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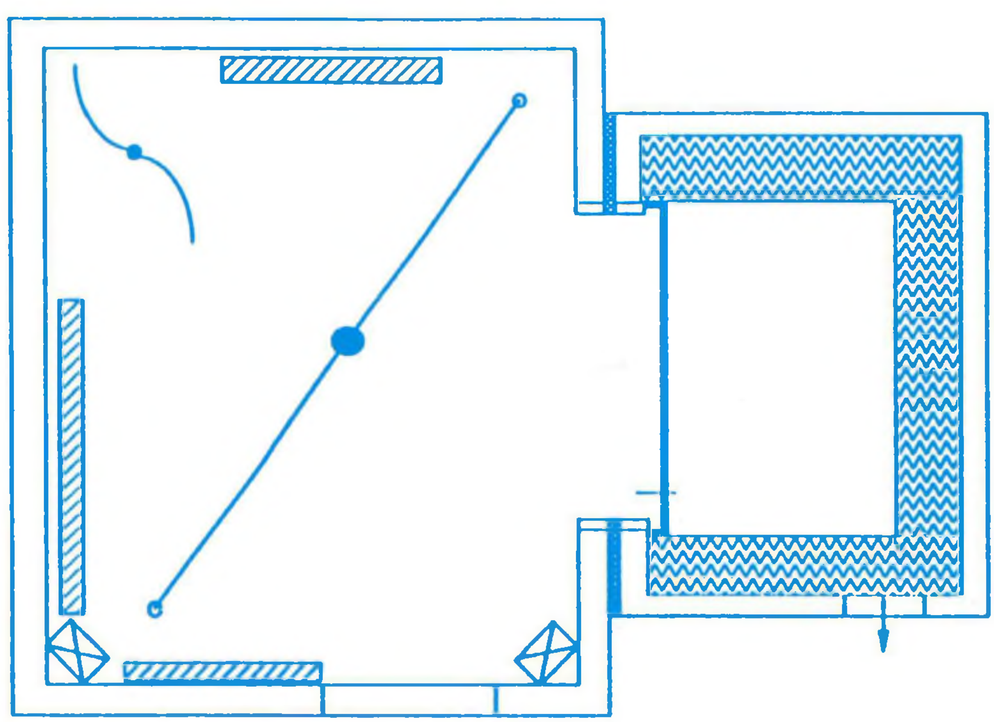

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l'Association Canadienne d'Acoustique

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EDITORIAL

Ce numéro coïncide avec l'arrivée d'une nouvelle équipe de rédaction. Murray Hodgson a pris la relève de Raymond Hétu au poste de rédacteur en chef. Chantal Laroche l'appuiera en tant que rédactrice. Jim Désormeaux remplace Alberto Behar au poste de rédacteur associé à l'information. John O'Keefe poursuit son travail en tant que rédacteur associé à la publicité.

Je suis convaincu que tous les membres de l'association se joignent à moi pour remercier Raymond et Alberto de leur contribution. Nous devons un remerciement spécial à Raymond pour son énorme contribution à l'amélioration du journal. Je suis maintenant bien placé pour juger de l'investissement important de temps et d'énergie. Bravo!

Le journal s'améliore et progresse toujours. La qualité de présentation et de l'impression est meilleure. Ceci attire de nouveaux revenus. Le nombre et la qualité des publications ont augmenté. Des soumissions d'articles nous proviennent même de l'étranger.

Néanmoins, les efforts fournis pour promouvoir la soumission d'articles portant sur les activités canadiennes dans le domaine de l'acoustique ont partiellement portés fruits; ceux fournis dans le but d'utiliser le journal comme tribune pour des discussions portant sur les préoccupations propres à l'acoustique ont cependant échoué.

Fondamentalement, les préoccupations et les problèmes soulevés dans les numéros précédents demeurent les mêmes. Quelles sont les attentes des lecteurs de l'Acoustique Canadienne et sont-ils prêts à contributer à l'atteinte de ces objectifs?

Nous solicitons davantage de publications en psychoacoustique et dans le domaine des vibrations. Je n'arrive toujours pas à comprendre pourquoi les lecteurs n'utilisent pas davantage le journal pour publier leurs résultats de recherche, présenter leurs activités et discuter de leurs préoccupations.

Assez de bavardage, c'est le temps de passer à l'action. Vous trouverez dans ce numéro un court questionnaire dont le but est de connaître votre opinion sur l'Acoustique Canadienne. Vos réponses nous aideront à améliorer le journal et à planifier son avenir. Prenez le temps d'y répondre. L'anonymat est assuré; c'est votre point de vue qui importe. Je présenterai les résultats dans le prochain numéro. J'utiliserai ces résultats dans le but de répondre à vos attentes. Il n'en tiendra qu'à vous d'en profiter.

This edition of Canadian Acoustics sees a change of editorial team. Murray Hodgson has taken over from Raymond Hétu as Editor-in-Chief. Chantal Laroche will assist him as Editor. Jim Désormeaux replaces Alberto Behar as news editor; John O'Keefe continues as advertising editor.

I'm sure I speak for all members of the Association in thanking Raymond and Alberto for their contributions. A special thanks is due Raymond for the great improvements he has brought to the journal. Only now am I appreciating the tremendous amount of time and energy involved. Bravo!

The journal continues to improve and mature. The quality of presentation and printing is better. It attracts increased revenue. The number and quality of papers has increased. It has attracted submissions from abroad.

On the other hand, attempts to promote articles describing Canadian acoustic activities have been only partly successful; those to establish the journal as a forum for active discussion of acoustic issues have failed.

Basically, the same issues and problems, discussed in various past editorials, remain. What do its readers want Canadian Acoustics to be, and are they willing to help make it thus?

We still need more submissions - especially in psychoacoustics and vibrations. It continues to puzzle me why readers don't take more advantage of the journal to publish research, advertise their activities, discuss their concerns.

Enough talk - time for action. Included in this issue is a short questionnaire aimed at finding out what you think about Canadian Acoustics. It will help us to improve the journal further, and to plan its future. Please take the time to complete it. It is anonymous; your views are important. I'll discuss the results next issue. I'll use them to provide what you want. Then it's up to you to use it.

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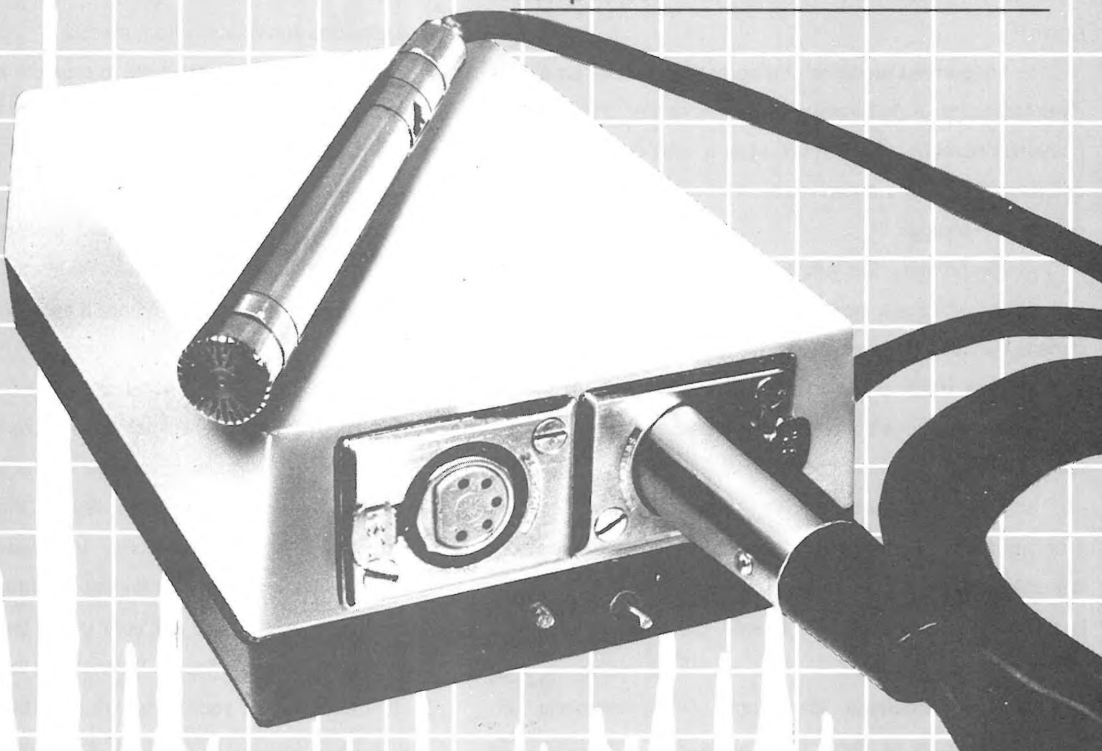

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ACOUSTICS BEGINS WITH ACO

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A REVIEW OF SOME PRELIMINARY RESULTS ON THE AUDITORY REPRESENTATION OF SPEECH

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ABSTRACT

Speech perception studies have traditionally focused on the identification of the acoustic cues that are needed to distinguish the sounds of speech. Recently, however, techniques have been developed that allow investigation of the auditory speech cues. Direct physiological measurements have been made of the output of the auditory system at the levels of the auditory nerve and cochlear nucleus during stimulation by speech signals (e.g. Sachs & Young, 1979). In the present paper, some studies that have used psychophysical techniques to estimate the output of the human auditory periphery during speech stimulation and comparison with perceptual measures of the same stimuli are reviewed.

RÉSUMÉ

Les études de la perception de la parole se sont jusqu'ici intéressées à l'identification d'indices acoustiques permettant de distinguer les sons de la parole. Cependant, des techniques, récemment mises au point, offrent la possibilité d'évaluer les indices auditifs de la parole. Ainsi, la réponse du système auditif au niveau du nerf auditif et du noyau cochléaire a été mesurée au moyen d'indices physiologique et ce, en présence de signaux de la parole (e.g. Sachs et Young, 1979). Le présent article expose une revue de quelques travaux traitant de mesures physiologiques permettant d'estimer la réponse du système auditif périphérique de sujets humains en présence de stimulations par la parole. La comparaison de ces données aux mesures perceptuelles en présence des mêmes stimuli est également passée en revue.

* The paper is based on an invited talk at the annual meeting of the Canadian Acoustical Association, October 6, 1988.

Traditionally, cues for speech sound recognition have been defined almost exclusively in terms of the acoustic properties of the speech signal itself. The search for the acoustic cues that distinguish the sounds of speech has focused on the systematic manipulation of speech signals in order to determine the effect on perception. This approach has resulted in the generation of a long list of acoustic cues that determine or influence what label a listener assigns to a speech sound. In different listening situations, the relative perceptual weight of each of these cues may change.

For example, some of the salient acoustic cues which have been identified as contributing to the distinction between "gold" and "bold" are the frequency of an initial aperiodic energy burst, the direction of change of the second spectral prominence in the periodic portion of the signal and the overall shape of the spectrum of the first 25 ms or so of the word (e.g. Blumstein & Stevens, 1980; Cooper, Delattre, Liberman, Borst & Gerstman, 1952; Kewley-Port, 1983; Liberman, Delattre, Cooper & Gerstman, 1954). Furthermore, the acoustic information that distinguishes these two speech sounds differs depending on which sounds occur before and after the sound, the talker characteristics of the person producing the sound, and the location of the sound in a word or an utterance (e.g. Delattre, Liberman & Cooper, 1955).

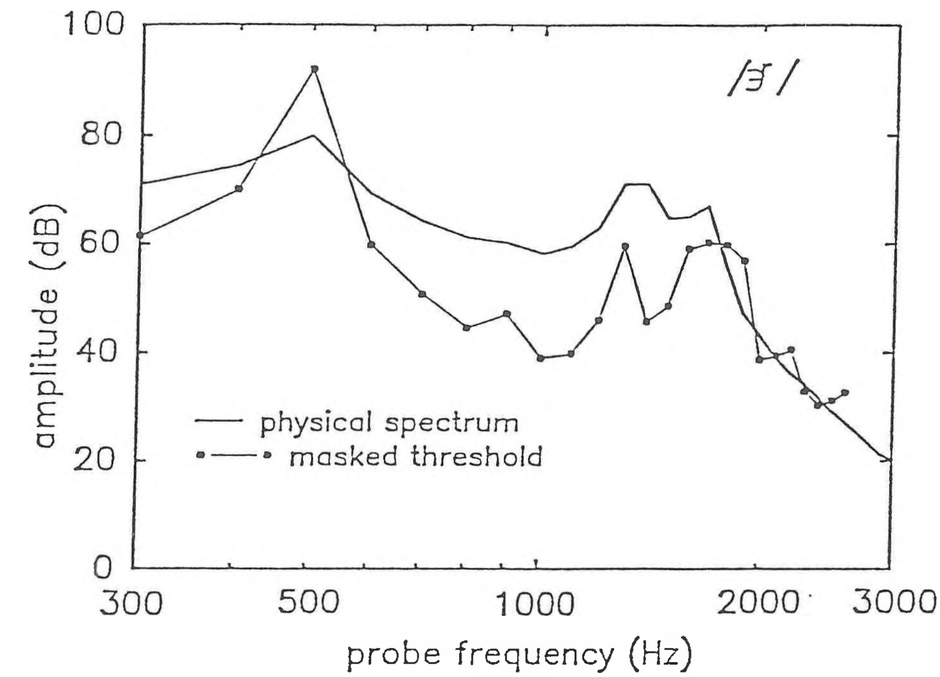
Although such acoustically-based investigations have yielded much information concerning the relevant acoustic parameters of speech, recent contributions from auditory physiology offer the possibility for studying the dependence of speech perception on the auditory representation of speech cues. Of particular interest is the question of what speech spectra would look like at the output of the auditory periphery rather than at the output of a digital-to-analog converter. For example, to what extent do the temporal and frequency resolving powers of the ear preserve the potential speech cues identified by acoustically-based analyses? When a change in the acoustic information in a speech signal does not change the listener's percept, is this because of the lack of a corresponding change in the auditory representation of the signal or because some higher level decision process has determined that both auditory patterns constitute the same speech sound?

The impetus provided by the recent, multi-disciplinary research efforts to understand speech processing has led to two converging approaches to quantifying this auditory form of speech information. The first approach is to formulate explicit models of human auditory processing of speech. These models have been developed by individuals with engineering and/or physiology backgrounds, such as Delgutte (1987), Searle, Jacobsen and Rayment (1979) and Seneff (1987). The models are based on known and predicted physiological responses of the peripheral mammalian auditory system to complex auditory stimuli and, in particular, to speech sounds. The outputs of the mathematical models are then compared to acoustic representations of the signal, such as amplitude spectra.

Empirical studies, such as those undertaken by Carney and Geissler (1986), Delgutte (1980; 1984), and Sachs and Young (1979), have demonstrated that the physical characteristics of the speech signal are well-represented in the auditory-nerve firing patterns, as measured by rate and period synchronization. The auditory nerve functions as a carrier of an internal representation of the temporal and spectral characteristics of the acoustic signal.

Such approaches have provided valuable insights for speech researchers. However, they do not directly measure human processing of speech, and they cannot be used to compare peripheral speech processing and speech perception in the same individual with the same speech token. An alternative research approach is to use psychophysical techniques to estimate the auditory patterns available to the listener when perceiving speech.

The amount of masking produced by a stimulus at different frequencies can provide a psychophysical estimate of the auditory representation of that sound. For example, using a steady-state vowel as a masker, a pattern of the masked thresholds for each of a series of probe tone frequencies can be obtained. In figure 1, the spectrum of an /ɜ́/ vowel, used as a masker by Van Tasell, Fabry and Thibodeau (1987), is shown by the solid line. Three spectral prominences are present in this steady-state, synthetic vowel, corresponding roughly to the first three formants of the vowel masker. Along with this physical spectrum, transformed forward-masked thresholds for probes ranging from 300 to 2600 Hz are plotted with connected filled circles. The ordinate represents the amount of masking produced by the vowel.



Adapted from Van Tasell, Fabry and Thibodeau (1987).

Figure 1. Solid line: spectrum of a steady-state synthetic /ɜ˞/ vowel that was used as the masker. Data points (filled circles) represent transformed, forward-masked thresholds.

This masking pattern is taken to be a frequency-domain representation of the auditory excitation pattern produced by the vowel. Not surprisingly, vowel masking patterns such as these have shown that the auditory representation of a vowel may differ from its acoustic spectrum in ways that are consistent with what is known about the processing capabilities of the peripheral auditory system (Bacon & Brandt, 1982; Moore & Glasberg, 1983; Van Tasell, Fabry & Thibodeau, 1987). In particular, the spectral peaks in the masking pattern are sharper than in the acoustic spectrum, due to the suppression of masker activity in frequency regions that are adjacent to the spectral peaks. These suppression effects are only visible in non-simultaneous masking conditions, in which the masker activity may suppress itself, but not the probe activity.

In the case of a dynamic speech signal, such as a consonant-vowel syllable, the time frame over which the output of the auditory periphery is observed can be manipulated by changing the duration of a probe tone and assuming that the masked threshold represents the pattern of activity integrated over the duration of the probe tone. Unlike traditional acoustical analyses, the effect of temporally adjacent acoustic information on the auditory representation will be included in the estimate of the auditory representation. The nonsimultaneous masking effects of adjacent speech segments will influence the detection of the probe tone and will therefore be reflected in the masking patterns. This is a further advantage of the auditory over acoustic modes of representing complex sounds.

Two studies in which this psychophysical masking paradigm was used to estimate the auditory representation of speech in human listeners differ from most similar studies because they also included perceptual measures obtained with the same speech signals. Cheesman, Van Tasell and Ortmann (1987) reported the results of a study in which the speech maskers were natural consonant-vowel syllables, /ba/, /da/ and /ga/, spoken by a female talker. The first 25.6 ms of these signals, representing the portion of the consonant that contributes the most to the identification of the consonant, was subjected to linear predictive coding (Markel & Gray, 1976). The results of these analyses for the three maskers are shown by the solid lines in Figure 2.

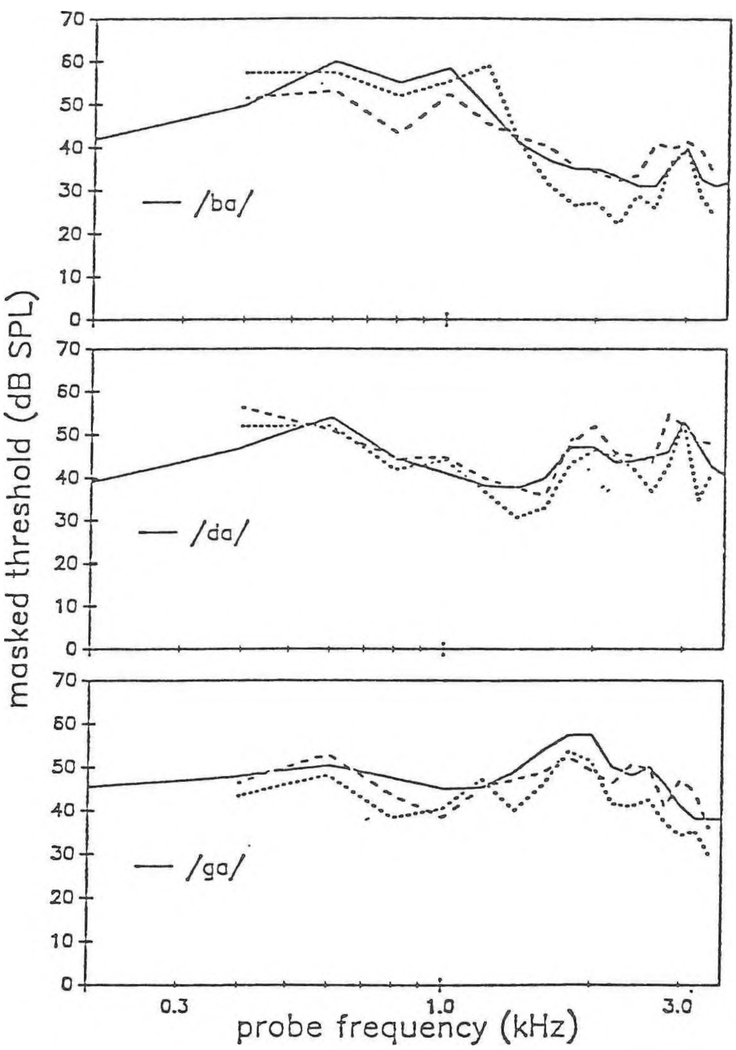


Figure 2. Solid lines represent the LPC spectra of the first 25.6 ms of the masker syllables /ba/, /da/, and /ga/, in the top, middle and bottom panels, respectively. Dashed lines (S1) and dotted lines (S2) connect the masked thresholds for 20-ms probes presented at the onset of the masker syllables.

Psychophysical masking patterns were obtained for probe tones that were presented during the first 20 ms of the masker syllables. Thresholds were estimated with a two-interval forced-choice adaptive-tracking procedure (Levitt, 1971) and were an average of thresholds obtained over two adaptive runs.

The masked thresholds for the probes for the two listeners are represented by the broken lines in Figure 2. Not only did these masking patterns match the overall shape of the onset spectra, but also most of the fine structure remained as well. For the /ba/ and /da/ maskers -- in the top and middle panels -- masked thresholds were highest at or near the frequencies corresponding to the first three spectral peaks. Van Tasell, Fabry and Thibodeau (1987), using steady-state synthetic vowels as maskers in a forward masking paradigm, have also reported that the frequency of masking pattern peaks may be shifted with respect to the peaks in the acoustic spectrum of the masker. This result is shown in the data of Cheesman, Van Tasell and Ortmann (1987) for listener S2, for whom the second peak in /ba/ was shifted up in frequency in the masking pattern relative to its position in the physical spectrum. With the /da/ masker, the third spectral peak was shifted down for the listener Sl.

For the masker /ga/, in which the second and third spectral peaks of the masker were relatively close in frequency, the peaks in the masking pattern were less systematically related to the masker spectrum. The two listener's patterns differed from each other and from that of the onset spectrum in both the number and location of the maxima.

Cheesman (1989) also obtained masking patterns using dynamic speech maskers. However, in this study masking patterns were obtained at several points in time during the speech masker. The masking stimuli were synthetic syllables that were perceived by the subject as being the consonants "s" or "sh" paired with the vowels "i" and "u". The consonants "s" and "sh" are typically characterized by several hundred milliseconds of bandpass noise that is generally higher in frequency for "s" sounds than for "sh" sounds.

The stimuli chosen for this study are particularly interesting because the same aperiodic energy is perceived as a different consonant, either "s" or "sh", depending on which of the two vowels follow it. Figures 3 and 4 contain spectrographic displays (CSRE, Jamieson, Nearey, & Ramji, 1989) of the two masking syllables. The noise spectra were identical for the two syllables; because the syllables were formed with the same frozen noise, only the vowels differed. Figure 3 depicts the noise followed by an /i/ vowel of the syllable that was identified as the word "she" by the listener; Figure 4 depicts the same noise followed by an /u/ vowel for the syllable that was identified as the word "sue" by the listener.

For each masker, auditory masking patterns were obtained at four points in the syllable: at the intersection of the consonant with the vowel (designated time 0), 25 ms into the vowel (+25 ms), and 25 and 50 ms before the onset of the vowel (-25 and -50 ms, respectively). At each of these points, simultaneous masked thresholds were determined for 10-ms probes at frequencies from 1000-5000 Hz, in 250-Hz steps. Thresholds in this study were made by method of adjustment; that is, the listener adjusted the level of the probe until it was just audible (cf. Spiegel, 1987).

Figures 5 and 6 illustrate the masking patterns produced by two maskers at the four different positions in the syllables. These are data from a single subject. The masked thresholds have been connected by the solid lines. Each data point represents the mean of five threshold adjustments; the standard deviation of the estimates is less than 2 dB. Quiet thresholds for these 10-ms probes,

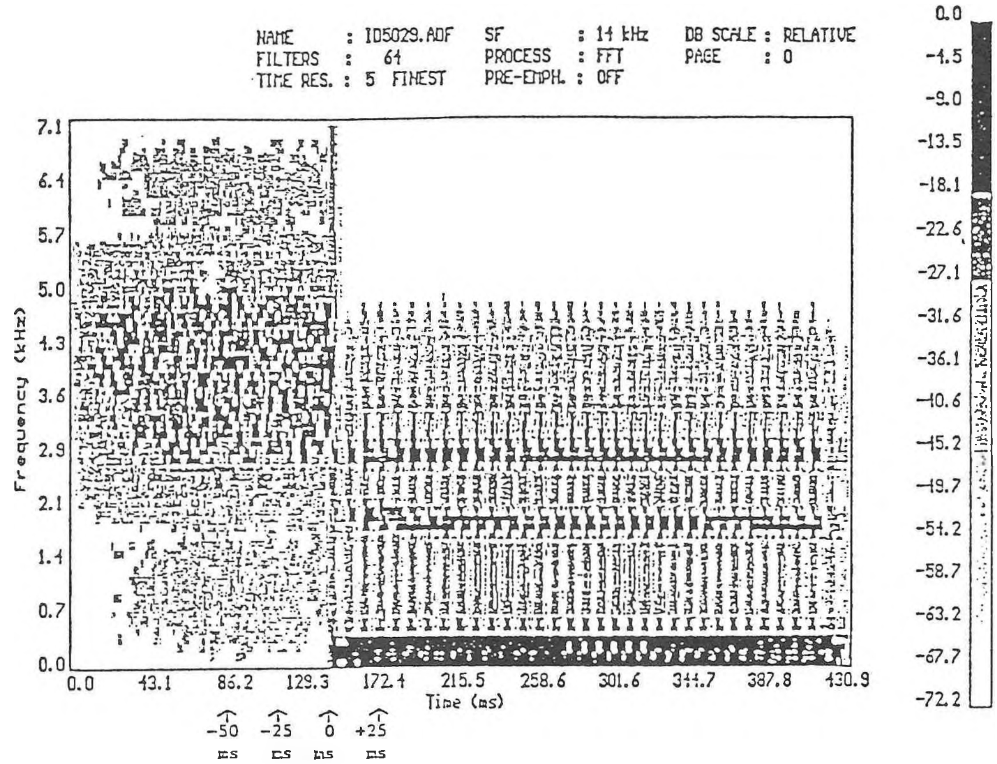


Figure 3. Spectrogram of the synthetic masker syllable "she". Arrows below the spectrogram indicate the four probe positions used to obtain masking patterns.

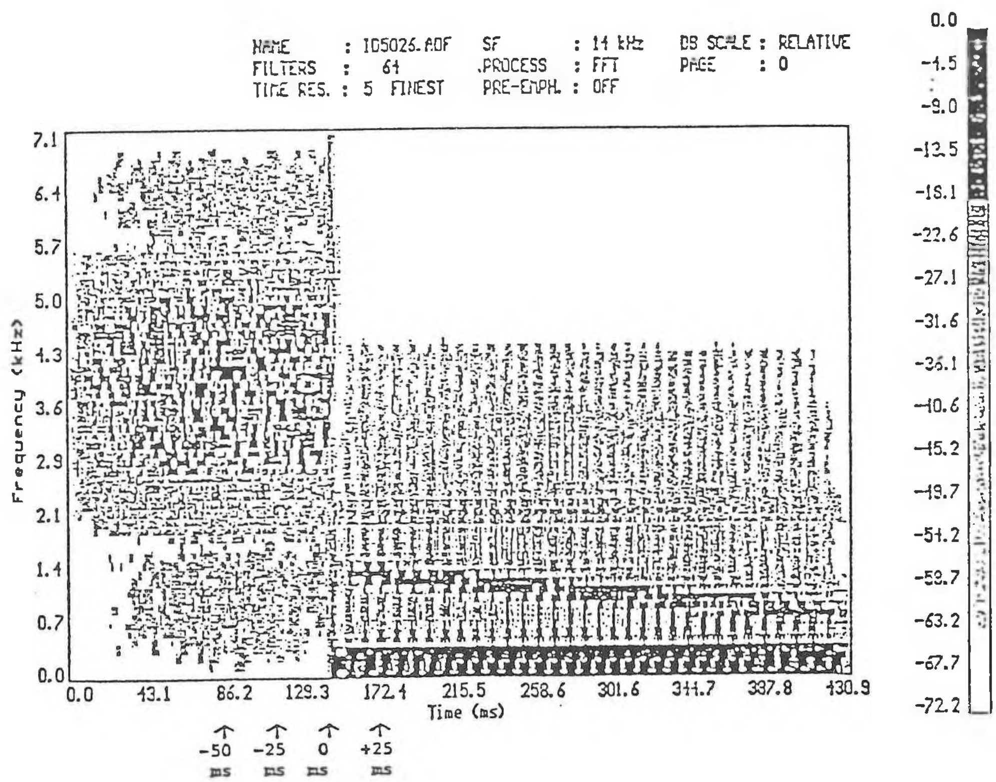


Figure 4. Spectrogram of the synthetic masker syllable "sue".

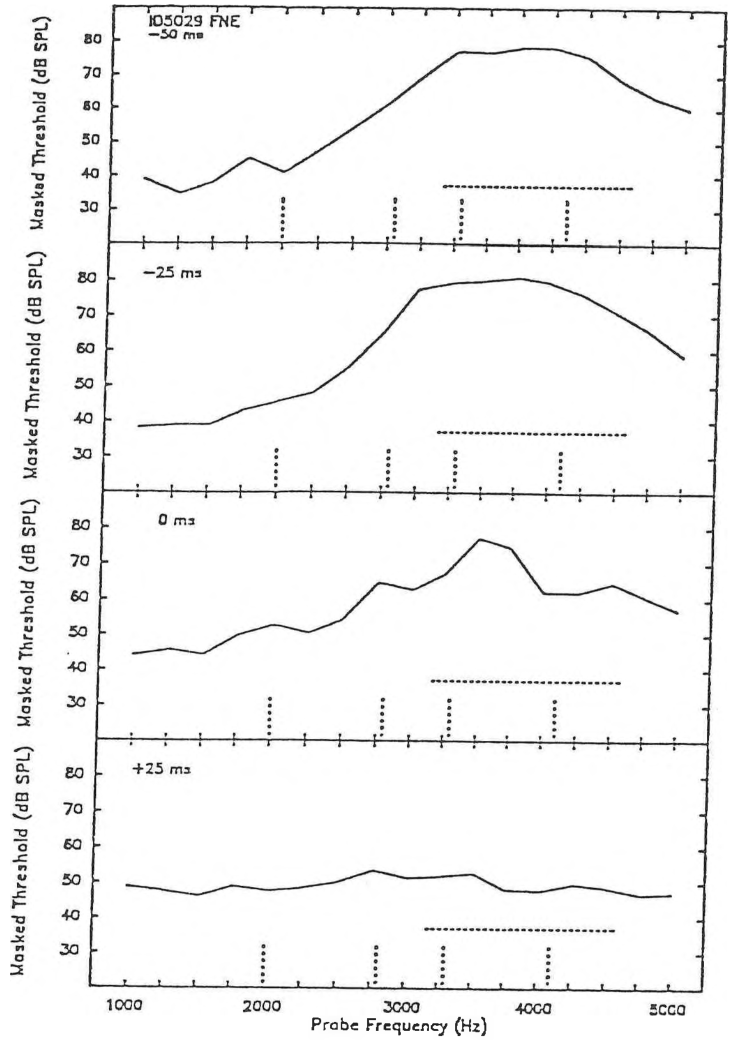


Figure 5. Masked thresholds as a function of probe frequency for 10-ms probes at each of four positions in the "she" masker. The dotted horizontal bar represents the pass-band of the consonant noise. The dotted vertical lines indicate the frequencies of the spectral prominences in the vowel between 1 and 5 kHz.

using the same method of adjustment, were typically around 28 db SPL for frequencies below about 3 kHz and rose to around 35 dB SPL at the highest frequencies used in this study.

In addition to the masked thresholds, some parameters of the masking stimuli have been plotted on these curves. The dotted horizontal line indicates the passband of the consonant noise. The four vertical lines at the bottom of each panel indicate the frequencies of the spectral prominences in the vowel portion of the maskers. Recall that during the -25 and -50 ms probe times, only consonant noise is present in the masker. At time 0, the consonant ceases and the vowel commences and the energy present is quite low. At +25 ms, only vowel energy is present in the masker.

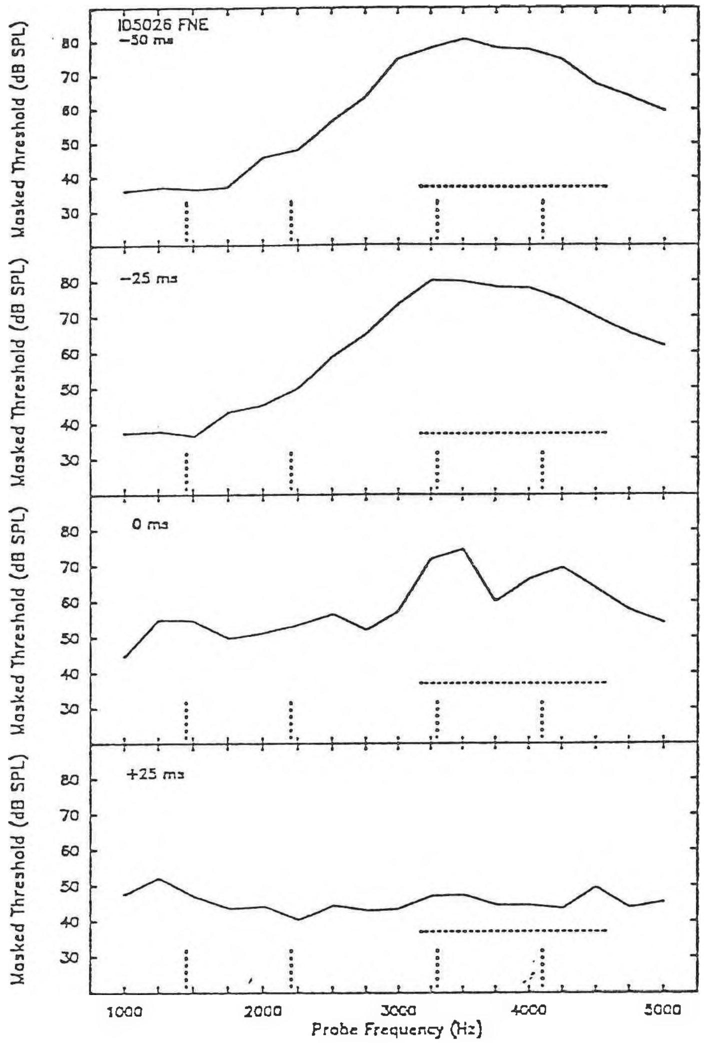


Figure 6. Masked thresholds as a function of probe frequency for 10-ms probes at each of the four positions in the "sue" masker. Dotted lines represent masker parameters, as in Figure 5.

Three points are noteworthy in these data. First, during the consonantal portion of the masker, most of the masking occurred at the frequency of the consonant. Second, there was some indication during the consonant and at the intersection of the consonant with the vowel (time 0) that the vowel itself was doing some backward masking, i.e. raising the threshold in frequency regions where there were peaks in the vowel spectrum.

Third, there was a relatively flat masking pattern during the initial part of both of the vowels (+25 ms), in which some small peaks were observable that probably correspond to peaks in the vowel. More importantly, these flat patterns provided an example of a limitation of the simultaneous masking technique in the estimation of the auditory representation of dynamic signals. Although there were more intense spectral peaks in the masker at +25 ms than at 0 ms, this was not reflected in the masking patterns. Masker activity may have effectively suppressed both the masker and the probe and reduced the size of the observed peaks at +25 ms. At 0 ms and earlier, much of masking at the formant frequencies may be backward masking. Such auditory interactions of temporally-adjacent speech energy may be responsible for the perceptual effects described above, in which the perceptual identity of the consonant (either "s" or "sh") was determined jointly by the noise spectrum and by the spectrum of the following vowel.

These research efforts have focused on the relationship between the perceptual identity of a few, dynamic speech sounds, and the auditory representation of those same sounds, as estimated from psychophysical masking patterns. The present efforts are unique in this focus on the relation between these aspects. In future work, this program of research will explore the limitations and interpretations of the estimation procedure and further define the association between the auditory representation of speech and its perception. It is hoped that this work, together with attempts to model auditory peripheral function based on research in auditory physiology, will converge to provide an improved understanding of auditory functioning with speech and other complex acoustic signals.

REFERENCES

Bacon, S. P. & Brandt, J. F. (1982). Auditory processing of vowels by normal-hearing and hearing-impaired listeners. **Journal of Speech and Hearing Research, 25**, 339-347.

Blumstein, S. & Stevens, K. (1980). Perceptual invariance and onset spectra for stop consonants in different vowel environments. **Journal of the Acoustical Society of America, 67**, 648-662.

Carney, L.H. & Geissler, C. G. (1986). A temporal analysis of auditory-nerve fiber responses to spoken stop consonant-vowel syllables. **Journal of the Acoustical Society of America, 79**, 1896-1914.

Cheesman, M. F. (1989). The auditory representation of context-conditioned fricatives. Unpublished doctoral dissertation, University of Minnesota.

Cheesman, M. F., Van Tasell, D. J. & Ortmann, T. M. (1987). Masking patterns for syllable-initial stop consonants. ASHA Annual Meeting, New Orleans.

Cooper, F. S., Delattre, P. C., Liberman, A. M., Borst, J. M. & Gerstman, J. L. (1952). Some experiments on the perception of synthetic speech sounds. **Journal of the Acoustical Society of America, 24**, 597-606.

Delattre, P. C., Liberman, A. M. & Cooper, F. S. (1955). Acoustic loci and transitional cues for consonants. **Journal of the Acoustical Society of America, 27**, 769-773.

Delgutte, B. (1980). Representation of speechlike sounds in the discharge patterns of auditory-nerve fibers. **Journal of the Acoustical Society of America, 68**, 843-857.

Delgutte, B. (1984). Speech coding in the auditory nerve: II. Processing schemes for vowel-like sounds. **Journal of the Acoustical Society of America, 75**, 879-886.

Delgutte, B. (1987). Peripheral auditory processing of speech information: implications from a physiological study of intensity discrimination. In M. E. H. Schouten (Ed.), **The Psychophysics of Speech Perception**. Dordrecht: Martinus Nijhoff.

Jamieson, D. G., Nearey, T. M. & Ramji, K. (1989). CSRE: A Speech Research Environment. **Canadian Acoustics 17** 23-35.

Kewley-Port, D. (1983). Time-varying features as correlates of place of articulation in stop consonants. **Journal of the Acoustical Society of America, 73**, 322-335.

Levitt, H. (1971). Transformed up-down methods in psychoacoustics. **Journal of the Acoustical Society of America, 49**, 467-477.

Liberman, A. M., Delattre, P. C., Cooper, F. S. & Gerstman, J. L. (1954). The role of consonant-vowel transitions in the perception of the stop and nasal consonants. **Psychology Monographs, 68**, 1-13.

Markel, J. D. & Gray, A. (1976). **Linear Prediction of Speech**. New York: Springer-Verlag.

Moore, B. C. J. & Glasberg, B. R. (1983). Masking patterns for synthetic vowels in simultaneous and forward masking. **Journal of the Acoustical Society of America, 73**, 906-917.

Sachs, M. B. & Young, E. D. (1979). Encoding of steady-state vowels in the auditory nerve: representation in terms of discharge rate. **Journal of the Acoustical Society of America, 66**, 470-479.

Searle, C. L., Jacobsen, J. & Rayment, S. G. (1979). Stop consonant discrimination based on human audition. **Journal of the Acoustical Society of America, 65**, 799-809. Seneff, S. (1987). A model for the transduction stage of auditory speech processing. **Journal of the Acoustical Society of America, 82** (Sl), 583(A).

Spiegel, M. F. (1987). Speech masking I. Simultaneous and nonsimultaneous-masking within stop /d/ and flap /r/ closures. **Journal of the Acoustical Society of America, 82**, 1492-1502.

Van Tasell, D. J., Fabry, D. A. & Thibodeau, L. M. (1987). Vowel masking patterns and vowel recognition by hearing-impaired subjects. **Journal of the Acoustical Society of America, 81**, 1586-1597.

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Montreal, Quebec, H4P 1K6
Tel: (514) 340-8392 Fax: (514) 340-8318

APPEL À COMMUNICATIONS

SEMAINE DE L'ACOUSTIQUE CANADIENNE, 1-5 OCT. 1990

Holiday Inn Crowne Plaza, Montréal, Québec

◆ 1, 2, 3 Oct. **Séminaires** (en anglais, notes de cours en anglais ou français)

- *Acoustique et contrôle du bruit: théorie et pratique* (3 jours: 1, 2, 3 Oct.)
Une présentation moderne avec démonstrations de la théorie acoustique et ses applications aux mesures sonores et aux techniques de contrôle du bruit. Quelques logiciels de base "PC" seront fournis. Donné par le Groupe d'Acoustique de l'Université de Sherbrooke (GAUS).

- *Lutte contre le bruit dans les bâtiments* (1 jour: 3 Oct.)
Une présentation exhaustive des principes et des méthodes de contrôle du bruit dans les bâtiments existants ou en projet. Donné par l'Institut de Recherche en Construction, Conseil National de Recherches Canada (CNR).

- *Démystification de la propagation sonore à l'extérieur* (1 jour: 3 Oct.)
La propagation sonore à l'extérieur sera expliquée et les possibilités offertes par les solutions analytiques utilisant les derniers développements théoriques seront décrites. Donné par le GAUS et Dr. Gilles Daigle du CNR.

- *Techniques numériques en acoustique* (1 jours: 3 Oct.)
Une présentation avec démonstrations de plusieurs techniques numériques comprenant éléments finis, éléments de frontière (collocation ou variationnels) pour des problèmes acoustiques extérieurs/intérieurs et couplés/découplés. Donné par Dynamic Engineering, U.S.A.

◆ 4, 5 Oct. **Programme technique**

- Des communications sont sollicitées dans tous les domaines de l'acoustique, y compris l'acoustique architecturale, la réponse biologique aux vibrations, l'ingénierie acoustique, l'acoustique musicale, le bruit, l'acoustique physique, l'acoustique psychologique et physiologique, les communications orales, l'acoustique structurale et les vibrations, l'acoustique sous-marine, le traitement et l'enregistrement numériques des sons.
- Soumettre résumés (et optionnellement textes complets) avant: 1er juin 1990
- Les résumés acceptés seront publiés dans l'Acoustique Canadienne et les textes complets acceptés seront publiés dans les actes du congrès.

◆ **Envoyer 4 copies du résumé** (et optionnellement 4 copies de la publication) avant le **1er Juin (date impérative)** au président du programme technique:

Dr. Frédéric Laville
G.A.U.S., Génie mécanique
Université de Sherbrooke — Tél.: (819) 821-7154
Sherbrooke, Québec, J1K 2R1 — Fax: (819) 821-7903

◆ Pour **plus d'information** contacter le président du congrès:

M. Harold Forester
PARAMAX Electronics Inc.
6111 Royalmount — Tél.: (514)340-8392
Montréal, Québec, H4P 1K6 — Fax: (514) 340-8318

Preparation of abstracts and papers

Abstracts. Abstracts must be prepared in accordance with the enclosed Instructions for the Preparation of Abstracts.

Since the June 1 deadline for receipt of abstracts at the above address will be strictly enforced, it is the contributor's responsibility to ensure that they will be forwarded to the Technical Chairman on time. Authors desiring notification of receipt of their abstracts should include a stamped self-addressed postcard which will be returned when the abstract is received. Authors invited to participate in special sessions should send all materials to their particular special session organizer for receipt one week prior to the June 1 deadline.

Papers for Proceedings. For those wishing to submit a paper to be reviewed for publication in the Proceedings, send with the abstract, four copies of the paper. Feedback from reviewers and notification of acceptance will be sent to the author before July 10. The deadline for the final version of the paper to be received is August 15. Further details are provided on the final page of this Call for Papers.

Formats: Symposium, Lecture or Poster

Individuals or groups of individuals are encouraged to organize a Symposium or group of from four to eight papers structured around a particular theme (e.g., sound recording; industrial noise measurement). The collection of abstracts and papers for the symposium will be submitted by the symposium organizer for review as a complete package.

More typically, papers will be submitted independently, and will be subsequently grouped into appropriate categories for presentation.

Poster sessions will provide an alternative means of presenting work informally. Authors will be asked to stand by their posters during a certain time period in order that those interested may speak to him or her about the material. Details for production of the Poster will follow upon acceptance of the abstract.

Student Awards

There will be up to three awards of $500 made for the best contributions by students as judged by the Canadian Acoustical Association Meeting Awards Committee. The award is based on both oral presentation and submitted paper. Student papers must be presented as a lecture. The paper may be jointly authored, but the student must be the first author of the paper. Students must be enrolled in graduate programs on May 1, 1990.

Exhibit

Exhibitors will also be on hand displaying the latest in instrumentation, materials and technology.

Préparation des résumés et des textes complets des communications

Résumés. Les résumés doivent être préparés selon les instructions pour la préparation des résumés.

Parce que la date limite du 1er Juin pour la réception des résumés à l'adresse donnée précédemment sera impérative, c'est la responsabilité de l'auteur de s'assurer que le Président du programme technique reçoive les résumés à cette date ou avant cette date . Les auteurs qui désirent recevoir un accusé de réception pour leur résumé doivent inclure une carte postale timbrée à leur adresse qui leur sera retournée quand leur résumé sera reçu. Les auteurs qui sont invités à participer dans des sessions spéciales doivent envoyer tous les documents à l'organisateur de la session spéciale pour qu'il les reçoive une semaine avant la date limite du 1er Juin.

Textes complets des communications. Ceux qui souhaitent soumettre un texte complet de communication qui sera arbitré pour paraître dans les actes du congrès doivent envoyer avec le résumé quatre copies du texte complet. Les commentaires des arbitres et l'acceptation seront envoyés pour que les auteurs les reçoivent avant le 10 Juillet. La date limite pour la version finale du texte est le 15 Août. Plus de détails sont donnés dans la dernière page de cet appel à communications.

Formats: symposium, conférence ou session "poster"

Des individus ou des groupes d'individus sont encouragés à organiser un symposium: un groupe de quatre à huit communications structurées autour d'un thème particulier (par exemple, l'enregistrement sonore, les mesures de bruit industriel). Les résumés et publications d'un même symposium seront soumises ensemble pour arbitrage par l'organisateur du symposium.

Plus typiquement, les publications seront soumises indépendamment les unes des autres et seront regroupées par la suite dans des catégories appropriées.

Des sessions "poster" permettront de présenter d'une autre façon le travail. On demandera aux auteurs de rester à côté de leur poster pendant un certain temps de façon à ce que ceux qui sont intéressés puissent parler à l'auteur au sujet de ce qu'il présente. Des détails pour la production des posters seront donnés après acceptation des résumés.

Prix étudiant

Il y aura jusqu'à trois prix de 500$ donnés aux meilleures présentations étudiantes jugées par le Comité de la Société Canadienne d'Acoustique sur les prix. Le prix est basé à la fois sur la présentation orale et sur la communication écrite. Les communications étudiantes doivent être présentées comme une conférence. Il peut y avoir plusieurs auteurs, mais l'étudiant doit être le premier auteur de la communication. Les étudiants doivent être inscrits dans des programmes gradués le 1er Mai 1990.

Exposants

Les exposants seront à la disposition des participants au congrès et montreront les dernières nouveautés en instrumentation, en matériel et en technologie.

Instructions for the Preparation of Abstracts for Papers to be Presented at the 1990 Meeting of the Canadian Acoustical Association

1. Quadruplicate copies of an abstract are required for each meeting paper; one copy should be an original. Send the four copies to the Technical Program Chairman, Frédéric Laville, Département de génie mécanique, Université de Sherbrooke, Sherbrooke, Québec, J1K 2R1, in time to be received by **June 1, 1990**. Either English or French may be used. A cover letter is not necessary.

2. Limit the abstract to 200 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 instead.

3. Use the sample format shown on the second page of these instructions. Title of abstract and names and addresses of authors should be set apart from the abstract as shown. 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. Give references as shown in the example on the reverse side.

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. If invited, state, "invited".
   (b) Name the area of acoustics most appropriate to the subject matter: Architectural Acoustics, Bioresponse to Vibration, Engineering Acoustics, Musical Acoustics, Noise, Physical Acoustics, Psychological and Physiological Acoustics, Speech Communication, Structural Acoustics and Vibration, Underwater Acoustics, Digital Sound Processing and Recording or other.
   (c) Telephone number, including area code, of the author to be contacted for information. Non-Canadian authors should include country.
   (d) If more than one author, name the one to receive the acceptance notice.
   (e) Overhead projectors and 35-mm slide projectors will be available at all sessions. Describe on the abstract itself any special equipment needed.
   (f) Indicate your preference to present a lecture or poster.

[Adapted from Acoustical Society of America Guidelines]

Instructions pour la préparation des résumés des communications qui seront présentées au Congrès 1990 de la Société Canadienne d'Acoustique

1. Quatre copies du résumé sont demandées pour chaque communication, une copie doit être l'original. Envoyez les quatre copies au président du programme technique, Frédéric Laville, Département de génie mécanique, Université.de Sherbrooke, Sherbrooke, Québec, J1K 2R1, à temps pour être reçues avant le **1er Juin 1990**. L'anglais ou le français peuvent être utilisés. Une lettre d'accompagnement n'est pas nécessaire.

2. Limitez le résumé à 200 mots, y compris le titre et le nom du premier auteur et l'adresse; les noms et les adresses des co-auteurs ne sont pas comptés. Les formules qui sont séparées du texte sont comptées comme 40 mots. N'utilisez pas les formes personnelles "je" ou "nous"; utilisez la forme passive au lieu.

3. Utilisez l'exemple présenté en deuxième page de ces instructions. Le titre du résumé et les noms et adresses des auteurs doivent être séparés du texte comme montré. Le texte du résumé doit être un seul paragraphe et la première ligne doit commencer en retrait. Le résumé entier doit être tapé avec *double interligne d'un seul côté d'une page* de format 8 1/2 par 11 pouces ou A4.

4. Assurez-vous que l'adresse de l'auteur qui doit recevoir la notification d'acceptation est complète sur le résumé pour s'assurer que tout arrive à temps.

5. N'utilisez aucune note en bas de page. Utilisez des parenthèses carrées pour citer les références ou les remerciements. Donnez les références comme il est montré dans l'exemple sur l'autre page.

6. Ne soulignez rien sauf ce que l'on souhaite être mis en italique.

7. Si la lettre ℓ est utilisée comme symbole dans une formule, écrivez la lettre ℓ à la main et écrivez "lc ell" dans la marge du résumé. N'intercallez pas la lettre capitale O avec les nombres là où elle peut être confondu avec zéro, mais si c'est inévitable, écrire "capital oh" dans la marge. Identifiez les symboles phonétiques par des remarques marginales appropriées.

8. Au bas du résumé donnez l'information suivante:
   - (a) Si la communication fait partie d'une session spéciale, indiquez la session. Si invité, écrire, "invité".
   - (b) Donnez le domaine de l'acoustique le plus approprié pour la matière traitée: l'acoustique architecturale, la réponse biologique aux vibrations, l'ingénierie acoustique, l'acoustique musicale, le bruit, l'acoustique physique, l'acoustique psychologique et physiologique, les communications orales, l'acoustique structurale et les vibrations, l'acoustique sous-marine.
   - (c) Numéro de téléphone y compris le code régional de l'auteur qui doit être contacté pour information. Les auteurs non-canadiens doivent inclure le pays.
   - (d) S'il y a plus d'un auteur, nommez celui qui doit recevoir le communiqué d'acceptation.
   - (e) Les rétro-projecteurs et les projecteurs de diapositives 35 mm seront disponibles à toutes les sessions. Décrivez sur le résumé lui-même tout équipement spécial qui serait nécessaire.
   - (f) Indiquez votre préférence pour présenter sous forme de conférence ou de poster.

[Adapté d'après les directives de la Société Américaine d'Acoustique]

SAMPLE FORMAT FOR ABSTRACT

A survey of new facilities for measurement. John S. Doe and Jane S. Smith (X Ltd., 90 X Ave., XCity, Ont. LXL 9X9).

The measurement of x and the changes in the shape of y during z has been a persistent problem for x scientists. In recent years a number of new techniques have become available for measuring x and y and this paper will briefly survey some of these. Included will be a description of (a) the M Institute of N super microbeam project. ....etc...........(b)...
(c) ....text ....
....more text ....
....text (not more than 200 words) ....
(d) ....etc ....
....
This concurs with an earlier report [J.S. Someone and J.S. Someoneelse, Canadian Journal of X and Y, 14, 31-35, (1985)]. It is suggested that because of a, b is the most practical approach to x in most situations. [Work supported by ZZZ Foundation].

Technical Area: Speech Communication

Method of Presentation: Prefer lecture but willing to give as poster

Telephone number: 418/555-7897 Ext. 481 (J.S. Doe)

Send acceptance or rejection notice to J.S. Doe

Special facility: VSH video tape player, cassette audio tape player, amplifier and speakers.

EXEMPLE DE RÉSUMÉ

Une enquête sur de nouvelles autorisations de mesure. John S. Doe et Jane S. Smith (X Ltd., 90 X Ave., XCity, Ont. LXL 9X9).

La mesure de x et les changements dans la forme de y pendant z ont été un problème persistant pour x scientifiques. Dans les années récentes, un certain nombre de nouvelles techniques sont devenues disponibles pour la mesure de x et y et cette communication va brièvement survoler quelques-unes de celles-ci. Inclus sera une description de (a) l'Institut M du projet du super rayon microscopique N ....etc...........(b)..
(c) ....texte ....
....d'avantage de texte ....
....texte (pas plus que 200 mots) ....
(d) ....etc ....
....
Ceci est en accord avec un rapport qui est paru plus tôt [J.S. Quelqu'un et J.S. Quelqu'un d'autre, Journal Canadien de X et Y, 14, 31-35, (1985)]. Il est suggéré que à cause de a, b est l'approche la plus pratique pour x dans la plupart des situations. [Travail supporté par la Fondation ZZZ].

Domaine technique: Communication orale

Méthode de présentation: Préfère une conférence mais acceptera de présenter sous forme de poster

Numéro de téléphone: 418/555-7897 Ext. 481 (J.S. Doe)

Envoyer la notification d'acceptation ou de rejet à J.S. Doe

Équipement spécial: Magnétoscope VSH, lecteur de cassettes audio, amplificateur et haut-parleur.

Instructions for the Preparation of a Full Paper for Publication in the Proceedings of the Meeting

1. NUMBER OF PAGES. The manuscript **must** be less than 6 pages long.

2. TYPEWRITER. The use of an electric typewriter or letter quality printer with carbon film ribbon and elite or pica type is strongly recommended. **Script type is not acceptable. Text recognizable as printed by a dot matrix printer will not be accepted.**

3. MARGIN LINES. The manuscript must be typed within a one inch margin on all sides.

4. ERRORS. Errors in typing must **not** be erased but must be opaqued with correcting ribbon or a white correcting fluid. Do not make corrections or changes in pencil. If necessary, corrections typed on a piece of paper may be pasted over the original text.

5. PROOFREADING. Proofread your manuscript carefully. The manuscript will be reproduced without further proofreading or opportunity for retyping.

6. INDENTING. Indent each paragraph 5 characters.

7. SPACING. The manuscript must be typed single-spaced. Use double-spacing only to set off equations, headings, and subheadings. Do not use double-spacing between paragraphs unless the new paragraph has a subheading.

8. FIRST PAGE:
   8.1 TITLE. Put the title 2 inches below the top of the first page. All capitals, flush left.

   8.2 AUTHOR(S) NAME(S). Put the authors full name 3 inches below the top of the first page. Capitalize only the first letter of each name, flush left.

   8.3 AUTHOR(S) ADDRESS(ES). Put the author(s) address(es) below their name(s) using a double space to separate it from the name(s). Capitalize only first letters, flush left.

   8.4 INTRODUCTION. The first paragraphs normally constitute the introduction, which may or may not be labeled as such. Put the heading 4.5 inches below the top of the first page.

9. SECTION HEADINGS. Section headings should be typed centered on the page and in capital letters only. Double-space above and below section headings. Do not underline section headings.

10. SUBHEADINGS. Subheadings should be typed underlined, flush with the left hand margin, and only the first letter of each word should be capitalized. The subheading should be integrated into the paragraph. A double-space precedes a paragraph that starts with a subheading.

Instructions pour la Préparation d'un Texte Complet de Communication à paraître dans les Actes du Congrès

1. NOMBRE DE PAGES. Le manuscript **doit** avoir moins de 6 pages.

2. MACHINE À ÉCRIRE. L'utilisation d'une machine à écrire électrique ou d'une imprimante de qualité lettre avec un ruban carbone et avec les caractères de type élite ou pica est fortement recommandée. **L'écriture script n'est pas acceptable. Le texte qui sera reconnu comme ayant été imprimé par une imprimante à points ne sera pas accepté.**

3. LES MARGES. Le manuscript doit comporter une marge de un pouce de tous les côtés.

4. LES ERREURS. Les erreurs de frappe ne doivent **pas** être effacées mais doivent être opacifiées avec un ruban correcteur ou avec un fluide correcteur blanc. Ne pas faire de changements au crayon. Si nécessaire, les corrections tapées sur un morceau de papier peuvent être collées sur le texte original.

5. RELECTURE. Relisez votre manuscript soigneusement. Le manuscript sera reproduit sans plus de relecture ou sans d'autres opportunités pour qu'il soit retapé.

6. RETRAIT. Faites un retrait de 5 caractères pour la première ligne d'un paragraphe.

7. INTERLIGNES. Le manuscript doit être tapé en simple interligne. Utiliser le double interligne seulement pour mettre en évidence les équations, les titres et les sous-titres. Ne pas utiliser le double interligne entre les paragraphes à moins que le nouveau paragraphe comporte un sous-titre.

8. PREMIÈRE PAGE:
   - 8.1 TITRE. Mettez le titre 2 pouces en dessous du haut de la page. Tout en capitales, et commençant à la marge de gauche.
   - 8.2 NOM DES AUTEURS. Mettez le nom complet (prénom + nom) des auteurs 3 pouces en dessous du haut de la première page. Utiliser des capitales seulement pour la première lettre du nom et du prénom. Commencer à la marge de gauche.
   - 8.3 ADRESSE DES AUTEURS. Mettez les adresses des auteurs en dessous de leur nom en utilisant un double interligne pour les séparer des noms. Mettre en capitales seulement les premières lettres. Commencer à la marge de gauche.
   - 8.4 INTRODUCTION. Le premier paragraphe normalement constitue l'introduction qui peut comporter ce titre ou un autre. Mettre le titre 4,5 pouces en dessous du haut de la première page.

9. TITRES DE SECTION. Les titres de section doivent être centrés sur la page et tout en capitales. Un double interligne au-dessus et en dessous des titres. Ne pas souligner les titres.

10. SOUS-TITRES. Les sous-titres doivent être tapés soulignés en commençant à la marge de gauche et seulement la première lettre de chaque mot doit être en capitales. Le sous-titre doit être intégré dans le paragraphe. Un double interligne précède un paragraphe qui commence avec un sous-titre.

11. ÉQUATIONS. Si des symboles d'équations ou des lettres grecques ne sont pas disponibles sur votre marchine à écrire, écrivez les symboles lisiblement et nettement à l'encre de chine. N'utilisez pas d'encre bleue parce qu'elle ne sera pas reproduite.

12. EMPLACEMENT DES ILLUSTRATIONS. Les illustrations probablement réduites en taille et attachées au manuscript avec de la dissolution caoutchouc doivent préférablement être situées dans le texte mais si nécessaire peuvent être situées à la fin du texte. **Les illustrations et les titres des illustrations doivent être lisibles sans qu'il soit nécessaire de tourner le manuscript de 90°.**

13. NUMÉROTATION DES PAGES / NOM DU PREMIER AUTEUR. En commençant avec la page 2, taper ces indications 1/2 pouce sous le haut de la page, le numéro de page au bord de la marge de gauche et le nom du premier auteur touchant la marge de droite (Capitale pour la première lettre seulement).

14. RÉSUMÉ (OU CONCLUSIONS). À la fin du texte de la communication, la dernière section est normalement la conclusion ou le résumé.

15. RÉFÉRENCES. Toutes les références doivent apparaître à la fin de l'article en utilisant le format recommandé dans JASA.

16. ENVOI. Relisez soigneusement votre manuscript pour qu'il soit prêt à être reproduit. Faire des copies pour vos fichiers. Envoyer le manuscript original et trois copies du texte complet avec quatre copies du résumé. Utilisez un carton raidisseur.

[Adapté des recommandations INTER-NOISE/NOISE CON]

11. EQUATIONS. If equation symbols or Greek letters are not available on your typewriter, write the symbols legibly and neatly in India Ink. **Do not use blue ink, as it will not reproduce.**

12. LOCATION OF ILLUSTRATIONS. The illustrations suitably reduced in size and attached to the manuscript with rubber cement should preferably be located within the text material but, if necessary, may be located at the end of all text material. **The illustrations and captions should be legible without turning the manuscript 90°.**

13. PAGE NUMBERS / FIRST AUTHOR'S NAME. Starting with page 2, type these 1/2 inch below the top of the page, the page number flush left and the first-author name flush right (capitalize first letter only).

14. SUMMARY (OR CONCLUSIONS). Following the body of the paper, the last section is normally the Conclusions or Summary.

15. REFERENCES. All references should appear at the end of the article using the format recommended in JASA.

16. MAILING. Carefully proofread your manuscript in final camera-ready form. Make copies for your files. Mail the original manuscript and three copies together with the four copies of your abstract. Use a cardboard stiffener.

[Adapted from INTER-NOISE/NOISE-CON Guidelines]

CONFERENCES / CONGRES

Acoustics 90, Conferences at ISVR, March 27-30, 1990. Contact: ISVR Conference Secretary, Institute of Sound and Vibration Research, The University, Southampton SC9 5NH.

First French Conference on Acoustics, April 10-13, 1990. Contact: Congres Francais d'Acoustique, I.C.P.I. Lyon, 25 rue du Plat, 69288 Lyon Cedex 02, Lyon, France.

Meeting of the Acoustical Society of America, Pennsylvania State College, May 21-25, 1990. Contact: Sabih I. Hayek, Department of Engineering Science and Mechanics and the Applied Research Laboratory, The Pennsylvania State University, University Park PA 16802.

Symposium on Physical Acoustics, K.U. Leuven, Campus Kortrijk, Belgium, June 19-22, 1990. Contact: O. Leroy, K.U.L. Campus Kortrijk, E. Sabbelaan, B-8550 KORTIJK, Belgiu, Telephone: (056) 21 79 31, Telefax (056) 22 89 20.

International Tire/Road Conference 1990, Sheaton Hotel Gothenburg, Sweden, August 8-10, 1990. Contact: International Tire/Road Conference Gilbert & Sebastian, St. Badhusgata 18, S-411 21 Gothenburg.

Inter-Noise 90, Gothenburg, Sweden, August 13-15, 1990. Contact: Tor Kihlman, Department of Applied Acoustics, Chalmers University of Technology, S-412 96 Gothenburg, Sweden. Telephone: (046) 31 72 22 11.

Structural Intensity and Vibrational Power Flow, Senlis-France, August 27-29, 1990. Contact: Centre Technique des Industries Mecaniqes, Departement Acoustique Industrielle, B.P. 67, F 60304 SENLIS (France). Telephone: (33) 44 58 34 15.

Noise Conference 90, The 1990 National Conference on Noise Control Engineering, Austin, Texas, October 15-17. Contact: Professor Elmer Hixson, Department of Electrical and Computer Engineering, University of Texas at Austin, Austin, Texas 78712.

29th Conference on Acoustics: Building Acoustics, Room Acoustics, Urban Acoustics, Strbske Pleso - High Tatras Czechoslovakia, October 2-5, 1990. Contact: House of Technology, Ing. 1. Goralikova, Skultetyho ul.1 832 27 Bratislava, Czecholovakia.

Meeting of the Acoustical Society of America, San Diego, California, November 26-30, 1990. Contact: Frederick H. Fisher, Marine Physical Lab, P-001, Scripps Institute of Oceanography, University of California, San Diego, La Jolla, CA 92093-0701.

COURSES / COURS

Acoustics and Noise Control, Seven Springs, Mountain Resort, Seven Springs, Pennsylvania, March 19-23, 1990. Contact: AVCN Continuing Education Division, 250 Shagbark Drive, R.D. no. 1, Cheswick, Pennsylvania, 15024, Telephone: (412) 265-4444.

Intensive Workshop in Industrial Hygiene, University of Toronto, April 23-27, 1990. Contact: Mrs. Julie Mendonca, Department of Chemical Engineering & Applied Chemistry, University of Toronto, 200 College Street, Toronto, Ontario, M5S 1A4.

Mechanical Vibrations, Seven Springs Mountain Resort, Seven Springs, Pennsylvania, May 21-25, 1990. Contact: AVCN Continuing Education Division, 250 Shagbark Drive, R.D. No. 1, Cheswick, Pennsylvania, 15024, Telephone: (412) 265-4444.

Acoustics and Signal Processing, Pennsylvania State University, May 30-June 28, 1990. Contact: Barbara Crocken, Graduate Program in Acoustics, P.O. Box 30, State College, Pennsylvania, 16804.

Audiology or Speech-Language, Graduate Level, University of Western Ontario, Fall 1990. Contact: Donald G. Jamieson, Faculty of Applied Health Sciences, Department of Communicative Disorder, Elborn College, London, Ontario,
Telephone: (519) 679-2111, (519) 661-2001.

NEW PRODUCTS / NOUVEAUX PRODUITS

Noise Cancellation Technologies, Inc.

NCT announces joint venture partnership with Walker Manufacturing Company to develop and market the world's first electronic muffler for automotive industries including light trucks. The electronic muffler uses computer technology to reduce noise, which improves engine performance, power and fuel economy.

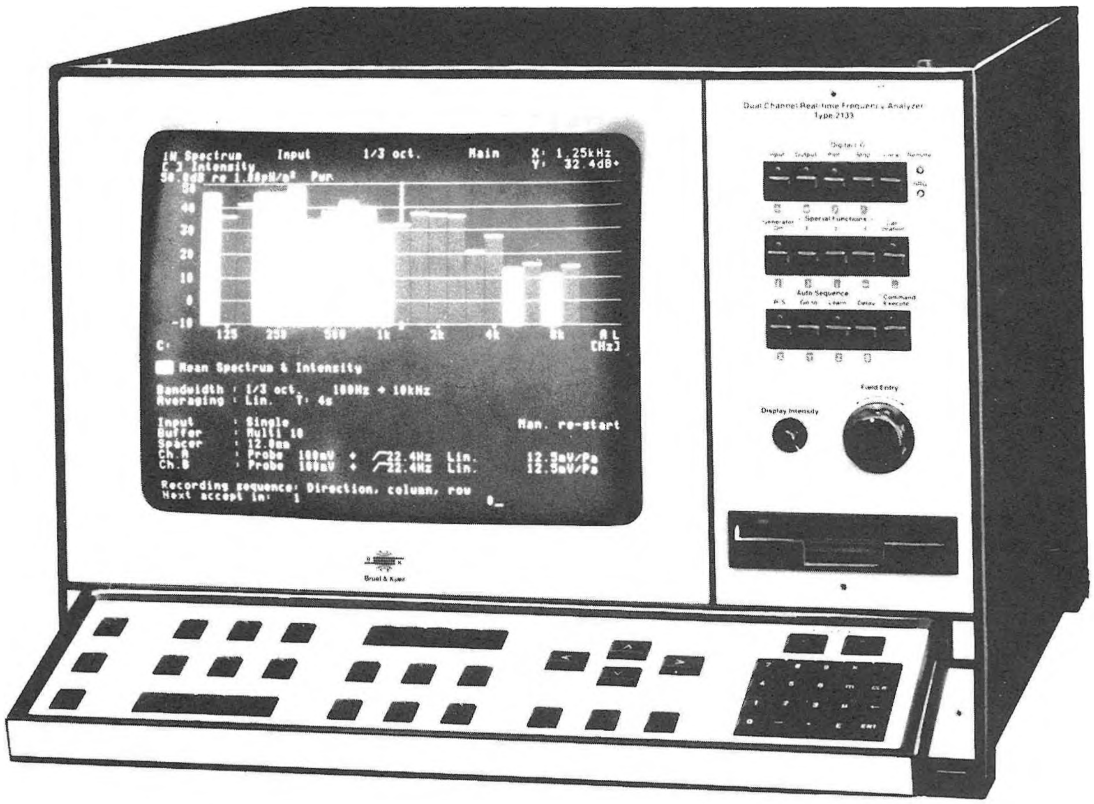
For further information contact, Michael J. Parrella, NCT, President, 575 Eight Avenue, 14th Floor, New York, NY, 10018, Telephone: (212) 560-1275.

PEOPLE IN THE NEWS / LES GENS QUI FONT LA MANCHETTE

Donald C. Knudsen, President of Knudsen Engineering Limited, has been named a 1989 recipient of a $25,000 Manning Award of Merit for his Digital Acoustic Imaging System (DAISY) which bridges the gap between underwater video cameras which are effective only in clear water at short range, and conventional sonars.

THE COMPLETE ACO

Our state-of-the-art instruments do far more than measure the intensity of sound in any given situation. With this system, Brüel & Kjaer



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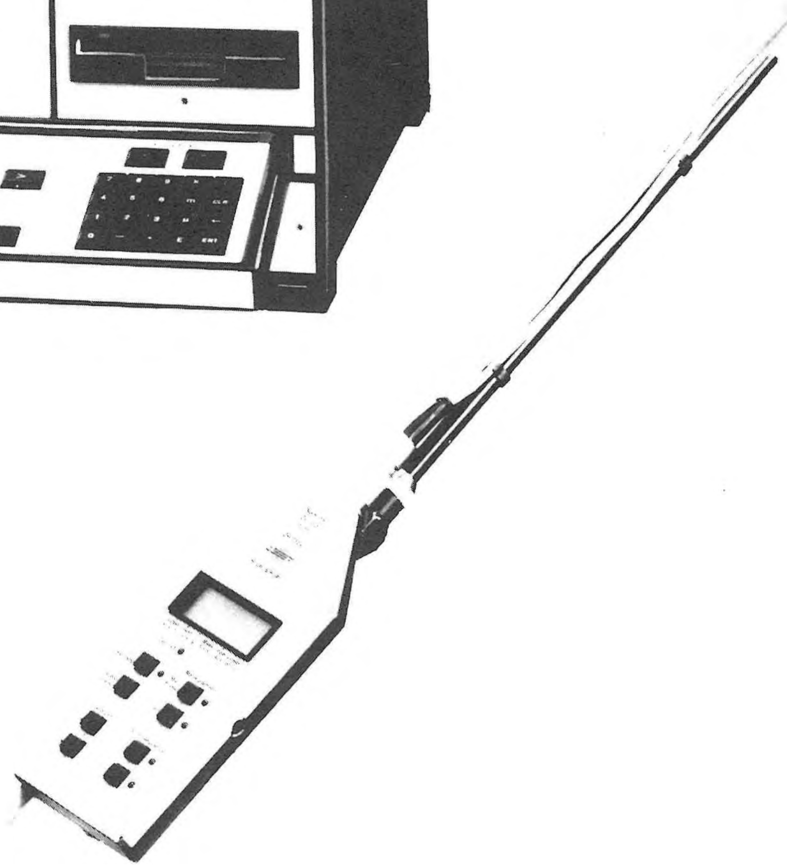

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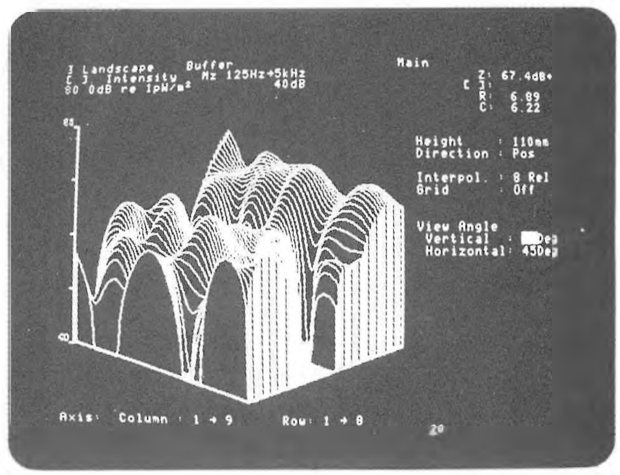
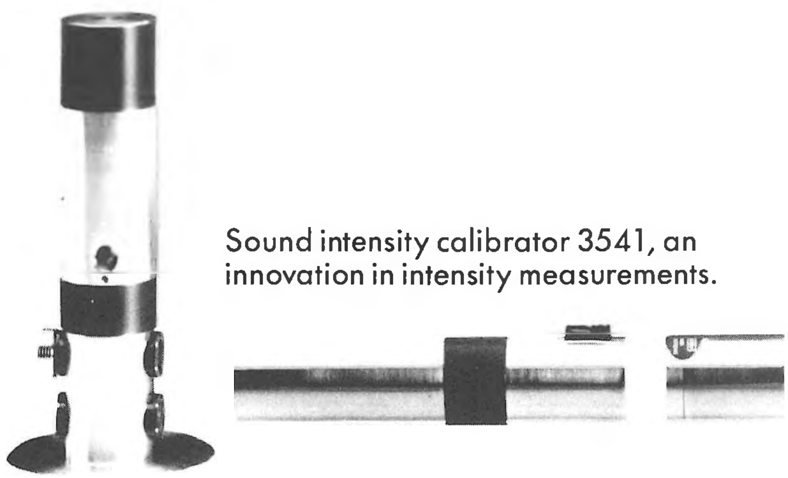


An MS-DOS compatible data storage is used in the built-in disc drive. An optional intensity mapping software package, the BZ 7021, is also available.



Sound intensity calibrator 3541, an innovation in intensity measurements.

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Canadian Acoustics / Acoustique Canadienne 18(1) 31-45 (1990)

Running a Test in an Intensity Based Measuring Facility.

by

R.W.Guy

Centre for Building Studies, Concordia University, Montreal.

Abstract

Intensity measurement has opened new prospects in many areas of diagnostic acoustics, but it is generally accompanied by the need for greater data gathering, strict discipline in measurement procedure, and involved data processing prior to result assessment. One consequence is the introduction of additional areas of potential error.

This paper presents the semi-automated procedures developed at the Centre for Building Studies to minimize user error in the running of a typical laboratory test. A Sound Transmission Loss measurement is used as an example.

An overview is also given of the new Intensity based measurement facility established at the Centre for Building Studies.

Résumé

Les mesures d'intensité ont ouvert de nouvelles avenues dans plusieurs domaines du diagnostique acoustique. Cependant, elles requièrent généralement une acquisition de données plus étendue, une très grande rigueur lors de la mesure et un traîtement de données élaboré afin de produire quelque résultat que ce soit. Chacune de ces exigences entraîne de nouvelles possibilités d'erreur.

Cet article décrit les procédés semi-automatisés développés au Centre des études sur le bâtiment dans le but de minimiser les erreurs dues à l'utilisateur lors d'un test typique en laboratoire. Une mesure de perte dans la transmission du son sert d'exemple.

Suit un aperçu des nouvelles installations du Centre des études sur le bâtiment dédiées aux mesures d'intensité.

1. Introduction

The Centre for Building Studies was established in 1977 and at that time a two chamber test facility was constructed to support research activity in sound transmission.

The facility dimensions, Figure 1, were dictated by physical constraints and the choice was made to construct one medium sized chamber, Chamber A, and a relatively small chamber, Chamber B.

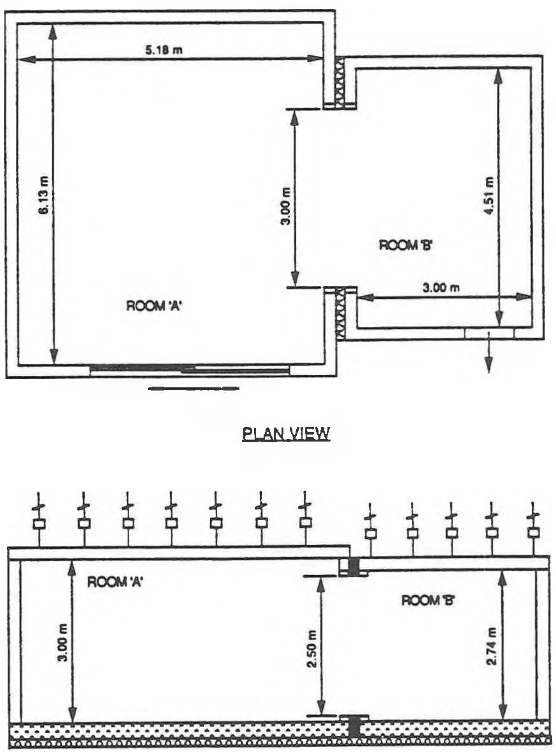

Figure 1. The Test Chambers at the Centre for Building Studies.

Chamber A has been qualified as a Reverberation Chamber in accordance with ANSI.S1.21 , Reference 2, as such it is suitable for small source sound power measurements; it would also comply as a source room for sound transmission loss measurements. However, because of the chamber B dimensions, the transmission suite formed by chambers A and B does not conform to standards for the purpose of sound transmission loss measurement. (See for example ASTM-E 90, Reference 1).

Over the past few years developments in instrumentation have been made which offer a solution to this chamber problem, namely developments in sound intensity measurement.

The laboratory measurement of sound transmission loss via sound intensity measurement typically requires just one reverberation chamber. The reverberation chamber is used to establish the source side intensity by sound pressure measurements, whilst the reception side intensity is measured directly.

Thus the decision was taken to refurbish the facility to better support an intensity measurement system and related measurement techniques.

The intensity measurement system employed at the Centre is the Bruel & Kjaer type 3360 in conjunction with a Multiplexer, B&K type 2811 . The 3360 system is suited for a point to point measurement procedure. This allows subsequent generation of surface contour plots when used with a one dimensional probe, and the determination of intensity vectors when used with a three dimensional probe. Both attributes enable surface intensity assessment, fault location in construction or engineering elements, as well as establishing source locations and directivity patterns.

However, it has been established, References 3 and 4, that strict criteria must be satisfied to ensure the correct use and end result of intensity systems employed for the measurement of sound power. Such criteria have yet to be formalised for the case of sound transmission loss measurements, but one may presume them to be similar and equally demanding.

As an example, reference 3 cites the need to measure both pressure and intensity at every point. The criterion resulting from this data assessment will indicate whether the intensity measurement is acceptable in relation to the reactivity of the sound field.

One consequence of such criteria is the need for a large data handling and processing capability. For example consider the typical data requirements of an intensity equivalent to an ASTM E 90 test (Reference 1), using the point to point system for reception surface intensity measurement, and a reverberant chamber as the source room:

16 Third Octaves (125 Hz to 4 kHz)
100 measurement points on the reception surface.
Sound Pressure Level measurement at each point.
Sound Intensity Level measurement at each point.

So far the need for 3200 data has been established and to this must be added source room data gathering.

If one now includes the prospect of three axis intensity measurement together with multiple surface assessment, it becomes clear that automatic data gathering and processing is essential.

In order to satisfy data gathering requirements the probe must be held in position for a time satisfying the bandwidth and averaging time product BT=400, see for example Reference 3, (16 seconds for each measurement type for a spectrum ranging up from 125 Hz. on the B&K 3360). In consequence, automation of the probe placement is also desirable.

Last but not least, the accuracy of an intensity measurement is dependent upon a number of factors, some inherent to the system and some to the environment within which the measurement is undertaken.

The optimum measurement environment is quiet and free field. This requirement is approximated within the laboratory by taking measurements in an anechoic chamber. In addition, if such a reception side is created, then greater sensitivity and choice of measurement position with respect to intensity vector determination is also realised.

Measurement system accuracy is assessed by calibration. In the case of intensity measurement, somewhat greater user participation and discipline is required for the calibration procedure as compared, for example, with sound pressure calibration.

Thus, given the complexities of calibration, measurement procedure, and result assessment, additional areas of concern arise, namely the correct sequencing of events and user responses.

This paper will introduce programmes which prompt the user and operate equipment during a test procedure. They are written with respect to the measurement system at the Centre for Building Studies, however the general objectives may be transcribed to other systems; namely to ensure correct test sequencing, instrument calibration, instrumentation settings, and maximum dynamic range for a spectrum read result.

2. <u>The Test Facility</u>

The new facility configuration is shown in Figure 2, and by comparison with Figure 1 it can be seen that most changes have been made to chamber B.

The surfaces of chamber B are lined with acoustic wedges. The wedges are in-house constructed and have a cut-off frequency of 125 Hz. They are approximately 0.5m deep from base to wedge tip and line the chambers back wall, side walls, and ceiling. Additional wedges on portable frames in modules of .5 x .6 m face area line the floor.

Room B also houses the probe traverse mechanism. This consists of a vertical framework on either side of the test aperture which acts as a guide to a horizontal member. The horizontal member can traverse up and down over the aperture height driven by a stepper motor. A probe holding carriage also stepper motor driven, may be manouvered to any position across the aperture width. The net result is a probe placement system capable of scanning over the 3 x 2.5 m test aperture to any location with an accuracy of 0.5mm.

The probe may be oriented towards the aperture, as in the case of a sound transmission loss test, or towards room B for sound power measurement. All subsequent probe placements, data gathering, and processing can now be under software control.

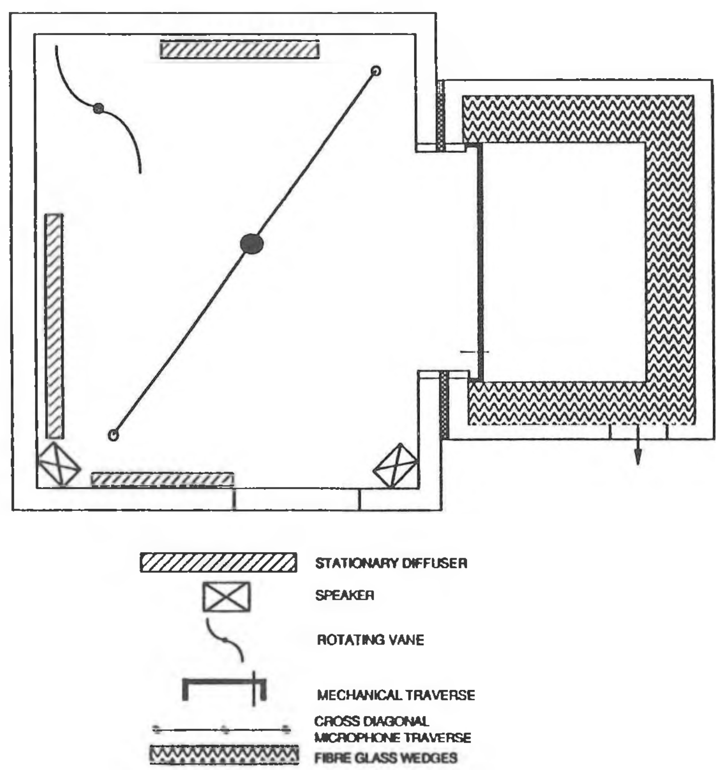

Figure 2. The Room Arrangement to Support Intensity Tests.

The automated system developed at the Centre for Building Studies to support both data gathering and probe placement is shown diagrammatically in Figure 3.

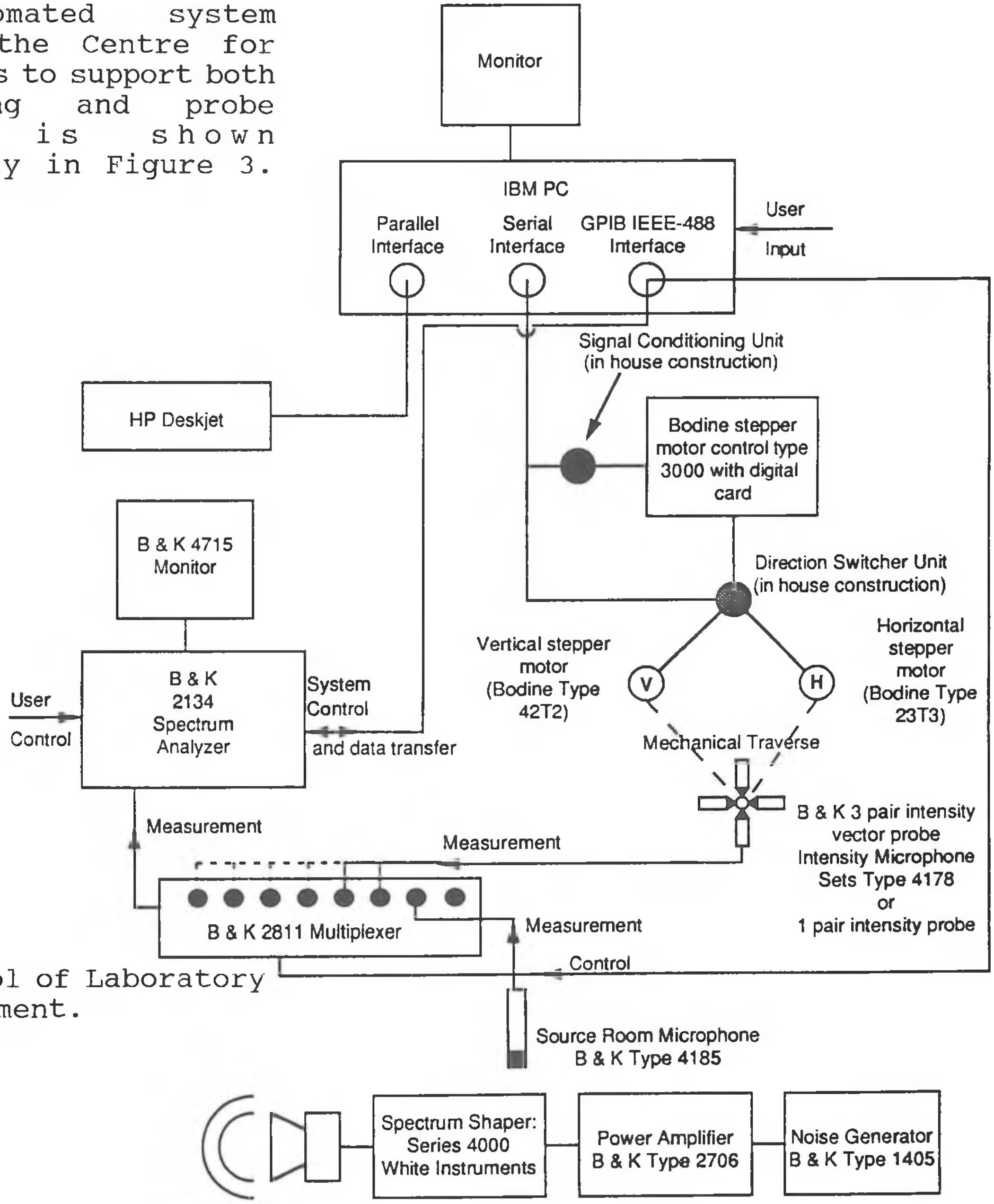

Figure 3. Control of Laboratory Equipment.

3. The Procedure

A test may be considered in three stages:

Stage 1. Instrumentation set-up, calibration, and test settings.

Stage 2. Data acquisition and test monitoring.

Stage 3. Data processing, result evaluation, and output.

Stage 1:

Several programmes have been developed during the course of the present work, each specific to a particular application and probe arrangement. However all involve transducer and system calibration, and most require the use of a multiplexer, so that an outline for the determination of sound transmission loss and surface intensity contour plots, will serve as a representative example.

The sound transmission loss is given by the formulation (Reference 5):-

$$TL = L_p - L_I - 6 + L_{Wh} + L_a - L_c$$

where

TL is the Sound Transmission Loss.
L_p is the Sound Pressure Level in the Source Room.
L_I is the Average Intensity Level on the Reception Side.
L_{Wh} is the Waterhouse correction
L_a is a Reception side measurement to test area correction.
L_c is a calibration correction

A measurement of the source room sound pressure level to the requirements of ASTM E 90, and the measurement of the sound intensity level plus sound pressure level at each grid point across the reception surface will now be required.

It may be noted in passing that employing an anechoic reception room will eliminate the need for corrections associated with absorption of the test panel surface in the presence of a reflective field, see for example Reference 7.

An overview of stage 1 elements is shown in Figure 4.

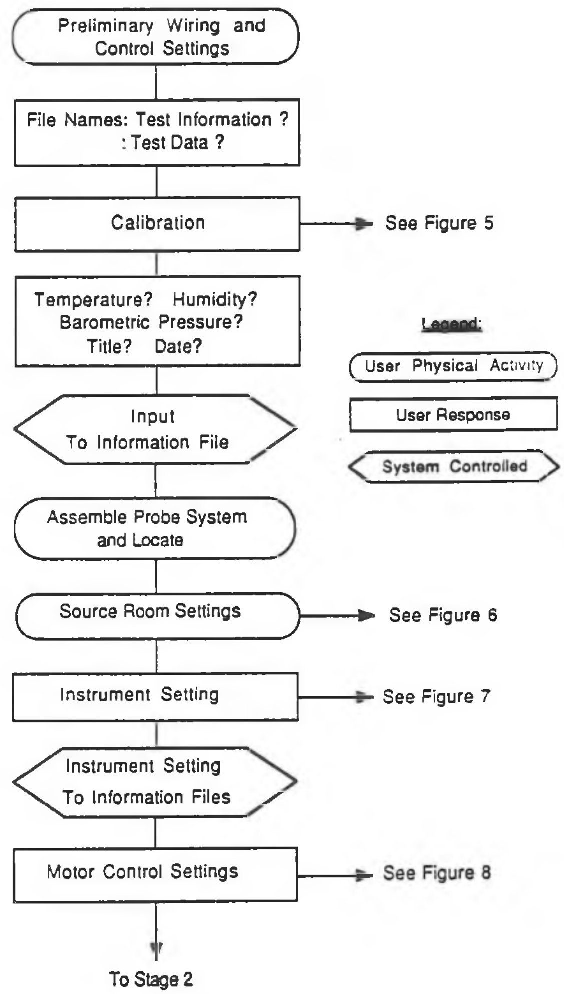

Figure 4. Overview of Stage 1. Instrument Set-up, Calibration, and Test Settings.

Three types of activity are represented, A User Physical Activity, A User Response, and A System Controlled Event.

Each user involved activity is accompanied by full instruction or necessary description on the visual display monitor and the next step is not encountered until prompted by the user; the system controlled events are accompanied by some visual display message or output to assure the user that something actually is happening, and to allow full test monitoring.

For convenience, stage 1 is further subdivided to:

a). The Calibration Sequence.
b). Source Room Management.
c). Instrument Settings.
d). Measurement Grid Set-up.

a). The Calibration Sequence

The calibration sequence is shown in Figure 5, and it can be seen to involve three types; pressure calibration, pressure-intensity index evaluation, and probe pair reversal.

The pressure-intensity index will subsequently be used as part of the measurement error estimate and in consequence is stored to file for later retrieval.

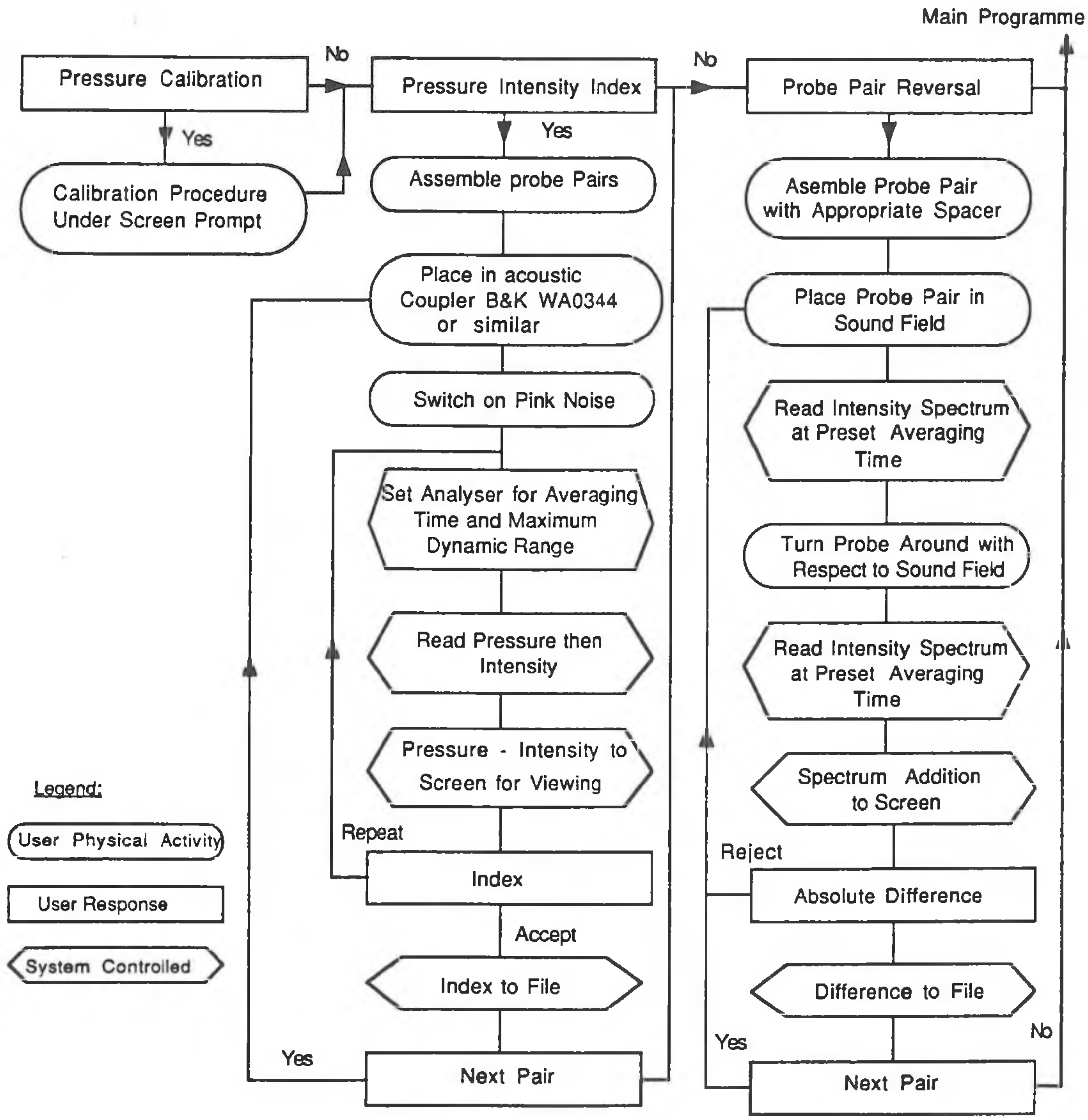

Figure 5. Calibration Sequence.

The probe pair reversal test serves the dual purpose of checking the probe consistency in use as well as identifying channel orientation for intensity direction sensing.

It involves sensing the intensity at each frequency band of interest with the probe oriented at 0, then 180 degrees to the source whilst maintaining the same acoustic centre. One should find the same absolute intensity measurement with the direction reversed. In the present laboratory procedure, this test is undertaken in approximate free field conditions with a broad band noise source.

b). Source Room Management

The source room management sequence is shown diagrammatically in Figure 6.

Establishing the base level for maximum dynamic range is accomplished under software control on the 3360 by switching the analyzer to Octave Filter Bandwidth and sensing the overall sound pressure level. A simple iterative manipulation of the input attenuation setting will then allow the maximum dynamic range to be established. The source room base level need only be established at the start of the test because of the spectrum's general stability.

In the case of sound transmission loss, a complication can arise with respect to the selection of the source spectrum, Pink or White. Most panels will yield low transmission loss at low frequency with high transmission loss at high frequency. On the reception side, low frequency intensity will dominate the measured spectrum and to avoid instrument overload the high frequency bands may be forced below measurement range. This prospect can be alleviated by employing White Noise as the source spectrum.

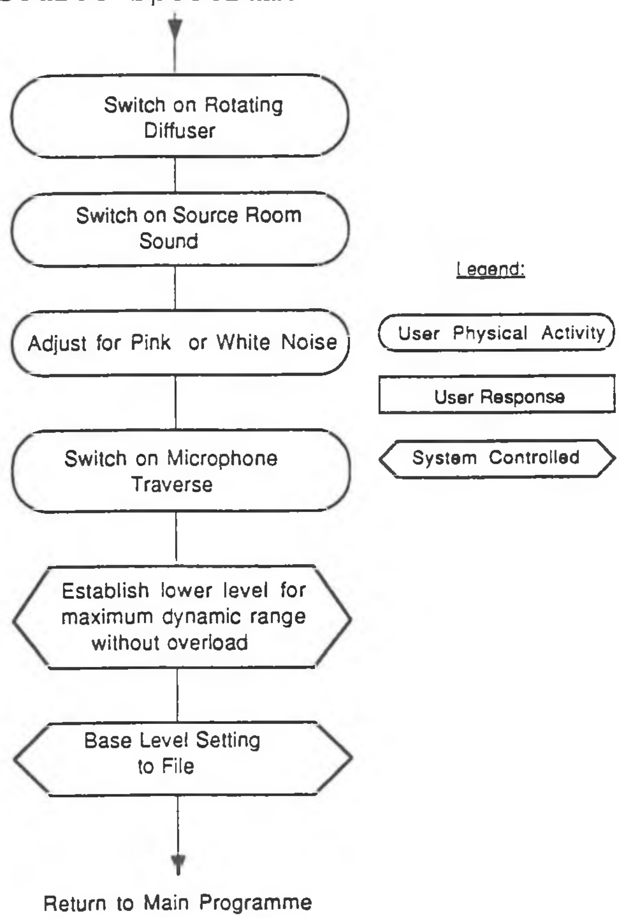

Figure 6. Source Room Management.

c). Instrument Setting

The instrument setting routine is shown in Figure 7. The settings will primarily depend upon the frequency bandwidth analysis required together with the frequency range.

Of great importance in the matter of the frequency range is selection of the appropriate microphone type and probe spacing. As can be seen, the user is stepped through the required decision making process and when automated analyzer setting is not possible, the user is prompted to manually select.

d) Measurement Grid Set-up

The measurement grid set-up procedure is shown diagrammatically in Figure 8. The grid usually consists of a two dimensional point array over a vertical plane as set by the traversing mechanism installed in Chamber B, see Figure 2.

In the case of sound transmission loss measurement the panel under test is treated as a noise source on the transmission side, and a procedure similar to that of sound power measurement may be employed to determine the average surface intensity.

One of two surface measurement schemes have been employed by experimenters so far (References 5 and 8), they are:

1. A single plane parallel to the test panel and located within a niche or at the interface of the niche and receiving room.(See Figure 9a).

2. A major plane parallel to the test panel, with a secondary surface scan for 'leakage' across the open edges to the reception room formed between the major plane and the test panel.(See Figure 9b).

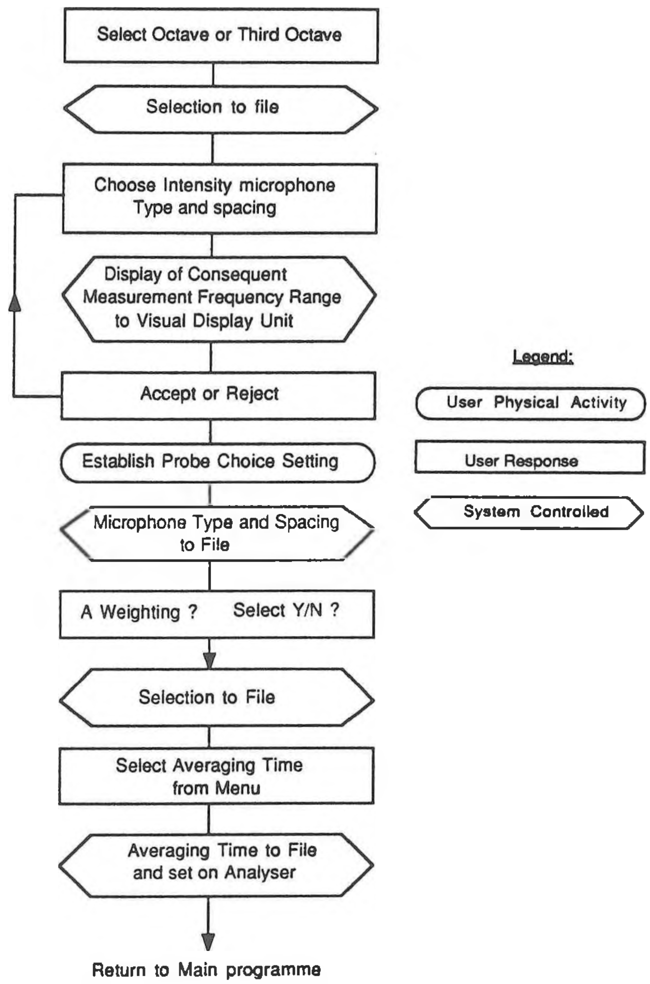

Figure 7. Instrument Setting.

Both surface schemes would typically require the main plane to be relatively close to the test panel in order to allow the development of surface intensity contours or to avoid adverse surface pressure-intensity ratios in a reverberant reception field. However, whilst the closest distance will be dictated by surface proximity measurement errors, (See Reference 6), problems of measurement interpretation can arise as a result of being within the panels near field.

Surface scheme 1 offers the advantage of a single plane scan, and this is preferable provided that the niche does not have dimensions which may influence the test result (Reference 9).

Assuming the single plane measurement pattern for the present example, the set grid will now form the basis for monitoring and progressing the test proper. In the case of automatic traversing the pattern will also establish the stepper motor controls and sequencing.

As can be seen from Figure 8, the rectangular grid requires the minimum data input of measurement plane height and width, together with the number of measurement rows and columns. In the case of an irregular spaced grid, the coordinates of all points must be input.

Once the pattern is established a scale representation of all points is presented to the user on the viewing monitor; this serves as a check prior to starting the measurement procedure and as a progress guide during the test.

<u>Stage 2</u>:

The data acquisition sequence is shown diagrammatically in Figure 10, and whilst the probe movement may be under manual or automatic control, once the probe is located the measurement sequence will be automatic.

The actual order of data gathering is not significant provided each is preceded by appropriate dynamic range fixing.

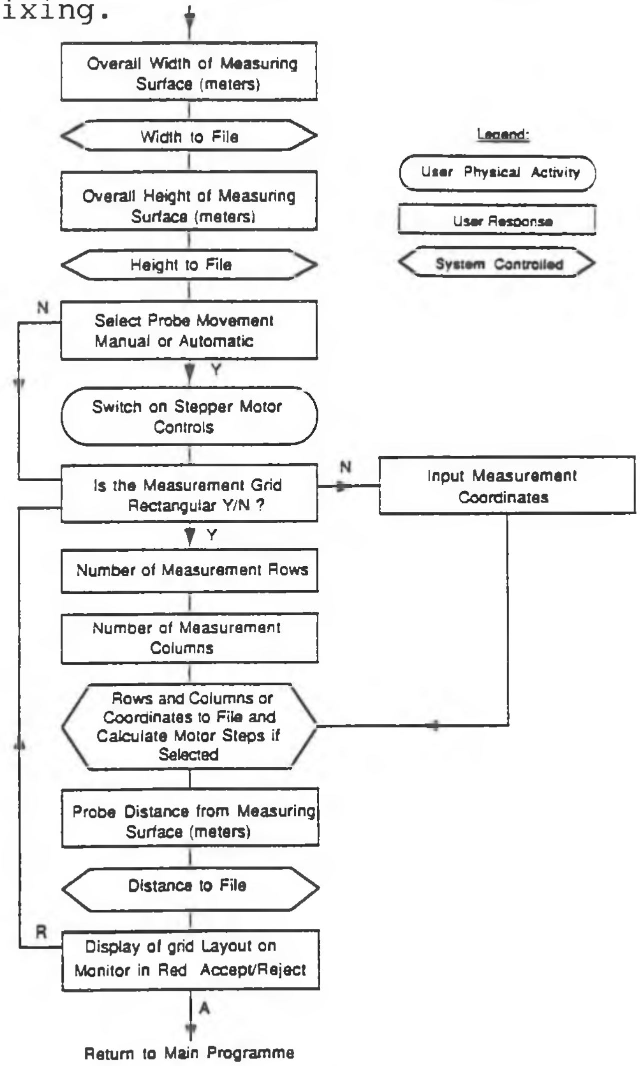

Figure 8. Measurement Grid Set-up.

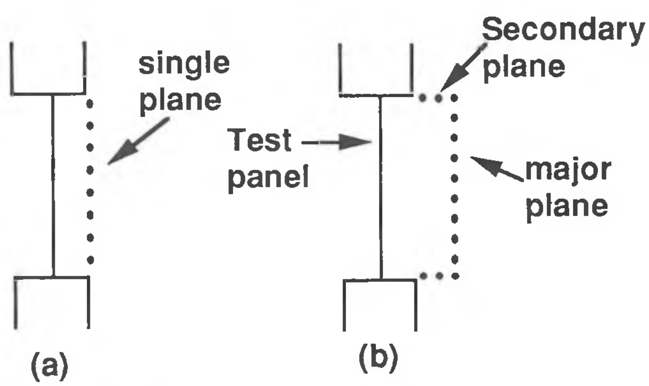

Figure 9. Surface Measurement Schemes.

Progress monitoring is achieved at this stage by the use of a colour code system for the grid points shown on the visual display monitor. If the point has not been measured then it is displayed in red, if measurements are taking place at the point then it is displayed in green, and completed points are blue.

In addition, during a point measurement sequence, the actual measurement type and the required multiplexer channels are shown underneath the grid display.

The spectrum reading is simultaneously shown on the analyzers display unit. Under probe automatic movement control, the full test sequence will be completed without further user intervention.

The vertical and horizontal bars on which the probe carriage is mounted have preset movement limit switches to avoid accidents to the probe resulting from incorrect input data; if tripped the movement system is put to neutral and an audible signal is generated. At the end of a test the probes last position is maintained to allow visual confirmation of correct overall movements.

With an averaging time of 16 seconds per measurement type, two 8 second dynamic base settings per point, an array of 100 points, stepper motor controlling and signal lull times, full data gathering under automatic control for a sound transmission loss and surface intensity contour test will take approximately 2 hours.

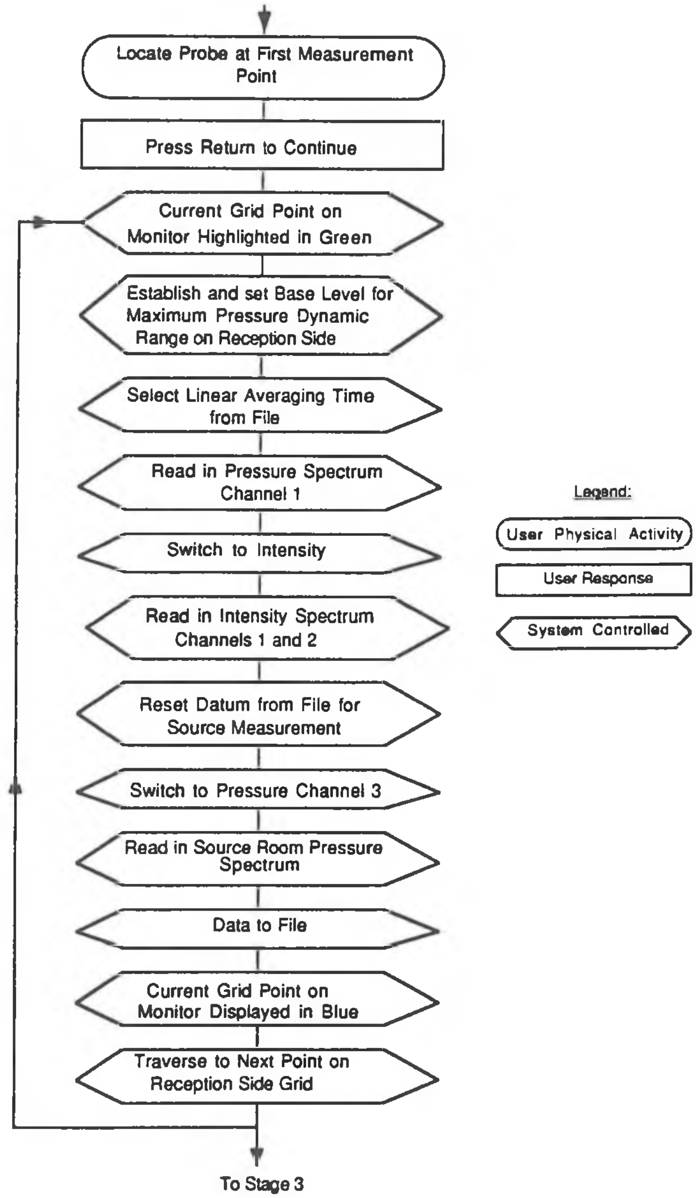

Figure 10. Stage 2, Automatic Probe Movement and Measurement.

<u>Stage 3:</u>

Stage 3 of the test sequence is concerned with data processing and its nature will depend upon the particular test requirements.

In the present example of

a transmission loss test the primary output could be similar to that of an ASTM E 90 test together with field indicators and test descriptors. However much greater insight into the transmission process is now possible.

The advantage of the current intensity based, point to point measurement system over a standard reverberant chamber test result may be considered under three headings:-

a) Product Development.

b) Fault Location.

c) Examination of Phenomena.

a) Product Development

Consider the surface profile of transmitted intensity for a given window shown in Figures 11 and 12.

The system tested was a Vertically sliding window set within an aluminum frame.

The two vertical sliders (top and bottom), are arranged to seal within the tracks of the frame and against each other across the centre of the window.

Figure 11 displays the transmitted intensity at 250 Hz, whilst Figure 12 shows the result at 2000 Hz.

At low frequency, maximum intensity can be seen emanating from the sides of the window, or from the frame track. Three dimensional intensity vector measurement would probably clarify this point.

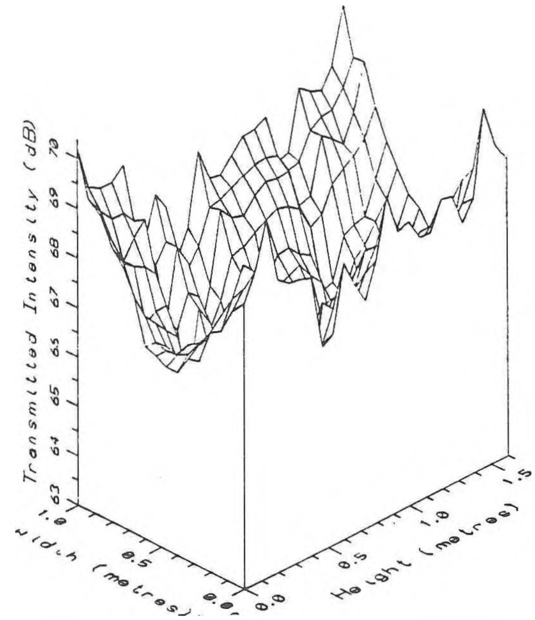

Figure 11. Transmitted Intensity for a Vertical Sliding Window at 250 Hz.

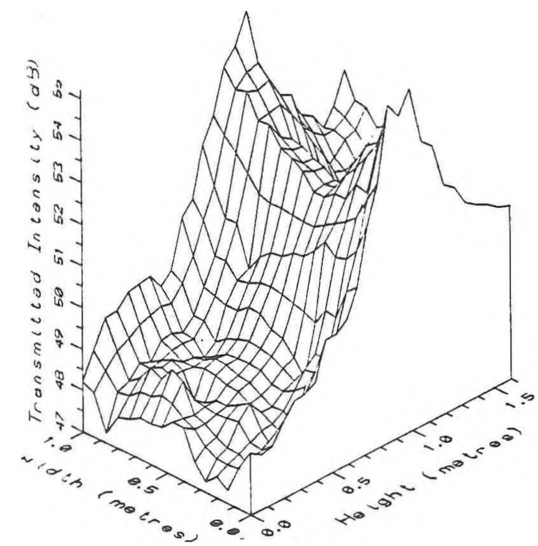

Figure 12. Transmitted Intensity for a Vertical Sliding Window at 2000 Hz.

At higher frequencies, maximum intensity is measured at and about the horizontal junction of the sliding panes. in addition, more energy is transmitted from the top of the window system compared to the bottom.

Such information may now be further processed to yield detailed design suggestions.

b) Fault Location

The identification of unexpected or untoward sound transmission paths can be used to confirm the correct installation or integrity of a test specimen.

Figure 13, (Reference 10), displays the results of two transmission loss tests. The lower transmission loss curve, shown dashed, was obtained after purposely removing some of the edge sealing between the test panel and containing wall. The result, if viewed in isolation, would probably be accepted as a true indication of the panel's performance. The upper curve of Figure 13 shows the panel performance prior to introducing the fault.

Figure 14 displays a contour plot of transmitted intensity at 1600Hz after introduction of the fault. The fault location at the left hand side of the panel can clearly be seen. Thus the surface intensity scans will give confidence to the installation integrity.

c) Transmission Phenomena

The examination of sound transmission phenomena can be undertaken in much greater detail than hitherto possible.

For example, Figure 15 displays the transmitted surface intensity profile at 400 Hz of a standard double glazed window consisting of two 3mm. glass panes separated by an air gap of approximately 10 mm.

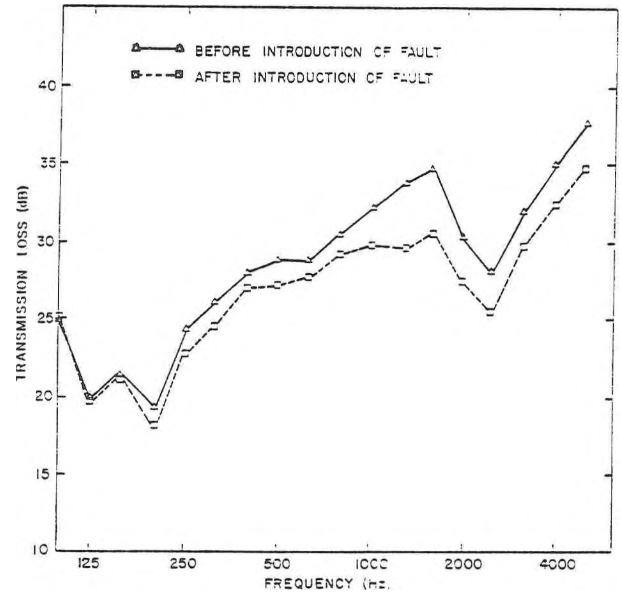

Figure 13. Comparison of Transmission Loss before and after introduction of a fault. 1.14 m x 1.14 m panel.

Figure 14. Transmitted Intensity at 1600 Hz after introduction of a fault.1.14 m x 1.14 m panel

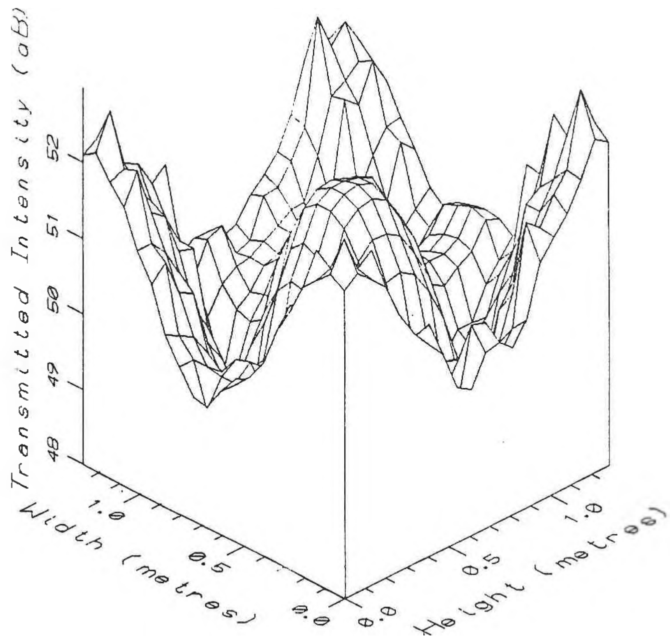

Figure 15. Transmitted Intensity at 400 Hz for a double glazed window.

The profile displayed may be interpreted as the fundamental mass- spring-mass resonance of this system which occurs within the 400 Hz third octave band.

The surface plots presented here are achieved by use of 'Surfer', a programme developed by Golden Software, Inc.

Conclusion

Much care and attention is required to successfully complete a sound intensity based test. However with the aid of the ubiquitous PC the user can avoid many pitfalls and realise an end result far superior to that obtained by other measurement techniques.

References

1. ASTM -E90-87 " Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions". 1988 Annual Book of ASTM Standards, pp 595-604.

2. Lang, M.A., Rennie, J.M., "Qualification of a 94 cubic meter reverberation room under ANSI.S1.21, Noise Control Engineering. Sept-Oct 1981, pp 64-70.

3. "Determination of the Sound Power Levels of Noise Sources Using Sound Intensity Measurement at Discrete Points". ISO Draft Proposal ISO/DP 9614 dated 1988-09-12.

4. "Engineering Method for the Determination of Sound Power Levels of Noise Sources using Sound Intensity". Proposed ANSI Standard S12.12-198X, Draft dated October 1988.

5. van Zyl, B.G., et al. " On the Formulation of the Intensity Method for Determining Sound Reduction Indices ". Applied Acoustics. Vol 22, No.3,1987 pp213-228.

6. Rasmussen, G. " Phase Errors in Intensity Measurement ". Bruel and Kjaer Publication Intensity Measurements, Sept. 1987, B1-B5.

7. van Zyl, B.G., Erasmus, P.J. " Sound Transmission Analysis in Reactive Fields by Sound Intensimetry". Noise Control Engineering.
Vol. 28, No. 3.,1897,pp 113-119.

8. Cops, A.,and Minten, M. " Comparative Study Between the Sound Intensity Method and the Conventional Two Room Method to Calculate the Sound Transmission Loss". Noise Control Engineering.
Volume 22, No. 3, 1984, pp 104-111.

9. Guy, R.W., Sauer, P., " The Influence of Sills and Reveals on Sound Transmission Loss", Applied Acoustics 17 (1984), pp453-476.

10. De Mey, A., Guy, R.W., "Exploiting the Laboratory Measurement of Sound Transmission Loss by The Sound Intensity Technique", Applied Acoustics, Vol. 20, (1987), 3 pp. 219-236.

MINUTES OF CAA BOARD OF DIRECTORS MEETING
MCKAY ROOM, CHATEAU HALIFAX, N.S.
OCTOBER 17, 1989 2:30 PM

1. PRESIDENT'S OPENING REMARKS AND TREASURER'S REPORT S.M. Abel

   Welcome to Halifax. Regrets from G. Faulkner and C. Andrew.

   Agenda for general CAA meeting circulated.

   A change to this meeting was agreed on in order to first discuss the Treasurer's Report.

   Issues of charitable organization and its implications on operating expenditure and income tax were discussed.

   Based on the tabled financial statements for 1989 a proposed budget for 1990 was presented. Advertising revenues and journal printing costs were also discussed.

2. EXECUTIVE SECRETARY'S REPORT M.M. Osman

   The fee structure for 1990 was the highlight of this report.
   The following structure was agreed on:

General Membership	\$ 35
Student	\$ 10
Subscriptions	\$ 35
Sustaining Subscribers	\$150

   The proposed budget is expected to raise about \$K 15 (inclusive of all other revenues) which is just sufficient to cover operating expenses.
   A secretarial budget of \$1500 was proposed and accepted.

3. EDITOR'S REPORT R. Hetu

   Changes in the editorial team were announced and the status of material for publication seemed to be in good order.
   The price for back issues was raised to \$10.00 an issue to cover postage and handling.

4. REPORT OF CHAIRMAN FOR CAA '89, HALIFAX B. Cyr

   The proceedings were issued and a letter of thanks to N.S. Power to be sent.

   About 40 persons attended the 2 day seminars and 100 were expected for the CAA meeting

   Costs were in line with expectations and a profit of \$4000 inclusive of \$1500 seed money was expected.
   The software package for registration was to be passed on to H. Forester for the Montreal meeting .

5. 1991 CAA ANNUAL MEETING

For 1991, an invitation from Edmonton (G. Faulkner and E. Bolstad) was received. Also interest from Winnipeg (J. Mckay) was expressed.

6. MEMBERSHIP CHAIRMAN'S REPORT A. Cohen

A list of new members up to August 1989 was circulated. A budget of $1000 would be sufficient to run this office, provided no new initiatives are taken.
The membership levels were also discussed.

7. PRIZES

The following prizes/awards and their status were addressed:

Directors'Award	S. Abel
Bell Prize	L. Brewster
Postdoctoral	B. Dunn
Underwater Acoustics	J. Leggat/A. Cohen
Canada Wide Science Award	A. Cohen
Student Presentation	B. Dunn

In addition Eckel Industries have expressed interest in donating $5000 as a prize in physical activities.

8. OTHER BUSINESS

The following business items were discussed:
Emeritus membership and who would be eligible.

I-INCE member to represent CAA is T. Embleton

A letter from 13ICA soliciting CAA's opinion on the venue for holding the meeting. The President will present it to the general membership.
Elections for directors and choice of officers were proposed by Past President (C. Sherry),

2 retiring directors N. Lalande and W. Sydenborgh would be replaced by C. Laroche and A. Behar.

Four officers were proposed and accepted,
- B. Dunn to replace S. Abel
- W. Sydenborgh to replace M. Osman
- M. Hodgson to replace R. Hetu
- C. Andrew to continue

For B. Dunn to become president he had to step down as a director and to be replaced by D. Chapman. The President thanked the leaving directors/ officers and congratulated the new slate.

Adjourned 5:15 pm

Prepared by M. M. Osman

MINUTES OF CAA ANNUAL MEETING

BLUENOSE ROOM, CHATEAU HALIFAX
OCTOBER 18, 1989 - 4:00 PM

1. <u>PRESIDENT'S WELCOME</u> S.M. Abel

   Welcome to Halifax. Attendance is almost same as last meeting in Toronto.

2. TREASURER'S REPORT S.M. Abel on behalf of C. Andrew

   This report was distributed to present members and its details discussed, especially statement 5 dealing with operating fund.
   Motion "To accept the 1989 CAA Financial Statements report as presented".
   Moved: T. Northwood Seconded: R. Hetu Carried.

3. EXECUTIVE SECRETARY'S REPORT M.M. Osman

   After presenting the main activities in 1989, the need for higher fee structure was presented.
   Motion: "That the 1990 membership dues shall be as follows:
   General Members - $35, Students - $10, Subscriptions - $35, Sustaining Subscribers - $150"
   Moved: E. Bolstad Seconded: R. Hetu Carried.
   Motion: "That the minutes of the last general meeting be accepted as published in Canadian Acoustics Vol.17, No.1"
   Moved: C. Sherry Seconded: R. Hetu Carried.

4. EDITOR'S REPORT R. Hetu

   Changes in the editorial staff were announced. Vote of thanks to R. Hetu proposed by D. Morrison and applause. H. Forester raised the issue that the journal should be used as a means of all types of communications among members.

5. MEMBERSHIP CHAIRMAN'S REPORT A. Cohen

   About 100 new members have joined. Membership in the maritimes has been increased.

6. PRIZES/AWARDS

   Some announcements were to be made the following day at the closure of the annual meeting.
   Director's Award, 2 each $500, to be announced the following day.
   Edgar and Millicent Shaw Postdoctoral prize will be announced in the journal by B. Dunn.

   Bell Speech Prized will be awarded in the journal by L. Brewster.

   Underwater Acoustics to be announced by J. Leggat

   Canada Wide Science Award, A. Cohen and M. Zogorsky to announce the winners the following day.

   Student Presentation, a debate took place re. graduate vs. undergraduate students, B. Dunn will take that into account.

Finally the new prize by Eckel Industries was announced and accepted with thanks. T. Embleton will chair the subcommittee responsible for this prize.

7. ANNUAL MEETINGS

The 1988 meeting in Toronto made a profit of $368.
The 1990 meeting will be held in Montreal at the downtown Holiday Inn October 1-5, 1990. There will be 3 day seminars and a 2 day symposium.
H. Forester is the convenor and F. Laville will be responsible for the technical program.

The 1991 meeting will be held in Edmonton, Alberta, this was decided after a discussion on the choice between Edmonton and Winnipeg. It is possible to hold a future meeting in Winnipeg.

8. OTHER BUSINESS

An honorary category of membership was agreed on for members who are 65 years of age and have been members for the preceding 10 years. This category will be exempted from membership dues.

The CAA representative on I-INCE is T. Embleton.
D. Morrison announced that a total of $3600 were paid back to CAA from the $5000 seed money given to hold ISO TC43 meetings in Toronto, 1988.

A letter from M. Hodgson re. the 13ICA was read and the pro and con arguments ensued on the idea of holding the meeting as planned in China or somewhere else. A count was taken for membership position and the president will convey that to ICA.

9. ELECTIONS C. Sherry

The 2 leaving directors were announced, N. Lalande and W. Sydenborgh.

New directors C. Laroche and A. Behar Elected
Officers:
- S. Abel to be replaced by B. Dunn
- M. Osman to be replaced by W. Sydenborgh
- A. Cohen to be replaced by M. Zogorsky
- R. Hetu to be replaced by M. Hodgson
- C. Andrew returning Accepted

Since B. Dunn was a director he had to step down and P. Chapman was proposed. Elected
Motion: "That the 1989 General CAA meeting be adjourned"
Moved: R. Halliwell Seconded: T. Northwood Carried

Adjourned 5:30 PM

Prepared by M.M. Osman
Past CAA Secretary

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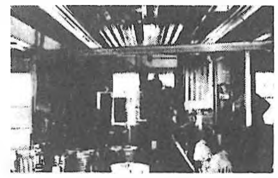

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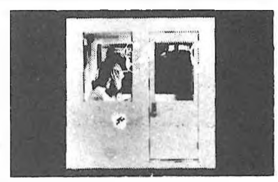

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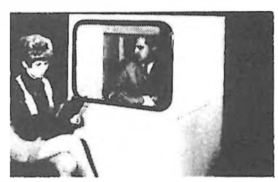

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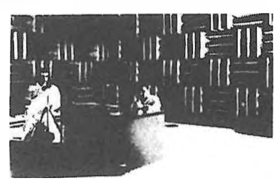

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QUESTIONNAIRE D'OPINIONS SUR L'ACOUSTIQUE CANADIENNE

Vos réponses anonymes à ce court questionnaire aideront les rédacteurs à améliorer le journal et à mieux desservir ses lecteurs. Votre opinion est importante. Nous vous serions reconnaissants de faire parvenir votre questionnaire complété avant le 31 mars à: Murray Hodgson, IRC M-27, National Research Council, Ottawa, Ontario K1A 0R6.

1. Quel est votre milieu de travail?

   INDUSTRIE EDUCATION GOUVERNEMENT
   ESTABLISSEMENT MEDICAL FIRME DE CONSULTANT AUTRE ______________

2. Quel est votre principal intérêt professionnel?

   Domaine: Acoustique Vibration Autre ______________
   Aspect: Physique Physiologie Psychologie

3. Quelle rubrique(s) d'Acoustique Canadienne lisez-vous généralement?

   PAGE COUVERTURE ARTICLES SCIENTIFIQUES/NOTES TECHNIQUES
   EDITORIAL PROCES-VERBAUX/RAPPORTS DE REUNIONS
   NOUVELLES INFORMATION CONFERENCE

4. Qu'appréciez-vous le plus dans l'Acoustique Canadienne?

   ____

   ____

5. Qu'est-ce qui vous déplaît le plus dans l'Acoustique Canadienne?

   ____

   ____

6. Est-ce que la revue satisfait vos attentes en tant qu'acousticien(ne) francophone? Oui Non
   Si non, quelles sont vos raisons?

   ____

   ____

7. Pensez-vous que l'Acoustique Canadienne devrait tendre à être:
   UN JOURNAL SCIENTIFIQUE: Oui Non UN BULLETIN DE NOUVELLES: Oui Non
   AUTRE: ______________________

8. Que proposez-vous pour améliorer l'Acoustique Canadienne?

   ____

   ____

9. Si vous n'avez jamais soumis d'articles à l'Acoustique Canadienne, quelles sont vos raisons?

   ____

   ____

10. Considérez-vous sérieusement soumettre un des éléments suivants à l'Acoustique Canadienne au cours des deux prochaines années:
    Article scientifique/Note technique?: Oui Non
    Un article décrivant vos activités professionnelles personnelles ou de groupe?: Oui Non
    Votre point de vue sur un aspect professionnel ou technique?: Oui Non

11. Utilisez l'espace ci-dessous pour ajouter tout autre commentaire personnel:

    ____

    ____

    ____

    ____

CANADIAN ACOUSTICS OPINION QUESTIONNAIRE

Your anonymous answers to this short questionnaire will help the editors improve the journal and better serve its readers. Your opinion is important. Please send your completed form, before March 31, to: Murray Hodgson, IRC M-27, National Research Council, Ottawa, Ontario K1A 0R6.

1. Where do you work?

   INDUSTRY   EDUCATIONAL ESTABLISHMENT   GOVERNMENT
   MEDICAL ESTABLISHMENT   CONSULTING FIRM   OTHER ________________

2. What is your main professional interest?

   Field: Acoustics   Vibration   Other ____________
   Aspect: Physical   Physiological   Psychological

3. Which features of Canadian Acoustics do you usually read?

   FRONT COVER   EDITORIAL   NEWS
   SCIENTIFIC ARTICLES/TECHNICAL NOTES
   CONFERENCE INFORMATION   MEETING MINUTES/REPORTS

4. What do you like about Canadian Acoustics?

   ____

   ____

5. What don't you like about Canadian Acoustics?

   ____

   ____

6. Do you think that Canadian Acoustics should aim to be:

   A SCIENTIFIC JOURNAL: Yes   No
   A NEWSLETTER: Yes   No
   OTHER: ____________________

7. How could Canadian Acoustics best be improved?

   ____

   ____

8. If you have never published a paper in Canadian Acoustics, why not?

   ____

   ____

9. Would you seriously consider submitting the following to Canadian Acoustics in the next year or two:

   SCIENTIFIC ARTICLE/TECHNICAL NOTE?   Yes No
   ARTICLE DESCRIBING YOUR OR YOUR GROUP'S PROFESSIONAL ACTIVITIES?:   Yes No
   VIEWPOINT?:   Yes No

10. Please add any other comments you may have:

   ____

   ____

   ____

   ____

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