



National  
Microelectronics  
Institute

# NEW IDEAS, BRIGHTER FUTURES

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ANNUAL REVIEW 2000/2001



National  
Microelectronics  
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## A LETTER FROM THE CHAIRMAN

The first year of the new millennium was a good one for both the semiconductor industry and for the NMI.

For the industry, demand outstripped capacity and prices were firmer again. It was a year of investment and expansion for most of NMI's membership. A highlight of the year was Atmel's purchase of the empty manufacturing plant on North Tyneside.

The NMI, on the industry's behalf, successfully finalised a Negotiated Agreement with the government with regard to the Climate Change Levy. In return for agreeing to reduce energy consumption per unit output, continuing existing trends, companies in the industry can obtain an 80% reduction in the Climate Change Levy for the next 10 years. This will save the industry around £6M per year.

Through the NMI, we have continued to develop support for education and training. We now have a complete series of operator and technician courses available throughout the UK, the series of postgraduate manufacturing modules being offered by 10 universities is fully operational, and we have obtained funding from EPSRC to develop a complementary series of design and product introduction modules with a second university consortium.

The latter initiative is part of NMI's expansion to support IC design and embedded software development, with support from the DTI. Over half of the IC design groups in Europe are located in the UK. They include some of the most successful in the world, including ARM, Cypress Semiconductors, Mitel, Motorola, Sony, Atmel, Analog Devices, Philips, Tality and hundreds of others. New design investments are announced continually, with the UK playing a leading role in the design of many electronics systems, including digital video (set top boxes, graphics and games), cellular communications (both voice and data), wireless communications, avionics systems, automotive systems and financial systems.

In both design and manufacturing the semiconductor industry still faces a worldwide skills shortage. The education system in the UK is working with us to address the situation locally. There is still much to be done. In particular, we need to ensure that more children choose to continue to take maths, science and technology through to A-levels (and Scottish Highers).

Much good work is being done in this area. However, we have concerns, as an industry, that some initiatives are adding needless complexity to the UK education system.

The recent pilot programmes to introduce Foundation Degrees are already showing signs of undoing our industry's work on HNC and HND qualifications. Universities are latching on to the funding for Foundation Degrees and some are indicating that they will cease to license HNDs to Further Education colleges. This has been a vital route in the provision of well trained technicians, many of whom go on to become excellent engineers. A re-launch of HNDs as Foundation Degrees would have supported a manageable evolution of existing provision whilst at the same time raising the image of HND-level education.

Fortunately, our industry is now in a position, through the NMI, to influence government thinking in areas such as this. I would like to encourage your commitment to the NMI so that we can continue to enhance support for the industry in the UK.

James Weir  
NMI Chairman  
NEC Semiconductors (UK) Ltd.

# DIRECTION

Building on our **success** to date.

## DIRECTION

The NMI is a not-for-profit organisation owned by companies designing and manufacturing semiconductors in the UK and Ireland, together with their suppliers and regional development agencies.

Its remit covers improvement activities in all aspects of the design, product introduction and manufacture of integrated circuits, including embedded software.

## DESIGN

Following on from its successful work on manufacturing, NMI started to address the skills needs for IC design and product introduction in late 1999.

During 2000 we represented the industry's interests to the DTI and DfEE on skills shortages in the product development community. As a direct result, employers wishing to recruit from outside the European Economic Area no longer need to prove that they have advertised the post and been unable to fill it. This has simplified the administrative procedure and shortened recruitment cycles.

Since then we have led a successful bid to EPSRC for funding for a series of postgraduate modules to be provided by a number of specialist modules in the UK. This bid has been accepted and work on the programme commenced early in 2001. The first modules will be delivered starting in October 2001.

A number of new members have joined the NMI to support this work and a number of existing members have extended their

membership to cover design. The DTI has also offered a grant to cover the first two years of activity in this field.

## A FRAMEWORK FOR COLLABORATION

The common theme behind all of NMI's activity is to address the efficiency of the industry, either by improving best-practice in business processes, by increasing the efficiency of existing staff or by increasing the supply of new entrants to the industry. To achieve this NMI operates in 4 closely-related fields:

### 1. The value network

Improvement of the value network of the industry – this includes issues such as supply chain development, e-commerce, collaborative business process improvement, Health and Safety, and response to taxation changes.

### 2. A working skills pipeline

The NMI and its members work closely with FE colleges, Universities, vendors and funding bodies to ensure that the best relevant education and training is available.

Courses currently available include Vocational Qualifications, Higher National Certificates and Diplomas, intensive University courses at masters-level, and vendor courses in support of manufacturing and design.

We also maintain close working relationships with DTI, DfEE, EMTA, the HE/FEFCs, the Engineering Council, IEE, FEI, Electronics Scotland, the Welsh

Electronics Forum, SSSF, JEMI, SEMI, SBA, the UK regional development agencies and other relevant bodies.

### 3. Increasing the numbers of students taking appropriate courses

High technology industry is facing a skills shortage world wide. In the UK this is partially due to the number of students electing to take technical degrees remaining at a high, but constant, level of about 50,000 per year, whilst the number of degrees awarded has risen rapidly.

The semiconductor industry aims to play its part in encouraging more youngsters to continue to take maths, science and technology subjects at school.

### 4. Achieving business objectives via skills development

Our members strive to increase profits by reducing Work in Progress, Cycle Times, Time to Market, and costs.

NMI has run a number of collaborative programmes, as part of its value network activity, to directly address issues affecting profitability. For example, our work on best practice in Autonomous Maintenance.

However, the knowledge of how to achieve such goals is embedded in the individuals in an organisation. NMI is working on best practice to ensure that companies' training systems are optimised to develop the skills needed to maximise profitability.

# THE VALUE NETWORK

Enhancing the business environment in the UK.

The NMI operates a number of working groups in this field. The most important have been:

## CLIMATE CHANGE LEVY

In direct response to the UK's commitments under the Kyoto agreement to reduce Green House Gas (GHG) emissions the Government announced in March 1999 their intention to introduce a Climate Change Levy (CCL), or Energy Tax, on industry's use of energy.

To compensate for the cost of the levy on industry as a whole the government proposed to reduce employer's National Insurance Contributions so that the overall level of taxation was unchanged. The net effect will be to shift the burden of taxation from employment of staff towards use of energy.

The microelectronics industry is fully supportive of the Governments stated goal to minimise GHG emissions. However, we consider the CCL to be a bureaucratic and distorting approach to addressing this issue. In addition, a large proportion of GHG emissions come from the domestic sector which to date is to be exempt from any environmental taxation. The NMI has presented these views to the government during the consultation process.

The proposal offered an alternative approach to those industries regulated, or due to be regulated, under the International Pollution and Prevention Control (IPPC) regulations. This was that they could enter into a voluntary agreement with the Government to reduce energy consumption. In return for meeting agreed targets they would only have to pay 20% of the new levy. In principle, this provides a route for a section of manufacturing industry to dramatically reduce the impact of the tax by taking voluntary action.

Fortunately for the semiconductor industry, all of our fabs are liable to regulation under IPPC and are therefore eligible to enter into a Negotiated Agreement to reduce emissions per unit output.

The NMI quickly recognised the necessity of entering into a voluntary Negotiated Agreement on behalf of its members. We have spent the last 18 months, with our members, negotiating with the Department for Environment Transport and the Regions (DETR) to agree an acceptable approach for the semiconductor industry, and other electronics sectors. Key features are:

- Targets are site-specific – site-level efficiencies previously made have been recognised.
- Fabs are treated as 'black boxes' and that all the energy used within them is subject to the Negotiated Agreement.
- By 2010 the sector will have reduced its energy consumption "per unit of output" by 59% of the levels used in 2000.

The NMI CCL Negotiated Agreement is open to non members. However, all participating semiconductor companies have decided to join the NMI giving them the added benefit of access to other NMI initiatives. For example, the NMI is now investigating the possibility of Emissions Trading on behalf of the sector.

Word on NMI's progress has spread through the wider electronics industry. Companies outside the semiconductor sector pay an administration fee to contribute towards the effort that the NMI and its members have put in to addressing the CCL, and to cover administrative costs.

The NMI has secured a CCL Negotiated Agreement for the Cathode Ray Tube (CRT) manufactures in the UK. The target agreed for the CRT sector represents a 21% saving in energy consumed per unit of output in 2010 compared to the sector's performance in the year 2000.

All semiconductor manufacturers in the UK who have entered into agreement with the NMI (which is the vast majority) will be charged the CCL at the reduced rate of 20% from 1 April. They will also see a reduction in their National Insurance Contributions. The result will be an approximately **zero net change in taxation** for the semiconductor industry in the UK.



## MICROELECTRONICS SAFETY PASS (MSP)

The Microelectronics Safety Pass (MSP) is a training programme designed to improve health and safety awareness within the industry. It has been developed by EHS experts working in the industry and is recognised by most of the fabs in the UK and Ireland.

Each manufacturing site has a duty of care to ensure visitors work safely. Visitors are normally therefore required to be inducted to make them aware of the hazards and practices on-site. This induction is very similar at each of the fabs. This means that the staff of suppliers to multiple fabs, may have to receive repeated inductions throughout the year.

The MSP takes the similarities from each induction and incorporates them into a single programme. This is delivered at regional industry training centres across the UK and individuals will be required to be retrained every 2 years.

The MSP will replace existing induction programmes for participating fabs over the coming months. It will be phased in to allow the estimated 2000 trainees to go through the programme. Full implementation is expected by the end of 2001 and training dates are available from the end of March.

The programme is being supported and driven by the two main supplier representative bodies in the UK, SSSF and JEMI UK. We have also seen an initiative by the Health and Safety Executive (HSE) to promote awareness of safety within industry. This initiative sees the HSE encouraging the individual industry sectors to develop their own health and safety programmes. We are clearly demonstrating that we are a proactive industry in terms of employee welfare.

The current list of companies that will accept the MSP include Atmel, National Semiconductor, Motorola, Shin-Etsu Handotai, NEC, Filtronic CSL, Philips, Zetex, ESM, Mitel, Seagate and Analog Devices (Belfast). We expect this list to grow over the coming months as we approach the remaining UK fabs and compound semiconductor companies.

### TPM

Five companies are working on Total Productive Manufacturing with the NMI. They have been identifying areas for collaborative work and developing a solution that will satisfy their varying requirements.

We identified early in the programme that TPM in itself would be too large a programme for this type of collaboration. After a series of discussions we identified that we should focus on one of the TPM pillars – Autonomous Maintenance – the process of training operators on lower level equipment maintenance tasks.

Autonomous Maintenance was seen to provide similar benefits to each of the group members. These benefits included:

1. Freeing time of key technical staff.
2. Developing operators.
3. Higher machine availability.
4. Better product quality.
5. Faster response to issues

We are now developing an Autonomous Maintenance implementation process with supporting documentation.



# THE SKILLS PIPELINE

A complete series of **educational** and **vocational** training courses.

The semiconductor industry has been supporting relevant courses in further and higher education for over 10 years. This has been approached on a UK-wide basis and in a more structured manner since the NMI was established 4 years ago.

We now have a suite of technician and postgraduate courses available in the UK. Iterative improvements continue to be made and status is as follows:

## **TECHNICIANS AND OPERATORS**

A complete range of vocational education and training courses are available for operators and technicians across the UK.

National Certificates, Higher National Certificates and Higher National Diplomas are available from 10 industry-supported Further Education Colleges across the UK. Similar content is covered under the Edexcel 'Plant and Processing Engineering' qualification in England and Wales, and the SQA 'Mechatronics with Semiconductor Options' qualification in Scotland.

Industry supports the colleges through college workshops, advice on lecturer development, donating equipment and support for 3 regional college consortia.

The college workshops are 3-day events run by industry specialists to provide in-depth training to College Lecturers. They include visits to manufacturing sites and equipment vendor training facilities.

Vocational qualifications (NVQ/SVQ) in Performing Manufacturing Operations (level 2), Engineering Maintenance (levels 2 and 3), and Technical Services (level 3) have been contextualised for the semiconductor industry and are accredited by EMTA.

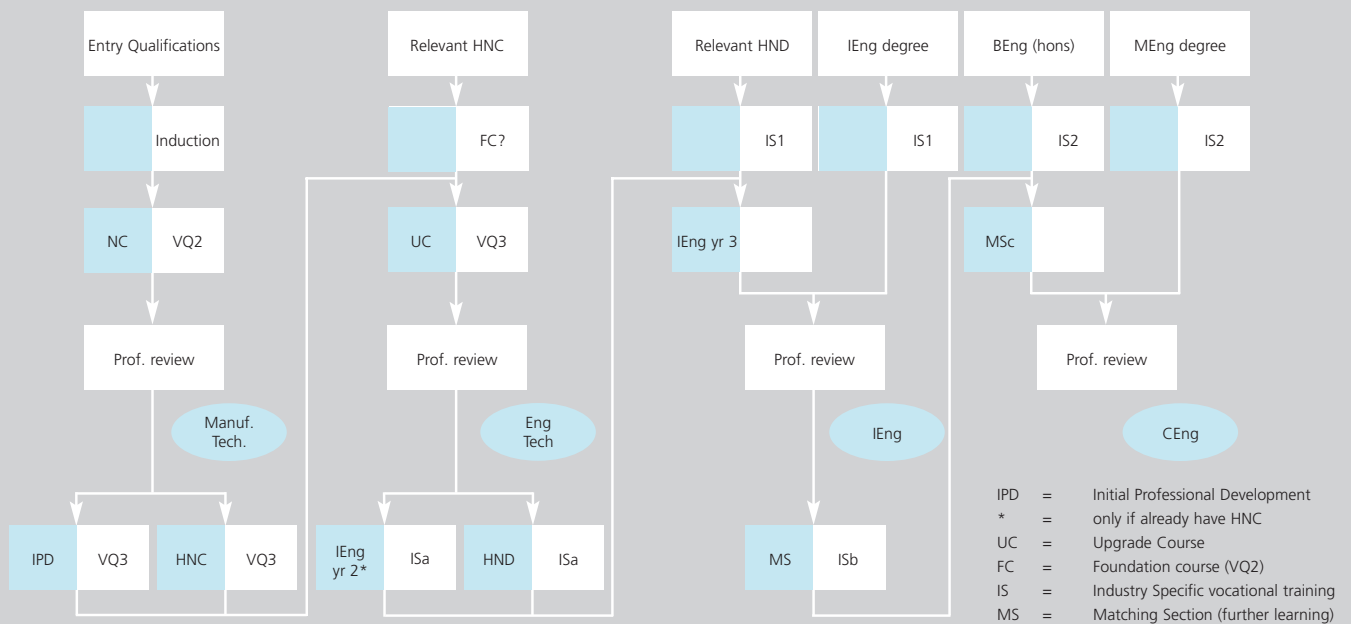
Work has recently started towards the third revision of this range of courses. NMI is chairing an EMTA working group to revise the National Occupational Standards for Electronics Technicians. This work will provide the basis for the next iteration of UK qualifications.

Industry and major suppliers are working to define a standard approach to ensure that agreed training objectives are met by vendor courses. Courses which meet these standards will receive industry endorsement.

## **UNDERGRADUATE COURSES**

Industry already works closely with Universities in the UK. We have not asked for additional specialist microelectronics degree courses established as we need employees with broad-based qualifications. However, we are keen to see more undergraduates take microelectronics design and technology modules as an option.

NMI is presently consulting with its members to obtain their guidance on the course content required for such modules. We will then review the allocation of industrial sponsorship to students taking the modules and to universities providing them.



## POSTGRADUATE COURSES

Since its formation the NMI has been working with a network of UK universities to establish 2 complementary programmes of postgraduate modules at Masters-level.

The first programme of modules, on [semiconductor manufacturing](#), is now successfully operational. 5 modules have been delivered to about 100 participants and a further 5 modules are scheduled to be run in 2001. This is equivalent to training 25 full-time MScs for the industry.

The modules are designed for graduate engineers employed in semiconductor manufacturing. 16 modules are presently available from Glasgow, Edinburgh, Heriot-Watt, Newcastle, Liverpool, UMIST, Cardiff, Swansea, Surrey, and Southampton Universities.

The programme is very flexible. It is designed so that delegates can register to take a single module. Subsequently they can take additional modules to gain an academic qualification. For example, they can gain an MSc by taking 8 modules and carrying out an in-company project.

Each module involves the equivalent of 2 weeks' distance learning (over a period of two to three months) plus an intensive one-week residential course held at the specialist lead university.

Industrial experts have been actively involved in the development of the modules to ensure that the technical content of the course is fully up to date and relevant to industry's needs.

Further information is available at [www.icprocessing.com](http://www.icprocessing.com).

A second programme of modules, on IC design and embedded software development, is now being assembled. It follows the framework established by the manufacturing programme and offers the same degree of flexibility.

However, it will also provide delegates with remote access to all industry-standard design software to use as part of the course.

This programme builds on the wide range of modules already available to support IC design and embedded software development, including those offered by:

- The [Institute for Systems Level Integration \(ISLI\)](#) – consisting of the Universities of Edinburgh, Glasgow, Heriot-Watt and Strathclyde.
- The [Radio Frequency Engineering Education Initiative \(RFEI\)](#) – consisting of the Universities of Bristol, Bradford, Surrey, Portsmouth and York.
- The [Advanced Microelectronics for Industrialists IGDS](#) offered by Bolton Institute and UNN.

It is structured to allow industry to request other specialist universities to offer modules in their fields of expertise.

Because the programme is based on existing modules it will be possible to offer modules starting in October 2001.

Updates on the status of the development of this programme are available via the NMI web site.

NMI would like to acknowledge the Engineering and Physical Sciences Research Council for their contribution to the cost of development of both of these programmes, under the Integrated Graduate Development Scheme and Masters-level Training Programme initiatives.

# THE SKILLS FUNNEL

We are taking action to help fill the 'funnel' that supplies our industry with employees.

High technology industries around the world, including the UK, are experiencing a skills shortage. We know that semiconductor design and manufacturing companies have great difficulties attracting the skilled staff that they require.

The number of graduates leaving UK universities with technical degrees has remained roughly constant over the last 6 years at just under 50,000 per annum. This fixed number of graduates is having to supply a rising demand from across the economy.

We are taking action to help fill the 'funnel' that supplies our industry with employees, starting prior to university.

We have set ourselves the objective of increasing the number of students choosing (and able to choose) to take relevant school subjects, college qualifications and degrees.

Our strategy is to demonstrate an effective approach by spending a small amount of effort and cash on demonstrator programmes. These should act as a catalyst to convince government and other bodies of the need for action and to show how results can be achieved.

Action is required in two areas:

## INCREASING THE UPTAKE OF COURSES

We wish to encourage students to take subjects that could lead them to a technical career in general, and potentially into semiconductors.

We are targeting a specific message for each age group. We have found it difficult

to 'sell' technical careers, such as engineering, to young people under the age of 14. We have adopted, and recommend, a different approach – to sell them the wide range of career opportunities that are opened up through maths, science and technology (MST) qualifications.

As an industry we:

- Have developed and continue to develop videos and packs for children and their parents and teachers.
- Look to sponsor the teaching of mathematics and science – from funding science labs to offering subject prizes.
- Support development of undergraduate courses and sponsor students.

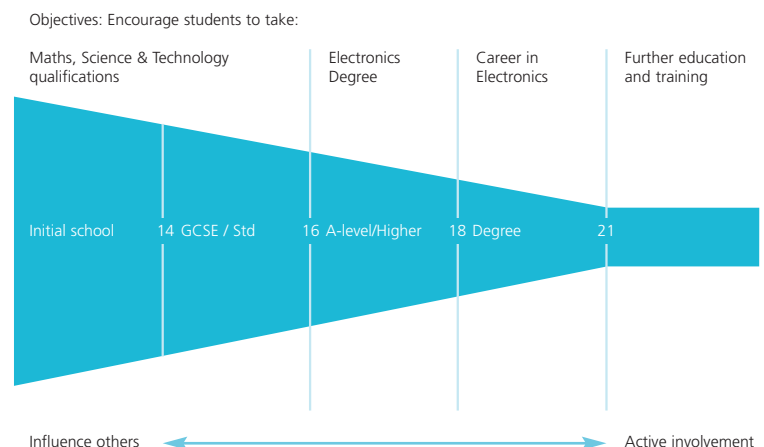
## INFLUENCING IMPROVEMENT IN THE EDUCATION SYSTEM

The industry cannot directly change the education system. We must work by communicating our needs and opinions to government and other bodies.

To this end we are involved with:

- The government's Information Age Partnership skills working group on Information Technology, Electronics and Communication.
- Chairing the EMTA working group on Electronics technicians, and with other EMTA groups.
- SQA's engineering advisory board.
- DTI's Electronics skills survey advisory group.
- Links with DTI, DfEE and the Scottish Executive.
- Links with Scottish Enterprise, the Welsh Electronics Forum, a number of English RDAs, FEI and Electronics Scotland.

These contacts give our industry the opportunity to influence development of the education and training system to ensure that it meets our needs.



# ACHIEVING BUSINESS OBJECTIVES

## Via skills development.

The main aim of any commercial company is to maximise profit. To achieve this, a manufacturing company will typically set goals in the areas of:

- Cost of production – effective use of resources and methods
- On-time delivery to customers – cycle time management and planning
- A quality product – sound manufacturing methods

Semiconductor companies generally operate effective continuous improvement programmes to address these goals. However, comparison across the NMI membership has shown that there is still scope for improvement.

### TEAM LEADERSHIP

Of course, business objectives are achieved via the skills of the individuals in a company. To be effective, improvement activity must involve the team leaders who control staff carrying out manufacturing activity.

It is vital therefore that team leaders have the skills and knowledge to manage in one of the most dynamic manufacturing environments.

We have therefore been working with our members to develop a team leader development programme, which has been designed to ensure that key business objectives are incorporated into all aspects of the programme.

Following an evaluation of what a fab needs of its team leaders the following set of modules were defined:

1. Production management
2. Delegation
3. Effective appraisals
4. Communications
5. Dynamic problem solving
6. Performance management
7. Time management
8. Administration

The first four modules have been completed by a team of NMI and member specialists.

At first glance, the modules appear to cover the usual subjects. However, they are all being written from the perspective of business improvement – how team leaders can use them to address business objectives.

The modules incorporate industry-specific case studies. Participants have to develop action plans for the course and link these to their company's ongoing improvement programmes. These two aspects ensure that the modules are directly related to participants jobs and, we believe, lead to effective learning.

The return on the training investment can be linked directly to fab performance through the actions plans and fab metrics.

We are considering accrediting the programme through the Institute of Management's Certificate of Management and/or their VQ at levels 3 and 4.

### MEMBER SUPPORT

NMI continues to develop industry best practice and to enhance its internal expertise in:

- Training systems management – how to establish training systems that contribute to business results.
- Manufacturing systems – including staff resourcing, cycle-time improvement, WIP management, and bottleneck management.

NMI staff work with a number of member companies to assist them with their improvement activities in the above fields. In one case this has led to projected cost reductions in excess of £100 thousand per annum, a 20% increase in available staff, and an improved training system.

A typical scenario might involve a training manager joining a semiconductor company from another industry. The NMI would work with them to bring them up to speed with the industry and their company's training system.

Another scenario might involve NMI running the first pilot courses in the leadership skills programme, whilst working with the production management team to integrate action plans into the company's improvement activities.

NMI full members are allocated a number of days of support per year as part of their subscription.

# MEMBERSHIP

The work of the NMI is funded by its members to **support** the microelectronics industry.

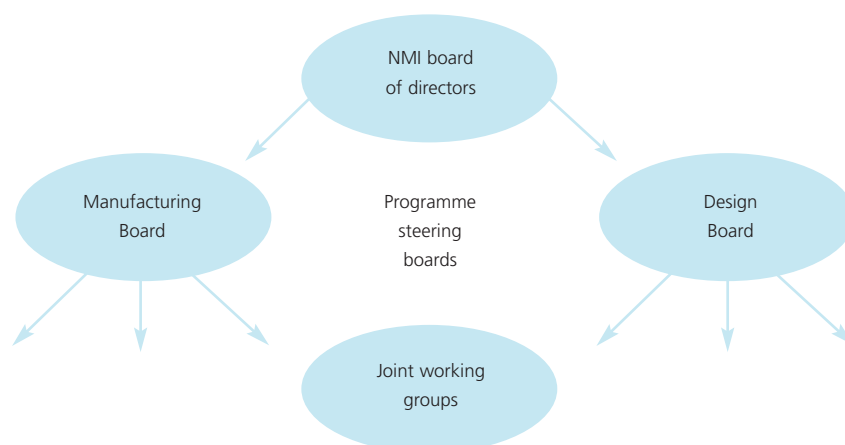
## MEMBERSHIP OF THE NMI

The work of the NMI is funded by its members (both industrial and regional development agencies) to support the microelectronics industry. Membership of the NMI supports the continuation of the work described in this review. Membership is available in two categories (Manufacturing and Design) and at two levels (Full and Associate Membership). The NMI is controlled by its Board of Directors and by two Programme Steering Boards. Full members can appoint a representative to one (or both) of the two Programme Steering Boards.

Each category of associate members elects at least one member to the appropriate Programme Steering Board. We encourage smaller suppliers and vendors to be members of JEMI and/or SSSF. Larger suppliers and vendors should consider joining NMI and also being members of JEMI and/or SSSF.

NMI's membership in January 2001 was:

	Full	Associate
Manufacturing and design	Atmel, Motorola, National	
Manufacturing	ESM, Mitel, NEC, Philips, Seagate	Analog Devices, Applied Materials, BOC Edwards, Dynex, Filtronic, Heraeus, Marconi Caswell, Raytheon, Shin-Etsu, Trikon, Zetex
Design	ARM, Infineon, Tality	Sony, Cypress
Regional	Scottish Enterprise, Welsh Development Agency (via Welsh Electronics Forum)	OneNE





The following table lists the main benefits of membership:

	Annual subscription	Benefits of membership
Non-members	Nil	Improved profile of the microelectronics industry. Improved supply of skilled staff. Participation in 'open' tier programmes by invitation.
Associate Members	≥£5,000	<i>Non-member benefits plus:</i> Vote for a representative on the appropriate Programme Steering Board. Access to one (or more) NMI 'standard' programme(s). Discount on 'value tier' initiatives, such as the CCL. Access to NMI courses at discounted rates. Access to NMI staff support at associate member rates.
Full Manufacturing member	≥£30,000	<i>Associate member benefits plus:</i> Representative on the appropriate Programme Steering Board – strategic guidance of NMI.
Full Design Member	≥£20,000	Access to an unlimited number of NMI programmes. Up to 10, 15 or 20 days per year of dedicated support from NMI staff – this includes improvement activity and course provision. Additional days support at full member rates.

NMI classifies its initiatives into a number of tiers. The following table lists the currently defined tiers, who can participate in each tier, and whether a fee applies:

Tier		Full Members	Assoc. Members	Non Members
Open	Initiative benefits the industry as a whole rather than participants	Free	Free	Free
Standard	Normal NMI facilitated programmes (e.g. TPM working group)	Included	1 included <sup>1</sup>	Not available
Value	NMI-driven, value-added programmes (e.g. CCL rebate)	Included	Discounted fee	Fee
Extra	Company specific support activity	Full member rate	Associate member rate	Fee

<sup>1</sup> Additional initiatives can be selected for higher membership fees.

# ACHIEVEMENTS

What we have been doing for **you**.

## INCREASING EFFICIENCY

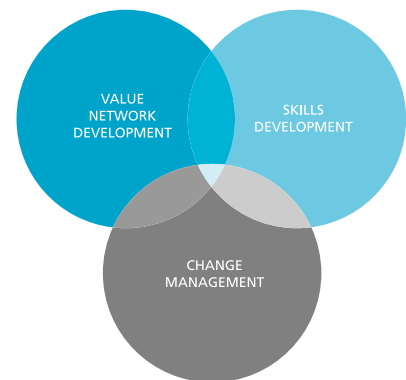
- Saved over £6M per annum for the industry through a Climate Change Levy Negotiated Agreement.
- Developed a Microelectronics Safety Pass for the UK.
- Facilitated industry networks in the areas of Total Productive Manufacturing and Purchasing.

## DEVELOPING SKILLS

- Complete set of operator and technician qualifications available across the UK.
- Series of postgraduate manufacturing modules available from 10 UK universities.
- Funding from ERPS for the development of a series of postgraduate design modules.
- Defined job roles for which employers need not prove that they have advertised the post before recruiting from outside the European Economic Area.
- Industry strategy developed for us to play our part in encouraging students to take maths, science and technology qualifications.
- Developed an approach to training management and developing leadership skills that can impact on business objectives.

## A COMMON VOICE WITH INFLUENCE

- Increased the profile of the semiconductor industry with government bodies, educational institutions, regional development agencies and other industry bodies.



National  
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I would like to acknowledge the work of many individuals within our membership whose efforts have contributed to these results.

Clive Dyson  
NMI Chief Executive

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