inter•noise 96
25th Anniversary Congress – Liverpool

INCE: 07

EDUCATION IN ACOUSTICS - DEMAND AND SUPPLY

T Kihlman

Department of Applied Acoustics, Chalmers University of Technology, S-412 96, Goteborg, Sweden

1. INTRODUCTION

Noise is the environmental factor which directly concerns more people than do other pollutants in the environment. This has been shown through numerous social surveys performed in several countries. There used to be two classical symbols for progress, industrial prosperity and power - smoke and noise. Now the smoke has been reduced at least below annoyance level through good engineering enforced by societal demands but we still have quite too much noise. Therefore, there are many tasks for engineers in order to design quieter products and a substantially quieter community for the next 25 years. This is one essential demand upon the sustainable society.

Much remains to be done. I would like to quote professor Manfred Heckl with two sentences: 1) "There is no law of nature that says that a quiet product must be more expensive than a noisy one", and 2) "It is easier to construct a car which is faster than to design a car which is quieter". Considering the situation I think it is more important for the society today to design quieter cars than faster ones and therefore it is our responsibility to rise the competence in noise control and acoustics among our engineering students.

In this session we will discuss education in acoustics. The subject can be tackled on several levels. One is the actual course contents with an adequate choice of good demonstrations and laboratory work to make the student familiar with the subject. This has been the subject for several conference presentations and education committees where the most effective pedagogic methods have been communicated between academic teachers. Recently this was treated in a session at Forum Acusticum 96 in Antwerp. It is also interesting to look at and compare training programs in acoustics, esp. in those universities where comprehensive such programs are offered to the students. We have some presentations of this kind in the session.

I have chosen another approach for my introductory paper. Given the fact that noise for a long time has been such a severe environmental problem we must ask ourselves the question why the situation is no better. Have we failed in our education? Is our education adequate in content and volume to provide the competence to make the society substantially quieter in the next 25 years? Do we need to develop a better strategy to get a more effective system? This question was also taken up for discussion at the International Congress on Acoustics, Trondheim 1995 in the so called ICA club.

2. NOISE - A HIGH PRIORITY ISSUE FOR MORE AND MORE MANUFACTURERS OF CONSUMER PRODUCTS

Low noise levels are getting more and more important for quality consumer products. This is now realised by manufacturers of cars and house hold equipment. For cars and some other products the noise problem has two aspects. One is that emission levels have to fulfill society's demands. The other is customers' demand for comfortable noise levels. For more and more manufacturers the latter aspect comes in the foreground. The market for silent products is a fact and acoustic comfort is becoming increasingly important for the competition.

This pressure from the market has led to substantially quieter dish washers, refrigerators, vacuum cleaners, etc. as well as aeroplanes, trains and private cars, which have become quieter for the customer. In the car industry a whole battery of sophisticated engineering methods have been developed and taken into daily use to identify and solve the noise problems.

Silent design is increasingly a cost benefit challenge for product manufacturing companies. The level of "acceptance and procedure for verification" is well documented in authority regulations, standards and customer specifications. It becomes increasingly important to pre-estimate sound performances.

Noise reduction at the source is really a challenging subject which demands increasing skill and innovativeness.

3. NOISE - INDUSTRY ALONE CAN NOT SOLVE THE PROBLEM

When smoke was identified as a severe problem the society acted with demands on the polluter. The solution has been reduction at the source. With noise the situation is different. The society has no chance to solve the noise problems by increasing the demands on the polluters only.

The reason is that practically all machines are too noisy. If I may make a very general statement, society's noise problem would not be solved at the source unless each machine would be 20 - 30 dB quieter in ordinary operation than it is today. There is no example of so successful noise reduction at the source that a ripe industrial product has been redesigned so that it has become 20 - 30 dB quieter. Such a noise reduction demands change of technology as for instance change from

mechanical type writers to word processors or from private cars to bicycles.

The traffic noise situation is a good illustration. To create a good acoustic outdoor environment in the neighborhood of each road and street would require a noise reduction of just 20 - 30 dB from each individual car in ordinary driving mode. In contrast, the total effect of the last 25 years' efforts in noise reduction of cars have given a net noise emission reduction of 1 -3 dB of the individual vehicle!

Most noise problems must therefore be tackled also between the source and the receiver and at the receiver - a well known fact for each acoustician. This implies planning and building with acoustical competence and also general skill on a system level.

4. INDUSTRY'S VIEW - SOME EXAMPLES

What does industry demand from engineers they want to employ as far as noise is concerned? I have asked this question to a number of persons involved with noise or acoustic problems in different industries with substantial groups of noise control engineers, mainly in the mechanical engineering sector. I have been disappointed in the respect that so few were ready to answer my questions. So, we only have one representative for industry among the contributors to this session! Engineers in industry struggle with the noise problems but quite too few seem to have a very strong opinion about how these problems should be formulated in demands upon the education system and the problem is not understood at the management level. In practice industry leaves the whole initiative to the university. This is unfortunate realising that the university is one of the most conservative systems that exists (which is often quite good). Therefore, strong market forces are necessary to bring about a change in the education. This market force could best be an articulated industry demand for engineers with an adequate education in acoustics and noise control.

Almost unanimously industry reports that it is much too difficult to find well educated and skilled engineers to employ in their "noise groups". This is also clear when looking at all advertisments for engineers with noise control expertise and knowing how many who have such an education.

The demands or desires that the employers express on these engineers are curricula containing typically 4 - 5 courses in sound and vibration covering radiation, room acoustics, absorbers, structureborne sound, SEA, sound insulation, modal analysis, vibration isolation, measurement technique with signal processing and psychoacoustics and of course modern numerical methods.

The only deviating answer was obtained from Rolls Royce. Their "current views" are that "....Acoustics, per se, is not a high priority. The emphasis these days is on attracting broadly based graduate Engineers with a solid grounding in Aerodynamics or Mechanical engineering. Most of our current Noise Specialists have had no education or training in Acoustics at all and simply "learn on the job"."

When it comes to the building industry it must be said that at least in Sweden even the biggest building enterprisers are incapable of specifying needed educational background to solve their problems in terms of buildings with too high indoor and outdoor noise levels as well as unsatisfactory sound insulation. They realise a market where tenants ask for better sound quality and rely upon the acoustic consultants to help them to solve these problems - often too late in the projects! Also the cities, for their town planning have to rely solely upon the acoustic consultants.

5. CONCLUSIONS

My conclusion is that acoustics and noise control needs to be better developed and integrated as part of the competence within the manufacturing industry, the building industry and community planning. It is therefore an important subject for students in mechanical engineering, civil engineering, town planning and architecture.

Typical curricula in civil and mechanical engineering contain one or two basic courses in acoustics, often among the electives. It is essential that a majority of the students get this training as a minimum to make them aware of the complexity of the problem. However, such a training does not give sufficient competence to reach our goal - to make our society substantially quieter in the next 25 years. Also more elaborate programs are needed. In Sweden as in many other countries such more comprehensive programs are available at least on the Master level. It is important to discuss as we may do in this session what such programs should contain and whom they should reach. I am convinced that substantially more students than today need such a training to give us a chance to reach the goal.

When examining the situation for the basic courses, my experience - which I share with many collegues - is that they do not get sufficient support from other courses in the schools of mechanical as well as civil engineering. And I would say that this is the core of the problem. Acoustics is "different" for the students! The situation gets clearer when dealing with the comprehensive programs. Acoustics crosses the boundaries between the different schools of engineering that were created approx. 100 years ago and ambitions from acousticians to develop good education programs come in conflict with the conservative university forces.

However, acoustics is not more different from civil or mechanical engineering than is electrical engineering! It just needs its own set of basics in the education as each of the other schools of engineering do. This must be understood by those who have the strategic responsibility for the structure of our educations. Otherwise we will not reach society's goals. This is a joint responsibility for the managements of the university and the industry and the governmental bodies concerned with our noise problems.