared to normal hearing, compared to typical hearing for their age, and compared to their own past results, then they perceive that audiometric trends are related to hearing conservation behaviors. When audiograms are exploited for their motivational value in this manner, they are quite useful in raising awareness and empowering employees. In contrast, when audiometric results are not openly shared with employees, workers may

correctly perceive audiometric monitoring as a charade carried out for regulatory compliance alone.

British Columbia stands out as a place where excellence in hearing conservation has been fostered by the policies of the Hearing Conservation Section of the Worker's Compensation Board of B.C. under the leadership of audiologist Margaret Roberts. Perhaps Raymond Hétu is unfamiliar with the successes in western Canada or elsewhere.

Perhaps Hétu has been so angered by particular poor programs that he cannot perceive the possibility of good ones. However, his indictment of all those involved in hearing conservation is not only unfair, but diminishes his potential to achieve change because his opinions are so biased. Hétu would benefit from a deeper look at exemplary hearing conservation programs, as well as from coaching in how to survey the scientific literature in an objective manner, plus a workshop in professional ethics.

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Comments on: R. Hétu, "The Hearing Conservation Paradigm and the Experienced Effects of Occupational Noise Exposure", *Canadian Acoustics* 22(1) 3-19 (1994).

Alice H. Suter, Ph.D., Ashland, Oregon

Raymond Hétu's article has, no doubt, generated a considerable amount of controversy, as would anything that so boldly challenges current thinking. But it is very worth-while reading, not only because it should promote some soul-searching on the part of thousands of people who practice hearing conservation, but also because it contains

many important, if not always very palatable, truths.

First, I agree with Dr. Hétu that the concept of hearing conservation popularly held by most hearing conservation professionals excludes noise control. But it is not perceived this way by all. In the U.S., for example, authors of the preamble to OSHA's hearing conservation amendment make it clear that noise control is the preferred method of controlling worker exposure (OSHA, 1981), although OSHA does not explicitly say that engineering controls are an integral part of a hearing conservation program. NIOSH does say this, however, in its "Practical Guide to Effective Hearing Conservation Programs in the Workplace." (Suter and Franks, 1990)

There are many other points on which I agree with Dr. Hétu. I too have noticed the influence of economics on the development of early noise and hearing loss standards. Examples of these are: the shift from the earlier AMA formulas to the 1959 version, even though there was no empirical support for the later version, and the adoption of the 90-dB(A) Walsh-Healey noise standard in 1969 after an 85 dB(A) version had already been officially promulgated in 1968. With respect to the 90-dB(A) limit, the Labor Department admitted at the time that it was "the upper limit of a daily dose which will not produce disabling loss of hearing in more than 20 percent of the exposed population" (DOL, 1970). Dr. Hétu provides the additional example of the 6-month waiting period, which was adopted specifically to prevent most workers from filing claims (see also Zenz 1972, as quoted in Ginnold, 1979).

Economics also have their influence on contemporary practices. It is often true, as Dr. Hétu has stated, that hearing conservation professionals use the threat of worker compensation claims as the primary tool to motivate employers to institute hearing conservation programs. It is also reasonable to assume that many hearing conservation professionals have come to believe that this is the major rationale for hearing conservation.

Dr. Hétu is correct in his supposition that the sole emphasis on hearing sensitivity in hearing conservation programs fails to recognize other adverse effects of noise. Of special importance is the neglect of the effects of noise on speech communication and warning signal perception, which have implications for industrial accidents. Another area of neglect has been the combined effects of noise and other agents, which, fortunately has begun to be noticed by scientists in acoustics, some of whom are associated with NIOSH (see Fechter, 1989; Morata, 1989; Morata *et al.*, 1991). Dr. Hétu's descriptions of the various effects of noise (in his Fig. 2) and the consequences of noise-induced hearing loss (in Fig. 1) demonstrate the complexity of noise effects and should be enlightening for hearing conservationists focussing solely on loss of hearing sensitivity.

Hétu's article brings out the need for rehabilitation of workers with noise-induced hearing loss, which has been curiously overlooked by those who specialize in hearing conservation. He points out that such benefits as amplified telephones, warning signals that have been adjusted to the needs of hearing-impaired individuals, and rehabilitative services are almost never mentioned. These services should include speech reading, auditory training, and counselling.

Dr. Hétu also makes a good point when he states that the current interest in non-occupational hearing loss diverts attention from occupational noise. It is certainly helpful to recognize and try to minimize the contribution of non-occupational noise sources, but some professionals maintain that non-occupational noise is the primary source of noise-induced hearing loss among industrial workers, and the rationale for this posture seems to be to remove the burden of noise control from today's employers.

I agree with Dr. Hétu that the role of engineering noise control is increasingly underplayed and that existing technology is not implemented because of a lack of demand. I was surprised that he did not mention the U.S. OSHA's CPL 2-2.35, which represents the epitome of the concept of substituting noise control with "hearing conservation." Shortly after the second version of the hearing conservation amendment was promulgated, federal OSHA[1] issued a directive to its compliance officers stating that companies should not be cited for the absence of feasible engineering controls until workers' eight-hour time-weighted average exposure levels exceeded 100 dB(A), so long as the companies had in place an "effective hearing conservation program." (OSHA, 1983) Because an "effective hearing conservation program" was never defined, the directive effectively raised the permissible exposure limit to 100 dB(A). This policy has since been incorporated into OSHA's "Field Operations Manual." No wonder there has been a lack of demand for noise control technology.

Dr. Hétu states correctly that there is a popular assumption that noise is here to stay and that it is not possible to engage in manufacturing without causing some amount of hearing impairment. This choice has been made by scientists and professionals, many of whom were in the employ of or subsidized by industry, but it has also been made by policy makers. It *has,* however, been subject to public debate in

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1 Approximately half of the states in the U.S. have their own OSHA programs, and several of the states did not adopt the 100-dB(A) federal compliance policy.

the U.S. and vigorously opposed by worker representatives, but the policy remains unchanged.

With respect to hearing protection devices, Dr. Hétu enumerates some of their many problems, including the fact that they often yield little if any protection. He gives the hearing conservation professionals no credit, however, for recognizing these problems, trying to improve public awareness of them and trying to make the wearing of hearing protectors more comfortable and more successful. Many hearing conservation professionals and hearing protector manufacturers are making considerable efforts along these lines. It is true that hearing protectors have become the foundation of the hearing conservation program since they are the only part of the program that actually reduces noise exposure in the absence of engineering controls.

Most hearing conservation professionals have come to believe that hearing protectors are all that we have to fall back on, and many advocate, as Dr. Hétu points out, the punishment of workers by suspension and even termination if they fail to wear their protective equipment. It is quite likely that these kinds of measures are often doled out without fully evaluating workers' objections to hearing protectors, especially the fact that some of them may be unable to hear needed communication and warning signals. I was surprised that Dr. Hétu did not discuss the adverse effects of hearing protectors on speech communication and warning signal detection since that is a common reason why workers resist them, and quite a legitimate one in many cases.

It is true, as Dr. Hétu indicates, that audiometry does not *save* hearing, although he dismisses its value as an educational and motivational tool, for the company as well as for the worker. He points out, however, that "not a single documented case of noise control has been motivated by the results of such tests," and, although I would hope that such cases exist, I have not seen one either. He also points out correctly that industrial audiometry, even when it is conducted by researchers, is often plagued by problems of reliability and validity, and, when conducted by hearing conservationists, much of it has been performed in an extremely slipshod manner, greatly undermining its usefulness.

Dr. Hétu demonstrates the uniqueness of the phrase "hearing conservation in noise" by suggesting the absurdity of comparable phrases, such as "renal function conservation in lead" and "balance conservation on vibrating structures." In fact, I have often heard people slip up and say, "noise conservation" instead of "hearing conservation!" It appears that our acceptance of hazardous levels of noise is unique and that no other toxin or harmful physical agent is accorded this status. Noise is the only workplace hazard to which OSHA applies the blatant double standard of one permissible level in the regulation and another, much more lax standard in its enforcement policy.

Hétu's discussion of the effects of noise-induced hearing loss as experienced by workers is particularly valuable. These observations are drawn from years of research by Hétu, Getty, and their colleagues. Every hearing conservation professional should be reminded of the facts that workers often attempt to conceal their hearing impairments, that workers with hearing impairment are often stigmatized, and that these problems, along with the impairments themselves, adversely affect family life. This concealment must indeed serve to underplay the risk of noise-induced hearing loss.

There are certain points on which I take issue with Dr. Hétu's treatise. First, I maintain that the concept of hearing conservation does not belong to any particular group: not to the AAOO (now the AAO), or to any government agency, or even to the National Hearing Conservation Association. As I have mentioned earlier, it does not exclude engineering noise control, and at times, NIOSH, OSHA, and other groups have pointed this out (see, for example, the American Industrial Hygiene Association's manual, (Berger *et al.*, 1986)). The concept of hearing conservation can be broad, inclusive, and altruistically based or it can be narrow, exclusive, and based entirely on profitability, or it can fall anywhere in range of intermediate positions, depending on the motives and the awareness of the user. No doubt, many hearing conservation practitioners are unaware that the hearing conservation paradigm they may be using is motivated entirely by economics.

Also, in spite of its many weaknesses, I disagree that audiometric testing is merely a tool to argue against worker compensation claims. On the contrary, it is more likely to argue *for* worker compensation claims and that is why many employers opposed it from the beginning.

Dr. Hétu maintains that concern about noise-induced hearing loss began with the earliest worker compensation awards in 1948 and 1951. It is clear that these claims had a powerful influence on the concern demonstrated by management representatives and the professional community, but noise-induced hearing loss was certainly not a "non-issue" before that time. Numerous articles published in the 1930s and 1940s discuss occupational hearing loss and the use of hearing protection devices to reduce the risk (eg. Bunch, 1937; Knudsen, 1939; McCoy, 1944). In fact, a few articles on the subject appeared as early as the last century and the early 1900s (eg. Holt, 1882; Barr, 1890; Barr and Barr, 1909).

Hétu points to what seems to be the indifference and narrow-mindedness of the otologists that played leading roles in the development of hearing conservation because they did not recognize the many adverse effects of noise other than reduction in hearing sensitivity. In their defense, however, it should be noted that not a great deal was known about the other effects of noise in the 1950s, and loss of hearing sensitivity has always been the effect that is most easily recognized and quantified. Certainly speech interference was known, but not much research had been conducted on the other effects that Dr. Hétu mentioned, such as voice disorders, stress effects, annoyance, and pregnancy outcome. Many of these areas are inadequately researched even today, although that does not diminish the need for caution on the part of employers and hearing conservation professionals.

Finally, it seems that Dr. Hétu is sometimes too quick to generalize. I would temper some of his statements. First, he *always* assumes a purely economic motivation on the part of those who develop and conduct hearing conservation programs, when this is not always the case. He also contends that "the persistent background belief is that occupational hearing loss is the exception not the rule in noisy industrial settings." To support this statement he cites a NIOSH study showing that *one* hearing conservation program has been effective in preventing occupational hearing loss (Franks, Davis, and Kreig, 1989), which most professionals in the field know is a relatively rare occurrence, and that the hearing losses observed were most likely non-occupational. While it is true that some contemporary hearing conservationists are focussing their attention primarily on non-occupational hearing loss, a great many of those who work in noisy industry are aware that occupational noise is the primary culprit in most cases.

Another area where Dr. Hétu seems to generalize too quickly is his contention that hearing conservation professionals "blame the victim" by using the audiogram to make workers responsible for their own hearing losses. He also states that "the idea of failure of the personal protective equipment is simply inadmissible to the hearing conservationists." While these statements may be true sometimes, it is my experience that hearing conservation professionals generally blame the noise first, and then look toward the workers' use of hearing protectors and the company's diligence in providing the right kind of protection, etc. They know that hearing protectors are not infallible. So, if blame is to be partialled out, it belongs with the noise, the hearing protectors, the company, and the workers. Different hearing conservationists will allot the blame differently, but I don't believe it is common practice to say to workers, "You've caused your hearing loss by not wearing your protectors." Certainly, OSHA does not penalize the workers for failure to wear their hearing protectors, but it may penalize the company. As Dr. Hétu has stated, however, the company may penalize the workers, and often does.

After reviewing Dr. Hétu's article one might deduce the following: If indeed audiometric testing is as useless as he makes it out to be, then hearing conservation programs are probably not conserving much hearing. I see this is a very real possibility. And if the main purpose of hearing conservation has always been to limit worker compensation claims, and if indeed it is true that audiometric testing sometimes serves to *document* the evidence of occupational hearing loss, then hearing conservation has never been successful at its original purpose. Why, then, does hearing conservation continue to be practiced so widely? The obvious reason, at least in the U.S., is that it is required by OSHA. But even in the absence of OSHA, it is likely to be continued, perhaps because it has become institutionalized and would be carried forward by its own momentum. The other possibility is that it actually is effective, at least in some cases and to some extent, at preventing noise-induced hearing loss.

It is imperative that we find out whether and the extent to which hearing conservation programs are effective. However, until such time as a large, national study is conducted by in impartial agency, such as NIOSH, we won't know whether hearing conservation is a snare and a delusion, as Dr. Hétu maintains, or whether these programs have value. In the mean time, everyone involved in hearing conservation should read and reread Dr. Hétu's article, let go of the defensiveness that he is likely to provoke, and do some soul-searching. We all need to remember that protecting workers against the adverse effects of noise is the only justification for hearing conservation programs.

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Reply to comments on: R. Hétu, "The Hearing Conservation Paradigm and the Experienced Effects of Occupational Noise Exposure", *Canadian Acoustics* 22(1) 3-19 (1994).

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In my description of how the hearing conservation (HC) paradigm operates [1], emphasis was placed on the historical context from which it emerged and its basic presuppositions, at the expense of a detailed analysis of all the nuances that can be found in the literature on the way HC is defined and practised. I agree with Alice Suter's comment [2] that among HC practitioners, a whole spectrum of motives, values, and degrees of awareness may be found. I nevertheless strongly believe that there is a common basic perspective that is shared by a vast majority of professionals involved with the problem of noise in the industrial workplace. Its pervasiveness masks the fact that it is merely one possible perspective. Its generalized endorsement allows it to define reality. This commonly held perspective tends to obscure its basic presuppositions, thus operating as a "black box".

The comments made by A. Behar and J. Desormeaux [3] and by Julia and Larry Royster [4] tend to illustrate and confirm the existence of the HC paradigm, remaining precisely within the confines of that perspective. To elaborate further, let us look at the way the paradigm operates, as schematized in Figure 1. Arguments raised by the above authors are essentially framed within the specific outputs of the HC black box, namely, hearing sensitivity management issues. Health professionals often have the best intentions in trying to prevent occupational hearing loss by means of HC. Yet, their normative approach to the problem of noise exposure leads them adopt the role of teaching the proper things to be done, that is, wearing hearing protectors, and of reproaching those who do not comply with the teaching. The operation of their paradigm becomes clear when one looks at its exclusions. A paradigm can be viewed as a habit of mind that constitutes a cognitive barrier [5]. People are generally not aware of such exclusions, and if this unawareness is not borne in mind, my description of

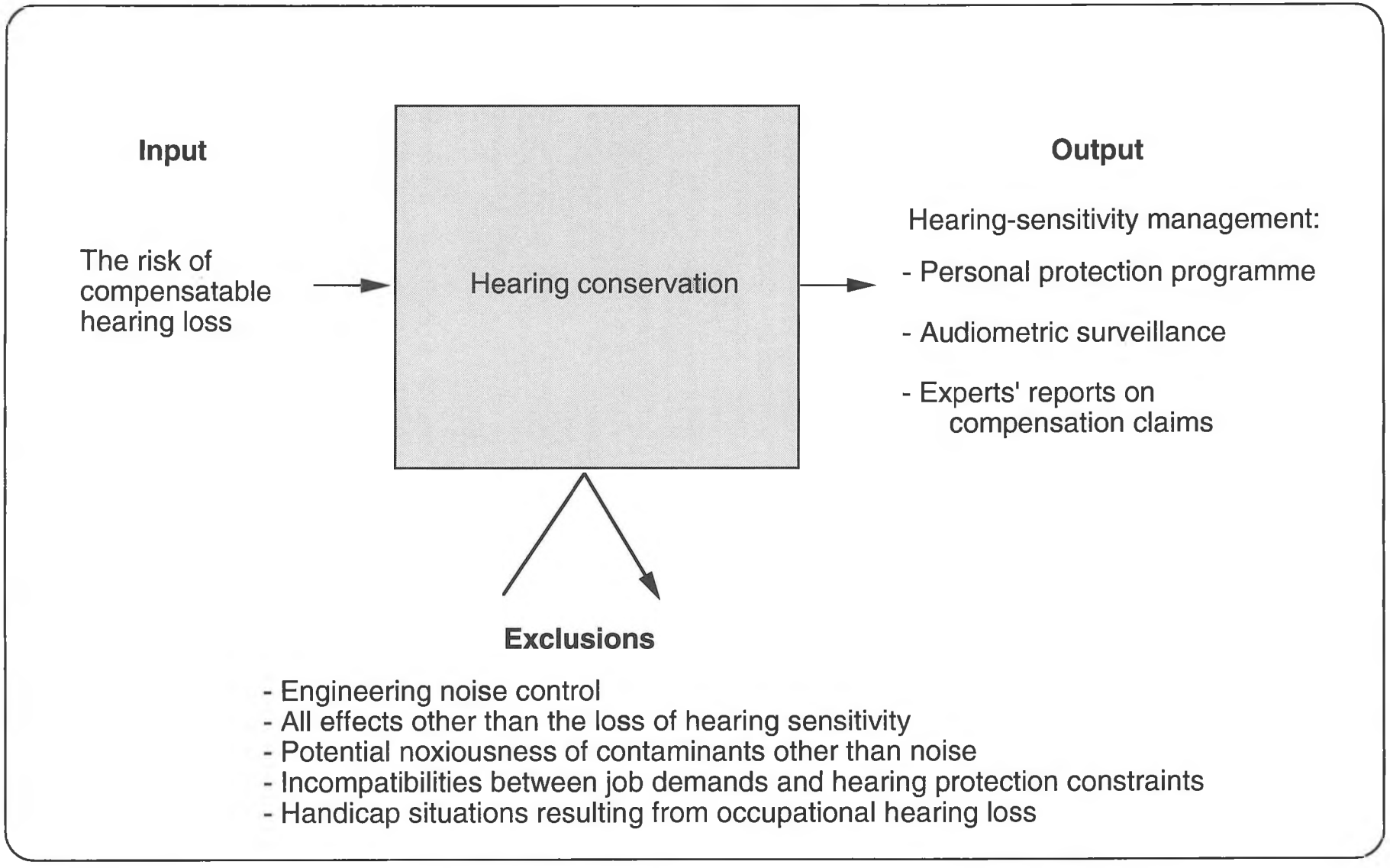

Figure 1. Schematic representation of the way in which hearing conservation operates as a black box.

alliances between groups of professionals advocating HC (section 2.5 of the paper), might be misleading. The fact that so many professional organizations and institutions have adopted the HC perspective originally put forward by otologists does not necessarily mean that each professional involved in the practice of HC explicitly endorses employers' interests and concerns and ignores those of noise-exposed workers. However, they share, consciously or not, a vision that leads to the exclusion or downplaying of the issues summarized in Figure 1.

The debate itself as to whether or not engineering noise control is part of HC is revealing, again illustrating the focus of the paradigm. As pointed out in Alice Suter's comment, the U.S. Federal Regulation and O.S.H.A. policy do indeed exclude noise control from HC. This exclusion is further attested to by the sparsity of accounts on industrial noise control achievements in the literature. Incidentally, in one such account, the outcome of engineering control was defined in terms of the percentage of workforce that could be *dropped from* hearing conservation [6].

The exclusion of noise exposure effects other than loss of hearing sensitivity speaks for itself. I agree with Alice Suter's assertion as to the lack of knowledge of such effects at the time the "Guide for Hearing Conservation in Noise" was first published in 1957. However, later versions of the Guide as well as the general literature on HC consider loss of hearing sensitivity as the only input into their programmes. Furthermore, I contend that this narrow HC perspective has acted as an obstacle to systematic investigation of other effects of noise exposure in the workplace. This is especially true in regard to the influence of noise on auditory signal perception, as briefly examined below.

Royster and Royster point to "the increasing interest and research into the potentiating effects of exposure to workplace chemicals on the development of noise-induced permanent threshold shifts in hearing". What about chemicals such as organic solvents, that can affect hearing independently of noise? The interest in ototoxic agents other than noise has not emerged from the practice of HC. As a matter of fact, it took over a decade for toxicologists to succeed in interesting hearing specialists in such toxins [7]. And as yet, to my knowledge, exposure to such substances is not part of the present day hearing conservation programmes.

I also agree with Royster and Royster' insistence on the fact that the hearing conservation community recognizes the shortcomings of hearing protectors. But I maintain that *incompatibilities* between job demands and hearing protection constraints are excluded by HC. The key word in Postulate D ("Hearing protective device can always be an effective and adequate means to prevent compensatable hearing loss") is "always". Acknowledging the possibility of such an incompatibility would mean having to design a new output from the HC black box, namely, worksite accommodation rather than prescribed protection.

That such incompatibilities exist is made obvious when one assesses the effectiveness of auditory warning signals for workers who sustain noise-induced hearing loss and who are requested to wear hearing protection [8]. This issue represents a complex matrix of factors that are not considered as inputs in HC programmes, namely, the interaction between auditory demands, masking noise and reverberation, reduced auditory capacities and use of hearing protection. The existence of such a problem and its solution will probably be brought up by cases in which provisions of the Americans with Disability Act will be applied. It will represent completely new challenges to hearing conservationists because the problem does not fit into the HC paradigm.

The way in which the HC black box constitutes a mental barrier is well illustrated by the almost-total absence of empirical descriptions of what needs to be heard in industrial workplaces and how such auditory demands can be brought into correspondence with normal or impaired auditory capacities [9]. Despite nearly four decades of intervention by hearing specialists in industry, the potential problems raised by the extensive use of acoustic signals in noisy surroundings are still undocumented. It is revealing that, when visiting a plant, no one can answer the question as to who is responsible for auditory warning signals design and adjustment. The hearing sensitivity of workers to pure tones in a quiet environment is systematically and repeatedly measured, but what needs to be heard at the work sites is unknown. Clearly, there is need for a paradigm shift if safety is to be taken into account when considering industrial sound environments.

The above clarifications pertain to the issue of the exclusions from the HC black box. Its actual output also deserves some discussion. Several comments on my paper referred to the effectiveness of HC programmes as assessed by means of audiometric data. Royster and Royster suggest that I have been blinded by the outcome of particularly poor HC programmes in Québec. It is true that cross-sectional analysis of audiometric data collected in plants where HC programmes had been implemented showed rather distressing results: the prevalence of significant hearing loss (that is, losses above the 90th centile of the age effect after exclusion of other factors of hearing loss) was over 40% in most of these plants [10]. These included mines, foundries, saw mills, and metal production plants. This high prevalence could mean that HC experts in Québec have been doing a poor job. Yet, the published outcome of some

of their programmes appears to be highly consistent with the HC tradition [11]. British Columbia is stated by Royster and Royster as "a place where excellence in hearing conservation has been fostered by the politics of the Hearing Conservation Section of the Worker's Compensation Board of B.C.". However, if Alberto Behar's sources are valid, this excellence means that, in B.C., "approximately 2,500 workers' compensation claims are accepted each year at a cost of $10 million" [12]. This represents an index of failure rather than success, as HC was originally designed to control the risk of compensatable hearing loss.

What Royster and Royster appear to define as the "gold standard" for an effective HC programme is their own *judgement* and observations of the quality of hearing protection fitting (as pointed out in section 2.3 of my paper, referring to the draft of an American National Standard for evaluating the effectiveness of HC programmes). A more objective criterion might be the proportion of workers being overexposed to noise. If audiometry is to be promoted as the measuring stick of success, epidemiology should be relied on for the definition of such "gold standard". Accordingly, an effective programme would lead to a relative risk of significant hearing loss (above the age effect) of 1; in other words, the prevalence of significant hearing loss should be the same within groups of industrial workers and office workers. A minimum requirement for such a demonstration would be that hearing tests are performed in such a way that close to zero-decibel hearing threshold levels at 500 Hz and above can be measured. This does not appear to be the case in a majority of test facilities in American industry [13]. I thus share Suter's view expressed in her final comment, stating that the present day value of HC programmes is unknown.

Finally, if, as suggested by the last comment from Royster and Royster, it is unethical to challenge a prevailing paradigm, scientific progress should be considered an unethical social process every time it involves a paradigm shift.

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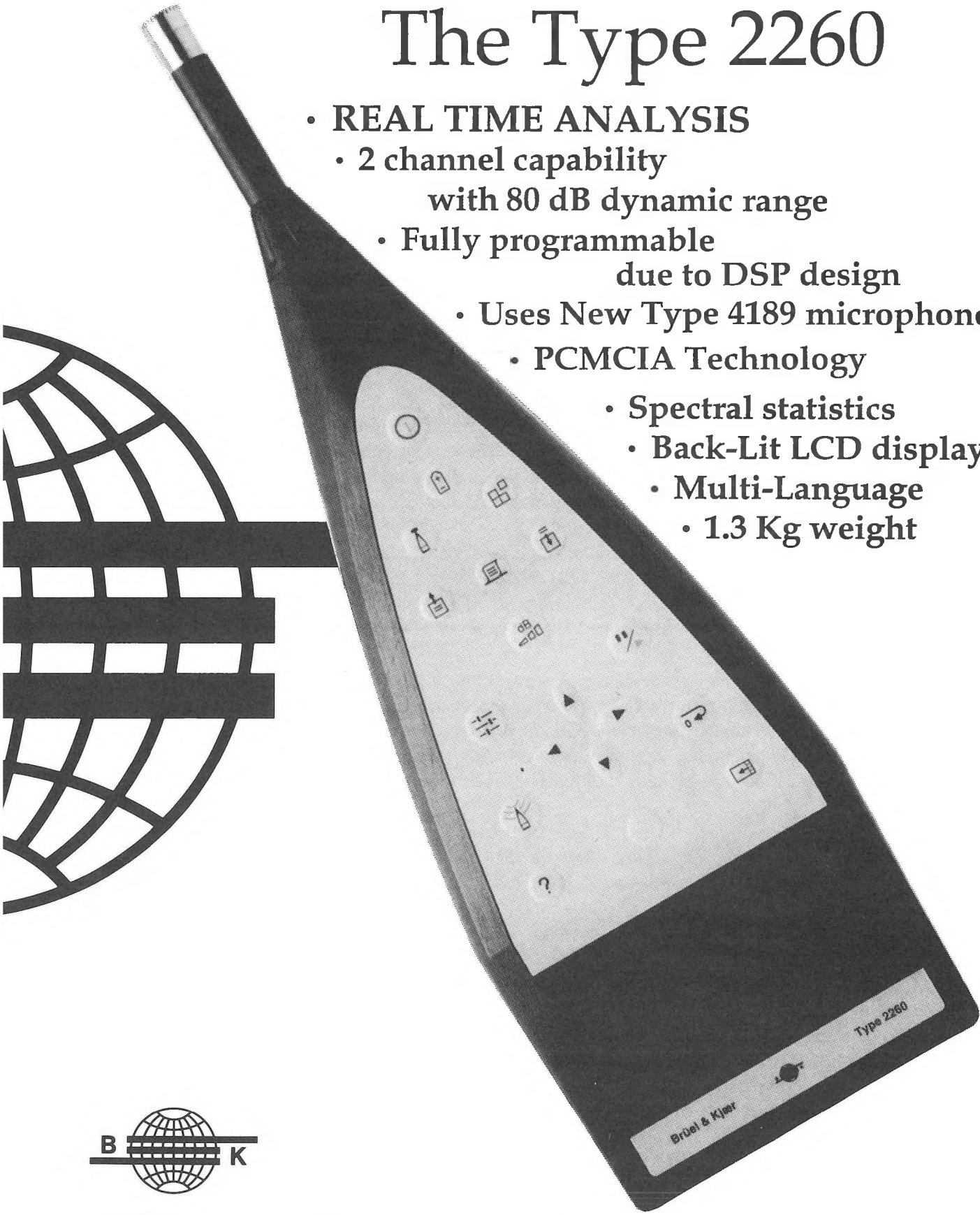

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To submit a communication :

- Send an abstract of 300 words maximum to the technical program chairman ***before May 19, 1995***. This deadline will be strictly enforced. The abstract should be prepared in accordance with the instructions enclosed is this issue of ***Canadian Acoustics***.
- A notification of acceptance will be sent to the authors ***before June 1, 1995*** with a registration form.
- A two-page summary paper, prepared in accordance with the enclosed instructions, will be sent to the technical program chairman ***before July 14, 1995***. This deadline will be strictly enforced. The summary papers will be published in the proceedings issue of ***Canadian Acoustics***.

Address the abstracts and summary papers to :

D[r] Alain Berry, technical program chairman
Département de génie mécanique
Faculté des sciences appliquées
Université de Sherbrooke
2500, boul. Université
Sherbrooke (Québec) J1K 2R1
Phone number : (819) 821-7148, Fax : (819) 821-7163

Registration fee : the registration fee for the Symposium and the completed registration form must be sent with the summary paper.

Summary of dates :

May, 19 :	Deadline for receipt of abstracts.
June, 1 :	Notification of acceptance.
July, 14 :	Deadline for receipt of summary paper, registration form and registration fee.
October, 25-26 :	Symposium.

Student competition : student participation to the Symposium is strongly encouraged. Monetary awards will be given to the three best communications. Students must signify their intention to compete by submitting the ***"Annual Student Presentation Award"*** form in this issue, to be enclosed with the abstract.

APPEL DE COMMUNICATIONS
Semaine canadienne d'acoustique 1995
Symposium, 25 - 26 octobre

Des présentations sont sollicitées sur tous les domaines de l'acoustique et des vibrations. Un certain nombre de sessions techniques portant sur des thèmes ciblés sont déjà planifiées. Ces sessions seront prises en charge par un organisateur désigné et incluront des communications invitées. En voici la liste avec les organisateurs correspondants :

• Contrôle du bruit :	D[r] F. Laville	(514) 289-8800, poste 7662
• Parole-Audition :	D[r] D.G. Jamieson	(519) 661-3901
• Méthodes numériques en acoustique :	D[r] K. Fyfe	(403) 492-7031
• Méthodes expérimentales en acoustique :	D[r] Y. Champoux	(819) 821-7146
• Acoustique architecturale :	D[r] J.S. Bradley	(613) 993-9747
• Psycho-physio acoustique :	D[r] Ch. Laroche	(613) 564-2933
• Vibrations :	D[r] L. Cheng	(418) 656-7920
• Contrôle actif du bruit et des vibrations :	D[r] A. Berry	(819) 821-7148

Les présentations soumises seront réparties dans les sessions précédentes ou dans d'autres sessions si besoin est.

Pour soumettre une présentation :

- Envoyer un résumé de 300 mots maximum au responsable technique ***avant le 19 mai 1995***. Cette échéance devra être scrupuleusement respectée. Les résumés devront être préparés en suivant les instructions incluses dans ce numéro d'***Acoustique canadienne***.
- Une notification d'acceptation du résumé sera envoyée aux auteurs ***avant le 1[er] juin 1995*** avec un formulaire d'inscription au Symposium.
- Un sommaire de deux pages, préparé suivant les instructions incluses dans ce numéro d'***Acoustique canadienne***, devra être envoyé au responsable technique ***avant le 14 juillet 1995***. Cette échéance devra être scrupuleusement respectée. Les sommaires seront publiés dans les actes du Symposium.

Veuillez faire parvenir les résumés et les sommaires à :

D[r] Alain Berry, responsable du programme technique
Département de génie mécanique
Faculté des sciences appliquées
Université de Sherbrooke
2500, boul. Université
Sherbrooke (Québec) J1K 2R1
Téléphone : (819) 821-7148, Télécopieur : (819) 821-7163

Frais d'inscription : les frais d'inscription au Symposium et le formulaire d'inscription dûment complété devront être expédiés avec le sommaire.

Résumé des dates importantes :

19 mai :	Date limite de réception des résumés.
1[er] juin :	Notification d'acceptation.
14 juillet :	Date limite de réception du sommaire, du formulaire d'inscription et des frais d'inscription.
25-26 octobre :	Symposium.

Concours étudiants : la participation des étudiants au Symposium est fortement encouragée. Des prix en argent seront décernés pour les trois meilleures communications. Les étudiants doivent indiquer leur intention de participer en complétant le formulaire ***"Prix annuels relatifs aux communications étudiantes"*** qui figure dans le présent numéro et en le joignant au résumé.

Instructions for the Preparation of Abstracts

1) Duplicate 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 the deadline. 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 and fax numbers, 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) Deux 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 la date de tombée. 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 remerciements. **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)** Les numéros de téléphone et de télécopieur, 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.

Instructions pour la Préparation des Articles à être Publiés dans le Cahier des Actes du Congrès

Général - Soumettre un article prêt-à-copier d'un maximum de deux pages présenté en deux colonnes. Ne pas inclure de sommaire. Tout le texte en caractères Times-Roman. Disposer les figures dans le haut ou le bas des pages si possible. Lister les références dans un format logique à la fin du texte. Envoyer l'article au président du Programme Technique avant la date de tombée . Le format optimal peut être obtenu de deux façons:

Méthode directe - Imprimer directement sur deux feuilles 8.5" x 11" en respectant des marge de 3/4" dans le haut et sur les côtés et un minimum de 1" dans le bas. Titre en 12pt, caractères gras, en simple interligne (12pt), centrés sur la page. Le reste du texte en 9pt en 0.75 (9pt) interligne, dans un format en deux colones, avec une largeur de colonnes de 3.4" et une séparation de 1/4". Noms des auteurs et adresses centrés sur la page avec les noms en caractères gras. Les titres de sections en caractères gras.

Méthode indirecte - Dactylographier ou imprimer comme suit, réduire au trois-quart (s.v.p., s'assurer de bonnes photocopies) et assembler l'article sur un maximum de deux pages 8.5" x 11" avec les côtés et un minimum de 1" dans le bas. Titre en 16pt avec 1.33 (16pt) interligne, centré sur la page. Le reste du texte en 12pt avec simple (12pt) interligne. Noms et adresses des auteurs centrés sur la page avec les noms en caractères gras. Titres des sections en caractères gras. Imprimer les colonnes de texte sur quatre feuilles 8.5" x 14" avec une largeur de colonnes de 4.5", une longueur maximum de 12.25", en laissant de la place pour le titre, les noms et les adresses sur la première page

Instructions for Preparation of Articles to be Published in the Conference Proceedings Issue

General - Submit the camera-ready article on a maximum of two pages in two-column format. Do not include an abstract. All text in Times-Roman font. Place figures at the top and/or bottom of the pages, if possible. List references in any consistent format at the end. Send to the Chairperson of the Technical Programme by the deadline. The optimum format can be obtained in two ways:

Direct method - Print directly on two sheets of 8.5" x 11" paper with margins of 3/4" top and sides, and 1" minimum at the bottom. Title in 12pt bold with single (12pt) spacing, centred on the page. All other text in 9pt with 0.75 (9pt) line spacing, in two-column format, with column width of 3.4" and separation of 1/4". Authors' names and addresses centred on the page with the names in bold type. Section headings in bold type.

Indirect method - Type or print as follows, reduce to three-quarters size (please ensure good copies) and assemble article on a maximum of two 8.5" x 11" pages with margins of 3/4" top and sides, and 1" minimum at the bottom. Title in 16pt bold type with 1.33 (16pt) line spacing, centred on the page. All other text in 12pt with single (12pt) line spacing. Authors' names and addresses centred on the page with the names in bold type. Section headings in bold type. Print individual text columns on four sheets of 8.5" x 14" paper with a column width of 4.5", a maximum length of 12.25", and leaving room for the title and mes and addresses on the first page.

ACOUSTICS WEEK IN CANADA 1995

SEMAINE CANADIENNE D'ACOUSTIQUE
Loews Le Concorde, Québec

EXHIBITION
October 25 - 26

The Organizing Committee for Acoustics Week In Canada 1995 is pleased to announce that there will be an exhibition of Instrumentation, Software, Materials, as well as Literature related to all aspects of Acoustics, and Noise and Vibration Control. An area adjacent to the meeting rooms has been made available as an Exhibition space. Companies are invited to exhibit their products and services. The cost will be $275 for a table. This includes a partial subsidy of the morning and afternoon conference coffee service that will be held in the exhibition room. Exhibition space will be reserved on a first come, first served basis. You are advised to reserve as soon as possible, as space is limited. A non-refundable deposit of $100 must accompany all reservations, the balance being due on or before September 29, 1995. To reserve space and / or obtain further information, please contact:

Jacques Savard
SNC - Lavalin
2 Place Félix-Martin
Montréal, Qué.
H2Z 1Z3

Tel: (514) 393-1000
Fax: (514) 393-9540

EXPOSITION
25 et 26 octobre

Le comité organisateur de la Semaine canadienne d'acoustique 1995 est fier d'annoncer qu'une exposition sur l'instrumentation, les logiciels, le matériel et la documantation relative à tous les aspects de l'acoustique et de la lutte contre le bruit et les vibrations a été prévue dans un espace adjacent aux salles de réunion. Les compagnies pourront y exposer leurs produits et leurs services au prix de 275 $ par table, ce prix englobant une subvention partielle des pauses café du matin et de l'après-midi qui auront lieu dans le local d'exposition. Puisque le nombre de places est limité, il importe de faire les réservations le plus tôt possible; ces dernières seront traitées sur la base du premier arrivé, premier servi. Un dépôt non remboursable de 100 $ doit accompagner toute réservation, le solde devant être payé le ou avant le 29 septembre 1995. Pour tout renseignement ou pour toute réservation, prière de communiquer avec:

Jacques Savard
SNC - Lavalin
2 Place Félix-Martin
Montréal, Qué.
H2Z 1Z3

Téléphone: (514) 393-1000
Télécopieur: (514) 393-9540

Acoustics Week in Canada 1995

Loews Le Concorde Hotel - Quebec

Seminar

****

ENVIRONMENTAL NOISE MONITORING

Date: October 24, 1995
Presented by: Larson Davis Laboratories
Contact: Yvon Larose - Dalimar Instruments Inc.
Tel.: (514) 424-0033 Fax: (514) 424-0030
Language: English
Cost: $100.00

Content

The broad topic of environmental noise monitoring can extend from simple on-the-spot measurements using a handheld sound level meter to the complex networks of remote noise monitoring stations (NMSs) digitally linked to a central computer via modems which are increasingly being utilized around major airports and manufacturing facilities.

In this seminar, we will begin by examining some of the numerous acoustical parameters which can be easily measured (Leq, Lpeak, Ln statistics, SPL Time Histories, etc.) in terms of the information they provide to the user. We will then address the issue of noise event detection and some of the measurement and analysis techniques available to assist in the identification of the noise source.

On the subject of permanently installed noise monitoring systems, we shall address the issues of calibration, data downloading, central station callups upon detection of noise events, real-time frequency analysis and measurement of non-acoustic parameters such as wind, temperature and humidity.

Note

A basic understanding of acoustics and measurement systems is required.

This seminar will only be offered if there is sufficient registration by September 15, 1995.

Semaine Canadienne d'Acoustique 1995

Hôtel Loews Le Concorde - Québec

Séminaire

****

SURVEILLANCE DU BRUIT ENVIRONNEMENTAL

Date: le 24 octobre 1995
Présenté par: Larson Davis Laboratories
Pour information ou inscription: Yvon Larose - Dalimar Instruments Inc.
Tel.: (514) 424-0033 Fax: (514) 424-0030
Langue: Anglais
Coût: $100.00

Contenu

La vaste gamme des produits disponibles pour la surveillance du bruit environnemental va du simple sonomètre portatif jusqu'au plus complexe réseau de stations de contrôle du bruit à distance reliées à un centre informatique via modem. Ces systèmes sont de plus en plus utilisés par les aéroports et les industries manufacturières.

Dans ce séminaire, nous examinerons d'abord quelques uns des paramètres acoustiques qui peuvent facilement être mesurés (Leq, Lpeak, Ln statistics, SPL Time Histories, etc.) dans les termes de l'information qu'ils fournissent à l'utilisateur. Nous aborderons ensuite le sujet de la détection d'événements sonores et quelques techniques de mesure et d'analyse afin de vous assister dans l'identification de la source sonore.

Quant aux systèmes permanents de contrôle du bruit, nous aborderons les sujets de l'étalonnage, du transfert des données, des appels du poste central suivant la détection d'événement sonores, des analyses de fréquences en temps réel ainsi que des mesures de paramètres non-acoustiques tels que le vent, la température et l'humidité.

Note

Une connaissance de base des systèmes de mesure et d'acoustique est requise.

Suffisamment d'inscriptions devront avoir été reçues d'ici le 15 septembre 1995 pour que ce séminaire ait lieu.

Blachford

"The ABC's of noise control"

H.L. Blachford's Comprehensive Material Choices

Noise treatments can be categorized into three basic elements: Vibration Damping, Sound Absorption and Sound Barriers.

Vibration Damping

It is well known that noise is emitted from vibrating structures or substrates. The amount of noise can be drastically reduced by the application of a layer of a vibration damping compound to the surface. The damping compound causes the vibrational energy to be converted into heat energy. Blachford's superior damping material is called **Aquaplas** and is available either in a liquid or a sheet form.

AQUAPLAS DL is a liquid damping material that can be applied with conventional spray equipment or troweled for smaller/thicker application.

It is water-based, non-toxic and provides economical and highly effective noise reduction from vibration.

AQUAPLAS DS is an effective form of damping material provided in sheet form for direct application to your product. Available with pressure sensitive adhesive for ease of application.

Sound Barriers

Sound Barriers are uniquely designed for insulating and blocking airborne noise. The reduction in the transmission of sound (transmission loss or "TL") is accomplished by the use of a material possessing such characteristics as high mass, limpness, and impermeability to air flow. Sound barriers can be a very effective and economical method of noise reduction.

Blachford Sound Barrier materials:

BARYFOL®

Limp, high specific gravity, plastic sheets or die cut parts. Can be layered with other materials such as acoustical foam, protective and decorative facings to achieve the desired TL for individual applications.

Sound Absorption

Blachford's **CONAFLEX** materials provide a maximum reduction of airborne noise through absorption in the frequency ranges associated with most products that produce objectionable noise. Examples: Engine compartments, computer and printer casings, construction equipment cabs, ...etc.

Available with a wide variety of surface treatments for protection or esthetics. Material is available in sheets, rolls and die-cut parts — designed to meet your specific application.

Suggest Specific Material or Design

Working with data supplied by you, or generated from our laboratory, **H. L. Blachford** will make engineering recommendations on treatment methods which may include specific material proposals, design ideas, or modifications to components. Recommendations are backed by documentation which can include written progress reports containing summarization of goals and results, conclusions, data, test procedures and background.

A Quality Supplier

The complete integration of:

- Experience
- Advanced engineering
- Quality-oriented manufacturing technology
- Research and development
- Problem solving approach to noise control

Result in:

Comprehensive Noise Control Solutions

MISSISSAUGA (416) 823-3200
MONTREAL (514) 938-9775
VANCOUVER (604) 263-1561

SEMAINE CANADIENNE D'ACOUSTIQUE 1995 / ACOUSTICS IN CANADA 1995

Hôtel Loews Le Concorde - Québec

SÉMINAIRE / SEMINAR

INTERVENTION SUR LE BRUIT EN MILIEU DE TRAVAIL : UNE APPROCHE DE SANTÉ PUBLIQUE

INTERVENTION ON NOISE IN THE WORKPLACE : A PUBLIC HEALTH APPROACH

DATE: 24 octobre 1995

PRÉSENTÉ PAR: Raymond Hétu et Louise Getty,
Groupe d'acoustique de l'Université de Montréal

ENDROIT: Hôtel Loews Le Concorde

LANGUE DE PRÉSENTATION: le français

CE COURS S'ADRESSE: aux professionnels de la santé et de la sécurité du travail (médecin, personnel infirmier, hygiéniste), aux acousticiens, aux ergonomes, aux responsables patronaux et syndicaux en santé et sécurité du travail.

PERSONNE À CONTACTER: Manon Lamoureux, secrétaire du GAUM
(téléphone: 514- 343-7301; télécopieur: 514-343-5740)

COÛT: 100$

Le cours portera sur l'application d'une approche de santé publique à la question du bruit en milieu de travail industriel. Le but du cours est d'outiller les personnes participantes afin qu'elles puissent agir plus efficacement sur les comportements susceptibles de favoriser la réduction du bruit.

Le plan du cours s'établit comme suit:

1- Synthèse des impacts de l'exposition au bruit
- . Impacts professionnels en termes de santé et de sécurité du travail
- . Impacts psycho-sociaux de la surdité professionnelle

2- Élaboration d'une approche d'intervention sur le problème du bruit
- . Cadre conceptuel
- . Cibles et stratégies d'intervention
- . Obstacles à la prise en charge des problèmes de bruit
- . Élaboration d'un programme de promotion de la santé auditive
- . Processus décisionnel
- . Évaluation des interventions

Semaine Canadienne d'Acoustique / *Acoustic Week in Canada*

Cours intensif / *Intensive course*:

Les techniques de contrôle du bruit
Noise Control Technique

❑ **Contenu / *Content***

Partie A: Les bases essentielles: décibels, paramètres clefs, phénomènes, lois fondamentales

Part A: Basis: decibels, key parameters, basic laws

Partie B: Le contrôle du bruit en milieu de travail: règlements, techniques de contrôle, absorbants, transmission, silencieux, locaux

Part B: Noise control in working place: rules, noise control technics, absorbing materials, transmission, silensors, building

Partie C: Le contrôle du bruit des produits manufacturés: identifications, rayonnement, conception mécanique, politique d'achat

Part C: Noise control manufactured products: identifications, noise radiation, mechanical design, buying policy

Partie D: Le contrôle du bruit environnemental: règlements, propagation, écrans, effets atmosphériques

Part D: Environmental noise control: rules, propagation, barriers, ground and atmospheric effects

Nota: le cours se donnera en français

❑ **Originalités / *Novelties***

- Des exemples pratiques / *Practical examples*
- Une disquette de programmes sera remise à chaque participant(e) / *Programs available for each participant*
- Une emphase sur le pourquoi et le comment du lien vibration-bruit / *Vibrating why and how structure radiate noise*
- Un guide pour l'achat d'équipement / *Guide for buying equipment*

❑ **Professeurs / *Professors*:** J. Nicolas et A. L'Espérance, GAUS, Université de Sherbrooke

❑ **Durée / *Duration*:** 2 jours/*2 days* / **Date / *Date*:** 23-24 octobre 1995/*23-24 October 1995*
Lieu / *Place*: Québec, Hôtel le Concorde

❑ **Montant / *Fees:*:** 350$, payable à "Fondation Sonica" / *$350. to "Fondation Sonica"*
AVANT le15 septembre 1995 / *BEFORE 15th of September 1995*

❑ **Inscription / *Registration*:**
AVANT le 15 septembre 1995 / 25 places maximum
BEFORE 15th of September 1995 /maximum of 25 participants
Inscrivez-vous immédiatement / *Register as soon as possible*

❑ **Informations / *Information***
contenu détaillé du cours disponible sur demande
detailed content available upon request

S'adresser à / *Address to*:
Jean Nicolas, Département de génie mécanique,
Faculté des sciences appliquées, Université de Sherbrooke,
Sherbrooke (Québec) J1K 2R1
Tél.: 819-821-7157; Fax: 819-821-7163

The Canadian Acoustical Association
L'Association Canadienne d'Acoustique

MINUTES OF THE ANNUAL GENERAL MEETING

5:00 pm, October 20th, 1994
Citadel Inn, Ottawa

The Meeting was called to order at 5:06 pm.

1) **Welcome**

R. Hétu, President, welcomed members to the Meeting.

2) **Review of Minutes of Last AGM**

The minutes of the last AGM were accepted as printed.

3) **President's Report**

R. Hétu noted that the health of CAA was good, with a full slate of prizes for 1994 and a record number of papers for the conference. The plenary session on Hearing Accessibility was a first attempt at increasing visibility. Although success was perhaps limited, this was a first step.

4) **Executive Secretary's Report**

The paid membership for 1994 stands at 332, which is down 10% from 1993. Student members were up, but corporate subscriptions were again down. Members who do not pay their dues will continue to be removed from the mailing list on August 1st, which is the deadline for the September issue of the Journal.

5) **Treasurer's Report**

A printed report was presented by E. Bolstad. The Association continues to be in reasonable financial health, with expenditures slightly less than income. However the student travel subsidy and the cost of the proceedings issue are up, so the CAA must be careful.

D. Quirt thanked Eugene for his services over the years, specifically a total of 8 years as Treasurer, and for a good job restructuring the Association's finances.

6) **Editor's Report**

The Journal continues to be in good shape, in a break even situation but with a lack of papers. M. Hodgson is forming an Editorial Board to solicit papers. He has had a good response at the conference with over ten positions filled.

7) **Membership/Recruitment**

Membership is reasonably stable, however, D. Jamieson is eager to reverse the downward trend in corporate subscriptions. He should be notified of potential subscribers. An updated brochure has also been prepared, copies available from him.

8) **Awards Committee**

The Eckel, Bell, Fessenden, Directors, and Shaw Prizes were presented at the banquet. Student prizes were presented by A. Behar to M. Fortin, H. Ladak and C. Lesage.

Thanks were due to Alberto for co-ordinating the student prizes.

9) **Acoustics Week Reports**

Toronto, 1993

The Toronto meeting made a $4,200 profit.

Ottawa, 1994

110 registrants, 18 students and 25 new members for CAA. The efforts of T. Nightingale and J. Bradley on the student travel subsidy were recognized. Thanks were also due to Trevor for organizing a successful conference.

Quebec City, 1995

The conference will be at the Hotel Loews le Concorde, October 23rd and 24th with seminars following.

Calgary (Banff?), 1996

10) **Other Business**

H. Forester deplored the inactivity of the committee formed at Toronto, 1993 to raise the visibility of CAA. Harold suggested that CAA form a committee to lobby governments on noise issues, with honorariums and expenses for committee members.

The suggestion received a mixed response. It was noted that many CAA Officers do considerable work for CAA with no reimbursement.

It was agreed the H. Forester, M. Roland-Meiszkowski and any others interested would prepare a formal proposal for consideration at the BoD meeting in June 1995.

11) **Elections**

Secretary: T. Nightingale was nominated by the Nominations Committee and acclaimed.

Treasurer: J. Hemingway was nominated by the Nominations Committee and acclaimed.

Directors: D. Quirt and S. Dosso were nominated by the Nominating Committee for the two Director positions vacant and acclaimed.

12) **Adjournment**

The meeting was adjourned at 6:27 pm.

MINUTES OF THE BOARD OF DIRECTOR'S MEETING

7:00 pm, October 18th, 1994
Citadel Inn, Ottawa

Present:	R. Hétu	D. Chapman	E. Bolstad
	D. Jamieson	D. Quirt	T. Nightingale
	M. Hodgson	J. Hemingway	B. Gosselin
	S. Abel	E. Slawinski	R. Ramakrishnan
Regrets:	A. Behar	S. Forshaw	F. Laville
	M. Roland-Mieszkowski		C. Sherry

The Meeting was called to order at 7:02 pm.

The minutes of the BoD meeting, June 12th, 1994 were accepted as written.

1) **President's Report**

R. Hétu welcomed all to the meeting.

2) **Executive Secretary's Report**

The paid membership for 1994 stands at 332, which is a decrease of 10% over 1993. Student members were up 41% but corporate subscriptions were again down.

3) **Treasurer's Report**

The Association continues to be in reasonable financial health. However, interest rates continue to be low and the Student Travel Subsidy is expected to be higher this year.

4) **Editor's Report**

The Journal continues to be in a break even situation, with a lack of papers. Costs have increased slightly. However, the proceedings issue for the Ottawa meeting will cost $6,200 as against the usual $2,000. M. Hodgson has started forming an Editorial Board to solicit papers.

5) **Membership/Recruitment**

The updated brochure was circulated. Mailings to University departments to continue.

6) **Awards Committee**

Directors:	Graduate, awarded to A. Abdou
	Professional under 30, no applications
	Professional over 30, awarded to R. Hétu
Bell:	Awarded to M. Lantz
Fessenden:	Awarded to C. L. McNeil
Eckel:	Awarded to T. Busch
Student:	To be awarded at the Annual General Meeting. A. Behar to step down, R. Ramakrishnan to take over. Thanks to Alberto for his input.

A unified brochure to be prepared by D. Chapman; assistance with translation required. Brochure to be inserted in Journal.

7) **Acoustics Week Reports**

Ottawa, 1994

Record number of papers, 94. Two seminars cancelled. Awards to be presented at banquet by award co-ordinators.

Quebec City, 1995

Hotel Loews le Concorde, Monday October 23rd. Committee already formed.

Calgary, 1996; Windsor (?), 1997; Sherbrooke, 1998

8) **Nomination Committee**

Nominations by the Committee are as follows:

Secretary:	T. Nightingale
Treasurer:	J. Hemingway
Directors:	D. Quirt
	S. Dosso

9) **Other Business**

Motion: "That the Treasurer's budget for 1995 be $1,500 and the Secretary's $1,650."
Proposed: E. Bolstad
Seconded: R. Ramakrishnan
Carried

A plenary session on Hearing Accessibility will be held on Thursday at 11:30 a.m. A press release has been prepared.

Thanks were made to Eugene Bolstad for his significant contribution to the Canadian Acoustical Association over the years.

The meeting was adjourned at 9:48 pm.

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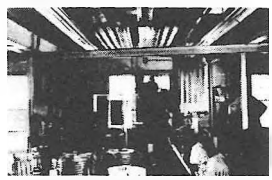

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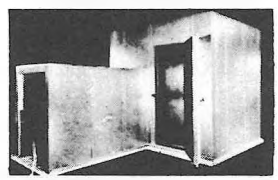

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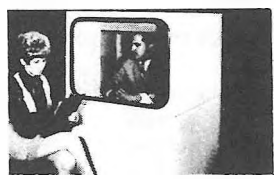

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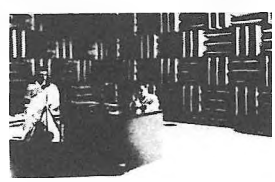

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NEWS/INFORMATIONS

CONFERENCES

International Conference on Computational Acoustics: April 5-7, 1995, Environmental Applications, Southampton, UK. Contact: J. Evans, Conference Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton S04 2AA, UK. Telephone: +44 703 293223, Fax: +44 703 292853.

Vibration and Noise '95: April 25-27, 1995, Venice, Italy. Contact: M.J. Goodwin, School of Engineering, Staffordshire University, P.O. Box 333, Beaconside, Stafford ST18 0DF, England. Telephone: +44 785 275212, Fax: +44 785 227741.

ACOUSTICS '95 - Environmental Noise and Vibration: May 9-11, 1995, Spring Conference of the IOA, Liverpool, United Kingdom. Contact: Institute of Acoustics, Agriculture House, 5 Holywell Hill, St. Albans, Herts, ALI IEU, United Kingdom. Telephone: +44 727 848195; Fax: +44 727 850553.

129th Meeting of the Acoustical Society of America: May 31-June 4, 1995, Washington, DC, USA. Contact: Elaine Moran, Acoustical Society of America, 500 Sunnyside Blvd., Woodbury, NY II797, USA. Telephone: +1 (516) 576-2360, Fax: +1 (516) 349-7669.

2nd International Conference on Acoustics and Musical Research: 3rd week, May 1995, Ferrara, ITALY. Contact: Conference Secretariat, CIARM95, National Research Council of Italy, Cemoter Acoustics Department, Via Canal Bianco, 28-44044 Ferrara. Tel. +39 532 731571-Fax +39 532 732250. E-mail CIARM95@CNRFE4.FE.CNR.IT.

International Symposium in Music and Concert Hall Acoustics (MCHA95): May 15 to 18, 1995, Kirishima, Kagoshima-Prefecture, JAPAN. Contact: The Kirishima International Concert Hall, Kagoshima, Japan for further details.

SAE Noise and Vibration Conference: May 15-18, 1995, Travorse City, Michigan, USA. Contact: Mone Asensio, SAE International, 3001 West Big Beaver Road, Troy, Michigan, USA. Telephone: 313 649-0420.

Noise Control '95 - 10th International Conference on Noise and Vibration Control: June 20-22, 1995, Warsawa, Poland. Contact: D. Koracecka, Central Institute for Labor Protection, ul. Czerniakowska 16, 00-701 Warszawa, Poland. Telephone: +482 623 4601; Fax: +482 623 3695.

8th International Conference on Low Frequency Noise and Vibration: June 21-23, 1995, Trondheim, Norway. Contact: B. Hughes, Multi-Science Publishing Company Ltd., 107 High Street, Brentwood, Essex CM14 4RX, England. Fax: +44 277 223453.

15th International Congress on Acoustics: June 26-30, 1995, Trondheim, NORWAY. Contact: ICA'95, SEVU, Congress Department, N-7034 Trondheim, Norway. Telephone +47 7359 5251/7359 5254, Fax +47 7359 5150, Electronic Post ica95@sevu.unit.no.

CONFÉRENCES

Conférence internationale sur l'acoustique du calcul (applications environnementales): Southampton, Royaume-Uni, du 5 au 7 avril 1995. Renseignements: J. Evans, Conference Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton S04 2AA, Royaume-Uni. Téléphone: 44 703 293223; télécopieur: 44 703 292853.

Vibration and Noise 95: Venise, Italie, du 25 au 27 avril 1995. Renseignements: M.J. Goodwin, School of Engineering, Staffordshire University, P.O. Box 333, Beaconside, Stafford ST18 0DF, Angleterre. Téléphone: 44 785 275212; télécopieur: 44 785 227741.

ACOUSTICS 95 - Conférence de l'IOA sur le bruit et les vibrations d'environnement: Liverpool, Royaume-Uni, du 9 au 11 mai 1995. Renseignements: Institute of Acoustics, Agriculture House, 5 Holywell Hill, St. Albans, Herts, AL1 1EU, Royaume-Uni. Téléphone: 44 727 848195; télécopieur 44 727 850553.

129e rencontre de l'Acoustical Society of America: du 31 mai au 4 juin 1995, Washington, DC. Renseignements: Elaine Moran, Acoustical Society of America, 500 Synnyside Blvd., Woodbury, NY 11797, Etats-Unis. Téléphone: (516) 576-2360; télécopieur: (516) 349-7669.

2e conférence internationale sur la recherche en acoustique et en musique: Ferrara, Italie, 3e semaine de mai 1995. Renseignements: Conference Secretariat, CIARM95, National Research Council of Italy, Cemoter Acoustics Department, Via Canal Bianco, 28-44044 Ferrara, Italie. Téléphone: 39 532 731571; télécopieur: 39 532 732250; courrier électronique: CIARM95@CNRFE4.FE.CNR.IT.

MCHA 95 - Symposium international d'acoustique musicale et de salles de concert : Kirishima, Kagoshima-Prefecture, Japon, du 15 au 18 mai 1995. Renseignements: The Kirishima International Concert Hall, Kagoshima, Japon.

Conférence SAE sur le bruit et les vibrations:Travorse City, Michigan, du 15 au 18 mai 1995. Renseignements: Mone Asensio, SAE International, 3001 West Big Beaver Road, Troy, Michigan, Etats-Unis. Téléphone: (313) 649-0420.

Noise Control 95 - 10^{e} conférence internationale sur la maîtrise du bruit et des vibrations: Varsovie, Pologne, du 20 au 22 juin 1995. Renseignements: D. Koracecka, Central Institute for Labor Protection, ul. Czerniakowska 16, 00-701 Warszawa, Pologne. Téléphone: 482 623 4601; télécopieur 482 623 3695.

8e conférence internationale sur le bruit et les vibrations à basse fréquence: Trondheim, Norvège, du 21 au 23 juin 1995. Renseignements: B. Hughes, Multi-Science Publishing Company Ltd., 107 High Street, Brentwood, Essex CM14 4RX, Angleterre. Télécopieur: 44 277 223453.

15e congrès international d'acoustique: Trondheim, Norvège, du 26 au 30 juin 1995. Renseignements: ICA 95, SEVU, Congress Department, N-7034 Trondheim, Norvège. Téléphone: 47 7359 5251/5254; télécopieur: 47 7359 5150; courrier électronique: ica95@sevu.unit.no.

ACTIVE 95 - Conférence internationale sur la maîtrise active du bruit et des vibrations: Newport Beach, Californie, du 6 au 8 juillet 1995. Renseignements: Symposium Secretariat,

ACTIVE 95 - 1995 International Symposium on Active Control of Sound and Vibration: July 6-8, 1995, Newport Beach, California, USA. Symposium Secretariat: Noise Control Foundation, P.O. Box 2469 Arlington Branch, Poughkeepsi, NY 12603, USA. Telephone: +1 914 462 4006, Fax: +1 914 463 0201.

INTER-NOISE 95: July 10-12, 1995, Newport Beach, California, USA. Contact: Institute for Noise Control Engineering, P.O. Box 3206, Arlington Branch, Poughkeepsi, NY 12603, USA. Tel. (914)462-4006, Fax. (914)473-9325.

17th Boundary Element International Conference: July 17-19, 1995, Wisconsin, USA. Contact: Lis Johnstone, Conference Secretariat, BEM 17, Wessex Institute of Technology, Ashurst Lodge, Ashurst Southampton, SO4 7AA. Tel 44(0) 703 293223, Fax 44 (0) 703 292853, EMail CMI@uk.ac.rl.ib, Intl EMail CMI@ib.rl.acc.uk.

Second International Conference on Theoretical & Computational Acoustics, August 21-25, 1995, Hawaii, USA. Contact: Dr. Ding Lee (Code 3122), Naval Undersea Warfare Center, Detachment New London, New London CT 06320 USA. Tel 203-440-4438 Fax 203-4406228.

1995 World Congress on Ultrasonics: September 3 to 7, 1995, BERLIN. Contact: WCU'95 Secretariat, Prof. Dr. J.Herbertz, Gerhard-Mercator-Universitat, D-47048 Duisburg, Germany. Tel +49(203)379-3243, Fax +49(203)37 35 34.

22nd International Symposium on Acoustical Imaging: September 4-6, 1995, Firenze, Italy. Chairman: Professor Piero Tortoli, President of the International Advisory Board - Professor Leonardo Masotti, University of Florence.

BETECH 95: September 13-15 1995, Liege, BELGIUM Contact: Liz Johnstone, Conference Secretariat - BETECH 95, Ashurst Lodge, Ashurst, SO40 7AA UK. Tel +44 703 293223, Fax +44 703 292853, EMail CMI@uk.ac.rl.ib., Intl EMail CMI@ib.rl.ac.uk.

130th Meeting of the Acoustical Society of America: November 27-December 1, 1995, St. Louis, Missouri, USA. Contact: Elaine Moran, Acoustical Society of America, 500 Sunnyside Blvd., Woodbury, NY 11797, USA. Telephone: +1 (516) 576-2360, Fax: +1(516)349-7669.

Forum Acusticum 1996: April 1-4, 1996, Convention Secretariat, Technological Institute K VIV, Christine Mortelmans and Diane Voet, Desguinlei 214, B-2018 Antwerpen, Belgium. Telephone: +32-(0)3-216.09.96, Fax: +32-(0)3-216.06.89.

COURSES

The Canadian Centre for Occupational Health and Safety (CCOHS), Hamilton, Ontario, is offering a one-day course in "Controlling Noise in the Workplace". This course is designed for joint health and safety committee members, line managers, plant engineers, safety officers, occupational health nurses, and personnel responsible for workplace health and safety. The dates are as follows: March 13, 1995 and June 12, 1995. For more information, contact Lyne Paquin at (905) 572-4489 or Customer Service at 1-800-668-4284, 250 Main Street, East, Hamilton, Ontario, Canada, L8N 1H6.

Noise Control Foundation, P.O. Box 2469, Arlington Branch, Poughkeepsi, NY 12603, États-Unis. Téléphone: (914) 462-4006; télécopieur (914) 463-0201.

Inter-Noise 95: Newport Beach, Californie, du 10 au 12 juillet 1995. Renseignements: Institute of Noise Control Engineering, P.O. Box 3206, Arlington Branch, Poughkeepsie, NY 12603, USA. Téléphone: (914) 462-4006; télécopieur: (914) 473-9325.

17e conférence internationale sur les éléments de frontière: Winconsin, États-Unis, du 17 au 19 juillet 1995. Renseignements: Lis Johnstone, Conference Secretariat, BEM 17, Wessex Institute of Technology, Ashurst Lodge, Ashurst Southampton, SO40 7AA. Téléphone: 44 703 293223; télécopieur: 44 703 292853; courrier électronique: CMI@uk.ac.rl.ib; courrier électronique international: CMI@ib.rl.ac.uk.

2e conférence internationale sur l'acoustique théorique de calcul: Hawaï, du 21 au 25 août. Renseignements: Dr. Ding Lee (code 3122), Naval Undersea Warfare Center, Detachment New London, New London CT 06320, États-Unis. Téléphone: (203) 440-4438; télécopieur: (203) 440-6228.

Congrès mondial de 1995 sur les ultrasons: Berlin, Allemagne, du 3 au 7 septembre 1995. Renseignements: WCU 95 Secretariat, Prof. Dr. J. Herbertz, Gerhard-Mercator-Universitat, D-47048 Duisburg, Allemagne. Téléphone: 49 (203) 379 3243; télécopieur: 49 (203) 37 3534.

22e symposium international sur l'imagerie acoustique: Florence, Italie, du 4 au 6 septembre 1995. Renseignements: président du symposium, professeur Piero Tortoli, président de l'International Advisory Board, professeur Leonardo Masotti, université de Florence.

BETECH 95: Liège, Belgique, du 13 au 15 septembre 1995. Renseignements: Liz Johnstone, Conference Secretariat, BETECH 95, Ashurst Lodge, Ashurst, SO40 7AA, Royaume-Uni. Téléphone: 44 703 293223; télécopieur: 44 703 292853; courrier électronique: CMI@uk.ac.rl.ib; courrier électronique international: CMI@ib.rl.ac.uk.

130e rencontre de l'Acoustical Society of America: St. Louis, Missouri, du 27 novembre au 1er décembre 1995. Renseignements: Elaine Moran, Acoustical Society of America, 500 Sunnyside Blvd., Woodbury, NY 11797, États-Unis. Téléphone: (516) 576-2360; télécopieur: (516) 349-7669.

Forum Acusticum 1996: du 1er au 4 avril 1996. Renseignements: Convention Secretariat, Technological Institute K VIV, Christine Morteimans et Diane Voet, Desguinici 214, B-2018 Antwerpen, Belgique. Téléphone: 32 (0)3216 0996; télécopieur: 32 (0)3 216 0689.

COURS

Le Centre canadien d'hygiène et de sécurité au travail (CCHST), situé à Hamilton (Ontario), offre un cours d'une journée intitulé Controlling Noise in the Workplace. Ce cours s'adresse tout particulièrement aux membres de comités de santé et de sécurité, aux superviseurs, aux ingénieurs d'usine, aux infirmières en santé au travail et à tous les responsables de la santé et de la sécurité au travail. Il sera offert le 13 mars et le 12 juin 1995. Pour inscription et renseignements, appelez Lyne Paquin au (905) 572-4489, ou le service à la clientèle au 1-800-668-4284. Le centre est situé au 250, rue Main est, Hamilton (Ontario) L8N 1H6.

Comprehensive Industrial Hygiene Review Course: May 27-31 and August 14-18, 1995, St. Paul, Minnesota. Sponsored by: Midwest Center for Occupational Health and Safety. Call Jim Viskocil, CIH or Chris Western at the Midwest Center for Occupational Health and Safety, (612) 221-3992.

NEW PRODUCTS

The NOISE LEVELS database, an excellent source of measured noise levels from a broad spectrum of industrial settings, is now available on diskette from The Canadian Centre for Occupational Health and Safety.

Data for NOISE LEVELS is gathered from both published and unpublished sources. Each record provides explicit information on the noise source (for example, piece of machinery or equipment), the industry, operation associated with the noise production, and the occupational categories. Several fields provide additional information such as type of noise, exposure duration per day, the presence of engineering controls, and the use of ear protection. Measurement data consists of one or more of the following: Sound Pressure Level (SPL) in dB(A), Time Weighted Average (TWA), Equivalent Continuous Noise Level (ECNL), and the octave band analysis. Bibliographic citations of data source are also provided.

Industrial hygienists, noise control engineers, researchers, health and safety committee members, and government agency personnel will find NOISE LEVELS invaluable. For more information call CCOHS Customer Service 1-800- 668-4284 or 905-570-8094.

Comprehensive Industrial Hygiene Review Course - Ce cours sera offert par le Midwest Center for Occupational Health and Safety du 27 au 31 mai ainsi que du 14 au 18 août 1995 à St. Paul, Minnesota. Pour inscription et renseignements, contactez Jim Viskocil, au CIH; ou Chris Western, au Midwest Center, (612) 221- 3992.

NOUVEAUX PRODUITS

La base de données NOISE LEVELS, produite par le Centre canadien d'hygiène et de sécurité au travail (CCHST) et disponible sur disquette, est une excellente source de niveaux de bruits industriels mesurés.

Chaque fichier contient des renseignements détaillés sur la source du bruit (type de machine ou d'équipement, par exemple), l'industrie, l'activité et les catégories d'occupations. D'autres champs fournissent des renseignements sur le type de bruit, la durée d'exposition quotidienne, la présence de dispositifs limiteurs de bruit et le port de protecteurs auditifs. Les niveaux de bruit sont mesurés à partir des méthodes suivantes: niveau de pression acoustique (SPL) en dB(A), moyenne pondérée dans le temps (TWA), niveau de bruit continu équivalent (ECNL) et analyse par bande d'octave. Des renvois bibliographiques sont également fournis.

NOISE LEVELS sera d'une aide précieuse aux hygiénistes industriels, aux ingénieurs acousticiens, aux chercheurs, aux membres de comités de santé et de sécurité et au personnel des organismes gouvernementaux. Pour de plus amples renseignements, contactez le CCHST au 1-800-668-4284 ou (905) 570-8094.

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ACOUSTICS BEGINS WITH ACO

The Canadian Acoustical Association
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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 to the prize coordinator 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 given year. 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, eligibility conditions and application forms from the appropriate prize coordinator.

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, Mount Sinai Hospital, 600 University Avenue, Toronto, ON M5G 1X6. Past recipients are:

1990	*Li Cheng*	*Université de Sherbrooke*
1993	*Roland Woodcock*	*University of British Columbia*
1994	*John Osler*	*Defense Research Establishment Atlantic*

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: Don Jamieson, Department of Communicative Disorders, University of Western Ontario, London, ON N6G 1H1. Past recipients are:

1990	*Bradley Frankland*	*Dalhousie University*
1991	*Steven D. Turnbull*	*University of New Brunswick*
	Fangxin Chen	*University of Alberta*
	Leonard E. Cornelisse	*University of Western Ontario*
1993	*Aloknath De*	*McGill University*
1994	*Michael Lantz*	*Queen's University*

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 $500 cash prize to be awarded annually. Coordinator: David Chapman, DREA, PO Box 1012, Dartmouth, NS B2Y 3Z7.

1992	*Daniela Dilorio*	*University of Victoria*
1993	*Douglas J. Wilson*	*Memorial University*
1994	*Craig L. McNeil*	*University of Victoria*

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, Occupational Hygiene Programme, University of British Columbia, 2206 East Mall, Vancouver, BC V6T 1Z3.

1994	*Todd Busch*	*University of British Columbia*

Directors' Awards

Three awards are made annually to the authors of the best papers published in *Canadian Acoustics.* 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: Blaise Gosselin, Hydro Québec, 5^{e} étage, 1010, rue Ste-Catherine est, Montréal, QC H2L 2G3.

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 Acoustics Week in Canada. Application must be made at the time of submission of the abstract. Coordinator: Alberto Behar, 45 Meadowcliffe Drive, Scarborough, ON M1M 2X8.

The Canadian Acoustical Association
l'Association Canadienne d'Acoustique

ANNONCE DE PRIX

Plusieurs 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 un formulaire de demande ainsi que la documentation associée au coordonateur de prix avant le dernier jour de février de l'année durant laquelle le prix sera décerné. Toutes les demandes 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. Les candidats doivent être 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 formulaires de demande auprès du coordonateur de prix.

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. Coordonnatrice: Sharon Abel, Mount Sinai Hospital, 600 University Avenue, Toronto, ON M5G 1X6. Les récipiendaires antérieur(e)s sont:

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