



National  
Microelectronics  
Institute

# NEW IDEAS, BRIGHTER FUTURES

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National  
Microelectronics  
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### A LETTER FROM THE CHAIRMAN

Welcome to the NMI's 1999 - 2000 Review - a summary of the collaborative work led and facilitated by the NMI over the last twelve months.

As we enter the new millennium, the market struggle to balance the supply and demand for our products globally appears to be easing. It is with relief that we enter a period when order books are strengthening. As ASP's start to strengthen the upward cycle of the industry presents us all with new opportunities.

In this period of renewed optimism, support of the NMI and its programme remains critical to our ongoing success. We must seize the new opportunities that are now presenting themselves and keep the competitive edge for the microelectronics industry in both manufacturing and design.

New challenges also present themselves in the shape of the knowledge revolution, for example the explosive uptake of the Internet. Knowledge transfer and speed of communication become ever more important, new markets with new opportunities are opening up, the consumer model is changing and business must adapt to survive. Our industry and its products are at the vanguard of this activity.

With the continued focus and support of the NMI we may feel confident that our fabs will be part of the technical drive advancing in the communications revolution. The NMI plays a key role in helping us to collaborate, not only within our own sector but also by reaching out to other areas, identifying and accessing world class knowledge and appropriate expertise as we need it.

Despite the hard times that our industry has been through, we have achieved a great deal through our effective collaboration during the last year. Real progress has been made in Education and Training, Business Process Development and, more recently, in support of the Design Community. We must continue to build on this progress as the market strengthens.

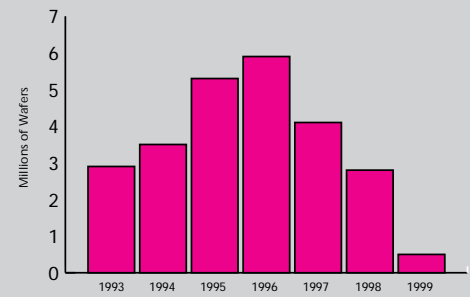
In closing I would like to encourage all of you in the industry to continue your support of, and work with, the NMI to ensure continued growth of this important business sector.

James Weir  
NMI Chairman  
NEC Semiconductors (UK) Ltd.

# VISION

The growth in the use of electronics in everyone's daily life continues to explode. The number of mobile phone users is expected to reach over **1 billion by 2003**.

## ANNUAL INCREASE IN WORLDWIDE WAFER CAPACITY



Source: The McClean Report

### THE UPWARD PART OF THE CYCLE

The growth in the use of electronics in everyone's daily life continues to explode. The number of mobile phone users is expected to reach over 1 billion by 2003 compared to 300 million in 1998. The majority of car engine control and braking systems are already controlled by electronics. The Internet is becoming commonplace. And digital electronics are expanding into existing applications, such as television. This has led to electronics becoming the fastest growing industry in the world - and it depends on a supply of semiconductor Integrated Circuits (ICs).

However, the rate of growth continues to make it difficult for the semiconductor industry to match capacity with demand. It takes close to three years to bring a manufacturing plant to full capacity. By the time a shortage has arisen, it is too late to invest.

Only twelve months ago we were explaining, in NMI's last Annual Review, that the semiconductor industry was facing temporary over-capacity and associated low product prices due to excessive investment some years earlier. Given the rising use of semiconductors in every day life, the question was when, not if, demand would again exceed supply.

We forecast that the turning point, when demand would exceed capacity, would occur in 1999, and indeed that did occur towards the end of the year. We are now again faced with lengthening lead times for products, capacity shortages and rising semiconductor prices.

Plants in the UK are running at capacity. Many are looking to expand and take on more staff. Filtronic have purchased the mothballed Fujitsu fab near Durham, and are ramping to produce GaAs circuits for mobile phones. The empty plants in Newcastle, Dunfermline and Newport are attractive locations to rapidly bring back into production.

It is vital that we build on the work carried out during the slowdown to develop the education and training support base in the UK. The existing manufacturers in the UK are keen to support inward investment agencies and ensure that the skills required to meet any new investment are available in advance. We look to collaborate with government to ensure that any skills demand that such investment brings is met with minimal damage to the industry.

### COLLABORATING TO COMPETE

Approaching 10% of world semiconductor output is made in the UK and Ireland. Over half of the design teams in Europe are located in the UK.

This certainly constitutes a cluster of activity in the global semiconductor industry. For it to thrive companies must work together to improve the local support environment – and NMI is here to smooth the progress of that collaborative activity.

NMI's abilities lie in applying change management skills to the development of both the industry's value network and its supportive education and training community. You can find more background to the NMI on page 9.

This review outlines our successes to date. They have been mainly in support of manufacturing, which has provided our initial funding.

We are now starting to apply the same techniques in support of product development. Our first step is described on page 8.

### GLOBAL TRENDS ON UPSWING



Source: The McClean Report

# BUSINESS PROCESS IMPROVEMENT

The NMI is working on behalf of its members to achieve a negotiated **reduction in CCL**.

## CLIMATE CHANGE LEVY THE NMI ACTS TO SAVE £M's

The NMI utilities group has been working to build on its success from last year, the key objective continuing to be the pursuit of cost saving opportunities for all forum members. Our major thrust has been directed at the upcoming imposition of the Climate Change Levy.

The Climate Change Levy (CCL) is a tax on industry's use of energy, which was first announced in the Chancellors Budget Speech in March 1999. The CCL is estimated to add at least 10% to the energy bill of our members from April 2001. Indicative levels of tax to be applied have been given as:

Electricity	0.43 p/kWh
Natural Gas	0.15 p/kWh

Revenue raised is to be recycled through a reduction in employers' NIC contributions equal to a 0.3p in the £ saving for each employee. The additional cost of the CCL to the semiconductor sector is about £4 million per annum.

The Government proposes to offer significantly lower rates of Levy to those energy intensive sectors who are prepared to sign up to legally binding agreements to improve their energy efficiency. Companies will also have to be subject to the Integrated Pollution Prevention and Control (IPPC) legislation. The NMI is negotiating such a reduction in CCL for the microelectronics sector, primarily on behalf of its members, but also for the sector as a whole.

It is envisaged that a reduction of 80% of the levy will be available to NMI's members in return for a commitment to an appropriate energy efficiency programme. This will save the semiconductor sector up to £3 million per annum.

## NMI AND THE SUPPLY CHAIN: FORGING LINKS WITH THE WIDER INDUSTRY

In a spirit of forging links across the wider industry, NMI and JEMI collaborated during 1999 to run two very successful supply chain days in Edinburgh and Newport. The sessions attracted over 50 delegates from a wide cross section of the supply community as well as representatives from large and small fabs. Invited speakers from PRTM, Strathclyde and Glasgow Universities and SPEED gave differing perspectives on supply chain management.

The meetings recommended that NMI and JEMI should join forces to work on win-win opportunities for the sector. The five key areas identified are summarised below:

- The Purchase and Supply Process

To investigate potential routes to reduce costs and improve efficiency in the sales / purchase cycle. Attention will be given to reducing the number of transactions required and to standardising e-commerce.

- Materials Management

To investigate routes to optimise costs by improving efficiency and optimising the supply of consumables.

- Logistics and Freight

To optimise procedures used for the freight and distribution of capital equipment, and spare parts - in particular to generate a model for the import and export of equipment, and consumables that avoids unnecessary payment of duties and VAT.

£3m  
Saving



- Equipment Hook Up

To standardise on requirements for equipment hook up, either for new build or additional install. Identify scope for cost savings and improved communication between participating groups.

- Forecasting Fab Requirements

To model the support requirements of UK based fabs over a three-year period.

NMI and JEMI have gone on to organise small working teams that will drive these initiatives forward during 2000.

### **PURCHASING OPTIMISATION**

The UK Microelectronics Purchase Consortium (UKMPC) was established in the early spring of 1999.

Initially six NMI members and Associates are participating to source items under joint terms. The first commodity selected by the group for consideration was Cleanroom Consumables.

The objective is to realise cost reductions for participating companies (both customers and suppliers) by avoiding repetitive negotiations relating to the sourcing and purchase of non-competitive consumable items.

### **MICROELECTRONICS SAFETY PASS (MSP) – A WORLD FIRST FOR THE SEMICONDUCTOR INDUSTRY**

The Microelectronics Safety Pass is a scheme designed by the industry to improve safety awareness among visitors to manufacturing sites, whilst achieving significant cost savings.

There is a legal requirement on manufacturing sites to provide visitors with appropriate health and safety information. This is normally done through an initial induction or training session, which lasts between 1 and 6 hours depending on the site, although the content across all sites is similar. Many visitors (especially vendor and supplier staff) visit more than one site throughout the year and this results in similar training being delivered multiple times.

The MSP was initiated to standardise and improve safety awareness, but has the added benefit of providing a mechanism to optimise the available time of supplier and vendor engineers. After 2 years of development the outcome is a single training programme that combines best practice from a number of industry experts.

A 5-hour training session will be delivered at validated industry training centres, which are located close to the main industry clusters to minimise travel costs. Each manufacturing site will provide information on their site specific safety systems (fire alarms and exits etc).

Delegates will be issued with a pass accepted at virtually all UK fabs. Training will be retaken every two years.

A comprehensive quality assurance system has been designed to ensure that training provision is of the highest standard:

- Trainers are validated to ensure they have the experience and skills to deliver the training to the highest standards.
- Delegates are assessed to ensure they will have sufficient knowledge to work safely when they visit a manufacturing site.

To ensure a smooth transition to the new system a comprehensive communication programme has been carried out over the last 6 months. Following this, the programme will be launched in April 2000.

In addition to an overall improvement in safety awareness, it is estimated that elimination of repeated training will save more than £1 million per annum.

# EDUCATION & TRAINING

## Preparing for Growth

### A VISION FOR VOCATIONAL EDUCATION AND TRAINING IN THE UK

In the past, we have criticised needless change within the education system and would not wish to create more confusion through a radical change. We prefer to consider how incremental changes to the current system can address our industry's needs. NMI is working to facilitate the development of a coherent approach that provides both vocational education and vocational training in a cost-effective manner.

This approach starts from a 'needs analysis' to identify the competencies required for a specific job. A competence may have educational and training components that are separated into two. Each component is classified as widely useful (a key/core skill), as industry sector specific, or as industry sub-sector specific. The classification allows modules to be developed for use across the widest possible range of industry.

A decision is made for each component to be accessed through a college qualification, a vocational qualification or some other route. As a guideline, if a competence is addressed in a college qualification then it should be omitted (or cross-referenced) in a

vocational qualification, and vice versa. Note that college qualifications will support some vocational training components and that vocational qualifications will support some vocational education components.

Finally, the mapping of the required competencies onto the chosen qualifications is documented in the form of a Personal Development Plan. This single (modular) document shows employees how the qualifications they are taking constitute an integrated approach to developing the competencies they need.

Having identified the necessary modules, our industry looks to identify mechanisms for the provision of quality teaching and training material. These can include collaborative development by colleges, NTOs and companies, and purchase from commercial providers. We aim to facilitate the development of distance learning (including computer-based) material as part of this collaborative activity. For example, regional FE College collaborative groups in Scotland, Wales and the NE of England have agreed to use the same computer-based learning standards so that they can exchange courses.

The provision of good course material and delivery mechanisms is the priority. It contains the added value. Subsequent auditing and accreditation is a form of quality control. We want the education

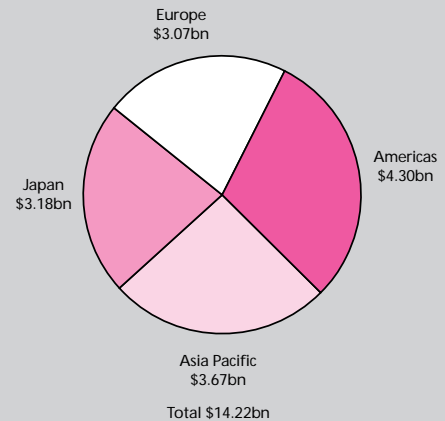
and training system to adopt the changes that have occurred in industrial quality control systems. Quality should be built into the design of the material and training courses, rather than being audited for (by NTOs) when a development programme is completed.

Any component (in a college qualification or vocational qualification) should be accessible via any registered training provider. This might be an FE College, an industrial training centre, an industrial employer, or any other provider. For example, if an FE college's practical course demonstrates that a student has satisfied a component of a VQ then that can be recognised and set against the VQ. Similarly, if a course run by an industrial training centre meets any of the requirements of a qualification then this should be counted towards that qualification.

In summary, college qualifications and vocational qualifications must become interlocking components of an overall vocational education and training scheme that is offered through a diverse group of training providers.

## SIA WORLD SALES REPORT

November 1999 \$ sales



### COMPARISON WITH EUROPE

NMI has compared the UK apprenticeship training to that being offered in Germany, as part of a Leonardo project on microelectronic apprenticeship training. The comparison demonstrated that the Modern Apprenticeship in the UK contains more than the equivalent vocational education and training of the new German Microtechnologist Apprenticeship.

### SUPPORT OF FE COLLEGES

The NMI Education and Training Board (ETB) agrees the standard approach to education and training for the industry in the UK. One of its major roles is the development of FE Colleges supporting the semiconductor industry.

Industry makes a significant input to the development of the colleges and their lecturers to ensure that the quality training required for semiconductor technicians is available.

Each company assists its local college directly. The industry as a whole runs College Workshops to provide specific lecturer training about twice a year. The latest was run in Scotland with the support of Scottish Enterprise. Equipment is donated to colleges when this is appropriate.

Training has been provided to college lecturers on, for example mechatronics, vacuum, plc's, robotics, SPC, and manufacturing practices. This knowledge is common to a wide range of manufacturing industry. The semiconductor industry is therefore supporting not only semiconductor specific courses but also lecturers able to work with advanced manufacturing industry as a whole.

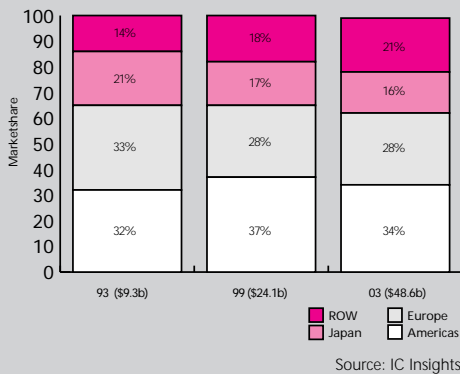
This year, a working group from the ETB has produced a Lecturer Development Plan. This defines the experience and skills required by lecturers to teach each of the semiconductor related modules. It suggests ways in which the necessary experience can be acquired by lecturers.

Three college consortia have been formed: the Scottish Microelectronics Skills Consortium, the South Wales Education for Industry Consortium and an FE consortium in the North East of England. Each of the groups has educational and industrial members to ensure that the correct courses are developed.

The consortia are collaborating to develop distance learning material. NMI has arranged for the three consortia to use a common framework and to develop complementary material. This avoids duplication of effort and makes the best use of regional funds.

**+25%**  
Sales Growth

## COMMUNICATIONS IC USAGE BY REGION



## TEAM LEADER DEVELOPMENT

Manufacturing sites rely on individuals being able to lead teams – from small to large. The ETB has been writing learning material to support the development of the necessary skills. The possibility of accrediting the course is being investigated with a number of Institutions and Training Bodies. The aim is to complete this programme by mid 2000.

NMI is also working with JEMI and SSSF to consider how team leadership skills can best be developed within the supply chain. This may lead to a project partially funded by the DTI.

## POSTGRADUATE COURSES IN SILICON MANUFACTURE

The master-level courses developed under the IGDS Masters-level training programme in Advanced Silicon Processing and Manufacturing Technologies have been launched. This IGDS programme is funded by the EPSRC.

The courses provide an excellent vehicle through which companies can support the continued technical education of their engineering staff. Engineers have the option of working towards a Master of Science degree by taking 8 of the modules and

completing an in-company project.

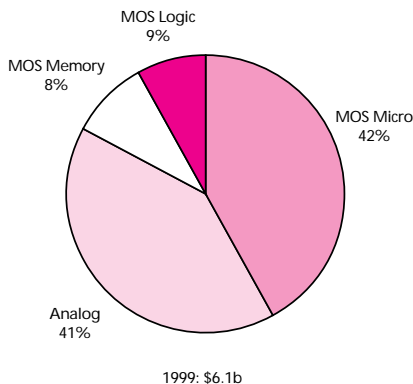
The first module will be delivered at the University of Edinburgh in early March 2000. The provisional schedule for the first seven modules is shown in the table below.

Students can enrol at any one of the ten participating universities. There are a total of 16 modules planned for the programme and each module will include a 1-week residential element.

This is an effective route for you to develop your staff. Please contact Sandy Peace, IGDS Course Administrator, on 01483 876138 or at [s.peace@ee.surrey.ac.uk](mailto:s.peace@ee.surrey.ac.uk).

Modules	Date	Venue
Devices and process integration	March 2000	University of Edinburgh
QA, yield, reliability and failure analysis	May 2000	UMIST
Power devices	September 2000	University of Wales, Swansea
Quantitative Methods	January 2001	Heriot-Watt University
Ion Implantation	March 2001	University of Surrey
Lithography	May 2001	University of Edinburgh
Oxidation and isolation	June 2001	University of Liverpool

Additional modules are being added. Please consult the NMI web site for details.



## AUTOMOTIVE IC MARKET BY DEVICE TYPE

Source: IC Insights

# FUTURE

NMI is looking to **build** on the wide range of design courses available.

## NMI GROWS TO SUPPORT IC AND SYSTEM DEVELOPMENT

The UK is 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.

IC design in these fields is rapidly expanding, with over half of the IC design groups in Europe located in the UK. They include some of the most successful in the world, including ARM, STMicroelectronics, Mitel, Motorola, Sony, Xilinx, Atmel, Analog Devices, and hundreds of others. New design investments are announced weekly.

To help support this growth, NMI is looking to build on the wide range of courses available to support systems, IC and embedded software development in the UK, including those offered by:

- The Institute for Systems Level Integration (ISLI) – consisting of the Universities of Edinburgh, Glasgow, Heriot-Watt and Strathclyde. The ISLI offers a range of courses aimed at system design, and partitioning into silicon hardware and embedded software.
- The Radio Frequency Engineering Education Initiative (RFEEI) – consisting of the Universities of Bristol, Bradford, Surrey, Portsmouth and York. This initiative offers courses in support of RF systems design.

- The Advanced Microelectronics for Industrialists IGDS offered by Bolton Institute and UNN. This is unique in offering an MSc in microelectronics design supported totally by computer-based distance learning.
- A number of other Universities including Cambridge, Essex, Imperial College, Manchester, Newcastle, Sheffield, Southampton, and Queens University Belfast.

NMI has led a submission to the Engineering and Physical Sciences Research Council (EPSRC) to establish a Masters-Level Training Programme for IC design and systems integration. The bid involves the ISLI, the RFEEI and Bolton Institute. It reserves funding for other Universities to contribute modules in their field of expertise.

The initiative will offer students a catalogue of the high quality modules selected to meet the demands of industry. These will be available as one-off modules at postgraduate (Masters) level. Most engineers might take a few such modules. However, a minority may wish to achieve the eight modules plus a project required for the award of an MSc.

The modules will be upgraded to support distance learning wherever appropriate. Residential periods will be used to address those sections of modules where distance learning is not the best approach.

Involvement of industry from the outset will ensure that there is a demand for each module to be provided. Modules will be linked to either industrial best practice in design and product introduction or to leading research activity on electronic systems.

If accepted by EPSRC, the initiative will provide an extendable framework to which additional modules can be added as technology advances or industry needs change.

If your company is interested in joining the NMI to support its work on product development, please contact Clive Dyson on (+44) 0131 449 8502. Membership fees for Design Members and Associates will be agreed with the design community.

Over recent months, the NMI has represented the industry's interests by making inputs to the DTI and DfEE on skills shortages in the product development community. This has led to a proposal that certain jobs be recognised as occupations in which there is a skills shortage. If this is accepted, employers wishing to recruit from outside the European Economic Area will no longer need to prove that they have advertised the post and been unable to fill it. This will significantly simplify the administrative procedure and shorten recruitment cycles.

# ABOUT THE NMI

## Value Network Development Skills Development Change Management

### THE NATIONAL MICROELECTRONICS INSTITUTE

The NMI is a not-for-profit organisation owned by its members. It was founded in 1996 to support the microelectronics industry and assist its continued growth. NMI's members are semiconductor manufacturers, design houses, suppliers to the industry, and regional development agencies. Its remit covers all aspects of the design, product introduction and manufacture of integrated circuits.

The organisation's expertise lies in the fields of:

- 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.
- Improvement of internal company operations – including manufacturing management, equipment engineering, and factory scheduling.
- Development of the education and training infrastructure. The NMI and its members work closely with FE colleges, Universities and funding bodies to ensure that the best possible education and training is available.
- Change management – a vital enabling skill for collaborative improvement initiatives.

The NMI operates working groups that bring together the appropriate experts in the industry to identify how cost savings and improvements can be made. This may involve identifying best practice and adopting it across the industry.

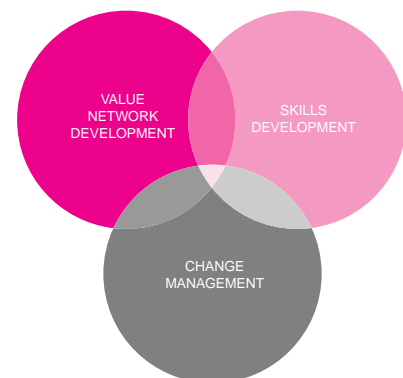
Most work is carried out in these working groups. Thus, although the direct cost of the NMI is around £350,000 per year, well over £2 million per annum is contributed in kind to NMI activity by industry, its suppliers and educational bodies.

Many initiatives require benchmark data to be collected. NMI acts as a trusted intermediary to collect any confidential information. This is then distributed as an overall analysis of the data so that the confidentiality of participants is maintained. Only those companies that contribute data to any benchmarking activity gain access to the full results.

NMI is committed to working with all relevant trade organisations in the industry. For example, both JEMI and SSSF are working with NMI to communicate the Microelectronics Safety Pass throughout the industry, gain feedback and improve the final system. 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.

The NMI has established working relationships with other industry bodies world-wide, including SEMI, Sematech and SIA. It participates in joint programmes, exchanges their outcomes and looks to minimise the duplication of effort.

NMI also works closely with regional bodies. These run their own support activities for their local industry. The NMI looks to link these activities into the national framework to allow best practice to be shared between the regions and common standards to be adopted.





## MEMBERSHIP OF THE NMI

The NMI is funded by its members (both industrial and regional development agencies) to support the microelectronics industry through the continuation of the work described in this review. Associate Membership is available in two categories - Design Associate and Manufacturing Associate. Each category of members elects a member to the NMI Board. NMI's membership in January 2000 was:

<b>Full members</b>	Industrial	ESM, Mitel, Motorola, National, NEC, Philips, Seagate
	Regional	Scottish Enterprise, Welsh Development Agency (via Welsh Electronics Forum)
<b>Associate members</b>	Industrial	Analog Devices, Applied Materials, BCO Technologies, BOC Edwards, Filtronic, Heraeus, Raytheon, Shin-Etsu, Zetex
	English Regions	OneNE

NMI classifies its initiatives into a number of tiers. The following table lists the currently defined tiers, who can participate, 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. Equipment Forum)	Included	1 included, others at a fee	Not available
Value	NMI-driven, value-added programmes (e.g. CCL rebate)	Included	Discounted fee	Fee
Extra	Company specific support activity	Discounted fee	Fee	Fee

The following table lists the main benefits of membership:

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 Member	≥ £5,000	Non-member benefits plus: Vote for a Category Director on the NMI Board Access to one NMI 'standard' programme (more at a fee) Discount on 'value tier' initiatives, such as the CCL Access to NMI courses at discounted rates Use of 'NMI Associate' logo
Member	≥ £30,000	Associate Member benefits plus: Director on the NMI Board - strategic guidance of NMI Access to an unlimited number of NMI programmes Use of 'NMI Member' logo

# ACHIEVEMENTS

NMI's initiatives will assist the industry in the UK to be prepared for the current upturn, with **better access** to a supply of trained staff

## WHAT WE HAVE BEEN DOING FOR YOU

**In its second full year of operation, many of NMI's initiatives started to come to fruition. We are on course to recover the costs of all NMI initiatives from direct savings this year. This means that all of the programmes with benefits that are less easily measured, especially in Education and Training, will have been completed 'for free'.**

All our initiatives should assist the industry in the UK to be prepared for the current upturn, with better access to a supply of trained staff and reduced costs in a number of areas.

## OUR MAIN ACHIEVEMENTS TO DATE ARE:

Value network and business process development:

- The microelectronics industry is on target to submit a draft agreement for a rebate agreement to the Climate Change Levy. NMI is accepted as the industry body for the sector by DETR. Companies that sign up to the rebate scheme and implement all cost effective measures', as defined in the agreement, will be able to gain an 80% rebate on the Levy.

- Development of the standard Microelectronics Safety Pass for the industry has been completed and pilot courses have been run. The pass will be fully launched this year with the pass becoming the preferred approach to Health and Safety training by mid 2001.
- Our equipment and manufacturing practices forums have identified a number of areas of best practice, resulting in significant savings for many members.
- Activity on the supply chain is progressing well. In particular, a number of initiatives are underway with JEMI, and the first Purchasing Consortium has been formed to simplify the purchase of fab consumables.
- NMI continues to run college workshops to keep lecturers up to date with developments.
- An IGDS course in Advanced Silicon Manufacturing has been launched with the first module to be run in March 2000. Each course will give postgraduate education and training at Masters level, with the option of obtaining an MSc by taking 8 modules and completing a project.
- NMI has led an initial bid to EPSRC for a similar programme to provide postgraduate education and training in IC, systems and embedded software development. If accepted this will be available in 2001.

## Improved education and training:

- Exchange of best practice – our Education and Training Board has developed into a highly effective working group.
- The industry-supported FE colleges in the UK are continuing to collaborate. 3 regional consortia are developing distance learning material to a common standard.

## A common voice with influence:

- NMI is recognised as a body representing the industry in the UK by many organisations, including DTI, EMTA, SQA, Edexcel, the Engineering Council, IEE, Ofgem, Scottish Enterprise, WDA, and SEMI.

## NMI HAS MOVED

NMI moved location in September of last year to new premises situated at Research Avenue South, still at Heriot-Watt University, Edinburgh. Most of our contact details remain unchanged:



National  
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Heriot-Watt Research Park      Fax 0131 449 8501  
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