

How NPL and Industry can work together more effectively: Electromagnetic Formulation 2006-2009

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1 Introduction

The formulation of the Department of Trade and Industry's Electromagnetic Metrology Programme 2006 to 2009 is taking place now. This is industry's and academia's chance to influence the formulation of the next DTI-funded programme that will begin in October 2006. The current Electromagnetic Metrology programme is one of the main science programmes within the National Physical Laboratory's Division for Enabling Metrology, and is funded by the Department of Trade and Industry's National Measurement System (NMS) Directorate. The main programme theme areas will be defined in the course of consultation with industry, academics and other stakeholders during the early stages of programme formulation. At this stage in the process we are interested in obtaining views on the measurement requirements that will be important on a three to five year time scale in the main industry sectors in the UK. Industrial and academic researchers can benefit by helping to align and define the work of the NMS Electromagnetic Metrology programme with their own projects and programmes, or with projects that they intend to bid for via Research Council, DTI or EU applied research programme funding. In this way their future measurement and standards requirements can potentially be delivered at no direct extra cost to their projects.

2 Current NMS Programme 2003-2006

The current Electromagnetic Metrology programme funds approximately 22,500 person/days over a period of three years. The UK National Measurement System is the national framework within which organisations such as the National Physical Laboratory establish primary standards of measurement (for mass, length, time, electrical quantities etc.) which are then rigorously linked to practical measurements in industry and commerce, local and national government, hospitals, research and the home by an unbroken chain of measurement comparisons all having stated uncertainties. In formal terms, it is the infrastructure ensuring that measurement in the UK is valid, fit for purpose, and internationally recognised.

The DTI's National Measurement System Directorate (NMSD) is responsible for securing the objectives of the NMS, through programmes of work in which it acts as a customer on behalf of a wide range of ultimate beneficiaries in the UK, and through further development and interpretation of underlying Government Policy. NMSD's aims are to promote industrial competitiveness by providing a comprehensive National Measurement System for industry, and to acting as the centre within Government for policy on measurement standards for industrial, commercial, environmental, healthcare and regulatory use.

The Electromagnetic Metrology Programme is one of several NMS programmes whose purpose is to ensure an effective, competitive and comprehensive measurement infrastructure to:

- support productivity and facilitate innovation within UK industry
- meet statutory and regulatory obligations
- facilitate free trade

Electrical and electromagnetic technologies pervade virtually every aspect of our lives, so much so that modern society is inconceivable without them. They facilitate wealth creation in both the industrial and service sectors, and are, perhaps, the most important factors in maintaining and extending our quality of life. Electronics, communications and Information Technology, three key sectors, are totally dependent on them.

Specific scientific themes and tasks that form part of the current 2003-2006 Electromagnetic Metrology programme are:

- Direct Current and Low Frequency Measurement Standards
- Radio Frequency and Microwave Electromagnetic Standards
- Antenna Calibration and Characterisation
- Electromagnetic Field Measurement and Mapping
- Electromagnetic Compatibility
- Waveform Measurements
- Electromagnetic Materials Measurement (Dielectric and Magnetic)
- Laser Power and Energy Standards
- Future Technologies
- Micro Electro Mechanical Systems (MEMS) for Electrical Metrology
- Modeling and Applications of Electromagnetic Structured Metamaterials
- Electrical Metrology for Biotechnology
- Knowledge Transfer

All NMS Science & Technology (S&T) Programmes have broadly similar objectives:

- To maintain and develop national measurement standards
- To provide measurement standards that are harmonised with those of UK's trading partners.
- To develop new methods of measurement to meet identified UK business and public sector needs, and promote international standardisation
- To promote the dissemination of information from the programmes which leads to the adoption of good measurement practice, and to provide support and advice to UK plc

3 The Future NMS Programme 2006-2009

The 2006-2009 Electrical and Electromagnetic programme will be defined from the input provided by UK industry and UK academia and evaluated by the programme's Measurement Advisory Committee on behalf of the DTI. The DTI National Measurement System Directorate is responsible for determining the objectives for the NMS programme 2006-2009, which are: -

- To provide and develop national measurement standards for DC and Low Frequency electrical and electromagnetic quantities, including the derived SI units of the volt and the ohm, and RF and microwave electromagnetic quantities at a level consistent with the current and future needs of UK industry, national and local government, and

research, and make them accessible to customers in as practical and economic form as possible.

- To ensure that the UK measurement standards for electromagnetic quantities are harmonised with those of the world, through intercomparisons and collaborative research leading to mutual recognition.
- To develop new and improved methods of measurement for electromagnetic quantities to meet identified UK needs, and promote international standardisation of these methods to ensure consistency in practical measurements, especially where these are used for regulatory and trading purposes.
- To enable knowledge transfer from the programme, and to provide technical support and advice to UK organisations and individuals undertaking measurement of electromagnetic quantities.

The main theme areas for the new programme will be defined in the course of consultation with industry, academics and other stakeholders during the early stages of programme formulation. The key sectors that have also been communicated to NPL via the DTI are as follows. These key sectors are areas in which NPL can assist UK plc and provide metrology for the coming 3 to 5 years under the current strategy.

- Communications
- Healthcare
- Electronics
- Instrumentation
- Sensors
- Process control
- Defence
- Security
- Energy
- Transport

4 Formulation of the 2006-2009 NMS Electromagnetic Programme

The process for developing the 2006-2009 Electrical Programme is currently happening and on the 7th September 2005 the initial orientation meeting took place at the conference centre of the Office of Manpower Economics, 76 Oxford Street, London W1. The purpose of the meeting was to identify new and emerging measurement requirements in electromagnetic metrology on a time scale of between three to five years and to relate these to the Department of Trade and Industry's Technology Strategy. Those attending included representatives of industry, universities, regulatory bodies, government departments, the programme's Measurement Advisory Committee, and the National Physical Laboratory. Representatives from the following industries were invited together with academics who had relevant expertise: Communications, Healthcare, Electronics, Instrumentation, Sensing and Process Control, Defence and Security, Energy and Transport. Discussion groups were organised around three of the themes from the DTI's Technology Strategy: 'Intelligent Connected World', 'A More Secure Environment', and 'Healthcare in an Ageing Society'. To identify new demands for calibration services a fourth group considered calibration across all industrial sectors and DTI strategy themes. The outcome from this meeting can be found in the Orientation Report located on NPL's Website [http://www.npl.co.uk/formulation/electrical/..](http://www.npl.co.uk/formulation/electrical/)

The next stage of the programme formulation process is the continuous consultation phase. The purpose is to identify the requirements for the UK NMS infrastructure under the scope and direction set out in the orientation report. We plan to organise a number of focus group meetings and consult with specific partners in industry and academia where appropriate.

An important aspect in the consultation process will be the identification of potential project partners. Industrial and academic researchers can benefit by helping to align the work of the NMS Electromagnetic Metrology Programme with their own projects and programmes, or with projects in which they are bidding for Research Council, DTI or European Union applied research programme funding. In this way future measurement and standards requirements can potentially be delivered at no direct extra cost to their projects.

Linking academic and DTI NMS research can:

- Create extra critical mass
- Allow us to share knowledge
- Enable industrial products to be market-competitive in a reduced time

The timetable for the next stages of consultation is:

- Sept 2005 – May 2006: continuous consultation with UK industry and other interested parties to identify requirements based on the scope and direction defined at the orientation meeting; to include theme-based focus groups.
- Jan 2006: pre-selection of requirements with the aim of defining 120% of budget prioritised to UK need.
- March 2006 – May 2006: public comment and project design, input from the wider stakeholder community.
- June 2006: decision conference (MAC working group and others) to prioritise projects and options to meet budget.

Details of forthcoming focus groups will be announced on the Formulation web site at: <http://www.npl.co.uk/formulation/electrical/>.

5 How Can the NMS Help You?

In the past it has been shown that industries that have been supported by the NMS programme have been able to design and manufacture better quality products, partly because UK measurement standards are harmonised with those of UK's trading partners. The programme has also provided industry with new measurement methods to meet identified UK business and public sector needs and to promote international standardisation. It has also provided technical support and advice to UK businesses and promoted knowledge transfer from the metrology programmes, which leads to the exploitation and adoption of good measurement practice. All of these benefits result in:

- Lower scrap rates
- Fewer rejects

- Less rework
- More efficient production processes
- Less energy consumption
- Better quality and process control
- Better functionality of manufactured products?
- More certainty that your suppliers will meet your specifications
- Optimum design and selection of plant and process equipment
- Excellent product design and development -existing and new innovative instrumentation

6 How Can You Help with NMS Programme Formulation?

All members of industry, academia and other stakeholders can help NPL and the DTI develop this programme. Without your help the programme will not provide the next 3-5 years worth of research and metrology that UK PLC plc really requires. Everyone can assist NPL to develop this programme on behalf of the NMS by visiting NPL's web site and completing the requirements questionnaire located at <http://www.npl.co.uk/formulation/electrical/interest.html>. You can offer to host a focus group or attend one if one is offered in an area of interest to you. You can talk to one of NPL's scientists or directly to the Formulation Team. There are always the opportunities for organisations to work with NPL on the NMS programme or by collaborating with us in others projects targeted in a specific area. For details of collaboration opportunities contact any scientist at NPL or fill in the appropriate section on the Formulation web site.

Industrial and academic researchers can benefit by helping to align the work of the NMS Electrical and Electromagnetic Metrology programme with their own projects and programmes, or with projects that they intend to bid for via Research Council or DTI and EU applied research programme funding. In this way your future measurement and standards requirements can potentially be delivered at no direct extra cost to your projects, and the collaborative mutual co-funding of Industry, Academic and DTI NMS research will create extra critical mass, provide your company with additional skills and knowledge and enable industrial products to be market-competitive in a reduced time.