

UK NATIONAL MEASUREMENT SYSTEM

MEASUREMENT ADVISORY COMMITTEE

Final Report

April 2005 – December 2006

1 Introduction

This is the final report of the Measurement Advisory Committee (MAC). Previous reports have been annual, but this one covers the extended period from April 2005 to the end of December 2006.

The sponsoring UK Government Minister is Mr Malcolm Wicks MP, Minister of State for Science and Innovation.

The MAC is an advisory Non-Departmental Public Body (NDPB) that advises the Department of Trade and Industry (DTI) on the effectiveness of programmes of expenditure in support of the UK National Measurement System (NMS). The NMS programmes, and their relative sizes, are shown in Annex One.

The objective of the MAC has been to offer the DTI strategic advice on the:

- Effectiveness with which the NMS supports innovation and competitiveness within UK business and industry;
- Priorities that the DTI should assign to programmes of work undertaken to meet the needs of the NMS;
- Broad objectives, balance and strategy for the UK Government's support of measurement.

In 2005-06 the DTI conducted a Strategic Review of the NMS¹ that made recommendations on the programme structure and processes and considered the appropriate advisory mechanism. It concluded that it was preferable to bring the advisory framework closer within DTI and aligned with wider Government, with a representative advisory board chaired by a DTI official. Thus, although the objectives of the MAC should continue, these would be pursued in another way.

Much of the advice to DTI on detailed metrology issues has been provided by a number of independent expert Working Groups. These groups, reformed into groupings to reflect the new programme structure, will continue. **The MAC strongly hopes that the substantial expertise of the Programme Working Groups will continue to play a major part in advising the DTI on priority needs for measurement in the national interest.**

2 Measurement

The UK NMS is universally regarded as being one of the top three in the world. Recent evidence suggests that the NMS has helped users of its services to achieve annual financial benefits of over £700 million. The DTI's 2003 Innovation Report included an indicative

¹ <http://www.dti.gov.uk/files/file32845.pdf>

estimate that the NMS, directly or indirectly, underpinned and enabled around £5 billion of UK Gross Domestic Product, as a result of DTI's annual expenditure on the NMS of approximately £60 million.

The need to understand and use measurements permeates all aspects of human endeavour. It is essential in social interaction, trade, commerce and industry. In some cases, measurements are referred to in a casual and imprecise way, and at the other extreme some parameters must be measured to stringent tolerances that may have legal implications. However, in all cases, behind every use there is a reliance on the standardisation of the measurement units, and a belief that the measurement scale can be trusted so that it need not be determined afresh with every usage. Of course, for critical applications the calibration of a local measurement standard must be checked periodically against better standards, but even here there is trust that there will be a reliable basic source against which calibrations may be checked and which will be maintained in a stable condition into the distant future.

With the introduction of innovative techniques and technologies, and with improved manufacturing capabilities, there is also an important need for the development of new measurement methods for both existing and newly required parameters. However, as measurements are so implicit in all human affairs, this need for the maintenance of existing measurement and calibration capabilities, for progressive improvement and for the development of new standards, is often not clearly recognised. The painstaking long-term research required for this purpose may often not be appreciated. **A priority for the MAC has been to provide advice that sought to ensure that the need for a sustained long-term Government commitment to maintaining and developing measurement capability was fully understood and in place.**

3 The Measurement Advisory Committee

The Terms of Reference of the MAC are shown at Annex Two. Some new appointments to the MAC were made in the Spring of 2005. The membership of the Committee is given in Annex Three. The activities and resources of the MAC and Programme Working Groups are described in Annex Four.

In addition to the regular biannual meetings of the MAC, held in the Spring and Autumn of 2005 and 2006, three additional meetings took place, some taking advantage of teleconferencing, to provide specific advice on:

- The draft conclusions of the DTI Strategic Review of the NMS;
- The potential impact on the NMS programmes of a reduction in DTI funding;
- The proposals from the National Physical Laboratory (NPL) for its future NMS work.

The MAC has benefited from increased support from the DTI NMS Programme Unit in 2006, enabling the Committee to provide considered advice on a number of strategic issues. Amongst other information the Committee has been able to contribute to and benefit from the preparation and development of a strategic road mapping process which looks forward to trends in future national needs and seeks to identify the innovations and developments in metrology technology and capability necessary to meet them. These roadmaps are an impressive piece of work, which could have an important role in informing future metrology priorities. The results should be very helpful in the formulation of future NMS programmes. **The MAC supports the targeted use and active maintenance of Roadmaps for priority technologies and sectors. It also welcomes the refinement of the selection criteria used during the programme prioritisation process.**

4 The Measurement Advisory Committee Working Groups

Each member of the MAC has chaired one or more of the expert advisory Working Groups. The 17 Working Groups are listed in Annex Five. During the period, Working Groups were established for the new metrology programmes of Engineering and Time, Frequency and the Metre.

It is understood that DTI intend to regroup the advisory activities into a smaller number of Working Groups in April 2007. With the new advisory model, the roles of the Working Group Chairs will become even more important. **The MAC recommends that robust mechanisms should be put in place for harvesting the wisdom that the Working Group Chairs would provide.**

Each Working Group has utilised a three-year process for the evaluation of measurement topics within their scope of interest, leading to the formulation and prioritisation of a set of metrology projects for DTI's consideration. The MAC has supported the proposed change to a more flexible process of evaluation and formulation of the NMS programmes. The Committee hopes that this will provide an opportunity for rolling review and appraisal of each programme and to prioritise work strategically when required for national benefit, not simply for the purposes of contract renewal. However, the Committee does support a three-year framework for contracts with the National Measurement Institutes in order to provide some security. **The MAC believes that the rolling formulation process should ensure a more rapid response to changes in measurement requirements and trends in innovation, while safeguarding valuable long-term research and the maintenance of capability.**

5 Selected Highlights

- a) During the period, key issues dealt with by the MAC included:
- i. **Future direction of the NMS** – the MAC concluded that NPL had carried out a thorough and soundly based review of its activities when making its proposals for the future development of the NMS. **This important review is welcomed by the MAC** and is discussed in more detail in Section 7.
 - ii. **The Watt Balance Mark III** – The MAC's observations and recommendations made in its 2004-05 Annual Report have not been pursued as assiduously as the Committee would have liked. In particular, little progress has been made in obtaining external funding; the assessment of the suitability of the new building has been delayed, with no serious consideration of alternatives; the width and scope of the advisory committee has not been increased; and the actions and recommendations of the advisory committee have not been followed up from meetings as far back as 2004 (e.g. to set up and maintain a risk register for the project, to engage more widely to ensure that NPL staff have not missed risk or design issues and to appoint a member of staff to focus on solving the problems). **The MAC endorses NPL's recommendation to the DTI that the Watt Balance projects should stop but adds the caveat that the plans and results achieved so far should be made available in the public domain for further development.**
 - iii. **The linear accelerator (LinAc) for radiation dosimetry** – The MAC's advice was influential in DTI's securing a commitment from another UK Government Department to fund a clinical-type LinAc that would be essential for maintaining dosimetry calibrations for the UK's National Health Service. However, NPL has now proposed to delay investment in the replacement of the research LinAc. The MAC is concerned

that NPL appear to be proposing to reverse the decision to run the two LinAc's in parallel, which had been based on a sound business and technical case at the time. The Committee is also concerned that without access to a research LinAc, NPL's ability to maintain its lead and support in all areas of dosimetry would be compromised. However, the MAC welcomes NPL's intention to investigate alternative cost and facility sharing opportunities. **The Committee reluctantly supports a delay in the investment in the Research LinAc while other possibilities are explored, but recommends that a decision be made by mid 2007. The MAC highlights the urgent need for DTI to provide funding for the infrastructure that is a necessary requirement for the research LinAc project.**

- iv. **Standard time transmissions** – Following a positive review by the MAC, the MSF radio time broadcast service has been extended by DTI for a further 10 years, with a new operator and at a new location. Furthermore, this will now be rebranded as 'the time from NPL', following the recommendation of the MAC
 - v. **The Measurement for Innovators Programme (Mfi)** – The MAC observes that this relatively new programme, which includes Joint Industry Projects, secondments and consultancies (for SME's), has been highly successful. It has attracted many good projects, achieved high impact and has been well received by both companies and scientists. There is a belief that the programme is promoting real science for real people with a real need. An impact assessment has reinforced this belief, citing case studies that show a direct benefit on the bottom line. **The MAC has expressed concern that DTI's funding for the Mfi programme is not secure and recommends that sources of continued funding be identified by DTI as a priority.**
 - vi. **Measuring the impact of the NMS** – The MAC recognises the challenges in obtaining meaningful data on the impact of the NMS but considers it important to collect a range of data. It has noted that DTI's economists have expressed the view that the NMS is well provided for in terms of supporting economic evidence. **The MAC has endorsed the collection of case studies as being powerful influencers and having a relatively low cost to develop.** It has also recommended that the alignment of the NMS strategy with the DTI's technology strategy should be emphasised and enhanced.
 - vii. **The National Measurement Awards scheme** – The MAC has restated its concern that the awards scheme has been terminated on the basis of limited available funds. It has observed that awards schemes can provide significant benefits in terms of generating publicity, rewarding success, increasing motivation and raising profile. The cost that had been suggested seemed rather high. **The MAC has recommended that the NMS Programme Unit should consider options for introducing measurement awards at lower cost, for example by partnering other organisations that already have established schemes.**
- b) MAC also welcomes:
- i. **The quality of science delivered and the international recognition for the work of the NMS** – For example, the Electromagnetic Programme reports regular publications in peer-reviewed journals and a highly successful British Electromagnetic Measurements Conference (BEMC) attended by 170 delegates from 18 countries. Another example is that the team working on internet-enabled metrology was awarded the 2005 IEE Measurement Prize. Also, the outputs of a key research project from the Flow programme (Balance Uncertainties and Data Reconciliation within Flow Measurement Systems) have already been implemented by Scottish

Water, with Thames Water, Mid Kent Water and Halcrow likely to follow, so potentially achieving huge savings in operational costs.

- ii. **The number of partners and collaborators with the NMS** – In particular, since the start of the Measurement for Innovators (Mfi) programme in August 2004 a total of 119 companies have been involved in over 33 Joint Industry Projects, most of which have led to either new product development or improved processes. There have also been 125 consultancies and 74 secondments.
- iii. **Realisation of new standards and services** – The output of fundamental research work on Venturi meters in the Flow programme has led to the development of innovative techniques for gas and wet gas flow measurement, which have been disseminated through conferences and documentary standards. Users are now implementing these techniques across many industrial sectors. The NMS also delivered internationally agreed best-practice guidelines for dealing with uncertainties, which has added new rigour to the framework for Key Comparisons of standards.

6 The DTI Strategic Review of the NMS

In the second half of 2005 the DTI undertook a review of the NMS programme structure and operations. Members of the MAC and the Working Groups took part in the initial consultations. In addition, the MAC was consulted at a special meeting on the emerging draft conclusions of the review, which resulted in revisions to some of the recommendations. In many respects the MAC supports the conclusions on the reshaping of the programme and advisory structures. The Committee sees the benefit of closer integration of the advisory process with DTI's decision making, but warns that future success will depend on the senior DTI officials concerned continuing to have enthusiasm and a full understanding of the long-term and essential nature of the development and maintenance of measurement standards. **Members of the MAC regret the loss of independence from DTI of the Chair of the proposed new advisory board but hope that an independent element will be sustained within the membership. As regards the Working Groups, MAC advises that it is of vital importance for the DTI to continue to have available broadly based independent expert advice.**

7 Budgetary cuts within the DTI

The MAC regretted the announced reduction in DTI's NMS budget in 2006. The Committee was particularly concerned about the rapid time scales within which the reductions had to be implemented. At the time, this had prevented the MAC from providing considered advice on priorities across the range of the NMS programmes and could have led to an unbalanced programme in the future.

The MAC's members, together with members of the Working Groups, provided evidence to DTI on the effects of potential reductions in spending, both on priority topics and on the impact on innovation. In addition, in July 2006, the MAC Chairman wrote to the former Minister of State for Science and Innovation (Lord Sainsbury of Turville) on behalf of the MAC to express alarm at the budget cuts that were being applied with possible resultant damage to UK competitiveness and innovation that would far outweigh the cost saving. The MAC's concern regarding the non-strategic approach to the cost cutting was highlighted. The MAC took the initiative to develop criteria to prioritise the implementation of any enforced cuts in a strategic manner for the widest UK benefit. The MAC sought assurance that no further cuts would be imposed until the completion of reviews of the programmes involved, using these strategic criteria.

It is disappointing that the budgetary reductions are taking effect at the same time as the programme structure is being reshaped following the Strategic Review of the NMS. However, the MAC has been able to provide constructive advice on ways of achieving the necessary budgetary reductions. In particular, a special meeting of the MAC was held, partly by teleconference, to discuss the strategic proposals made by NPL to accommodate smaller NMS budgets by reducing some work areas, whilst maintaining or enhancing others. The MAC provided robust independent advice to DTI on this complex issue, noting the need to balance commercial drivers with the need for scientific excellence. The MAC concluded that NPL had carried out a thorough and soundly based review of its activities when making its proposals for the future development of the NMS. The MAC was not able to support all of the proposed changes to NPL's suite of centres of excellence, having considered the need for the relevant capability in the UK and whether it should be located at NPL specifically. However, the Committee broadly accepted the approach and balance of funding between types of NMS programmes.

8 Conclusion

This report marks the end of the DTI's NMS Measurement Advisory Committee. The Committee has provided strategic advice to the DTI on measurement issues over many years and has welcomed the positive feedback as to its value. Members of the Committee wish to emphasise that the ability to make reliable and increasingly precise measurements must be maintained through a dynamic and well-funded NMS and that successful innovation in the UK will depend on the development and exploitation of new measurement standards and methods in emerging technological areas. The Committee expects the DTI's new organisational arrangements for the NMS programmes to be effective and looks forward to seeing evidence that the UK's citizens and businesses are benefiting from the NMS's far-reaching impact.

The Measurement Advisory Committee

February 2007

ANNEX ONE

DTI NMS Programmes

DTI's expenditure on the NMS programmes in 2005-2006 was approximately £60million, split between programmes as shown in Figure 1.

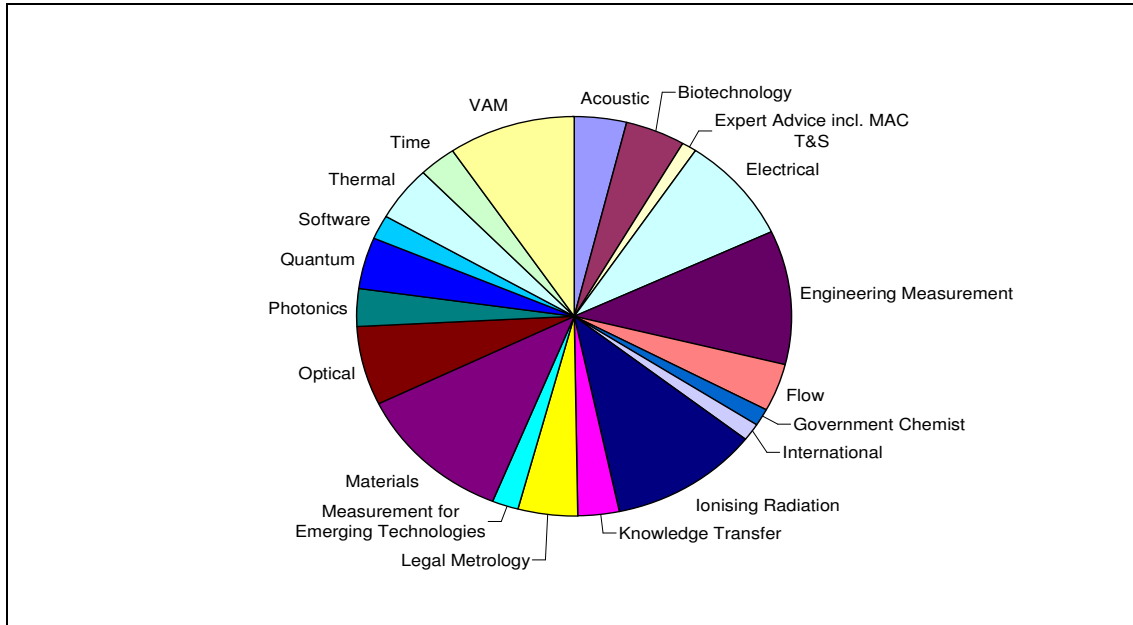


Figure 1. Summary of NMS programme expenditure, 2005-2006, by programme

ANNEX TWO

Terms of reference of the Measurement Advisory Committee

The objective of MAC is to offer the DTI strategic advice on:

- The effectiveness with which the NMS supports innovation and competitiveness within UK business and industry;
- The priorities that DTI should assign to programmes of work undertaken to meet the needs of the NMS; and
- The broad objectives, balance and strategy for the UK Government support of measurement.

This objective is achieved by advising on:

- The needs of users in business, industry and the community;
- Priorities for funding;
- The effectiveness of steps to ensure that good value is achieved from investment in NMS programmes and that the right balance is struck between measurement research and the needs of all users;
- The effectiveness of steps to secure greater engagement with business and industry and improve dissemination of the results of investment in the NMS;
- Input to DTI's longer-term forward looks;
- Key priorities for the UK measurement system within a European and global context.

ANNEX THREE

Membership of the Measurement Advisory Committee 2005-2006

Chairman

Professor Les Barclay OBE

Independent Members

Dr Penny Allisy-Roberts OBE Bureau International des Poids et Mesures (BIPM)	Mr SH Bowns Technology Futures Ltd
Dr Peter Cowley Quarndon Cognition Ltd	Prof. Les Ebdon Vice Chancellor University of Bedfordshire
Mr Richard Freeman The Precise Group	Prof. Ken Grattan City University
Dr Roger Jones Druck Holdings PLC	Dr Alan Johnson Emerson Process Management
Mr John Latham Coventry University	Mr Steve Lower Sira Environmental Ltd
Prof. Isobel Pollock Institute of Mechanical Engineers	Dr Matt Reed Unilever
Dr Janet Townsend-Stojic PA Consulting Group	Dr John Tyrer Department of Mechanical Engineering Loughborough University
Prof. Terry Wilkins Nanomanufacturing Institute University of Leeds	

Representatives from Other Government Departments

Dr John Dennis Central Science Laboratory DEFRA	Mr Cliff Double Medicines & Healthcare Products Regulatory Agency, Dept of Health
Mr Dave Jenkins Ministry of Defence	Dr John McGuinness Health & Safety Executive

ANNEX FOUR

The Measurement Advisory Committee and Working Groups: Activities and Resources

4.1 Activities

Members of the MAC and Programme Working Groups have acted as independent expert advisors to the DTI, so enabling DTI to be an intelligent customer of scientific and technical metrology programmes that meet industrial and public needs. In addition, the members have assisted DTI to appraise and monitor the performance of the NMS programmes against milestones and targets.

The MAC met six times in the period from April 2005 to December 2006. Three of the meetings were regular scheduled six-monthly meetings held at Loughborough University in October 2005, LGC Ltd in March 2006 and the University of Leeds in October 2006. Thanks are extended to Dr John Tyrer, the LGC management team and Prof. Terry Wilkins. The other three meetings were additional to the schedule and considered specific issues upon which the DTI sought the MAC's advice. These meetings were held at DTI buildings in London and used teleconferencing facilities.

The Programme Working Groups provided expert advice on the technical content and impact of the programmes listed at Annex Five. In the period of this Report (April 2005 to December 2006) the relevant Working Groups were engaged in the formulation and prioritisation of projects for the following programmes: Engineering Measurements, Flow Metrology, Electromagnetic Metrology, Time, Frequency & the Metre, Valid Analytical Measurements, Quantum Metrology, Thermal Metrology and Materials Metrology. In addition the relevant Working Groups were instrumental in guiding the following programmes through the formulation process that culminated in prioritisation of new projects in January 2007: Optical Radiation Metrology, Photonics Metrology, Measurements for Biotechnology and Software Support for Metrology.

4.2 Resources

The MAC has no dedicated budget. DTI's National Measurement System Programme Unit administers the running costs in the form of travel and subsistence expenses paid to members of the MAC and the Programme Working Groups in accordance with DTI guidelines. This expenditure for the period of the Report was approximately £150,000.

Members of the MAC have invested around ten days' effort per year on average in support of the Committee. In addition, the Programme Working Group memberships of about 130 people have contributed a total of at least 300 days effort annually. The DTI has expressed its gratitude to all these individuals who have shown sincere commitment to the NMS and have been prepared to put time and effort into helping the DTI to shape future programmes that will address the UK's metrology needs.

ANNEX FIVE

The Measurement Advisory Committee Working Groups

The 17 Working Groups are in the topic areas of:

- Acoustical Metrology
- Electromagnetic Metrology
- Engineering Measurements
- Flow Metrology
- Ionising Radiation Metrology
- Knowledge Transfer/ Measurements for Innovators
- Legal Metrology
- Materials Metrology
- Measurements for Biotechnology
- Measurements for Emerging Technologies
- Optical Radiation Metrology
- Photonics Metrology
- Quantum Metrology (longer term underpinning research)
- Software Support for Metrology
- Time, Frequency and the Metre
- Thermal Metrology
- Valid Analytical Measurements – Physical and Chemical themes