



# The High Technology Challenge

## An Industry View - slightly updated

Prof. John Roulston, OBE, FRSE, FIET, FREng., CEng.

[jroulston@scimus.co.uk](mailto:jroulston@scimus.co.uk)

# Background

## □ Personal view, based on industry experience.

- 35 years in Defence technology with major companies, - Microwaves, Signal Processing, Electro-optics, Software, Avionics.
- Director in two SMEs, both in England.
- Founding Director of a technology EEIG (Joint Venture) located in Paris with French/German partners.
- Ex-CEO, Filtronics – LSE listed - Cellular communications & Defence.
- Advisor to several start-ups, including one foreign enterprise.
- Started Scimus, knowledge-based engineering and science consultancy in February '06.
- Making a living as an international engineer.

## □ Relevant Interests

- Chair, IET Engineering Policy Group for Scotland.
- Chair, High Technology Talent Strategy Board for Scotland. (sponsored by Scottish Enterprise).
- Advisory Board, “SciFun” – science activity for school-children in Scotland.
- Scottish Enterprise regional development board member.

# Comment on the “Henley Study”

## Educating Engineers for the 21st Century: The Industry View

- ❑ In the high technology sector the issues are probably more acutely felt than in engineering generally.
- ❑ The issues identified have been around for a long time.
- ❑ The report does a very competent job of creating an up to date view and supporting it objectively.
- ❑ It covers the perspective of SMEs particularly well.
- ❑ It is a valuable contribution to analysing the problem and it deserves to be influential.
- ❑ I feel confident that few in industry, would or could, dissent from the picture it paints.

# Comment on the University Comment to the Henley Study

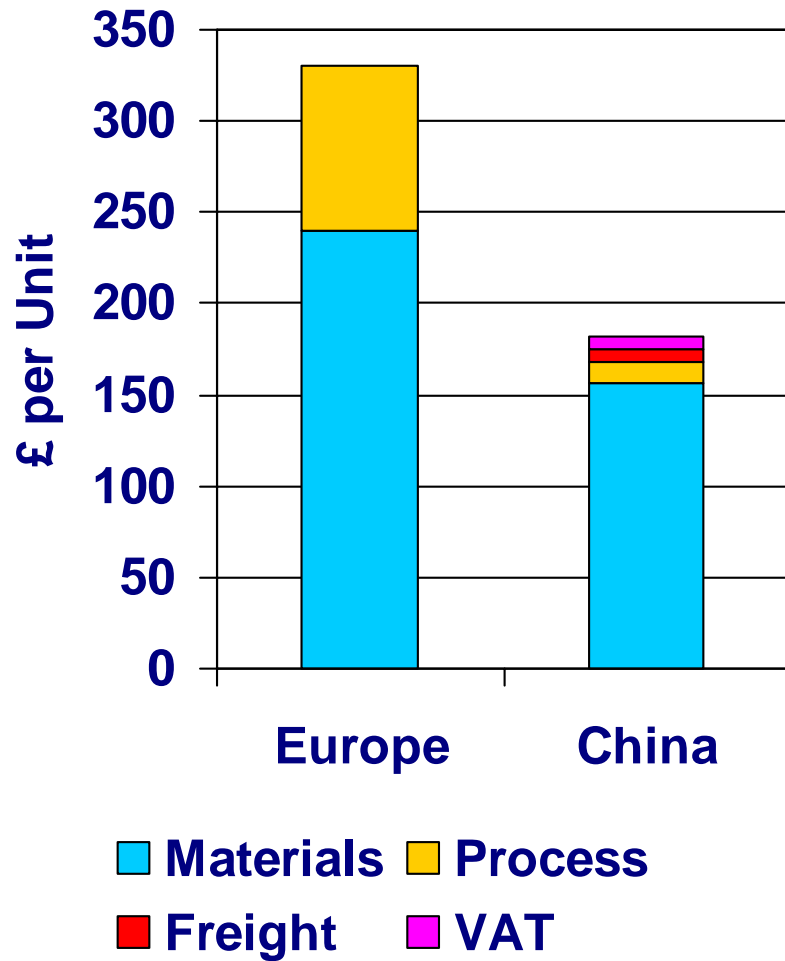
- ❑ Gratifying to see such an active response, albeit incomplete at last hearing.
- ❑ Some evidence of insularity.
- ❑ Some concern about opinions that would favour sacrificing fundamental elements for increased scope. Therefore worried about how to accommodate increased scope- could the Europeans be on the right track?
- ❑ But generally an encouraging response and one that justifies the Academy's efforts.

# Positioning of high-tech industry in the UK

- ❑ We don't have many major global players to act as catalysts for national engineering excellence, as for example,
  - Rolls-Royce in relation to Warwick (manufacturing technology), or,
  - BAE SYSTEMS in relation to Loughborough (systems engineering).
  - But, many foreign multi-nationals located in the UK demonstrate first-class initiatives in education, e.g. the Oracle Academy.
- ❑ In the UK, we are largely an economy of small firms supplying global giants in electronics, communications, automotive and advanced materials.
- ❑ All of these suppliers experience the pressure of global markets,
  - 15 – 20% per annum “price-down” suppressing growth.
  - migration of manufacturing to lower-cost economies.
  - need to focus on increasing levels of product integration with consequences for their internal knowledge resource.
  - increasing call on innovation as a competitive response.

# Economic Value of Low-cost Global Sourcing

(Courtesy, Filtronic plc.)



- ❑ European cost structure,
  - 73% materials.
  - 27% process.
- ❑ Chinese savings,
  - materials 35%.
  - process 86%.
- ❑ Delivery cost by sea 5% - air freight adds 11%.
- ❑ 4% unrecoverable VAT added in Jan 04.
- ❑ Chinese cost structure,
  - 86% materials.
  - 7% process.
- ❑ Overall saving 45%.
- ❑ Effectively dollar based.



# Globalisation progress pattern – example

(Courtesy, Filtronic plc.)

## □ Manufacture technology product in, say, China,

2000

- Testing and packing sub-assembled product from abroad.
- Assembling and testing from kits supplied from abroad.
- Qualification of indigenous suppliers.
- Localisation of key supplies.
- Full procurement/assembly/test in China.
- Export of partially complete products for testing and packing elsewhere.
- Export of complete units.
- New Product Introduction (NPI) in China from products developed elsewhere.
- New product development in China.

2005

# Implication of globalisation to industry

- ❑ Significant technology leakage – difficult to retain control of key technology in emerging nations.
  - Customers can and do benefit from technology leakage.
- ❑ Drives need for increasingly sophisticated product,
  - Higher technology content.
  - “Invisible” content – algorithms, software, firmware, knowledge.
  - Migration to more service-based activity.
- ❑ Demands higher skill and greater sophistication from staff,
  - Communicating ability – interpersonal skill – language ability.
  - Fundamentals of the underlying product science.
  - Modelling capacity – physics and mathematics.
  - Innovation and entrepreneurship – versatility.
  - Cross-discipline ability – technical and business capacity.

# What is important for graduate engineers in addition to their engineering specialisation?

- ❑ Basic Applied Mathematics of the “Victorian modelling school”,
  - Algebra, Basic calculus, Trigonometry, Geometry, Complex numbers, Matrices, Vectors, Sequences & Series, Numerical methods, Probability theory, Linear Ordinary Differential Equations.
- ❑ Classical Physics,
  - Mechanics, States of Matter, Electricity and Magnetism, Electromagnetism, Optics, Semiconductors, Vibrations and Waves, Concept of dynamical state.
- ❑ English language, vocabulary and grammar,
  - Sentence construction, punctuation, technical writing skill, presentation basics.
- ❑ One foreign language,
  - At sufficient proficiency to appreciate the difficulties encountered by foreigners speaking English.
- ❑ A grounding in engineering professionalism,
  - Product safety, Ethics, Professional Responsibility.
- ❑ A basic understanding of commerce, finance and business law.

# High Technology Industry's major concern

- ❑ Winning the future – depends upon product excellence which depends upon people who can create excellence and lead in a creative environment.
- ❑ Commodity technology today is so accessible it inhibits hobby technology for the majority, but some good stories – example, “Robot Wars”.
- ❑ Failing motivation among bright youngsters to follow the scientific path at age 14, – then they can't switch!
- ❑ Perception of the reward from science/engineering as not worth the effort involved – needs serious debate.
- ❑ The universities may do a great job, but the raw material flow is necessary,
  - Parental perception.
  - Social value and public perception.
  - Media assistance and Professional Institution support.

# In a technology-based industry, wealth comes from innovation

- Four ingredients need to be fostered in a society that expects to benefit economically from technological innovation,
  - Intellectual,
    - ❖ The individual mind dominates – the idea has to be accessibly recorded – the intellectual climate changes.
  - Technical,
    - ❖ Proper materials or techniques must exist. The technical climate must indicate feasibility or a path to feasibility.
  - Social,
    - ❖ The idea passes from Intellectual to Artisan. The social climate must promote this – civilisations have prospered or perished dependent on whether this element of innovation is represented.
  - Economic,
    - ❖ There must be benefit or reward for those who pioneer the change and the commercial climate must support the risks taken in the process.

# Final Observation

- ❑ In the UK we are not alone in our concerns about quality and quantity of engineering graduates.
- ❑ I hear similar views from colleagues in, Germany, Italy, France, Israel, USA and even Singapore.
- ❑ I see better conditions in Australia and Scandinavia and probably in Ireland.
- ❑ We do have enormous empathy and effort from a large number of “do good” individuals across Britain, myriad private initiatives but serious fragmentation in things that are publicly funded and a difficulty in harmonising public and private efforts.
- ❑ A number of discussion sessions I have chaired conclude that positively influencing parents is the single most important step in improving the outlook for technology industry, that is addressing the social and economic aspects of innovation.
- ❑ I do believe the professional institutions, with a simple agenda, have a vital role to play in promoting engineering for economic strength – it is one of the most important things, if not the most important thing on their agenda.

... and one example of influence ...

