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THE ROLE OF QUALITY STANDARDS IN ACOUSTIC INSTRUMENT MANUFACTURE

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1. INTRODUCTION

The overall objective of any measurement sequence must be to perform a quantification within known, and acceptable, limits of accuracy. In the case of "noise" measurements there are a number of links in the chain between the acoustic source and the observed subjective reaction and each of these can have a significant bearing on the quality of the result. The instrument is only one of these links but is one that is focused on first in order to determine the accuracy of the measurement; often to the detriment of the overall quantification being undertaken. Performance of the instrument alone can not be the sole arbiter of accuracy, both the relevance of the criteria that model the human reaction and the competence of the operator have just as much influence on the result. These latter points however, are not for discussion here and attention will be concentrated on the measurement hardware.

2. BACKGROUND

Modern instrumentation is extremely complex and is invariably operated by persons who are unable to assess the overall accuracy of the equipment, even if the specialist test equipments needed were made available to them. They have to rely upon forming an overall impression from those qualities that they are able to judge. Just as the consumer forms his opinion of the wholesome properties of a ready meal from its appearance, smell and his prior knowledge of the claimed ingredients. This assessment is performed with out any detailed knowledge of the dietary effect of the chemical processes used to bring about the conditions that would lead to the conclusion the manufacturer requires of the consumer. We have to rely upon the integrity of those who set up to supply us. Confidence is a key factor. By way of example I am perfectly prepared to pay many hundreds of times the material cost of a piece of plastic strip simply because I really believe that the markings on it are exact millimetres.

Previous reputation is therefore a key determinant of our impressions of quality. In a stable industry with only a few suppliers, reputation could be earned and protected as an asset of both the user and the supplier. To day the situation is changing rapidly, advancing technology is bringing new concepts to the market when users have not had time to build up a working knowledge [1,2]. At the same time commercial pressures are resulting in the down sizing of the major players[3] resulting in many spin off operations as staff are shed. With the growing internationalisation of the market many of these small players are finding their way into new markets that are geographically remote from their support base. A climate is being created where the traditional assessments of quality are no longer able to serve and protect the user. The old Anglo Saxon tradition of caveat emptor can simply not apply in our high technology and rapidly changing industry. New arrangements therefore, need to be made to ensure that the high standards of design and manufacture established by those companies that have been active in the market for the past 25 years or more are preserved.

As users are no longer able to form their own opinions as to the quality of these new developments they must look to "sub contract" the assessment to external agencies. This simple fact is the driver for the changes that are now becoming apparent in the acoustic instrumentation industry.

3. OPTIONS FOR CHANGE

There are a number of parallel activities that are currently in train that are being applied to meet the needs the professional acoustic engineer. These are either specifically driven by the acoustic community or are of a more general nature.

From within the acoustic community the highest profile activities relate to the formal sound level meter verification programmes under BS-7580[4] and the requirement for official calibration under the NAMAS scheme. In many ways these reflect the moves within the UK towards the practices that have been accepted in the teutonic and latin countries of the EEC for many years. They have always had a strong sense of awareness of the concepts of legal metrology and this has provided a system that proves that a measurement system is intrinsically accurate and stable before it is put into service. Instruments that are verified as such are then put through an official calibration procedure, usually every two years. Having completed this process the results produced using the instruments gain a certain legal status; it is simply not allowed for anyone to dispute the results. Any fees raised or criminal charges initiated based on the measurements can not be contested on the basis that the results are wrong, the idea being to simplify any chance of legal disputes ensuing. These are concepts quite different from the "weights and measures" inspections that were common in the English speaking world and they are much more suited to our high technology industries.

Throughout the world the Bauartpruefung of the PTB in Germany and the Homologation of LNE in France have become accepted as the independent seal of quality approval for sound level meters with many of the established names like Cirrus Research plc having equipments certified. As the UK scheme comes into effect this should further strengthen the confidence of instrument users here.

These arrangements do of course have a down side. The type approval programmes are very expensive and time consuming, thereby lengthening the design and development phase of the equipment. It is usual for the manufacturer to have to provide five samples of each instrument fully documented with a 'carnet de mesure' and this equipment is then continuously tested over a period of many months. The costs of these activities are naturally reflected in the purchase price of new instruments. Once an instrument is approved its design is "frozen" and this can be a break on the incorporation of modifications or improvements as the model moves through its life. Another view is that the approvals programme is a barrier to entry to the market, unless a manufacturer can see a certain level of sales for his product it would not be worth while submitting the equipment to the testing authorities. Many small suppliers, particularly those with limited engineering resource or who are located in the more distant parts of the world could be effectively blocked from the market by these arrangements. To put this into context the following quotations are taken from sound level meter catalogues currently being distributed in the USA, where they do not have any concepts of legal metrology in the European sense,

> *Now pollution that can be HEARD can be checked easily!*
> *Frequency weighting A simulates the ears sensitivity according to graph A according to IEC 123. (Measurement range 40-120 dB(A))*
>
> *Model SL120. $147.20. Abbeon Cal Inc. Catalogue 2002A page 113.*

Signal oscillator calibration and capacitance microphone ensure high reliability and stability base upon decibel weighting A (dBA) according to ANSI.
Model 407703. $104. Abbeon Cal Inc. Catalogue 2002A page 116.

Similar statements are made relating to the same instruments in the Davis Instruments catalogue.

None of these instruments are actually claimed to meet the standards, but the quoting of standard numbers in the product specification could well be confusing to the non expert. Similarly it is reasonable to suspect that some of the very low cost meters that actually claim compliance could well have difficulty proving it. Blocking such equipment from the market may not be such a bad thing after all!

Of the general quality schemes the best known is ISO-9000 (BS-5750). It calls for an independent and on going surveillance of the organisations quality managements systems, and these must be documented and reviewed through regular self audits. This has relevance to the acoustic instrument industry in as much that it applies a discipline on the operations, a discipline that engenders consistency in their activities. A by product of the audit programmes is the necessary data and platform for continual improvement programmes. The systems become very bureaucratic and it must be borne in mind that the scheme only verifies that the management methods of the business will consistently deliver their product or service to the standards they proclaim, be that good or bad in terms of the markets expectations.

4. CONCLUSIONS

There is growing need for there to be independent systems that will provide users of instrumentation with the confidence that the equipment they chose will perform to specification. These systems must run in parallel with the "competence" programmes for technicians making noise level measurements, for it is only with both the best equipment and trained operators that meaningful results can be obtained.

The current moves towards legal metrology encompassing both pattern verification and regular calibration will provide the corner stone of these requirements. Many manufactures may chose to go down the assessed quality route as it represents a good business discipline, such an approval would not however be such an important benefit to users.

5. REFERENCES

1. A.D. Wallis & S. O'Rourke — "Testing Computer Based Instruments" NAMAS 1993

2. P. Darlington & R. Tyler — "Developments in Digital Signal Processing for Hand Held Electroacoustic Instrumentation" Euronoise 92.

3. Danish Financial Journal — "Borsens Nyhedsmagasin", August 1991

4. BS-7570: 1992 Verification of Sound Level Meters.