Almost a hundred years ago Henry David Thoreau wrote, "Thank God, man cannot as yet fly, and lay waste the sky as well as the earth!" A great deal more coordination and concentrated effort will be required to prove Thoreau's fears unjustified. You, the acoustic fraternity, can help out through your constructive interest in regulations; by providing quantitative feedback and suggestions for improvement; by educating the public, both formally in course of jobs and informally through family and neighbours.

Through our combined efforts we may yet continue to enjoy the many benefits of aviation while alleviating its noise. Who knows, the airplane may yet become (to crib a line from Milton) the "Sweet bird than shunn'st the noise of folly".

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THE UNIVERSITY OF CALGARY ACOUSTICS GROUP

H. Jones
Department of Physics, University of Calgary
Calgary 44, Alberta

Work in acoustics at the University of Calgary is spread widely through the University and is actively pursued in two faculties, Engineering and Arts and Science, with an interest being taken in the subject by two others, Medicine and Environmental Design. The interest and activity in the area appears to be increasing and the number of co-operative projects between the different individuals involved is also increasing. There is sufficient interest in active liaison between the different individuals for the suggestion of the creation of a University of Calgary Acoustics Group to be considered seriously. Recognition of a common bond would be implied by the title and the existence of the Group should further the provision of more joint courses in basic topics in the subject at approximately graduate level.

The present and immediately projected work in acoustics is listed (in abstract form) below:

Dr. A.G. Doige, Head, Mechanical Engineering Department is engaged in research concerned with the dynamic characteristics of acoustic and mechanical systems by transient testing.

This research is aimed at the prediction and control of pressure pulsations in natural gas pumping stations. Excessive pressure variation adjacent to reciprocating compressors often produces dangerous mechanical vibration in the piping system and reduces compressor efficiency. The approach taken is to obtain the acoustic impedance of the line near the compressor from field pressure measurements. Acoustic characteristics of components such as mufflers (attenuators or snubbers) are obtained similarly from field pressure data. Laboratory analysis of the recorded data allows the calculation of the pressure distribution throughout the original system

and also for a modified system that has one or more of the major components altered or replaced. The prediction of pressure pulsations that result for any system change offers a means of avoiding excessive pulsations and resonant conditions when expensive alterations are made. The techniques of obtaining the dynamic acoustic properties of the system employ recently developed transient testing methods first used in structural dynamics. The system is excited in the field by a rapidly-swept sinusoidal input of approximately five seconds duration. Subsequent data analysis includes fourier transformation of the pressure signals and calculations by digital computer to obtain the pressure amplitude spectrum at any desired points throughout the system. The new methods employed should render field testing much more practical because the required instrumentation is minimized and data acquisition for each test requires, typically, less than ten seconds.

Dr. B.E. Dunn, Psychology Department, is engaged in auditory research. This work can be broken down into three areas, one primarily applied and two basic in nature.

The applied area deals with the effect of noise on human ecology. Up to this time the research has primarily dealth with the attitudes of individuals to their noise environment. The research has been part of a major noise survey supported by the Province of Alberta. He has also been interested in investigating certain stress responses produced by noise. At this point his research has primarily been in gathering available published data and not in laboratory or field research (but there appears to be considerable need for laboratory research in this area). Not directly related to noise per se in the sense of the noise survey, research done on perception of fidelity could be placed in this general category. This research has dealt with the effects of distortion and noise upon the desirability of music and speech passages as controlled by individual observers.

One of his basic areas is work on complex auditory processes primarily to do with binaural and contralateral masking. He is particularly interested in relating the binaural and contralateral masking effects to possible frequency type, as opposed to place type, mechanisms in the auditory system. He is also interested in the relationship of contralateral masking to the differences in response threshold of the inner and outer hair cells.

The other area of basic research in which he is interested is threshold theory. He is currently studying some basic theoretical models of signal detection. He is using primarily lateralization where a forced choice is required.

Professor D.R. Hill, Mathematics Department, is concerned with automatic speech recognition and synthesis.

The objective is to investigate generalized descriptors for the varying frequency spectrum of speech signals to allow practical recognition and synthesis procedures to be defined. The emphasis is not only on basic studies, to further the theory of recognition and synthesis, but also on the application of the fruits of this research in practical situations. The subgoals are: (1) the development and maintenance of an advanced signal processing facility for data acquisition and real-time equipment operation; (2) the development of measurement and analysis techniques for speech signals; (3) the development of pattern recognition strategies suited to the variable and voluminous data that characterizes speech, including dealing with the classical and related problems of "time normalization" and "segmentation"; (4) to improve our parameterization of speech for speech synthesis, reduce the data-rate required, and complete the set of rules required for good text-to-speech conversion; (5) to lay a sound basis for practical applications of the fruits of research; (6) to maintain an authoritative position in the field. Patents have been obtained, and another filed on aspects of the work. A speech output unit has been built, and Synthetic speech generated from a time-sharing system. Active co-operation with others advances sub-goal 5 (at Calgary with Dr. Hallworth, Ed. Psych. for Computer Aided Instruction; Essex U., Mr. Witten, and Beloit College, Professor Wheeler, both of the latter having actual hardware on loan). Possible industrial development is forecast.

Dr. H.W. Jones, Physics Department, has been engaged in theoretical and experimental studies related to acoustic imaging and holography. These studies have had three aspects, the first concerned with the theory of operation of Sokolov tubes, the second studying the general nature of ultrasonic imaging and the relation between image processing and receiver operation and the third concerned with the physical theory of acousto-optical lens and mirror systems. He has also undertaken work on environmental noise.

The first work has been completed to the point that a theory for image converter tubes of this type is now available and this theory is supported by adequate experimental verification. The limits of Sokolov tubes in their present form has become clear so that it is possible to make an adequate assessment of their potential in relation to the several other types of receivers.

The study of the second topic has shown that there is a limited range of possibilities in the use of particular types of receivers and it appears that it should be possible to specify the optimum use of such receivers in relation to the method of image production. The question of limiting resolving power of the different arrangements has not been satisfactorily explored; this is a critical factor in discussion of practical applications and consequently it is a subject of some interest.

It is hoped to apply some of the imaging work in a co-operative project with Dr. S. Nicholson of the Faculty of Medicine.

The third topic relates to the need to establish a complete theory for the performance of refracting and reflecting components in acousto-optical systems. Ordinary optical theory provides a starting point to this work. However, the extra degrees of freedom which arise from the effects of (i) the mode conversion of sound (from longitudinal to shear waves for example), (ii) the relatively small size of components compared with the wavelengths involved and (iii) the special problems relating to impedance matching, have not been treated adequately. Some co-operative studies relating to single lens have been done with workers in the U.S.

On environmental acoustics he was jointly responsible for the Calgary Noise Survey with Dr. Dunn and hopes to undertake a joint study on scaling with Dr. Vermeulen.

Dr. P.J. Vermeulen, Mechanical Engineering Department, has been engaged in the study of acoustic flame phenomena.

The interaction of acoustic pressure waves with a flame front is being studies by means of a simple single port burner using premixed gaseous fuel and air. A standard type diaphragm driver generates acoustic pressure waves of controlled amplitude which are fed through the burner port and so through the flame front. The resulting hydrodynamical motion of the front has been investigated by means of high speed photography, and significant signal amplification together with harmonic component modification has been shown to be the result of toroidal vortex shedding at the burner exit. The appearance of a one half harmonic of the modulating frequency has also been shown to be the result of vortex phenomena. The flame behaviour has been shown to be dependent on the frequency and sound pressure level of the excitation signal as well as on the equivalence ratio. The most significant effects are in the frequency range from 50 Hz to 500 Hz.

The fundamental work is continuing, and work is in progress applying the insight gained from the study so far to the design of engineering combustors of improved combustion performance, and, it is hoped, to combustors of reduced acoustic output though not necessarily simultaneously. It is particularly hoped that the combustors for small gas turbines may be improved. The research is presently supported by NRC A-7801.

A request for funding for a study of noise in wilderness areas has been made and this is intended to be a joint project between Dr. H.G. Kariel, Geography Department, and Dr. Vermeulen.

Mr. P.L. Li, Chief Building Inspector, City of Calgary, has acted as an honorary consultant to members of the Group in the environmental noise work related to the insulation of buildings. His contribution to a recent extramural course on environmental noise given by the Group is also acknowledged with appreciation.

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