Provision of Technology Transfer Clubs for Pressure, Humidity and Mechanical Metrology. ITT no. MPU8/45.7

April 1997 to September 1999

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October 1999

Abstract

The National Physical Laboratory (NPL) has operated the Humidity Club, Pressmet and the Mechanical Metrology Association, on behalf of the National Measurement System Policy Unit (NMSPU) of the Department of Trade and Industry (DTI), during the period from the end of April 1997 to September 1999 as specified in Contract ITT No. MPU 8/45.7.

Pressmet was originally established at NPL in 1995, the Humidity Club in 1981 and the Mechanical Metrology Association in 1997.

Feedback from Club members suggests that they benefit from being a Member of these Clubs in a variety of ways and for a variety of reasons. The growing membership trends seen over the term of the contract indicate that the benefits provided to Club members (annual and special-interest meetings, newsletters, web-site listings and hot links, membership directories, market digests, promotions, and so on) have been well received, but it is essential that these benefits are continually reviewed, added to and improved upon, with continual input from members, in order to maintain this growing membership of the Clubs in the future.

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Approved on behalf of the Managing Director, NPL,
by Dr G R Torr,
Head, Centre for Mechanical & Acoustical Metrology.

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1. INTRODUCTION

The National Physical Laboratory (NPL) has operated the Humidity Club, Pressmet and the Mechanical Metrology Association, on behalf of the National Measurement System Policy Unit (NMSPU) of the Department of Trade and Industry (DTI), during the period from the end of April 1997 to September 1999 as specified in Contract ITT No. MPU 8/45.7.

This report summarises our progress over the entire contract term. It also makes use of the attached appendices to refer, in particular, to the last 6 months of previously unreported progress (the latest newsletters, events and updates on membership trends).

Details on progress of the Clubs activities up until March 1999 have already been reported in detail in restricted Interim reports No.1 through to 4, to the NMSPU.

2. BACKGROUND INFORMATION

Pressmet (pressure measurement club) was originally established at NPL in 1995, the Humidity Club in 1981 and the Mechanical Metrology Association (covering force, torque, hardness and extensometry) in 1997.

2.1 Purpose of the Clubs

The Clubs provide an arena for members to exchange ideas, with each other and NPL, on measurement matters, best practice, international developments in metrology, the latest advances in techniques and instrumentation as well as the opportunity for discussing, learning and raising specific problems or issues of concern. The Clubs also provide members with the opportunity to influence future DTI supported measurement programmes in the UK. These aims have been achieved by providing the following benefits per Club each year:

- An annual meeting
- One/two special interest meetings
- A newsletter
- A Membership Directory
- World Wide Web coverage via the NPL site
- Group e-mails for Clubs communications
- Special offers and discounts for Club members
  A network of supporters
- Invitation to DTI programme formulation meetings

3. MILESTONES AND DELIVERABLES

3.1 Agreed Milestones

The agreed milestones/deliverables were as follows.

Milestone 1: Start-up meeting with NMPSU

Milestone 2: Interim reports (6 monthly)

Milestone 3: Final report

Milestone 4: Club information on NPL web-site

Milestone 5: Production of Membership Directories

Milestone 6: Establishment of the new Mechanical Metrology Association (force, hardness, extensometry and torque)

Milestone 7: *Not used.*

Milestone 8: Completion of review and prioritisation exercise

3.2 Milestone progress

All of the above Milestones have been completed.

Milestone 6 was postponed by 2 months in order to launch this new club (the Mechanical Metrology Association) at the first ever NPL Club Luncheon event and Manufacturing Week exhibitions, which ran alongside the launch at the NEC, Birmingham in November 1997.

The original Milestone 7 was incorporated into Milestone 6 above, as agreed with NMPSU at the Start-up meeting in 1997.

4. PROGRESS

4.1 Reports and monitoring of progress

A review of Clubs activities was presented to DTI (NMSPU) and their Measurement Advisory Committee (MAC) Mass Working Group at annual reviews at NPL in November 1997 and November 1998.

Six monthly interim reports have been submitted throughout the contract term, on time, as follows: September 1997, March 1998, September 1998, March 1999.

This document represents the Final report (Milestone 3).

4.2 Membership Directories

Throughout the term of the contract, hard copy Membership Directories have been produced annually and issued to members in each of the three Clubs. Copies of the 1997/8 and 1998/9 issues for each of the three Clubs have been provided with previous interim reports. A listing of Club members is given in Appendices 1, 2 and 3.

In addition to hard copy Membership Directories, electronic versions can be found on the NPL web-site under each of the appropriate Club pages. Each entry provides the opportunity for members to be linked to the NPL web-site via hot-links which have been especially set up (web-site addresses are listed in Section 6.4 of this report).

Approximately 60% of our members are now connected to the Internet and have their own web-sites and so benefit from these hot-links. All members feel that they have benefited from this service because of the extra publicity it allows them through a listing of their company profile and products/services.

4.3 Club Newsletters

Over the term of the contract, 3 newsletters have been issued each year for each of the three Clubs, totalling 9 newsletters.

Copies of the 1997/8 and 1998/9 newsletters of each of the three clubs have been presented in previous interim reports.

Copies of the latest 3 newsletters are attached to this report as follows; Mechanical Metrology Association News Autumn 1999 (Appendix 4), Humidity News Winter 1999 (Appendix 5) and Pressmet News Autumn 1999 (Appendix 6).

Club members continue to contribute their own measurement related articles and stories for inclusion in each newsletter.

4.4 A network of support for the clubs

NPL has built up a strong network of supporters for the clubs who take an active role in many of the club activities and meetings, as well as helping with promotional activities. Support such as this has provided further added value to the Club contract. Valuable support has regularly been provided by: external contacts, trade associations, press, NPL links across the laboratory and by Club members themselves.

Some examples of their contributions are listed below.

<u>Quality Today and Nexus Media Ltd</u>

Benefits of the Quality Today collaboration include:

A) For members:
- the opportunity for 50% reduction for Quality Today subscriptions
  Up to 50% discount on Quality Today supported seminars, exhibitions and events

B) For NPL/DTI:
  Free editorial space in the Quality Today journals
  Co-hosting and organisation of meetings and associated literature production

Introductions to industrial contacts
Free promotional opportunities for NPL at Quality Today events

BSSM (British Society for Strain Measurement)

BSSM have been supporting the Mechanical Metrology Association since it was established in November 1997. They have helped us to organise a large special interest meeting at NPL on Dynamic Testing and Calibration (1998). There is also an ongoing agreement whereby BSSM offer our Association members discounts on all their relevant meetings, training courses and seminars.

In terms of publicity and promotion, they provide us with the opportunity to include flyers with BSSM mail-shots and also allow us to have access to their Strain journal (circ. 3,000) for publicity purposes (adverts and flyers)

BMTA

The British Measurement and Testing Association, BMTA, provides promotional support by allowing NPL space in their newsletters to promote relevant club events and, on occasion, allowing NPL to include flyer inserts with their own mail-shots. BMTA have also recommended key speakers for some of our club seminars.

Infopress

This PR company carried out a brief consultancy into the new Clubs in October 1997. They presented an impartial review of our present and intended Club activities and suggested ways forward for improving the services we offer to members.

Members themselves

We have actively encouraged Club members themselves to take an active interest in steering and promoting the Clubs. Several members have now been involved in offering their own premises and facilities to run Special Interest Meetings, whilst also providing lunch for attendees. Members have also been keen to disseminate copies of our annual newsletters to their own customer contacts on our behalf.

Pan-NPL collaborations

Collaboration with other NPL Scientific Centres and Clubs has provided the opportunity to gain efficiencies and offer better value for money to our members. Collaboration has also opened up new avenues for promoting our Clubs.

Examples include:

- Humidity Club's link with the NPL Thermophysical Properties Awareness Club (TPAC) activities

- Pan-NPL involvement in the Dynamic Testing and Calibration Forum, held at NPL in May 1998, involving NPL's Mass, Pressure, Materials, Software and Acoustics groups

- Mechanical Metrology Association links with NPL's Materials Clubs.
- Links to NPL's Corporate Marketing and Communications Department activities such as the Competing Precisely and NMP events.

4.5 One-to-one meetings and visits log

This feedback activity has been ongoing throughout the contract term, with records of comments from Club members being logged and acted upon whenever possible.

5. CLUB MEETINGS

5.1 Special Interest Meetings - Summary

May 6th 1998: Dynamic Testing and Calibration Forum, run by the Mechanical Metrology Association at NPL

The Mechanical Metrology Association held its first Special Interest Meeting in May 1998 at NPL which highlighted and dealt with the topical and problematic area of dynamic measurements. Members of Pressmet were also invited to attend. This successful meeting (open to non-members as well) was attended by over 60 people and involved key industrial figures - such as Dr Ray Lohr, MD of Instron - giving of their time freely to chair the various sessions.

As well as bringing the members of the MMA and Pressmet together for the first time, this meeting drew on expertise from across the different Scientific Centres of NPL as well as from external organisations. The event was supported by BSSM (British Society for Strain Measurement), BMTA (British Measurement and Testing Association) and DTA (Dynamic Testing Agency).

June 4th 1998: Special Interest Meeting on Low Dew Points, run by the Humidity Club at Michell Instruments, Cambridge

In response to requests from members, the Humidity Club held its first Special Interest Meeting in June 1998 at the site of club member, Michell Instruments, Cambridge where the topic of low dew point measurements was discussed. Feedback from members indicated that such meetings were an extremely useful addition to the club, allowing them to concentrate on more focused aspects of humidity measurement.

A measurement inter-comparison between participating members is scheduled to take place as a result of this meeting.

August 26th 1998: Special Interest Meeting on Equivalence of standards & mutual recognition of calibrations - from the perspective of pressure and vacuum, run by Pressmet at NPL

This Pressmet special interest meeting took place in August 1998 with a guest speaker from

NIST covering issues related to the rapid growth in international trade, end-user expectations of product performance, and consequent questions about the equivalence of results and traceability of pressure measurements.

September 9th 1998: Torque '98 seminar, run by the Mechanical Metrology Association at the National Motorcycle Museum, Birmingham

In collaboration with Nexus Media, the Mechanical Metrology Association held a National Torque seminar (Torque '98) at the National Motorcycle Museum in Birmingham in September 1998. The event ran alongside a Competing Precisely event called Promoting the UK's Measurement Infrastructure.

Torque '98 itself was attended by approximately 60 people, including some 20 non-Club members. Topics covered included: automotive torque monitoring by GKN Westland Aerospace, Rotary Torque by Scientific Electro Systems, Germany and a presentation by Ford on Global Torque Auditing.

September 1998 (4-dates): NMS Mass Programme Formulation Meetings open to all three Clubs, held at DTI and NPL

All our Club members were invited to attend the recent round of NMS Mass Metrology Programme formulation meetings (focus groups) giving them the opportunity to have a direct input into the new 1999-2002 programme.

October 8th 1998: Special Interest Meeting on Low Dew Points - a second discussion run by the Humidity Club at NPL

Following the success of the first special interest meeting on low dew points (held at Michell Instruments, Cambridge in June 1998) NPL arranged for a follow-on session to take place at NPL in October 1998 (coinciding with the Humidity Club's annual meeting).

October 14th 1998: Special Interest Meeting on the Selection, Use and Calibration of Medium-vacuum Gauges, run by Pressmet at NPL

This meeting was designed for those who use vacuum gauges only as ancillary items of equipment and who are less familiar with the rather different rules-of-thumb that apply in the pressure range 10^{-1} Pa to 10^{3} Pa.

March 11th 1999: Special Interest Meeting on Trace Moisture in Gases - a follow-up discussion, run by the Humidity Club at Endress and Hauser Ltd, Manchester.

IMA Ltd agreed to host this meeting on behalf of NPL and offered us the facilities of their distributors, Endress and Hauser Ltd in Manchester, providing lunch for attendees as well. A popular option for our Club members.

May 1999: A special invitation to attend the NPL Thermophysical Properties Awareness Club (TPAC) annual meeting for Humidity Club members, held at NPL

A special invitation was negotiated for Humidity Club members to attend the TPAC

(Thermophysical Properties Awareness Club) Annual Meeting held in May 1999 at NPL. This provided an opportunity for both sets of Club members to come together for the first time.

May 18th/19th 1999: Special Interest Meeting - Torque '99, run by the Mechcnical Metrology Association at the National Motorcycle Museum, Birmingham.

Following on from the successful Torque '98 seminar held in Birmingham in September 1998, a further collaboration with Nexus Media enabled us to stage another Torque seminar at the National Motorcycle Museum, Birmingham in May 1999. Torque '99 ran alongside a Competing Precisely seminar, also open to our members, on the benefits of accurate measurement for quality and profitability in the manufacturing and process industries.

Again, the event was well attended and members commented on how much they benefit from and enjoy these annual Torque events.

The Torque meetings are open to non-members (at a higher rate) but this has encouraged many non-members to join the Association. Meanwhile, our existing members benefit from meeting and hearing presentations by end users and any new companies present. Presentations included Dynamic Torque and BSI Standards by AWS Ltd and Rotational Torque by HBM Ltd.

September 23rd 1999: Special Interest Meeting on Manufacturers' Specifications, run by Pressmet at NPL

This meeting was very well attended by members and sparked a lively debate about the variations and inconsistencies in manufacturers' specifications of the performance of pressure instruments.

November 2-4th 1999: Club Day Meetings, run by all Clubs and held at the NMP Conference, Brighton

The Humidity Club, the Mechanical Metrology Association and Pressmet will be represented at the NMP Conference on November 4th 1999, with each Club running a meeting as part of the NMP Conference Club Day. Details of the meetings and agendas can be seen in NMP Conference agendas (Appendix 7).

An exhibition stand devoted to Clubs is being provided at the NMP Conference, allowing the opportunity for our clubs to be promoted throughout the three-day event.

5.2 Annual Meetings

In accordance with the contract, an Annual Meeting was held for each club each year.

Pressmet:

March 1997 at NPL

This meeting included a presentation by Dr Andrew Wallard, Deputy Director of NPL, on international comparisons and the equivalence of certificates issued by national measurement

institutes. Other topics covered included, the progress of the Guide to the Measurement of Pressure and some pressure-specific problems with 'equivalence'.

2nd April 1998 at NPL

Presentations at this annual meeting included: Bob Spencer of the Proudman Oceonographic Laboratory presented a talk on Deep Ocean and Remote Sea Level Measurements in the South Atlantic using Pressure Sensors, GEC Marconi Materials Technology Ltd talking about the Measurement of Low Pressure in Semiconductor Processing Equipment and EA Technology on Pressure Leak Detection in High Voltage Insulation.

16th March 1999 at NPL

This meeting included a number of presentations from organisations including: ESA/ESTEC presenting a paper on Spacecraft Propellant Gauging, Pressure Measurements in the Off-shore Industry by Shell Expro, and Pressure Measurement in Nuclear Fuel Enrichment by Urenco (Capenhurst) Ltd.

Humidity Club:

2nd October 1997 at NPL

Presentations at this annual meeting included: the New Face of the NPL Humidity club by Ray Wilson of NPL, UKAS Accreditation by John Andrews of UKAS, and Survey results - is there a need to improve the provision of national standards for humidity, by WS Atkins.

October 1998 at NPL

Topics presented at this annual meetings included: Humidity Standards at DELTA in Denmark by Tom Hjerting Nielsen, NAMAS Accreditation - an Outline by Will McGivern of UKAS, and Humidity Measurement - an Industrial Application by end-user David Porter of Domnick Hunter

4th November 1999, Brighton

This meeting will run as part of the NMP Conference event in Brighton with guest speakers to include club members Robert Benyon from INTA, Spain and Richard Ayres from British Aerospace. Our guest speaker (non-member) will be Dr Colin Forno from JRC, Italy talking about the Effects of Humidity on Artwork and Related Aspects of Conservation.

Mechanical Metrology Association:

4th November 1997, at the NEC, Birmingham

This meeting acted as the launch of our new Mechanical Metrology Association and ran alongside the first meeting (luncheon) ever held for all NPL clubs.

8th October 1998 at NPL

One of the most interesting presentations was that by Prof Andrew Hunt, a consultant, who provided our Club members with a summary of his study, carried out on behalf of NPL, on Standards for the Measurement of Dynamic Force, Torque and Pressure.

4th November 1999 at the Brighton

This meeting will be held as part of the NMP Conference event in Brighton. The highlight of this meeting is a guest speaker from the Formula One team, Stewart Grand Prix, who will speak about the Importance of Measurement in Motor Racing.

6. PROMOTIONAL ACTIVITIES AND SPECIAL MEMBERS' OFFERS

6.1 Members' offers

In order to provide our Club members with maximum value NPL has organised specially negotiated discounts and offers.

Club members (though mainly the MMA) have been able to take advantage of some 25 specially negotiated discounted rates on various seminars, meetings, training activities and publications. These have included: 50% discount at the INSPEX seminars each year, between 20-50% off a large range of BSSM seminars, training courses and conferences, up to 50% discount on the Guides to Measurement publications, 50% off Quality Today magazine, free attendance at the NMP Club day event (Nov 1999) and so on.

6.2 Promotional Activities and Press

NPL Clubs Luncheon - November 1997, NEC Birmingham: The first luncheon of its kind, bringing together members of all NPL clubs for a seminar and lunch at the NEC, Birmingham, alongside the Manufacturing Week/INSPEX Exhibition.

Guides Launch - 28th April 1998, NEC: Members of the Mechanical Metrology Association and Pressmet and were invited to attend the Launch of three new measurement guides (Mass & Weight, Force, and Pressure & Vacuum) at the NEC in April 1998. Club members were given a free copy of a Guide of their choice (worth £30) and free entry to the C+I Exhibition for the remainder of the day.

The Clubs have also been promoted at the following events:

- November 1997 at the NEC (Manufacturing Week)
- November 1997 at the Metropole Hotel alongside the 1997 Metrology Award events
- November 1997 at the NEC, Griffen Suite while hosting the first ever NPL clubs luncheon event.
- April 1998 at the Humidity International Conference held at Kempton Park, Surrey

- April 1998 at the NEC alongside the Guides launch promotional activities
- August 1998 at the 11th International Mechanical Engineering Conference in Oxford (courtesy of BSSM who provided the Mechanical Metrology Association with free exhibition stand).
- May 1998 at the Dynamic Measurement and Testing Forum held by the Mechanical Metrology Association
- September 1998 at the National Motorcycle Museum, Birmingham (Torque '98 event)
- November 1998 at the Park Lane Hotel alongside the 1998 Metrology Award events
- May 1999 - Torque '99 seminar, Birmingham, National Motorcycle Museum alongside QM99 exhibition and associated events.
- November 2-4th, Brighton Metropole Hotel on the NMP Conference stand (NMS clubs) and during various meetings on Clubs day (4th November).

And in the following press:

Strain journal (August issue), Quality Today (various issues), New Scientist (Nov 98), Engineering Distributor and BMTA News. The NPL Press Office, with Infopress plc, also issued a press release on the establishment of the MMA to some 33 relevant journals and trade magazines.

6.3 Direct Mail activities

Over 60 mail-shots have gone to members of all three Clubs over the contract term and of these approximately 50% have been carried out on our behalf by Club supporters or other members.

Co-ordination of some mail-shots across NPL has helped us to achieve the maximum possible cost effectiveness and benefits to the DTI customer and Club members alike. Examples of this include use of the following mailings: NPL Annual Report, Serco World (articles have included promoting the launch of the new MMA - December 1997), Quality Today journal, Strain journal and BSSM mailings.

A mail-shot to 300 potential new MMA members was sent out to NPL's force calibration customers in August 1999.

6.4 World Wide Web

A description of each club and an on-line application form for membership can be found on the following pages of the NPL web-site:

Humidity club information: www.npl.co.uk/npl/clubs/humidity.html

Humidity Club newsletter preview at:
www.npl.co.uk/npl/news/newsletters/humidity/hum98s.html
and
www.npl.co.uk/npl/news/newsletters/humidity/hum98w.html

Pressmet Club information: www.npl.co.uk/npl/sections/pv/pressmet.html

Pressmet newsletters at : www.npl.co.uk/npl/news/newsletters/pressmet/index.html

Mechanical Metrology Association details: www.npl.co.uk/npl/clubs/mmclub.html

Mechanical Metrology Association newsletters:
www.npl.co.uk/npl/publications/news/mech/index.html
and,
www.npl.co.uk/npl/old_newsletters/mech98s.html

Note that, since the NPL web-site addresses can change from time to time, information on the Clubs can always be found by using the SEARCH facility and entering the Club name from the NPL Home Page.

All three clubs have a full listing of the Membership Directory, with company profiles, online on the NPL web-site. These Directories not only give a detailed listing for each member but also link directly to the member's own company home page. This facility is well appreciated and known to be a very popular benefit of Club membership.

Pressmet also has a service locator built into the Club web-pages which provides a fast route for members to identify suitable suppliers for equipment and services for pressure measurement.

7. ADDITIONAL SERVICES PROVIDED TO CLUB MEMBERS

In addition to the contractual obligations specified for this project, two additional services were tried, tested and adopted for the Clubs, providing added value to the DTI customer and members. These additional services are described below.

7.1 Group e-mails for Clubs

E-mail services have been set up for members of all three Clubs which allow members to communicate with each other instantly via special NPL group e-mail addresses.

Typical examples of the use made of the group e-mail are: allowing NPL to address members at short notice to provide meeting updates or special offers, as well as the option to provide a point of focus for members' enquiries. Some enquiries are answered by the Club members, as well as by NPL staff.

In Pressmet, the group e-mail facility has also been used to disseminate up-to-date information about international trading issues which affect many members. Examples include: the agreement on mutual acceptance of product and process-related measurements - taking steps

toward eliminating redundant product testing and other technical obstacles that can impede the flow of goods between the world's largest trading partners.

7.2 Free Information Bulletin

NPL has provided members of all three clubs with free 6-monthly Information Bulletins (Market Digests) which update them on special topics such as the latest news on instruments being developed or sold in a particular scientific field and market and company reports from the trade press.

8. MEMBERSHIP

8.1 Membership Growth and Recruitment Activities

Memberships of all three clubs has grown substantially over the term of the contract.

Overall membership trends for each club over the term of the contract can be seen in Figures 1, 2 and 3.

Membership has also started to open up to include members with broader interests. For example, for the first time in the Humidity Club we have a major food company and a gas regulatory body in the membership.

The last year has also seen a growth in the number of end users joining the three Clubs, especially the Mechanical Metrology Association.

Just as important is the number of people who are attending the Club events. Whilst it is difficult for some companies to justify club membership, their support and attendance at some of our Special Interest Meetings (often open to non-members for a fee) remains strong.

9. QUALITY PROCEDURES

NPL has been certified for its compliance to ISO9001 by LRQA. The following NPL Quality procedures were directly applicable to this project at onset:

QPNPL/B/004: Management of Large projects
QPNPL/D/004: Technology Transfer and Awareness Club Activity
QPNPL/D/002: Organising a Conference or seminar
QPNPL/G/006: Processing of Large Project Proposals and Contracts

10. PROJECT MANAGEMENT

Project Manager: Anne Kearney
Programme Manager: Graham Torr

11. FINAL CONCLUSIONS AND RECOMMENDED WAY FORWARD

Feedback from Club members suggests that they benefit from being a member of these Clubs in a variety of ways and for a variety of reasons.

In general terms, many members have commented favourably on the Special Interest Meetings which were introduced as a new benefit of membership during this contract. Such meetings give the attendees the opportunity to learn about new developments (or problems) in areas specifically of interest to them, indeed the meetings to date have mainly been based on topics suggested by the members themselves. Such meetings also provide the opportunity for the members to mix and talk to one another, thereby sharing experiences and using the opportunity to initiate new business links. It is also an ideal ground for sharing best practice advice and for discussing new measurement requirements or needs (such as extending a particular range of measurements or carrying out intercomparisons). In short, this is a key membership benefit and it is recommended that it is developed even further in the future.

As we move into the year 2000 it is essential that the operation of the Clubs moves forward in a similar way by availing of the increasingly wide range of electronic systems advances on offer. Within the current contract, Club members have expressed their appreciation of services such as the Members' listings on the NPL web-site with 'hot-links' to their company web-sites. Similarly, the group e-mail facility has found a growing number of uses through the way it allows simultaneous communication between the members.

An increasing percentage of our members are now enrolling for membership by downloading a Membership application form from the NPL web-site. Even this process is fast becoming out of date and in the future running of the Clubs it is recommended that members be provided, for example, with the opportunity/option of on-line, real-time electronic membership application forms and on-line payment systems. Such ideas will continue to bring the operation of the Clubs up to date with the technology now available whilst also making life simpler for the members and managers of the Clubs alike.

As mentioned in the main text of this report, a network of supporters has been built up in order to provide members and the DTI customer with additional special benefits. UK members have frequently commented on how much they enjoy the privileged opportunity to attend various non-Club, but related, meetings at zero or reduced price through our supporters and their activities. The opportunities for further collaborations and support of this kind should continue to be explored in the future.

Membership has been growing consistently for all three Clubs throughout the term of the contract. Similarly, the type of members that the Clubs have been attracting has started to open up on both sides of the manufacturing and instrumentation core to include academics and end users. This 'spread' is an important feature to retain and build on in the future as it expands the range of activities and opportunities a Club can provide which in turn will benefit the members and the DTI customer alike. Likewise, a growing membership in general is important so that existing members are continually being exposed to new contacts, can discuss issues in broader 'measurement' terms, and continually learn from each other with regard to their work, measurement applications, problem solving, quality, training issues and so on.

Club newsletters have always been recognised as a benefit of Club membership. However, feedback from some members indicates that a newsletter is not in fact 'news' if it is only issued once a year. Therefore, it is recommended that more frequent, and perhaps briefer, newsletters should be issued to Club members in the future.

The provision of hard copy Membership Directories as a membership benefit has received mixed responses. These listings of company descriptions and specialist areas is undoubtedly a good source of information both for the Club managers and the members. However, with access to the web now so widespread, it may be that an on-line version of the Directory will soon be sufficient.

From conversations with various Club members, it seems there is a surprising amount of weight given to continuity of the identities of the Clubs. This should be borne in mind in the future development of the Clubs.

NPL MECHANICAL METROLOGY ASSOCIATION LIST OF MEMBERS

APPENDIX 1

COMPANY	CONTACT NAME
APEK Design & Developments Ltd	Paul Flower
Absolute Calibration Ltd	M Funnell/R Tolliday
Advanced Witness Systems Ltd	R Sangster
Aircraft Research Establishment	David G Coulton
Amber Instruments Ltd	Paul Armstrong
Andrew Hunt Consultants Ltd	Andy Hunt
Atlas Copco Tools UK Ltd	Carl Klinkenborg
Avery Berkel	David Tyler
British Aerospace Airbus Ltd	E O'Brien
British Society for Strain Measurement	Jim MacKinnon/Dave Mitchell
Brunel Centre for Manufacturing Metrology	BE Jones
CSIR	Ben Burke
CV Instruments Ltd	John Beaumont/John Stead
Calibration Systems Ltd	Alan J Coster
Cleveland Metrology & Calibration Centre	DB Glencorse
Crane Electronics Ltd	Robert Hewitt
DERA	EJ Adams/J Evans
Dartec Ltd	Robert EM Ball
Electromac Measurement Services Ltd	KM Walton
Ford Motor Company	Alan Brady
Foundrax Engineering Products Ltd	Charles Austin
GB Quality Assurance	G Barley
GKN Westland Aerospace Aviation Support Ltd	Mike Groves
Glaxo Wellcome	Geoffrey R Lloyd
HBM Ltd	Robert Barrett
Hounsfield Test Equipment Ltd	T Adams
Indentec Hardness Testing Machines Ltd	JT Sidaway/Barry Dee
Industrial Measurements Ltd	Paul D Miles
Instron Ltd	Raymond D Lohr/CS Bahra
Donald Jay	Donald Jay
Joint Research Centre	Colin Forno
Kistler Instruments Ltd	Chris Collins
Kvaerner Davy Weighing Systems	A Bowen/AG Hardy
L.O.T.-Oriel Ltd	Angela Carslake
Peter R Lallem	Peter Lallem
Liverpool Trading Standards	Peter Devaney
Lloyds Beal Limited	GD Evans
Lotus Engineering	Raymond Hill
MIRA	Clifford Northall
Measurements Group UK Ltd	Geoff Mordan
Mitutoyo (U.K.) Ltd	Jon Hobden
National Physical Laboratory	Anne Kearney
Nobel Systems Ltd	Marketing Manager
Norbar Torque Tools Ltd	Barry Pratt
Novatech Measurements Ltd	AR Pitcher

continued/

Posidonia SrL	Ettore Ardito
R.D.P.-Howden Ltd	Nigel Metcalfe
R & H Testing Services	Roy Chamberlain
Rolls-Royce - Marine Power	Sue Hart
Rover Group Ltd - Quality Assurance	John Fletcher
Rover Group Ltd - Advanced Power Train Technology	Geoff Calvert
Sandberg	Simon Clarke/Brian Whitney
Sheffield Testing Laboratories Ltd	David Tame
Shering Weighing Ltd	SL Bannister
Smiths Industries	David Gill
South Yorkshire Trading Standards Unit	MJ Buckley
Star Industrial Tools Ltd	JW Chandler
TR Fastenings Ltd	Calum McMinn/Nick Gordon
Tedea Huntleigh	Anthony Cross/Gareth Robberts
Testing Calibration Services Ltd	Ian C Clayton/Roger L MacArthur
Thames Side-Maywood Limited	Mike Baker/Gary Chater
Timesync Controls	Colin Boyles
Torquemeters Ltd	Ben Van Millingen
Turner Powertrain Systems	Neil Smith
United Kingdom Accreditation Service	MJ Crossman
University College London	Dr SJG Taylor
University of Cambridge	Roger Denston
University of Liverpool	Head of Engineering Department
University of Southampton	JM Barton
University of Wales	Chris Graves

APPENDIX 2

COMPANY	CONTACT NAME
ABLE Instruments & Controls Ltd	Dave Quelch
Absolute Calibration Ltd	MR Funnell
Air Products plc	Greg Connell
Alpha Moisture Systems	H Patel
AromaScan	Martin Henery
Automatic Systems Laboratories	Philip C Amos/Alexander Mathie
Bio Products Laboratory	David R Evans
BOC Gases	C Geoghegan
Brownell Ltd	Martin Partridge
DELTA Electronics Testing	Tom Hjerting Nielson
DELTA F Corporation	Raymond Ford
DERA - Pyestock	PK Watson
Domnick Hunter Ltd	TA Kelly
Eaton-Williams Group Ltd	GC Stapley
Electronic Temperature Instruments Ltd	David Carter
Farfield Sensors Ltd	Neville Freeman
Gallaher Ltd	IP Stewart
GEC-Marconi Electro-Optics Ltd	Graham A Couser
GEI European Technical Centre	RF Pragnell
General Eastern Instruments	Ken Murray
Heinz Lucius	Heinz Lucius
Humitec Ltd	Peter Greaves
INTA, Instituto Nacional de Tecnica	Robert Benyon
International Moisture Analysers Ltd	David Parker
Justervesenet	Crina Rauta
Kodak Ltd	CD Barr
MBW Elektronik AG	Daniel Mutter
Meteorological Office	Alan Osmond
Michell Instruments Ltd	Mike Bannister
Moisture Control & Measurement Ltd	Richard Berka
National Physical Laboratory	Stephanie Bell
OFGAS	J Aucott
Panametrics Ltd	Trevor French/Des Regan
Procal Analytics Ltd	Robin J Hutchinson
Process Analyser Systems Ltd	Tim C Butler
Protea Electronics	Jan Hattingh
Protimeter PLC	Fil Dadachanji
Rotronic AG	Daniel Ritler
Rotronic Instruments (UK) Ltd	Robin Farley
Shaw Moisture Meters	Phillip Heyworth
Sira Test and Certification Ltd	Richard Brook
South Bank University	P Xiao
South Yorkshire Trading Standards Unit	MJ Buckley
Talbot Scientific Ltd	OP Rimmer
TRANSCO	Sati Lochab
TÜV Product Service Ltd	RL Harris
United Biscuits	Jeremy Bagley
Universal Calibration Laboratories	Clive Clifford-Smith
University of Westminster	Philipp Plathner
Vaisala Ltd	David Cridland
Wabco Automotive U.K. Ltd	B Thomas

APPENDIX 3

Pressmet Membership List

Absolute Calibration Limited	Mike Funnell
Antech Engineering Ltd	Jim Gunn
Bailey and Mackey Limited	Eric Sparks
BJS Research	Bernard Skillerne de Bristowe
BNFL - Magnox Generation	John Kew
BOC Edwards	Waleed Qader
Bourdon Sedeme Ltd	David Price
Bristol Industrial and Research Associates Limited	Richard Ward
British Aerospace Defence Limited	Tom Whalley
British Pressure Gauge Manufacturers Association	Kenneth Trevor Lee
Chell Instruments Limited	Paul Marks
CLRC Daresbury Laboratory	Ron Reid
Conax Buffalo Technologies	Tony Henton
DACO Scientific Limited	Peter Kerrison
Dartec Limited	Karl Johnson
Department of Trade and Industry	Graham Reed
DERA Porton Down	Andy Sedman
DERA Pyestock	Per Watson
DH-Budenberg Limited	Malcolm Parkinson
Druck Limited	John Curley
Electrical Mechanical Instrument Services (UK) Ltd	Des Gorra
ETL (Explorocean Technology Ltd)	Derek Noble
Facsimile Engineering Co.	Peter Nutting
Furness Controls Ltd	Colin Rendle
Gauge Developments Limited	Nicholas Smith
Hi-Pro Pressure Products Ltd	Roger Andrews
Hiden Analytical Limited	Terry Whitmore
Humitec Ltd	Peter Greaves
Institute of Measurement and Control	Michael Yates
Intermes NV	Phillippe De Ryck
Keller (UK) Ltd	Ian Clark
Kistler Instruments Ltd	Christopher Collins
Lee Vacuum Services Ltd	Robert Andrew
Lucas Control Systems	Gary Mills
Marconi Marine (VSEL) Limited	Paul Wilcock
Mensor Corporation	Paul Neilson
Meteorological Office	Alan Osmond
Metrology Limited	Mark Hay
MKS Instruments UK Limited	Andrew Dixon
National Physical Laboratory	David Simpson
Ovredal TCM S.L.	Arnstein Ovredal
Paul Sharples Consulting	Paul Sharples
Penny & Giles Aerospace Limited	Dave Cooke
PMC Consultants	Peter M Clare
Pressurements Limited	Mark Bryant

Proudman Oceanographic Laboratory	Peter Foden
Read Scientific	Bill Read
Rolls Royce plc	Chris Burden
RS Servicepoint	Michael Fawcett
Ruska Instrument Corporation	Mike Collins
S I Pressure Instruments	Harbi Mankia
SAE Gauges Limited	Alan Ellis
Sensit Limited	Gary Swindell
SIRA Test & Certification Limited	Phil Endersby
Smiths Industries Aerospace	David Gill
Solartron	Norman Reed
South Yorkshire Trading Standards Unit	Mike Buckley
Theta Systems Limited	Neil Morgan
Transducer Laboratories	Marion McAlinden
United Kingdom Accreditation Service	Phil Clow
Universal Calibration Laboratories	Clive Clifford-Smith
Universal Instrument Services Ltd	Neil Watson
University of Oxford	David Witt
Weston Aerospace	Peter Mason

ISSUE 3 • WINTER 1999

Mechanical Metrology Association *news*

HV 10, HRC

Welcome to the 3rd edition of the Mechanical Metrology Association's newsletter, bringing you information about our Association, our members' activities, NPL and news and events of interest to those with an interest in mechanical measurement. Our Association is now almost 3 years old and the membership continues to grow rapidly with an increase of over 58% in the last year alone.

NPL Force Section on the Move

A major redevelopment of the new NPL site is taking place under the Private Finance Initiative (PFI). Construction of NPL's new laboratory is progressing rapidly and the force standard machines and staff will be relocated during 2000.

Relocation will, inevitably, interrupt our measurement services for a few months but efforts are being made to offer our customers special services so as to limit any inconvenience. For example, early calibrations before the due date and at a discounted price.

For full details contact Dave Elkington, NPL (Extension 6344)

In this issue:

NPL National Physical Laboratory

NEWS ITEMS

New NVQ in Metrology

BSSM (British Society for Strain Measurement) and NPL are teaming up to co-produce a module in force, torque and strain - which will hopefully form part of the new NVQ in Metrology (level 3) being launched this year by the course organisers, Brunel University and Engineering and Marine Training Associates (EMTA). We will keep you posted on progress.

For further details of the new NVQ contact: Caryl Brown, Brunel University Tel: 01895 203361

Load Measurement Goes Digital

Electromac, together with an instrument supplier, is producing load cells that can interface directly with a computer and claim that interference or noise over long distances become far easier to handle making on-site calibration a simpler exercise. The company says that the signal conditioner called a 'D' cell is actually installed inside the load cell so there is virtually no chance for interference, and allows the equipment to be used in tight spaces.

Contact: Carl Taylor, EMS Ltd Tel: 01332 669911 Fax: 01332 669313

DTI Doubles Grant for Companies

DTI recently announced that it is to double its annual budget for Teaching Company Scheme (TCS), a scheme which helps small to medium sized companies innovate. TCS supports key developments in companies by putting in money to encourage collaboration with universities and other knowledge-based organisations (including NPL). The vital characteristic of any company/knowledge-based collaboration supported by TCS is an increase in the company's profitability produced as a result of a transfer of expertise from the knowledge-based partner.

TCS can be applied in virtually any discipline and for a wide range of potential users. Past programmes have had objectives such as: to develop software for machine vision systems; to implement an integrated marketing strategy; to identify a new range of botanical extracts; to establish a product design capability; to develop a new gas burner capable of satisfying future emission control standards; to develop a world class electroforming capability; to develop & implement a strategic marketing plan and a marketing information system.

A common feature of all collaborations supported by TCS is that the main work is performed at the company by recently qualified graduates normally on two-year contracts. The graduates are supervised by the company and by a supervisor from the knowledge-based partner.

TCS is sponsored by: Biotechnology and Biological Sciences Research Council; Department of Health; Department of Trade and Industry; Engineering and Physical Sciences Research Council; Economic and Social Research Council; Industrial Research and Technology Unit (Northern Ireland); Ministry of Agriculture, Fisheries and Food; National Assembly for Wales; Natural Environment Research Council; Particle Physics and Astronomy Research Council; and the Scottish Executive.

For more information contact: Neil Cryer
Tel: 01367 245200
E-mail: office@tcd.co.uk
Internet: http://www.tcd.co.uk

NEWS ITEMS

Standards Work on Dynamic Torque Calibration

Dynamic torque standards work has been proceeding at pace following the successful MMA meeting of May 1998 exploring Dynamic calibration and testing, instigated by BSI committee ISE/NFE 4.1.2.

The scope of the committee work is to enable continuous calibration of torque measurement devices as required by industry, whilst maintaining traceability to primary standards as used in BS 7882:1997amd1.

The committee has been able to identify and relate all aspects of the measurement chain. This includes mechanical and electronic instrumentation with visual displays and/or digital output, powered applicators as well as methods of recording the data by data logging, video recording etc. The work is continuing with the quantification of the parameters to produce classification tables for measurement devices.

The overall aim is to produce a workable, cost-effective calibration document to accurately quantify torque-measuring devices, by class, as they are used in practice. Whilst this work only covers the very low end of the dynamic range, hopefully it will lead to standards for higher dynamic rates. This work is a significant step towards this goal.

For further information contact Ron Sangster, Advanced Witness Systems Ltd, Tel: 01295 266939.

BSSM Special Offer to MMA Members

BSSM is offering members of the Mechanical Metrology Association the opportunity to attend their meetings, seminars and other events at a discounted rates of up to 50%.

BSSM was formed in 1964, with the following aims

- promote interchange of information on the engineering aspects of strain measurement
- initiate technical discussions via seminars, publication of papers and exhibitions.
- disseminate ideas on new equipment, techniques and educational matters relating to strain measurement.

Interests include the topics of resistance strain gauges, photo-elastic techniques and associated topics such as vibration, temperature measurement, transducer design, finite element, material properties and data logging.

For further details contact: Sue Hart, BSSM. Tel: 01332 661461 Fax: 01332 622940

Measurement Guides – 50% Price Reduction for MMA Members

Following a recent collaboration with Institute of Measurement and Control, we are now pleased to offer the Pressure, Force and Mass Guides to our club members for half price, at £15. This offer is valid on all our remaining stock of the Guides.

Non club members can also take advantage of a 30% saving (£20 per new copy) on the Guides from either the Institute of Measurement and Control or

continued on page 4

Torque '99 Seminar Held on 18 May 1999, National Motorcycle Museum, Birmingham

On the 18 May 1999 NPL and organisers, Nexus Media Ltd were pleased to run Torque '99, the second successful annual meeting of this kind.

Thanks to this year's presenters listed below;

- Dynamic torque update - Andrew Hunt Consultants (on behalf of NPL)
- Dynamic torque and BSI standards - Ron Sangster of AWS Ltd
- The global torque programme at the Ford Genk facility - Luc Franssens, Ford
- Rotational torque - Bob Barrett, HBM Ltd

Contact: Anne Kearney, NPL (Extension 6557) or Brendan Coyne, Nexus Media Ltd Tel: 01322 660070.

NPL. Further discounts available for orders of 6 or more copies.

Further details of the Guides can be found on the NPL web-site:

www.npl.co.uk/npl/publications/guides/mmguides.html

To purchase copies, contact: Sylvia Chantler, NPL Library (Extension 6880) or, Michael Yates InstMC Tel: 020 7387 4949

TRAINING AND SEMINARS

Increased Demand for Training at Measurements Group UK Ltd

Association member Measurements Group UK Limited have over 30 years experience in training engineers in the latest Experimental Stress Analysis techniques. Their regular courses are run by Senior Technical Support Engineers in their fully-equipped Training Centre in Basingstoke, Hampshire. The popularity of these practical courses and workshops has led to an increase in the number of training opportunities available in 1999, which will continue throughout the year 2000.

The 2-Day **Strain Gauge Workshop** offers an introduction to strain gauges but it also deals with all the practical aspects of surface preparation, bonding, attaching leadwires and protection. Although structured for the engineer/technician in particular, participation will also prove beneficial to anyone involved with strain gauges and is highly recommended by the BSSM as essential preparation for all levels of their approved Certification Scheme for Strain Measurement Personnel.

A practical **Instrumentation Day** is specifically designed either as an extension to the previous course or as a stand-alone day introducing strain gauge instrumentation and measurement techniques. A short lecture is followed by an experimental session encouraging hands-on experience of both static and dynamic instrumentation systems. Every experiment has been developed to demonstrate a practical application whilst allowing each instrument to be used to its full potential.

The **Transducer Day** may also be used as a supplement to the Strain Gauge Workshop, it is nevertheless extremely useful as independent training. This course covers both theoretical and practical sessions where, after consideration is given to the choice of materials and techniques for individual applications, each participant builds his/her own transducer which is then tested and calibrated.

Recently extended to three days, the **Photostress Workshops** offer a comprehensive introduction to the PhotoStress technique. This hands-on course guides participants through the background, theory and craft of the experimental stress analysis system before examining applications, problem solving and design validation.

In-house tailor-made courses can be arranged to suit any individual company or educational establishment's exact requirements with the subject matter structured to meet local demands.

For further information contact:
Catherine Keams, Workshop Administrator
Measurements Group UK Limited
Stroudley Road, Basingstoke
Hampshire, RG24 8FW
Tel: 01256 462131
Fax: 01256 471441
E-mail: mguk@compuserve.com or visit the Web Site at www.measurementsgroup.com

NEWS ITEMS

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Contact: Anne Kearney, NPL (Extension 6557) or Brendan Coyne, Nexus Media Ltd Tel: 01322 660070.

International News

Force and Torque Projects in South Africa

The South African National Metrology Laboratory (NML) is undertaking important projects in its force and torque measurement capability. New hardware and software will further automate their measurement services.

A device was designed and built by the NML workshop to cover the range from 10 N.m to 1000 N.m. Plans are to be submitted for step funding in the new financial year to design and build a similar device for torque load from 1 N.m to 10 N.m.

by Louis Marais and Benny Burke
CSIR, South Africa
Tel: +27 12 841 3481
Fax: +27 12 841 4458
E-mail:bburke@csir.co.za

New Developments in Hardness Measurement

Compound Testing

Two testing fixtures specially designed by Indentec illustrate the technological span of components that need to be hardness-tested nowadays to satisfy QA regimes.

At one end of the spectrum, the Stourbridge company has engineered a fixture to solve the problem of securing large curved surfaces during Rockwell testing. Designed to grip spades, shovels and post-holing tools, the quick-acting fixture uses self-aligning three-point supports and upper and lower clamping arms to grip variously curved faces of the implements. A hole in the upper arm provides access to the test point for the indenter as the machine's test table is raised and the test initiated.

The other fixture is capable of accommodating three different camshafts for Ford and Jaguar car engines. Designed for shafts of varying configurations and lengths, it enables the cam lobes on each to be automatically located in the correct positions for Rockwell testing.

The camshaft is mounted in a hinged carriage between spring-loaded centres adjustable for length and lockable. Each lobe is positioned for testing by sliding the carriage on a guide rail until the cam is beneath the indenter, where its test positions are positively fixed by indexing latches.

During the test procedure, both shaft and hinged carriage are supported by the raised test table as the test load is applied. Indentec says that fixtures can be custom- engineered for virtually any component.

Touchscreen

Indentec consider that touchscreen technology is one of the most significant advances in hardness testing in the last decade. The innovation promises a great deal, removing any final constraints on the direct use of the hardness-testing machine in data capture and analysis.

It also brings hardness testing into line with the general movement towards touchscreen techniques in production. A modern digital hardness tester with a touchscreen can become an integral part of the manufacturing cycle. It can deliver detailed test, specimen and identifying data for statistical process control in real time. The technology is available on both Rockwell and Vickers hardness testing.

Ford was one of the first to adopt touchscreen testing, at the company's Metallurgical Laboratory at Bridgend. The laboratory, which uses hardness testing to investigate and develop case-hardening specifications, installed a touchscreen digital Vickers tester with a built-in microscope and retractable nose-mounted indenter.

Trevor Sidaway, Managing Director,
Indentec Hardness Testing Machines Limited
Tel: 01384 896949
E-mail: mail@indentec.demon.co.uk

IN HOUSE NEWS - IN HOUSE NEWS - IN HOUSE NEWS

New DTI Mass Programme Underway

A new three-year programme of work on mass related measurements at NPL has been agreed by the DTI. The programme starts in October 1999 and its contents in the areas of force, torque, and hardness have been strongly influenced by contributions made by MMA members.

The programme includes measures to improve the force measurement services at NPL including automation of the deadweight force standard machines and the calibration data collection process. Following on from the MMA meeting on dynamic force, a report will be written on the errors introduced by using statically calibrated load cells to make non-static measurements and their economic significance.

A torque calibration service will be established and the reference machine enhanced to enable non-static torque measurement. A more accurate depth sensor will be developed for the hardness machine used to make Rockwell measurements and a range of calibration services will be set up covering common scales and indenters. An in-depth study on the estimation of hardness uncertainties will be carried out and a report written.

A series of intercomparisons of force, torque and hardness standards is planned with other national measurement institutes to ensure international agreement.

For more information - contact David Elkington. (Extension 6344)

New Standards for Hardness

In the wake of the recent ISO standard for Vickers hardness measurement (ISO 6507), come standards for Brinell (ISO 6506) and Rockwell (ISO 6508) hardness. Just published, these standards replace existing British and European standards which will be withdrawn. The draft standards are in the same format as ISO 6507 with part 1 laying down the test method, part 2 covering calibration of testing machines, and part 3 describing the calibration of reference blocks.

All international standards are a compromise and there are clauses in the current standards that the UK believe require amendment and we will be pushing for these at the 5-year reviews. Some of the more significant aspects of the draft procedures are as follows.

The introduction of hard metal (WC) balls for all Brinell measurements and as an option for Rockwell (denoted HBW and HRW to distinguish them from measurements made with steel balls labelled HBS and HRS).

The use of the newton equivalents of the old kilogram-forces has been maintained.

The requirement for indirect and direct verification has been introduced. Indirect verification is the checking of a machine using reference hardness blocks whilst direct verification is the checking of the indenter, force, testing cycle, and for Rockwell, the depth sensor. A direct verification (including the indenter!) needs to be carried out in the following circumstances:

- when the machine is installed or after having been dismantled
- reassembled or after relocation
- when the result of the indirect verification is not satisfactory
- when indirect verification has not been made for a period greater than 12 months

A new standard on instrumented indentation hardness testing (Universal Hardness) is being drafted and the UK is one of the three countries doing the drafting.

For more information on the draft standards, contact David Elkington, NPL. (Extension 6344)

Events Calendar 1999 - 2000

4 Nov **Mechanical Metrology Association meeting**
Metropole Hotel, Brighton.
Contact: Anne Kearney, NPL.
Tel: 020 8943 6556

9-11 Nov **Autotech 1999**
NEC, Birmingham
Contact: IMechE, Stephanie Love
Tel: 020 7973 1312

11 Nov **Education in automotive engineering**
NEC, Birmingham
Contact: IMechE
Jonathan Narbett,
Tel: 020 7973 1261

15-19 Nov **Manufacturing Measurement and Automatic Inspection**
Brunel University
Contact: Eileen McCarthy.
Tel: 01895 203224

23 Nov **Automotive multi-media systems**
IMechE HQ, Automobile division
Contact: Meleesa O'Neill.
Tel: 020 7973 1245

30 Nov **Residual Stress Measurement**
British Steel, Rotherham.
Contact: Jim Mackinnon, BSSM
Tel: 0141 577 6297

5-9 Mar 2000 **Smart structures and Materials and Nondestructive evaluation of aging infrastructure**
SPIE Marriot Hotel, Newport Beach, California, USA
Tel: (1)360 676 3290
e-mail: ss-nde@spie.org

5-7 Sep 2000 **Modern Practice in stress and vibration analysis**
University of Nottingham
Contract: Dr A Becker
Tel: 0115 951 3791
Fax: 0115 951 3800

19-21 Sep 2000 **Structural Integrity in the 21st Century**
DTA and AEA Technology event
Cambridge, UK Contact: Cheryl Gleave, AEA,
Tel: 01925 252322

FUTURE EVENTS

Tuesday 30 November 1999

Residual Stress Measurement at British Steel, Swindon Technology Centre, Rotherham

A one-day meeting has been organised at British Steel, Rotherham which will cover various aspects of residual stress measurement, including among other things, residual stress measurements on rails, modeling, control of residual stress in pipe welds and a tour of the British Steel R+D facilities.

Mechanical Metrology Association members and BSSM members can attend for £50 +VAT. All other attendees £60 +VAT.

For full details and/or registration please contact: Jim Mackinnon, BSSM.
Tel: 0141 577 6297 Fax: 0141 577 6281

5-7 September 2000

Modern Practice in Stress and Vibration Analysis University of Nottingham

Themes are to include: dynamics and vibrations, thermal stresses, fatigue, creep, wear, sports engineering, finite element techniques, fracture mechanics, damage assessment and metal forming.

This event is being co-sponsored by the Institute of Physics, the Institution of Mechanical Engineers and the British Society for Strain Measurement.

For further details, please contact:
Dr A Becker
University of Nottingham
Tel: 0115 951 3791
Fax: 0115 951 3800
E-mail: a.a.becker@nottingham.ac.uk

Formula One team Speaker at November MMA Meeting

This year the MMA's annual meeting and seminar will take place at the Brighton Metropole Hotel on 4 November. The meeting will be part of a larger event, the National Measurement Partnership Conference, which runs from 2-4th November. Free entry is available to Association members for the 4th November 1999.

Contact: Anne Kearney, NPL
(Extension 6557)

Further Information

For further details on the Mechanical Metrology Association please contact
Anne Kearney, NPL. Tel: 020 8943 6557 Fax: 020 8943 6940
E-mail: anne.kearney@npl.co.uk

Centre for Mechanical & Acoustical Metrology
National Physical Laboratory, Teddington , Middlesex, United Kingdom TW11 0LW

Telephone: 020 8977 3222 (Switchboard) Telephone: 020 8943 + Ext (Direct line)
Helpline Tel: 020 8943 6880 Fax: 020 8943 6458 E-mail: enquiry@npl.co.uk
Internet: www.npl.co.uk

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APPENDIX 5

ISSUE 3 • WINTER 1999

Humidity Club news

In this issue:

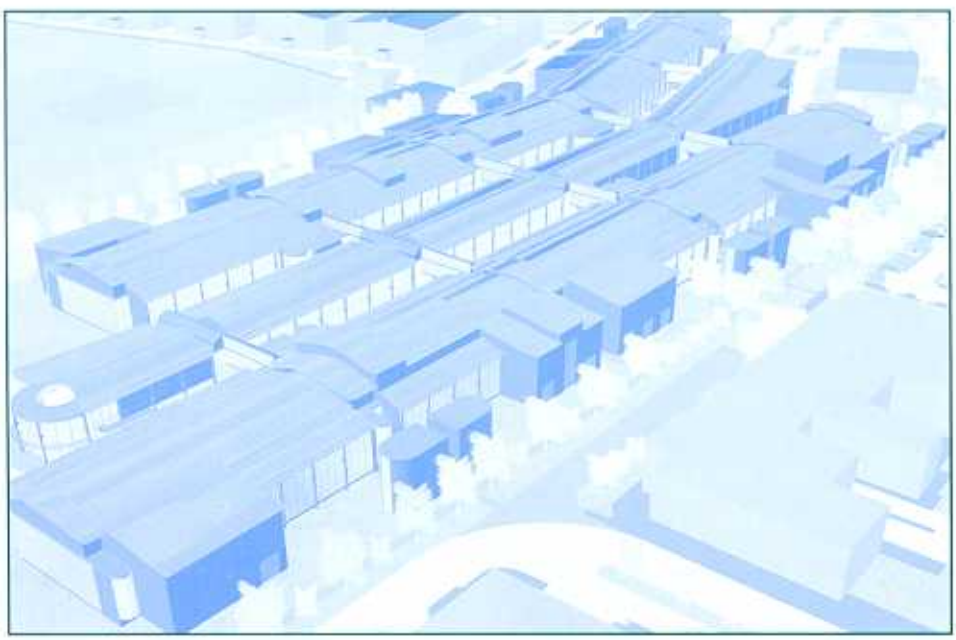
WELCOME to the third issue of the Humidity Club's newsletter, bringing information about our club, members' activities, NPL, news and events to those with an interest in humidity measurement.

We are pleased to announce that Humidity Club membership has increased by 24% in the last year. Thank you all for your continued support.

New Building for National Physical Laboratory

A major redevelopment of the NPL site is taking place under a Private Finance Initiative (PFI). Construction of NPL's new laboratory is progressing rapidly and the humidity area is likely to move after May 2000. Efforts are being made to offer our customers special services so as to limit any inconvenience. However, there is likely to be a break in the availability of dew-point and relative humidity calibrations. Anyone requiring NPL humidity calibrations around the time of the move should enquire well in advance so that the work can be scheduled.

Contact: Mark Stevens or Stephanie Bell, NPL
Tel: 020 8943 6402



NPL National Physical Laboratory

Water Activity Measurement

The measurement of relative humidity dates from the time of Leonardo da Vinci, who designed what possibly could be described as the first hygrometer using gravimetric principles. What is perhaps not such common knowledge is that the measurement of equilibrium relative humidity (expressed as %ERH), or water activity (expressed in the range of 0 to 1 in units 'aw'), may have also been around for a very long time. Water activity is primarily a measure which relates to the quality of a product, and it is principally used in the food and pharmaceutical industries. The whole concept of preservation is based on the lowering of water activity to inhibit bacterial growth, and two of the major additives used for centuries to do just that are salt and sugar. The Egyptians too were familiar with the concept, and their methods of preserving mummies may have been the first applications of product preservation by replacing water with a liquid with a low enough water activity value to prevent deterioration. It is not clear if this principle was known at the time, but the knowledge of selecting the right combination of oils and other substances to achieve this was developed to a fine art!

The first "modern" research into the effects and measurement of water activity began in 1949, but there seems to be a very slow response from the food and pharmaceutical industries to accept the benefits of this research in their quality control procedures. The Food and Drug Administration (FDA), and the Hazard Analysis and Critical Control Points (HACCP) programmes have both included water activity as a method of controlling product quality during the production and packaging phases.

The availability of low cost accurate measuring systems for water activity makes it so easy to determine 'aw' values with the minimum of effort. Reference standards in the form of saturated and non-saturated chemical compositions are also readily available with traceable calibration. Perhaps the concept of accreditation of testing and calibration laboratories in the European region has accelerated the process of providing measurement traceability to national standards. The reference standards currently available from one of the best known manufacturers of water activity equipment is based on chemical traceability. While this may perhaps not be an acceptable substitute for traceability based on measured results, this highlights another interesting aspect in the field of water activity measurement, namely the fact that the 'aw' value of a mixture product can be calculated – and then confirmed by measurement!

In metrology it is difficult to find another field where there is such a rate of development as in the humidity field. The Third International Symposium on Humidity and Moisture, which was held in London in 1998 under the auspices of the NPL and sponsored by the EC Standards Measurement & Testing Programme and the Institute of Measurement and Control, detailed much of the progress which took place in the thirteen years since the previous symposium. The proceedings are available from NPL, and anyone with an interest in the various aspects of humidity measurement in air, solids or liquids will find these publications of great value.

Water activity is bound to become one of the key measurement parameters in the food and pharmaceutical industries in the years to come. It will be especially challenging to meet the requirements in terms of quality and shelf life in Europe where the use of preservatives is being phased out. The selection of natural substances without changing the taste of a product will see to that.

This overview of water activity measurement and the important role it plays in manufacturing or preserving products for human and animal consumption has only touched on some of the principles, and anyone with an interest in this subject is encouraged to do a search on the Internet. In-between the sites giving details on water activities like swimming and sailing, there are many interesting sites with research information on the subject!

Contact: Jan Hattingh, Protea Electronics, South Africa
Tel: 00 27 011 786 3647
Fax: 00 27 011 887 1479

Dew Point vs. Frost Point

Measurements Statistical Process Control (SPC) techniques have become increasingly popular, and with good reason. When properly used, they provide a cost-effective way to enhance product yield and quality. The key to successful SPC implementation is the monitoring and control of critical manufacturing: parameters such as force, speed, temperature, pressure, flow, and moisture.

The sensors used to quantify these parameters must possess two key performance attributes: repeatability and absolute accuracy. These characteristics make it possible to closely scrutinize a parameter's low-level drift from nominal so that corrective action can be taken before such drifts adversely affect product yield. Conversely, drift and limited differential deadband or hysteresis effects are perhaps the most undesirable characteristics in sensors used for precise process monitoring.

Importance of moisture measurement

Of all the parameters to be monitored and controlled, the reliable measurement of moisture is unquestionably the most difficult because it is a function of the sensor technology itself as well as of the moisture parameter of interest. If RH measurements are required, for example, a bulk polymer electrolytic or lithium chloride sensor would seem to suffice. Because the typical hysteresis effects of these sensors range from 0.5 to 1% rh, however, the resulting uncertainty limits measurement sensitivity and resolution. On the other hand, aluminium oxide and capacitive technology (viewed in many cases as ideal for trace moisture, dewpoint, ppm, or % rh) also exhibits unacceptable levels of hysteresis, with sensor drift rates that may exceed the actual process parameter's deviation. All of these sensor technologies are acceptable when used within their associated performance envelopes. Of course, the user would also
weigh the cost of a particular technology against its performance.

Benefits of optical hygrometry

To optimize moisture measurement and minimize hysteresis effects, optical hygrometry must be used. This technique incorporates a thermoelectric heat pump that precisely regulates the surface temperature of an optical mirror in order to maintain a threshold formation of dew. Because the sensed temperature of the mirror precisely determines the actual prevailing dew point, it is the most fundamental and accurate moisture measurement technique. Hysteresis is virtually too small to measure; sensitivity is typically on the order of less than 0.03 °C dew point (DP). Absolute accuracy is a function of the mirror's temperature sensor performance. From the dew point value, moisture parameters such as % rh, wet bulb, vapor pressure, and ppm (volume) are obtainable once prevailing temperature and pressure are known. The higher cost of optical hygrometry measurements is offset by the enhanced product yield and quality delivered by tracking low-level moisture trend deviations.
"Process dew point"
is assuming a new importance in a variety of processing and manufacturing applications where moisture is critical to end product yield and quality, but continuous optical hygrometry does present some unique problems. A continuous mode of measurement requires that a dew level >0 °C is always present on the mirror surface. This is easily accomplished in laboratory metrology where the sample gas is typically pure air or nitrogen, but real-world process environments are somewhat harsher. Particulates can adhere to the wetted mirror surface; dust particles, for example, once in contact with the wetted surface will remain there and act as moisture-storing sponges. This stored moisture creates an artificially high dew point measurement. The result is a sluggish and inaccurate measurement while the sample gas dew point decreases to equilibrium. An in-line particulate or coalescing filter can be the source of a similar moisture equilibrium problem. In tracking a fluctuating moisture range, rising values always permit a quick response. On declining moisture levels, however, there is a measurement lag while the filters shed their moisture content. The lag can generally be reduced by operating at the highest possible sample gas flow rate.

Disadvantages of measuring frost point

When continuous dew point systems operate at 0 °C DP, they exhibit a characteristic uncertainty that is a direct result of their mode of operation. What actually occurs is that they begin measurements on dew point but later reflect frost point. The difference at 0 °C DP is trivial, but as the temperature changes linearly and reaches, say, -20 °C DP, the discrepancy might reach 2.0 °C, which is unacceptable. To better understand this phenomenon, consider that the continuous mode of chilled mirror hygrometry requires an optical signal indicating that dew formation is being maintained on the mirror. At dew points below 0 °C, moisture on the mirror will eventually freeze and a crystal lattice much like a snowflake will slowly grow. Moisture, however, can exist in a liquid state for prolonged periods of time below 0 °C, depending on variables such as molecular agitation, convection rate, sample gas temperature, dew point depression, and contaminants. From a measurement perspective, the period of time required to normalize the frost point values may vary from immediate to several hours and it is unpredictable.

For further information contact:
Fil Dadachanji at Protimeter plc.
Tel: 01628 472722

DTI Doubles Grant for Companies

DTI recently announced that it is to double its annual budget for Training Company Scheme (TCS), a scheme which helps small to medium sized companies innovate. TCS supports key developments in companies by putting in money to encourage collaboration with universities and other knowledge-based organisations (including NPL). The vital characteristic of any company/knowledge-based collaboration supported by TCS is an increase in the company's profitability produced as a result of a transfer of expertise from the knowledge-based partner.

TCS can be applied in virtually any discipline and for a wide range of potential users. Past programmes have had objectives such as: to develop software for machine vision systems; to implement an integrated marketing strategy; to identify a new range of botanical extracts; to establish a product design capability; to develop a new gas burner capable of satisfying future emission control standards; to develop a world class electroforming capability; to develop & implement a strategic marketing plan and a marketing information system.

A common feature of all collaborations supported by TCS is that the main work is performed at the company by recently qualified graduates normally on two year contracts. The graduates are supervised by the company and by a supervisor from the knowledge-based partner.

TCS is sponsored by: Biotechnology and Biological Sciences Research Council; Department of Health; Department of Trade and Industry; Engineering and Physical Sciences Research Council; Economic and Social Research Council; Industrial Research and Technology Unit (Northern Ireland); Ministry of Agriculture, Fisheries and Food; National Assembly for Wales; Natural Environment Research Council; Particle Physics and Astronomy Research Council; and the Scottish Executive.

For more information contact:
Neil Cryer, Teaching Company Directorate.
Tel: 01367 245200 E-mail: office@tcd.co.uk
Internet: http://www.tcd.co.uk

New Developments from Michell Instruments

Factory Mutual Listing Achieved

Michell Instruments Ltd, a European manufacturer of hygrometry equipment, has announced that it has received Factory Mutual (FM) listing for the intrinsically safe versions of its portable hygrometer, Cermax IS, and its dewpoint transmitter, Transmet IS.

FM Listing means that the devices are approved for use in both hazardous and non-hazardous areas within the American marketplace.

Developments

Michell Instruments have introduced new high precision, portable humidity generator, which calibrates relative humidity probes, cooled mirror and capacitance dewpoint sensors to ensure that they continue to operate at the correct accuracy for each application. The HG1 is traceable to NPL and NIST and enables probes and sensors to be calibrated quickly on site or at a calibration laboratory, giving system engineers complete confidence in the accuracy and traceability of process readings.

A further development is Michell's Cermet II which is a high performance, accurate on-line humidity monitor. It incorporates an intelligent ceramic moisture sensor and a self contained smart digital display and indicator, contained within a 1/8 DIN panel mounting case. The sensor and display are linked via a digital signal cable up to a maximum length of 1200m and, since the communications protocol is digital, the sensor is unaffected by interference from external EMI sources.

Finally, Michell's new Ceramic Moisture Sensor incorporates a combination of thin and thick film manufacturing techniques, drawn from the semiconductor industry, and high performance integrated digital signal processing. The sensor has at its core a highly stable ceramic substrate, upon which the humidity sensitive active layer is deposited. This active

layer has been developed to be highly specific to water molecules, and is intrinsically far more stable than more conventional aluminium oxide sensors.

For further information contact: Michell Instruments Ltd.
Tel: 0800 975 4770 Fax: 01223 426557
E-mail: info@michell.co.uk
Internet: http://www.michell.co.uk

DIARY DATES 1999-2000

2-4 November

NMP conference

Metropole Hotel, Brighton

Contact: Paula Knee, NPL Tel: 020 8943 6329

4 November

Humidity AGM

Metropole Hotel, Brighton

Contact: Anne Kearney or Tracey Collier, NPL

Tel: 020 8943 6557 or 020 8943 6710

March 2000

Special Interest Meeting on Trace Moisture Spectrometry at NPL

Contact: Stephanie Bell, NPL Tel: 020 8943 6402

DTI Supports Trace Moisture Intercomparisons

NPL has recently secured funding to act as a co-ordinator of Trace Moisture Intercomparisons up to at least September 2000. As part of this co-ordination project a special interest meeting was held at NPL in October attended by delegates from companies in the UK and Europe representing the pure gas industry, instrument manufacturers and suppliers.

An outline was given of the aims and benefits of carrying out a measurement intercomparison of trace moisture measurements. These include finding out the level of agreement between measured values, reliability of uncertainty estimates, evidence for (or against) provision of a standard and calibration service in this range of measurement. Some suggestions were presented as to the terms of participation, i.e. voluntarily, with NPL as co-ordinator preserving confidentiality of information during the comparison measurements.

Methods of reporting and analysing the data were discussed, noting that publication or other use of the resulting information would be subject to the consent of those involved. A summary of responses from the questionnaire was presented. These responses define some practical details of how measurements are to be conducted.

It was agreed among those present that circulation of two optical dew-point hygrometers would be appropriate, since they could be compared against one another to demonstrate transit without harm. Hygrometers have kindly been offered on loan to the exercise by MBW and by Michell Instruments. A generator was also offered but the benefits were not felt to be worth the added complexity and transportation costs involved.

The meeting also discussed the formulation of the NMS Programme for Valid Analytical Measurement (VAM) and the possible provision of a measurement standard for trace moisture.

Contacts: Stephanie Bell, NPL Tel: 020 8943 6402 and Tracey Collier, NPL Tel: 020 8943 6710

Club Supporters and Sponsors - Thank You!

The Humidity Club is sponsored by DTI and well supported by the following organisations; Nexus Media Ltd and BMTA and also by the following club members; Michell Instruments and Endress and Hauser Ltd.

Supporters offer various services to our club, including discounts for our club members, collaborations for training, seminars and meetings, publicity through their own publications or newsletters, speakers for our AGMs, sponsoring a single humidity meeting or event ...and all free of charge. Our sincere thanks go to them.

If you are interested in becoming a club supporter then please contact: Anne Kearney, NPL Tel: 020 8943 6557

New Relative Humidity Standard

Relative humidity calibrations directly against the UK national standard are now available.

NPL has maintained humidity standards in the UK since the mid 1980s. Through the use of the UK primary standards, NPL has been able to provide measurement services for dew point traceable to the base unit of temperature, and mixing ratio traceable to mass standards. The dew-point calibration service was UKAS-accredited in 1996.

However, for many years, NPL did not provide relative humidity calibrations. Instead, relative humidity was derived in other laboratories from traceable measurements of dew point and temperature.

Now, NPL can offer relative humidity calibrations directly against the NPL standard humidity generators. This recognises the steady improvement in relative humidity sensors, which have become increasingly reliable and robust over the years. The direct provision of relative humidity traceability also helps NPL to demonstrate equivalence with other national humidity standards worldwide. The relative humidity range of the standard is from 2 % rh to 98 % rh, at a wide range of temperatures up to 82 °C. The uncertainty is at best 0.5 percent of reading plus 0.1 % rh.

For more information, contact Tracey Collier, NPL. Tel: 020 8943 6710

Humidity Club AGM and National Measurement Conference

This year the Humidity annual meeting is taking place at the Metropole Hotel, Brighton on 4 November and will be part of a larger event, the new National Measurement Partnership Conference, which runs from 2-4 November.

Attendance at the annual Humidity Club meeting is free of charge to all our club members.

Contact: Anne Kearney, NPL Tel: 020 8943 6557 for further information.

Further Information

Membership information and additional copies of *Humidity Club News* are available from
Anne Kearney, NPL
Tel: 020 8943 6557.
Fax: 020 8943 6940.
E-mail: anne.kearney@npl.co.uk

Technical enquiries on humidity measurement should be addressed to
Tracey Collier, NPL
Tel: 020 8943 6710.
E-mail: tracey.collier@npl.co.uk

NPL Humidity Club
Centre for Mechanical and Acoustical Metrology
National Physical Laboratory
Teddington, Middlesex TW11 0LW
Tel: 020 8977 3222 (switchboard)
Tel: 020 8943 + Extension (direct line)
Fax: 020 8943 6306
E-mail: enquiry@npl.co.uk
Internet: www.npl.co.uk

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ISSUE 2 • AUTUMN 1999

Pressmet news

NPL PRESSURE MEASUREMENT CLUB

In this issue:

Welcome to the second and expanded issue of Pressmet news, the yearly newsletter that brings you information about Pressmet, its members' activities, NPL and future events. It has been a busy period since Issue 1, with well supported Annual and Special Interest Meetings, the introduction of a members' e-mail distribution list and a growing membership.

Pressure Metrology Conference

A very successful 3rd CCM International Conference on *Pressure Metrology from Ultra-High Vacuum to Very High Pressures* was held in Torino, Italy, in May this year. It was attended by 122 scientists, representing metrological institutions, universities and industries from 36 countries across all continents, and 63 papers were presented. The proceedings will be published in *Metrologia*. The conference was hosted by CNR-IMGC and chaired by Gianfranco Molinar (CNR-IMGC) and co-chaired by Charles Tilford (NIST) and David Simpson (NPL).

Contact David Simpson (Extension 6862) for more information.

NPL National Physical Laboratory

UKAS Accreditation for Transducer Laboratories

Transducer Laboratories' recent merger with Kistler Instruments Limited has led to expanded facilities which include the

calibration of piezoelectric and piezoresisitive sensors over the range 0.1 Pa to 700 MPa and charge amplifiers from 1 pC to 2 µC.

The latest addition to Transducer Laboratories' facilities is a dynamic pressure generator which operates up to 25 MPa with a typical pulse width of 10 ms. The laboratory has also gained UKAS accreditation for the calibration of charge amplifiers, is also in the process of achieving UKAS accreditation for hydraulic pressure calibrations, and is now registered to BSI EN ISO 9002.

Contact Marion McAlinden, Transducer Laboratories Limited (Tel: 01420 542555) for further details.

Kistler's New Cavity Pressure Sensor For Low Viscosity Melts

Kistler has introduced a new cavity pressure sensor, type 6167A, with a special membrane over the diaphragm for measuring the cavity pressure for the injection moulding of low viscosity materials. The company says its new sensing element provides higher sensitivity and improved resolution. The 6167A sensor has a front diameter of only 4 mm and Kistler state an operating temperature range of 0 °C to 200 °C in the mould, whilst the diaphragm is capable of withstanding melt temperatures of up to 450 °C. The stated pressure range is 0 MPa to 20 MPa with an overload of 50 MPa.

Contact Chris Collins, Kistler Instruments Limited (Tel: 01420 544477) for more information.

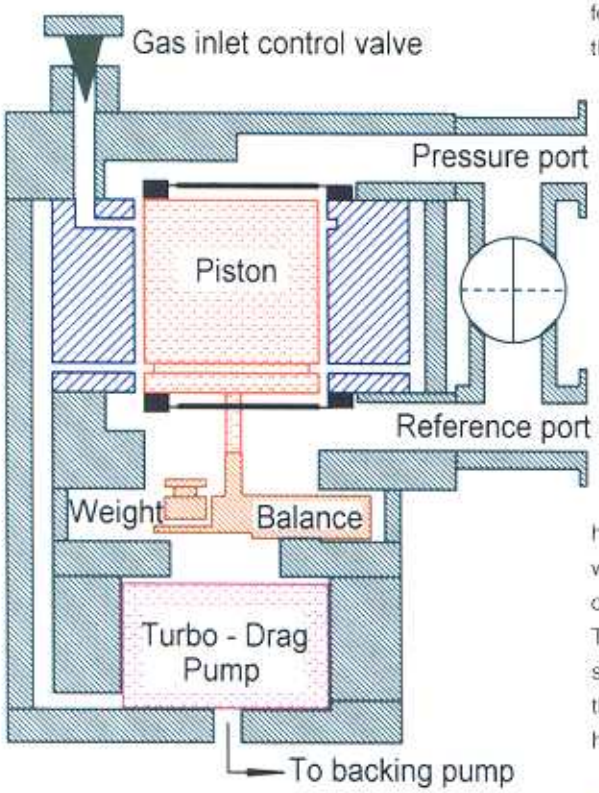
New Brazing Technology Developed by Keller

Keller has invested over £2.5M to enable its piezoresistive pressure chips to be brazed, rather than welded, into steel capsules. The company states that the new process reduces residual stresses in the structure, improving long-term stability because all the components are at the same temperature when joined. Keller lists the other advantages as an improvement in corrosion resistance by removing the weld junction and a great reduction in unit costs as each belt-fed furnace has a throughput of up to 1000 units per hour. Keller says the process is capable of brazing traditional 316L stainless steel, but also brass and nickel alloys, with the ultimate goal being the production of Isolated Automotive Pressure Sensors at $10 a piece.

Contact Ian Clark, Keller (UK) Ltd (Tel: 0118 973 5177) for more information

New Absolute Pressure Standard from Furness Controls

Furness Controls Ltd have developed their FRS4 low gauge pressure standard into an instrument for generating absolute pressure. The range covered is from 1 Pa to 2 kPa, with a resolution of 0.002 Pa, and from 2 kPa to 7 kPa with a resolution of 0.02 Pa. A vacuum pumping system has been developed which maintains the reference pressure, under the piston, at a value less than the respective resolutions. The diagram below shows a 75 cm^2 piston, held in place in the cylinder with suspension elements similar to those used in the gauge-mode instrument. The piston is mounted on an electronic balance which measures the resultant downward force produced by the higher pressure acting on the top of the piston. The pump providing the reference vacuum - a combination turbomolecular/drag pump - also pumps away the gas flowing between piston and cylinder, through a side duct. The scaling of the balance may be checked and, if necessary, adjusted under vacuum by means of an internal calibration weight. Trials are underway to determine the full potential of this new instrument.

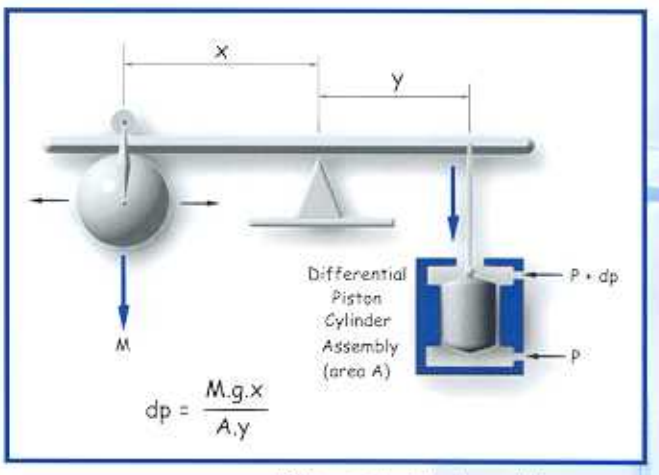


Absolute pressure standard

Contact Colin Rendle, Furness Controls Ltd (Tel: 01424 730316) for further details.

Theta Systems' Enhanced Differential Pressure Calibration Service

Theta Systems has introduced a new method of calibrating differential pressure transmitters using a novel differential-piston beam balance system. It comprises a differential-piston, beam and jockey-weight, and associated control electronics. The force produced by the application of the differential pressure is automatically counter-balanced by repositioning the jockey-weight on the beam. The system sensitivity is less than 1 pascal with a UKAS accredited best measurement capability, over its range, of ±0.015% of the differential pressure ±10 Pa. Theta note that the advantage of the technique is that calibration times are substantially reduced, typically halving those of conventional methods, which in turn results in lower calibration costs and quicker turn around times. The company point out that the new service will find its widest application in the Gas, Oil and Process industries but has potential in other areas.



Differential piston beam balance

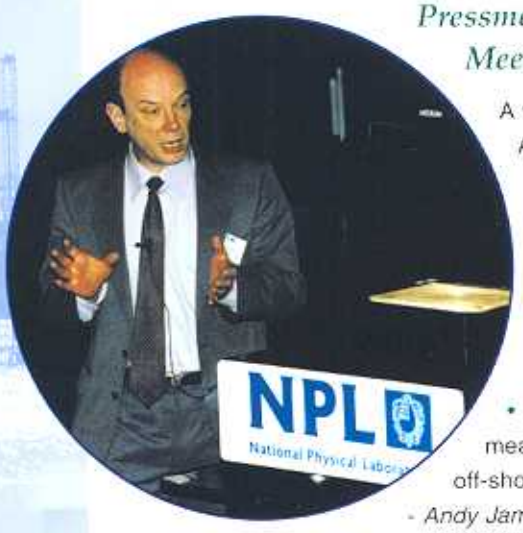
Contact Neil Morgan, Theta Systems Ltd (Tel: 01993 844953) for further details.

New Design Low-Expansion Pressure Hose from SI Pressure Instruments

SI Pressure Instruments has developed a new, cost effective, high pressure hose kit which minimises volumetric expansion caused by pressurisation. Such changes in volume do not happen 'instantly' on pressurisation but, depending on pipework design, may continue for some hours, producing characteristics which can easily be confused with system leaks. The new hose minimises this effect through a unique construction employing two layers of high tensile steel braiding. SI Pressure Instruments' new hose is known as HK-1000; it has self-sealing ends, and the company states it is suitable for use with water and oil and can operate at pressures up to 100 MPa.

Contact Harbi Maukia, SI Pressure Instruments Ltd (Tel: 0121 784 6855) for more information.

Pressmet Annual Meeting



Andy Jamieson speaking at Pressmet Annual Meeting

A very successful Annual Meeting was held in March and included talks on:

- Spacecraft propellant gauging - *Bill Berry, ESA/ESTEC*
- Pressure measurements in the off-shore industry - *Andy Jamieson, Shell Expro*
- Pressure measurement in nuclear fuel enrichment - *Derek Thomas, Urenco (Capenhurst) Ltd*
- FAA and 'Traceability to NIST' - update - *Andrew Wallard, Deputy Director, NPL*
- Modelling high-line differential pressure standards - *Mark Hay, Metrology Ltd*
- Primary vacuum standards - are they as good as we think? - *Vesna Music, NPL*
- NPL's potential programme of work in pressure & vacuum, 1999 - 2002 - *David Simpson, NPL.*

Contact Pauline Leggat (Extension 6321) for more information.

Ruska Report Unprecedented Demand for Training

Ruska Instrument Corporation have reported an unprecedented demand for training which has led to them running eight static pressure measurement training seminars for this year instead of their usual six seminars. The seminars which have been run since 1962 are now held at the new headquarters of Ruska in Houston, Texas. The lectures and laboratory courses are designed for metrologists, laboratory and quality assurance technicians, supervisors, engineers and others interested in the basic principles of static pressure measurement. Participants attend from all over the world coming from various industrial sectors, academia, government institutions and national standards laboratories and many return on a regular basis for refresher courses. Primary emphasis is placed on the principles and practices used in the calibration of pressure standards and measuring instruments including piston gauges, digital pressure controllers and other transducers. This five day exercise includes lectures and discussions on pressure measurement hardware and influences, demonstrations of pressure measurement techniques and numerous hands-on projects. Group projects include both hydraulic and pneumatic pressure measurements and formal calibrations from less than 10 Pa absolute to approximately 70 MPa in gauge mode.

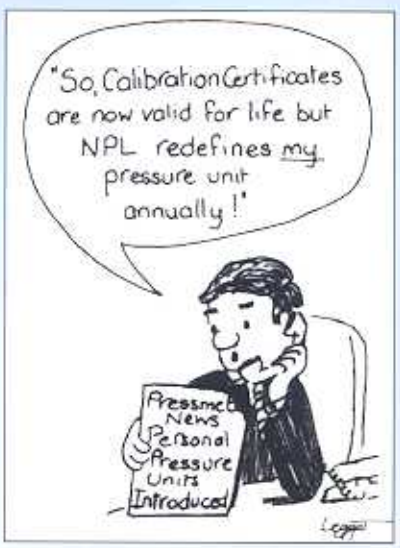
Contact Mike Collins, Ruska Instruments (Tel: 0116 231 7100) for more information on forthcoming seminars.

Second-Class 'Manometric' Pressure Units

The end is in sight for the so called 'manometric' pressure units, such as inches of water, millimetres of water, inches of mercury and millimetres of mercury, but a large part of the pressure community seems unaware of the potential problems in store for them.

Manometric pressure units - which express pressure in terms of the height of a column of liquid - depend on an assumed liquid density and acceleration due to gravity. These assumptions inherently limit their validity as no national metrology institutes realise pressure directly in terms of manometric units. Instead they use the internationally agreed SI unit for pressure - *the pascal* - and it is *impossible* to ascribe an *exact* conversion factor between the pascal and any manometric unit; the definitions are simply not compatible and cannot be made so.

Does this matter? In many pressure measurement applications the accuracies required are not affected by this definition-limit but the performance of modern transducers is approaching it. Thus, in the near future, the accuracy claims being made for otherwise state-of-the-art instruments scaled in manometric units will become inherently inferior. Even now, confusion and large errors abound through use of differing definitions, including alternative values of 'standard' gravity and varying assumptions about the density and temperature of the fluid. Misunderstandings about temperature assumptions alone can lead to errors of several tenths of a percent and there are many stories of this leading to major mistakes in pressure measurement.



In 1996 the Consultative Committee for Mass and Related Quantities (CCM) - under the Comité International des Poids et Mesures (CIPM) - approved a declaration aimed at encouraging the demise of manometric pressure units and recommended that they be excluded from conversion tables or, for a limited period, have a conversion factor with a clearly restricted precision.

Manufacturers continue to supply devices scaled in manometric units in response to their customers demand. So why do end-users continue to specify such obsolete and confusing units? There are probably no applications which *inherently* need manometric units and perhaps most end users, including some large influential organisations, simply repeat earlier specifications.

The change will have to be made at some stage, as accuracies increase through technological advance and the manometric units are seen to be incapable of coping. In the fullness of time, when their second-class nature is more widely appreciated, market forces will doubtless operate and naturally cause end users to abandon them. Would it not be beneficial to the pressure-measuring community for organisations to actively educate their customers and speed up the demise of these tired units?

I should be interested to hear your views and comments on the subject.

Contact David Simpson (Extension 6862) to discuss further.

Pressure Measurement in Aircraft Air Data Systems

Historically, mechanical instruments with aneroid capsules as the sensor element have been used to measure aircraft altitude and airspeed. Modern aircraft, however, need to fly within a closely prescribed speed and altitude flight envelope which requires greater accuracy than was traditionally available, and in what is often a metrologically hostile environment. This has led to the development of precision electrical pressure transducers which, when combined with a digital computer, is known as an air data computer (ADC). In modern aircraft ADCs have replaced mechanical instruments for all primary air pressure measurements and computations.

Today's challenge is one of further improvement in pressure measurement performance - arising from the increasing volume of air traffic which requires more aircraft to be able to fly in the same airspace. Vertical air lane separation is being reduced from 2000 ft to 1000 ft in the flight levels between 29 000 ft and 41 000 ft; this is known as Reduced Vertical Separation Minimum (RVSM) and has been in operation since March 1997 on the North Atlantic routes; full implementation in European airspace is expected by 2001.

At the same time, the emphasis for the future is on less frequent testing and longer life of the pressure transducers at the heart of the ADCs. Typical requirements for pressure transducers include:

Pressure accuracy at 40 000 ft (19 kPa)	< ±13 Pa (±15 ft)
Long term stability	< ±7 Pa/year (10 kPa to 130 kPa)
Mean time between failure	>1 000 000 hours
Life of installation	25 years

At first glance it might seem that the accuracy requirements for altitude-measuring pressure measurements are comfortably within the capabilities of UKAS accredited laboratories, eg 13 Pa (15 ft) is about 0.07% of 19 kPa (40 000 ft), but the accuracy requirement relates to use of a transducer in an airframe - which is considerably more hostile than the comparatively benign environment of a temperature-controlled calibration laboratory! Typical environmental conditions would include:

Temperature	–40 °C to +95 °C
Acceleration (any axis)	20 g
Acoustic noise	140 dB

Modern air traffic requirements really are demanding performance from pressure transducers and calibration systems which is close to their current limits. Weston Aerospace (formerly Solartron) has been involved in the development of vibrating cylinder (VC) pressure transducers to meet increasing aircraft performance for over 40 years. Its VC transducer is used extensively for both civil and military ADC, FADEC (Full Authority Digital Engine Controls), and in ADTS (Air Data Test Set) ground based calibration equipment used to test and calibrate aircraft air data systems around the world.

Contact Peter Mason, Weston Aerospace, (Tel: 01252 544433) for more information.

Events Calendar for 1999

Sept 16
BMTA Workshop on Uncertainty Evaluation
Society of Chemical Industry
London
Contact: Ray Wilson, BMTA
Tel. 020 8943 5524

Sept 23
Pressmet Special Interest Meeting - Manufacturers' Specification Sheets
NPL
Contact: Pauline Leggat
Tel. 020 8943 6321

Sept 30
Competing Precisely event - electrical theme
Reading
Contact: Paula Knee, NPL
Tel. 020 8943 6329

Oct 1-21 1999,
Bordeaux, France. Metrologie '99
For further information contact:
Sandrine Gazal, e-mail:
sandrine.gazal@wanadoo.fr
Tel. 00 4 67 91 33 42 or
Fax. 00 4 67 91 33 43

Oct 20
Uncertainty of Measurement - Awareness and Practice
Brunel University
Contact: Eileen McCarthy,
Tel. 01895 203224

Nov 2-4
NMP conference
Brighton Metropole Hotel
Contact: Paula Knee, NPL.
Tel. 020 8943 6329

Nov 4
Pressmet Special Interest meeting
Brighton Metropole Hotel
Contact: Pauline Leggat, NPL.
Tel. 020 8943 6321

New Format Hard-Copy Members' Directories

The 3rd edition of the hard-copy Members' Directory, to be published in September 1999, will be in a revised A5 format. As with previous editions, it will include company profiles and contact details for each member, including e-mail and website addresses, where available.

Contact Pauline Leggat (extension 6321) for more information.

Members' Web Directory

The information in the hard-copy directory may also be found on the NPL website at *www.npl.co.uk/npl/section/pv* by clicking on *Directory of contacts* or *Company profiles*. An interactive *Service locator* enables readers to find members who can provide specific pressure-related services. Further clicking on a logo links the reader directly with that member's website.

Members are reporting an increasing number of enquiries from potential new clients via Pressmet's Web pages. It is therefore recommended that members check that their company's details are up to date, particularly the hyperlink to their own website - alterations can be incorporated very quickly.

Contact Pauline Leggat (Extension 6321) for more information.

Special Interest Meeting - Manufacturers' Specification Sheets

On 23rd September Pressmet will be holding a meeting to discuss issues related to difficulties in interpreting pressure and vacuum equipment specification sheets. Topics are expected to cover:

- purchasing sensors on the basis of specification
- claims made by competitors
- specifications meaning different things in different countries
- accuracy claims which are better than available in national laboratories
- over-optimistic client expectations

Presentations will be made by members, including Bourdon Sedeme Ltd, Chell Instruments Ltd, Druck Ltd, Humitec Ltd, Keller (UK) Ltd, Mensor Corporation, Metrology Ltd, National Physical Laboratory, Rolls-Royce plc, Sira Test & Certification Ltd, South Yorkshire Trading Standards Unit and Theta Systems Ltd.

Contact Pauline Leggat (Extension 6321) for more information.

Further Information

Additional copies of this Newsletter and NPL service information are available from:
Pauline Leggat on 020 8943 6321
Fax: 020 8943 6132
E-mail: pauline.leggat@npl.co.uk

Centre for Mechanical and Acoustical Metrology
National Physical Laboratory
Teddington
Middlesex TW11 0LW

Telephone 020 8977 3222 (switchboard)
Telephone 020 8943 + Ext (Direct line)

0999/1716/PPG/2K

APPENDIX 7

11.00 Improved economics in flow measurement and allocation using software modelling techniques
M Basil, Flow Limited

11.30 Audit trail and methods
B Maurer, Flow Calibration Services Ltd

12.00 Lunch and exhibition

13.30 The DTI's flow programme – flow measurement and industry
P Johnson, NEL

13.50 Flow measurement of particulate solids in pipelines
Y Yan, University of Greenwich

14.15 Recent advances in ultrasonic technology for flow measurement
S Milford, Panametrics

14.40 Challenges of accurate subsea flow metering
S Clark, ISA

15.05 Thermal metering – experience in the field
M Carr, Endress & Hauser

15.30 Tea and close

Humidity Club

10.00 Progress on NPL humidity standards
S Bell, NPL

10.30 Overview of the Society of Environmental Engineers
R Ayres, British Aerospace

11.10 An interlaboratory comparison of European accredited calibration laboratories using relative humidity sensors
R Benyon, INTA standards laboratory, Spain

12.00 Lunch and exhibition

13.30 Measuring the behaviour of wood panel paintings to humidity with moire techniques
C Forno, JRC, Ispra, Italy

14.10 Humidity drying processes - an industrial review
H Lucius, Consultant, Denmark

14.45 A UKAS calibrated solution to field calibration of sensors
P Greaves, Humitec Ltd

15.30 Coffee and close

Mechanical Metrology Association

10.00 Welcome and Introduction
D Elkington, NPL

10.05 UK force standard facilities - the next 3 years
D Elkington, NPL

10.20 Mechanical measurements in the world of motor racing
P Priest, Formula One team, Stewart Grand Prix,

11.00 Advances in Load cells
G Roberts, Tedea-Huntleigh Europe Ltd

11.30 Optical techniques for measuring the mechanical behaviour of structures and materials
C Forno, JRC, Ispra, Italy

12.00 Lunch and exhibition

13.30 Recent developments in BS EN, ISO, and ASTM standards for force measurement and the requirements for uncertainty estimation
A Knott, NPL

14.00 Designing a load cell to minimise the effects of different loading conditions
A Knott, NPL

14.30 A description of the DTI funding available to companies
N Cryer, Teaching Company Directorate

15.30 Coffee and close

Pressure Measurement Club (Pressmet)

13.30 Performance of high-line differential pressure standards
M Hay, Metrology Ltd

14.15 Discussion of the above

15.30 Coffee

16.00 The UK's National Standard Barometer - designing a replacement
D Simpson, NPL

16.30 Discussion of the above

17.30 Close

Software Support for Metrology Club

10.00 Introduction
D Rayner, NPL

10.30 Choosing and installing a Laboratory Information Management System (LIMS)
S Lower, SIRA

11:00 LIMS: Overview of the LIMS market
C Thurston, Labsystems

11:30 LIMS: A user perspective
Linda Hilton, Unilever

12:00 Lunch and exhibition

13.30 METROS - reusable software routines for metrology
G Morgan and I Reid, Numerical Algorithms Group Ltd

14:00 Issues in measurement system validation
B Wichmann, NPL

14:30 A best-practice guide and training course on the development of virtual instruments
L Emmet, Adelard

15:00 Format standards for measurement data
A Scott, NEL

15.30 Coffee

Figure 1

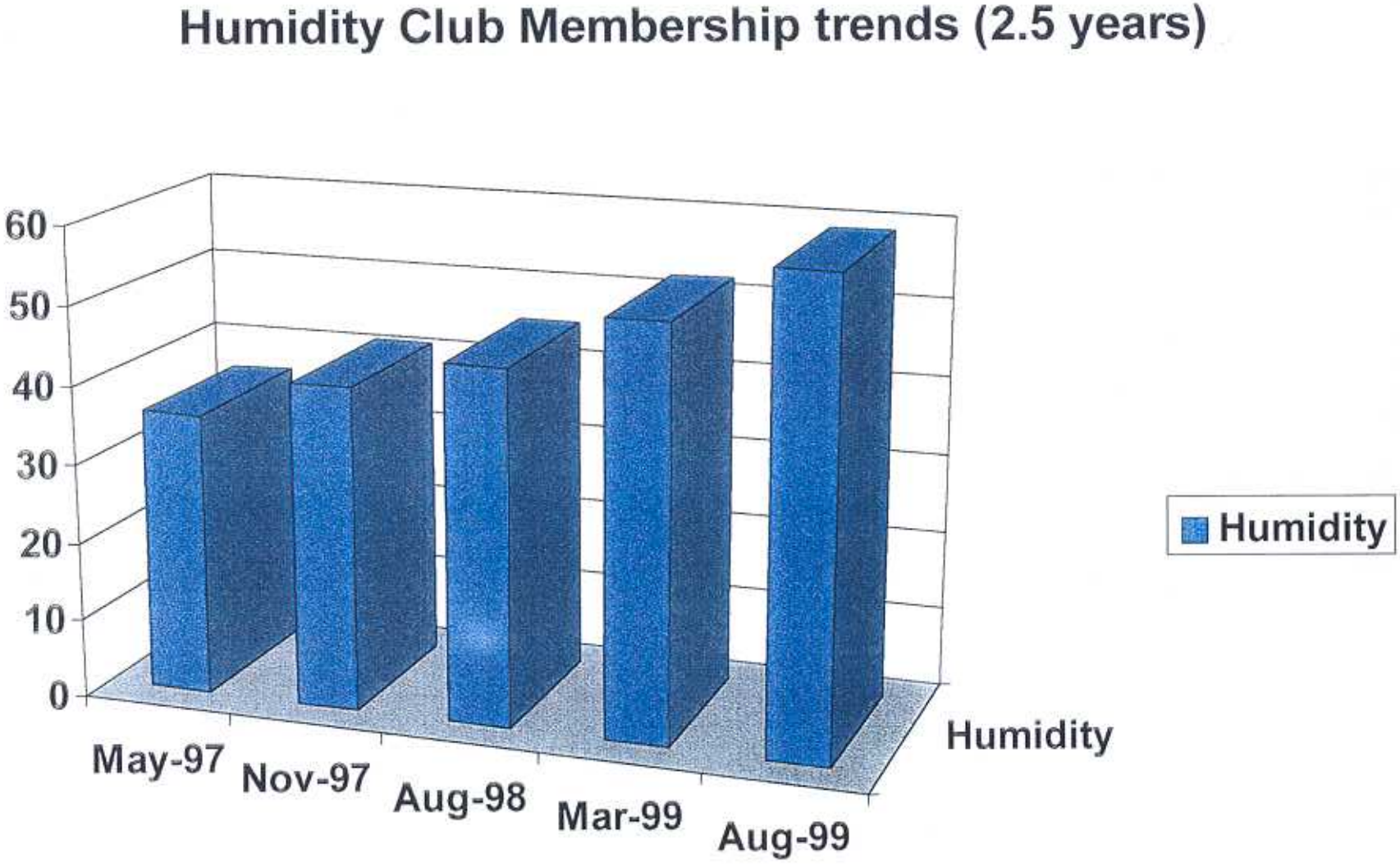

Humidity Club Membership trends (2.5 years)
60
50
40
30
20
10
0
May-97
Nov-97
Aug-98
Mar-99
Aug-99
Humidity
Humidity

Figure 2


MMA Membership trends (2.5 years)
80
70
60
50
40
30
20
10
0
May-97
Nov-97
Aug-98
Mar-99
Aug-99
MMA
MMA

Figure 3

Pressmet Membership trends (2.5 years)