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Acoustics and Sustainability:

How should acoustics adapt to meet future demands?

Sustainability of acoustics education in Australia

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ABSTRACT

There is a high demand in Australia for new staff for acoustical consulting companies, as evidenced by the "positions available" listings. Companies would ideally like to hire staff with a good engineering, physics or building background plus an understanding of acoustics. Programs of study at University may deal with the principles of acoustics and vibration but there is usually a need for supplementary education and training for new staff in practical applications of those principles. In this paper we will discuss the development of the requirements for sustainable acoustics education in Australia. In particular we will explain the development and implementation of the flexible Professional Education in Acoustics program aimed at providing for ongoing acoustics education. This program is based upon the UK Institute of Acoustics Diploma program and designed to meet the criteria identified by the profession. This paper will provide the basis for further discussions during a workshop on acoustics education in Australia.

INTRODUCTION

In many countries there is a high demand for staff to work for consultancies and agencies specializing in acoustics. For the right person with the right skills there are good opportunities for a career as an acoustics consultant in private industry or as an acoustics specialist in government or semi government agencies. For new personnel wishing to enter the field, a basic degree in a science or engineering or building is usually required, a number of other undergraduate courses such as architecture can also lead to a career in acoustics although this is less common; eg as stated by Walters from the UK Institute of Sound and Vibration Research (ISVR) [1]

"To get into an acoustically related career you will probably need to study for a degree in physics or an engineering related subject at a respected university."

It has been clearly identified by the profession, in particular the Association of Australian Acoustical Consultants (AAAC), that there is a need in Australia for opportunities for those embarking on a career in acoustics to build upon their undergraduate studies and develop and enhance the skills and knowledge in the area of acoustics.

In this paper we discuss firstly some aspects of sustainability relating to engineering and science education in Australia. We then discuss the requirements/options for a sustainable education in acoustics in Australia. An overview of the initiatives to develop a flexible program for acoustics education in Australia is given. This paper is intended to stimulate further discussion on the topic.

EDUCATION AND SUSTAINABILITY

Before discussing sustainability for acoustic education we first need to consider what is relevant for sustainability for education and in particular for engineering and science

education. Using Wikipedia as a reference [<http://en.wikipedia.org/wiki/Sustainability>] a definition of sustainability is

"..... a characteristic of a process or state that can be maintained at a certain level indefinitely"

The term "sustainability" in recent time has been widely used for consideration of the long term future of ecological systems. More recently sustainability has been linked to other topics like sustainable economies and sustainable buildings. Although the term 'sustainable education' does not seem to be in common use, one can perhaps consider 'education' as 'a process' and then assess what is necessary to ensure that this process is maintained.

In the engineering and science fields there is a range of education outcomes that institutions and organisations need to assess and ensure are being met by their programs of study. For example the Engineers Australia accreditation process, available from www.engineersaustralia.org.au/, provides for two accreditation management systems; one for programs at the level of professional engineer and the other for programs at the level of engineering technologist. The specifications for outcomes of both of these programs are similar with one focussing on the broader profession and the other on technological aspects of engineering. Compliance with the specifications in the management system is required for accreditation. This could be considered as a means for ensuring the 'sustainability' and 'stability' of engineering education. The profession has taken the responsibility for identifying the requirements which provide a stable listing against which the program of study in each University is checked.

The ten educational outcomes for the accreditation management systems specify attributes including: ability to apply knowledge; ability to communicate; ability to

undertake problem identification; etc. The section on the curriculum identifies learning experiences which include: enabling skills and knowledge development; in depth technical competence; personal and professional skills development; etc. The specifically identified skills that require development are:

- Ability to communicate;
- Information literacy and ability to manage information and documentation;
- Creativity and innovation;
- Understanding of and commitment to ethical and professional responsibilities;
- Ability to function as an individual and as a team leader and member;
- Capacity for lifelong learning and professional development; and
- Appropriate professional attitudes.

These skills would provide the basis to develop understanding and knowledge in any particular field of engineering or science. Any consulting company would be looking for these generic skills in their new staff as well as staff who have an interest in acoustics shown by seeking out noise and vibration subjects in their undergraduate degree.

ACOUSTICS EDUCATION AND SUSTAINABILITY

The regular employment advertisements for positions with consulting companies indicate there is a strong demand for new staff and that acoustic consulting is a growing field. Ideally employers would like to offer positions to graduates who already have all the attributes of a professional engineer or scientist plus a good understanding of acoustics. However there are no Australian and only a few international institutions offering an undergraduate degree specifically in acoustics. Within general engineering or science degree programs the opportunities to undertake courses focusing on acoustics depend on the presence of staff who are particularly enthusiastic about the subject and so offering the courses.

Acoustics is generally considered as a specialty and studied following completion of undergraduate studies. Once a new staff member is employed by an acoustics consultancy or in an acoustics area within a government agency, their supervisor usually seeks a means to quickly develop their skills in acoustics. It is at this point there can be a problem because either the education opportunities do not exist within a reasonable distance from the place of employment or the requirements for the program are such that it is difficult to undertake the study while continuing to work effectively.

One option is for the organization to provide in-house training, careful supervision and mentoring. For larger organisations such an approach can be successful but it involves considerable commitment from management to maintain an effective program while balancing the demands of the consultancy. For smaller organizations this approach may not be practical.

Another option is to support staff to attend courses that are available from external providers. Such short courses typically run from a few days to a week and are offered at irregular times and require attendance at specific locations. Although acoustics related short courses are not prescriptive training they are content driven and the content is determined by the provider. This may not be suitable as it may be too general, not have sufficient depth in the main areas of work or be too specialised

Another option is for the employer to support staff to undertake a formal post graduate program in acoustics. A Master of Engineering Science in Noise and Vibration has been offered by the University of NSW (some of which could be taken in distance mode). This program is no longer offered because the number of students did not meet the minimum number defined by the University for a viable program. So in Australia there are no formal post graduate programs focusing on acoustics. Some Universities do have a research focus on acoustics and vibration and consequently offer opportunities for post graduate research as well as offering some courses on acoustics and vibration. However ability to undertake these courses is dependent on location as there is a requirement to attend some or all of the classes at the University.

In the early part of this decade this was the situation faced by the consulting companies in Australia. They were expanding and seeking new staff but there were few, and decreasing, appropriate education opportunities for developing the skills of these staff. The Australian Acoustical Society (AAS) and the Association of Australian Acoustical Consultants (AAAC) identified the problem and agreed that both organisations should cooperatively take the necessary steps to establish a framework to ensure the sustainability of acoustics education for the benefit of the future of the profession. An education committee was set up and a set of criteria for an appropriate program of study determined.

DEVELOPMENT OF THE PROGRAM

The first step was to establish the brief for the education program that would best meet the needs of the various stakeholders. It was agreed that the essential requirements for the program included:

- Rigorous yet practical program offering courses covering the range of topics that are encountered in consultancies and agencies;
- Formal assessment process involving submissions and examination for each course;
- Available in the distance learning mode with no requirement to attend one particular institution at a specified time;
- Separate modules, each dealing with a different topic to allow for the priorities of each student;
- References to relevant Australian standards, policies, regulations and guidelines;
- Flexible completion time to allow for the varying work pressures;
- No formal education prerequisites to commence the program; and
- Possibility to convert or upgrade to a formal post graduate program of study.

The AAS/AAAC education committee (comprising representatives from both organisations) looked at the options that existed in Australia and internationally for appropriate further education programs. A number of Universities offered courses within other programs of study but these required the student to attend that particular institution for the classes and this may not fit with the working requirements. Limited opportunities existed for specializing in acoustics subjects within a more general Master program of study. But again these were specific to certain locations and required attendance at the specific institution either throughout the term or for a residential period. Internationally the Postgraduate Diploma in Acoustics and Noise Control offered by the UK Institute of Acoustics (IOA) [2] seemed to best meet most of the requirements that had been identified. It has been running since 1975 and:

"...was set up to provide specialist academic training to meet the educational requirements for Corporate Membership of the Institute of Acoustics. Over the years the course has become well established as providing high level training in real-world practical acoustics."

This diploma is normally undertaken during a formal university program of study. However there is also the option of a tutored distance learning scheme. The committee began communication with the IOA to ascertain further detail on the program and assess its suitability for Australia. It soon became clear that this program did provide an excellent basis for an Australian program but that it would need considerable updating and revision to include Australian references. The IOA program is also in the process of revision in part to update but also to restructure to meet the requirements of the Bologna agreement which is aimed at making academic degree standards and quality assurance standards more comparable and compatible throughout Europe. A major effect of this restructure would be to have fewer courses in the program. Yet one of the criteria for the Australian program was to have a number of modules each focusing on specific topic areas.

From negotiations with educational institutions it was realised that it would be difficult and time consuming to formally establish a program of study based on the IOA diploma structure, within a University structure. There was also concern that the flexibility sought in the presentation of the course could be a barrier to such a formal program. It was therefore decided to develop the program as a series of short courses, or modules, in the first instance. This offered flexibility in terms of development and presentation of the modules to best meet the needs of the profession. This short course program was established under the Business Service Office of the University of New South Wales at the Australian Defence Force Academy. Should any students seek to pursue further study/research at a University the rigour and assessment within the program would assist with the determination of appropriate credit. For those pursuing a career in the industry it is intended that successful completion of all the modules will lead to the award of an AAS/AAAC Diploma.

Wonderful cooperation was achieved with the IOA and the material for the distance learning version of the first and compulsory module of the IOA Diploma course, General Principles of Acoustics, was provided to form the basis for the first module of the Australian program. The IOA also provided a sample test and sample tutorials. While the basic concepts of acoustics are clearly the same, considerable work was necessary to revise and update this material but the overall syllabus was maintained. It was then decided that further modules would be developed within Australia.

STRUCTURE OF THE PROGRAM

The Australian Professional Education Program in Acoustics will comprise a number of modules of which the first, General Principles of Acoustics, is compulsory. It is recommended that the module on Experimental Methods be undertaken second. This experimental module differs from those with similar titles in other programs as it focuses on the basic requirements for the range of measurements that are encountered in practice and is not based on measurements in a laboratory. The subsequent modules will include; Architecture and Building Acoustics, Environmental Acoustics, Noise and Vibration Control, Vibration and Shock and a project

Enrolment for each module is individually processed with the only prerequisite being successful completion of the General Principles of Acoustics module. The fully flexible nature of the program means that students can register at any time during the year. They are sent the material electronically for that module via secure pdf files. Each module includes assignments and experimental projects which are returned for assessment. There is no requirement to go to a common centre for the experimental work or the examination. These are done with the support from the senior staff of the consulting companies from the AAAC.

The experimental work has been designed to be undertaken using equipment that is widely available in consultancies and using noise and vibration sources that can easily be found. For example the work for module one includes an investigation of the importance of the time period for the measurement of time varying noise sources' and a second part requires measurement around a constant source, such as a vacuum cleaner, in different acoustic environments. The vibration experiment requires measurement on the casing of a machine and on a suspended floor. A senior consultant provides the supervision locally for the experiments. The registrants from one city are encouraged to undertake the experimental work together but each registrant must submit an individual report on the measurements. The assessment is based on their interpretation and comments on the findings of the experiment.

The examination for each module is offered four times a year. Supervision is provided by the registrant's employer. The examination file is sent in confidence to a nominated person who arranges for the invigilation of the test and return of the test paper and answer books.

No formal tutorial system has been implemented but ad hoc assistance is available. The consulting companies have given strong support for the program and provide assistance to the registrants as necessary. The registrants can also contact the program organisers by email or phone to obtain assistance.

IMPLEMENTATION OF THE PROGRAM

The first module, General Principles of Acoustics, has now been available for 2 years. The content is based on the IOA module of the same name but updated and amended to include modern measurement and analysis methods and relevant Australian standards, regulations, guidelines etc. Each section of this module has been reviewed by at least two senior acoustic consultants. Subsequent modules will not be based as strongly on the IOA modules. Reviewers with appropriate experience and expertise will be selected either from the consulting industry or from academia.

The promotion has been via a web page and an item in the AAS journal. The demand from consulting companies for this education for their new staff was immediately apparent with almost 40 registrants during the first year, of which only three were not employed as acoustic consultants. In the following six months a further twenty registered with four from agencies or smaller consultancies.

Only 25% of the 2007 registrants have completed the module within the year. The reasons for non-completion are varied. A few have left their employer and are no longer interested in pursuing the program. A few are taking a break from work for extended travel and intend to return to the program. The majority have stated that work pressures have made it not possible yet for them to devote the time necessary to work through the content of the module. For some, their supervisor has confirmed this is the case. For others it is very

likely that there is a lack of motivation to complete the work. This is a common experience with distance learning programs and the introduction of hard deadlines will assist with setting priorities. As the employer has paid for the registration for most of these registrants it is anticipated that the necessary motivation to complete will also be provided in due course. As the program continues and more registrants come from outside consultancies and so in house support, various options making use of the internet for communication amongst the registrants are being considered in order to maintain motivation for completion.

CONCLUSION

To address the need for sustainable and ongoing education programs to develop the skills of new staff for acoustical consulting companies a fully flexible distance learning program has been developed. This program is based on the model of the UK IOA Diploma with the first module covering the same syllabus of the first module of that program. The individual modules of the program are being offered via a short course program managed by a University. The issuing of an AAS/AAAC Diploma is being considered as a method of formalising the completion of all modules. The content of the program has been developed with the advice from the experienced consultants and each section of each module is carefully reviewed. The supervision for the experimental sessions and the examination is provided by experienced acoustics consultants. The demand for this education has been shown by the high number of registrants for the first module. The low percentage of completions after the first year is a little disappointing but reflects the difficulties of undertaking distance learning programs of study while working full time. Further modules for the program are being developed with strong support from the acoustic consultancies.

REFERENCES

- [1] Walters T, Acoustics: Looking for a sound career move?
<http://www.science-engineering.net/acoustics>
- [2] Institute of Acoustics Postgraduate Diploma in Acoustics and Noise Control
<http://www.ioa.org.uk/diploma.asp>