

A NEW ACOUSTIC TEST FACILITY IN WESTERN CANADA PART A
THE FACILITY AND ITS JUSTIFICATION

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Critical to our work in corrective acoustics and the development of custom noise barriers, etc., is the need to know how well a proposed design will actually perform before large expenditures are made. In the earlier years of our practice we used the usual devices of borrowing space in a gymnasium, shop, or other available facility to conduct tests in conditions simulating the job site. The results of course had to be judged in the light of known deficiencies in the testing procedure.

It was also very apparent to us that there were a number of manufacturers of building materials, wall systems, machinery and equipment, etc. in Western Canada who were not able to provide adequate acoustical ratings on their products because the cost and inconvenience of testing at distant laboratories was prohibitive.

For these reasons, we decided, in 1972, to start construction of a full scale test laboratory. After considerable evaluation it was decided that the facility should consist of two reverberation chambers, one of 11,000 cubic feet, the other 8,000 cubic feet. They would have a test opening between them to allow testing of wall transmission and/or the isolation of components of mechanical systems.

From an economic point of view it was apparent that considerable cost could be saved by locating the laboratory in the country, thereby avoiding or at least postponing the cost of double shell construction, spring mountings, etc. We were successful in obtaining a pleasant country setting, within a short distance of the city, with an excellent view of the smog shrouded downtown core.

As shown in Figure 1, a fairly simple layout was developed, with the two chambers, essentially separate buildings, on separate foundations, located close to the service workshop, the instrument shop, the control room and the engineering office.

To accommodate large test panels and equipment, both chambers have double leaf doors, 6 feet wide. The large chamber has a 10 foot high door so that wall test specimens can be rolled into place.

To avoid the somewhat debatable duct or tunnel condition surrounding a test panel which is inserted in the space between two test rooms, it was decided to build the chambers close together and insert the test

panels in the opening in one room in the manner of a plug. This of course required the development of a gantry, or lifting frame, which can handle the considerable weight of the panel. Test wall panels can be constructed in the removable steel frame or in the fixed wooden frame to suit the type of material or test procedure.

When the design of the chambers was first being considered, much thought went into the methods to be used for diffusion control and microphone sampling. From all the evidence available in many items of literature and in discussions with several authorities on the subject, it was decided to first of all adopt the dimension ratios of $1:\frac{3}{2}:\frac{1}{4}$ for the overall shape and to use rotating vanes and a rotating microphone. This seemed to offer the principal advantage of simplicity of instrumentation and speed of sampling during a test.

After considerable experimentation, it was finally determined that the only satisfactory power source for driving the microphone system would be obtained if it was located outside the room. This had the obvious benefit of allowing us to develop a very powerful unit which could also operate the vane system. The power units, one for each room, are located in small penthouses on the roof.

On reconsidering the vane system, it occurred to us that the principal function of the vanes was to offer a constantly changing room geometry, and that while there was considerable experimental evidence to show that some vane systems could be superior to others, it was also evident that as long as the amount and size of the vanes was sufficiently large, the differences between one system and another would be of little consequence for our class of work.

With a little imagination, a very simple arrangement was worked out, using standard size sheets of plywood and a system of ropes, in a manner of ancient Indian Punkahs, to effect the necessary movement. The plywood sheets, curved to provide necessary stiffness, are shown hanging about the room in Figure 2. The microphone boom and cradle are also shown. This form of swivel cradle allows the microphone to be carried in a full circle, without twisting or having to use slip rings in the cable connection.

One distinct advantage of this system is that the vanes are essentially distributed about the perimeter and do not occupy valuable test space in the center of the room, as is the case with many rotating vane designs.

The simple crank arm and wrist pin arrangement which drives the microphone boom and pulls the ropes attached to the vanes is shown in Figure 3. The transmission shaft coming through the roof carries a V-belt drive which operates the rotating microphone boom and a crank arm with wrist pin which is grooved to hold the ropes securely.

Finally, the compliment of instrumentation used in the control

room is shown in Figure 4. At the upper left is the noise generator and associated 1/3 octave filter set. Below that is the measuring amplifier and its associated 1/3 octave filter set which has a range of from 2 Hz to 200 K Hz. At the top of the equipment rack is a patch panel for interconnection of the various components in variable configurations. The broadcast quality recorder in the rack is used primarily for playback of tapes which are recorded in the field on our Nagra or Tandberg equipment. The small operator panel below the tape recorder contains remote functional switching, amplifier gain control, filter stepping, reverberation pulsing, etc. The strip chart recorder is located in a well in the operators' desk, providing convenient operation and a writing surface under the strip charts as they leave the recorder. Above the strip chart recorder is the X-Y plotter which is coupled to the strip chart recorder to provide immediate display of analysis curves on preprinted forms. Immediately above the X-Y plotter is the 1/3 octave filter shaper. In the rack and on the shelf is a monitor amplifier and speaker, the statistical distribution analyzer, and power amplifier.

Complimenting this equipment is a mobile instrument van, mobile power unit, narrow band analyzer, beat frequency oscillator, portable sound level meters, noise dose meters, tape recorders, impact testers, audiometry equipment, and the usual test instruments associated with an electronic laboratory.

We are quite proud of the facility which we have constructed and to demonstrate in a more rigorous manner that the rooms meet the technical requirements of a laboratory meant to be used in producing credible test results, a series of evaluation tests were conducted by Mr. Don Olynyk and Dr. Gary Faulkner. A summary of the results of this testing follows.

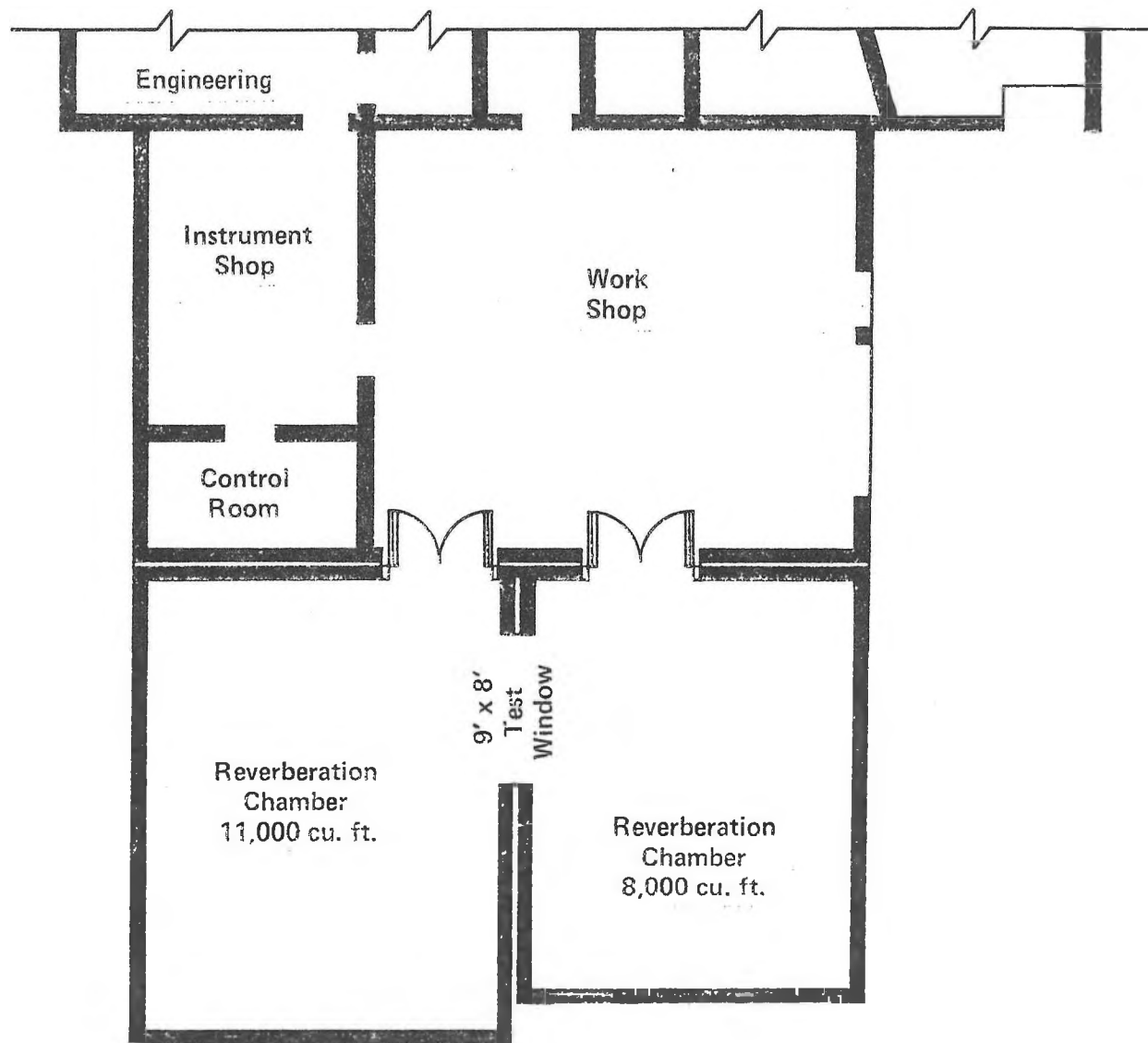


FIGURE 1 LABORATORY LAYOUT

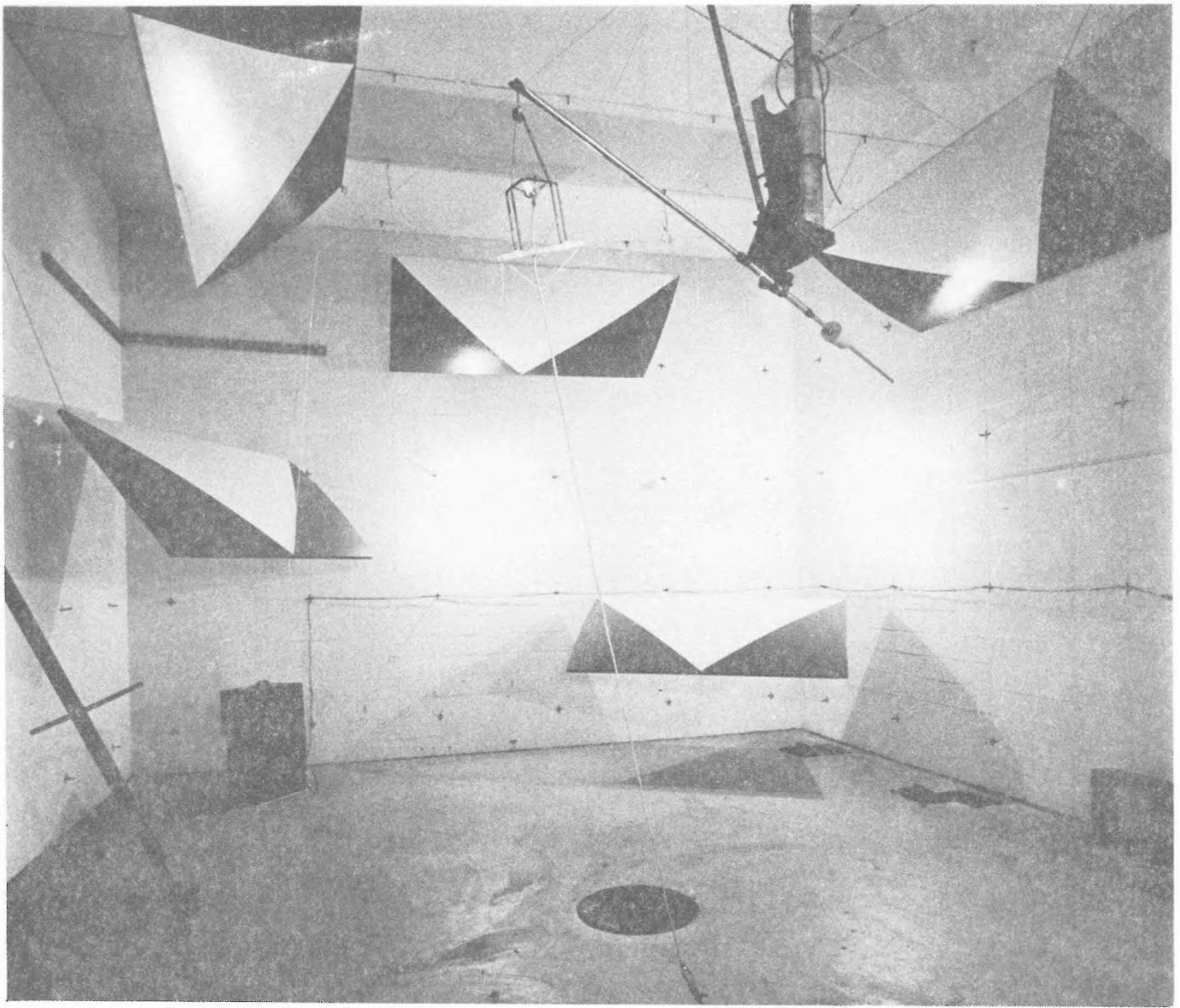


FIGURE 2

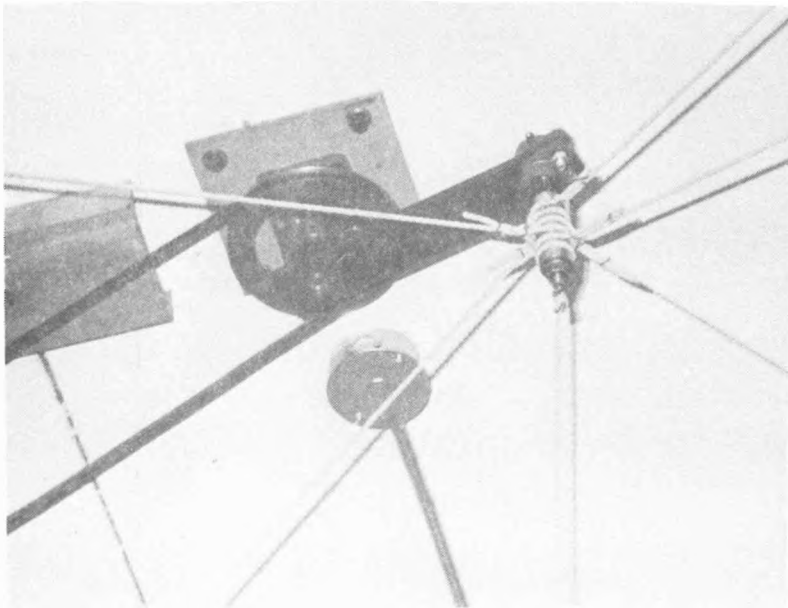


FIGURE 3

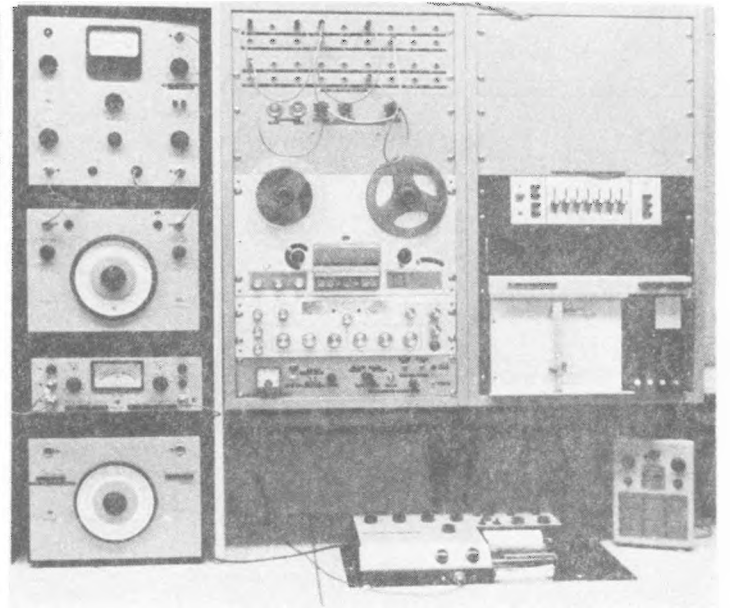


FIGURE 4