THE ROYAL SOCIETY

March 1998

Ref:

The Engineering And Physical Sciences Based Innovation House Of Commons Science And Technology Committee Inquiry

MEMORANDUM

1. The Royal Society welcomes the opportunity to give its views on engineering and physical sciences based innovation. The Society believes that the issues raised are of great importance: it will continue to be active in providing advice to Government and others on this subject.

2. The Society would like to draw attention to the following publications which are of relevance to this inquiry: *Intellectual Property and the Academic Community* (March 1995), *Technology Foresight* (October 1995) and *Realising our Potential Award (ROPA) Scheme* (August 1996).

3. This response has been endorsed by the Council of the Society. It was prepared by a group led by Professor A.M. Stoneham, and comprising Professor P. Hutchinson, Professor J.E. Midwinter, Professor E.P. Raynes, Professor J.D. Rhodes, Dr. M.J. Stowell and Dr. M.R. Tubbs.

"to inquire into the manner in which companies in the fields of engineering and physical sciences decide on developing new products and processes and the factors influencing their decisions, with particular reference to:

(i) the industrial application of Government-funded research;

Government funds for research with industrial relevance derive from a wide range of sources and programmes such as the EPSRC, the LINK scheme, Government Research Establishments, the National Health Service, the EU, EUREKA, company teaching schemes and through university collaborations with industry. Key points to note are that:

- relevance is almost impossible to measure on a time scale of one to three years;

- there are other valuable outcomes besides patents or other IPR, such as better-informed decisions regarding product development and commercial strategy, including the identification of ways not to proceed. These outcomes may be particularly valuable for key users, yet not publicly reported;

- the selection of research projects funded by Government may be unadventurous.

We recommend looking at the US scheme of seconding leading academics and industrialists to funding agencies. This has some advantages over traditional UK committee systems, which can be extremely conservative and which may promote incremental rather than innovative research. In the US such strategies have resulted in the better and more adventurous application of Government-funded research as a result of the expertise which is available and the high-level personal contact networks spanning industry and academe.

Collaborative links between industry and university departments, conducting exploratory basic or strategic work relevant to industry, can serve to provide industry with:

- a longer-term, broader and sometimes international window on the subject;
- a route to address questions that industry does not have the time to evaluate itself;
- benefits from wider collaborative groupings to attack relatively non-competitive issues that underpin technology.

(ii) the respective roles of Government Laboratories and independent research and technology organisations;

The reduction in recent years of Government Laboratories and of some large laboratories in the private sector has eroded important training functions, especially for technicians, where current schemes are inadequate. We feel that this has had a significant effect on the small- and medium-size technology-based companies (technology-based at all levels of sophistication) which tend to grow around such large laboratories. On-the-job training at Government Laboratories has been important for many sectors of the research community, including the academic sector, and this gap will be felt. This training role is additional to the solid case which can be made for the roles of Government Laboratories in conducting research for reasons of national security, as standards laboratories, as hosts for large, expensive kit, as hosts for missions, or where efficiency of resource utilisation means that work can not be done elsewhere.

Government Laboratories have traditionally provided stability to conduct research projects of longer duration. The obvious danger is that such laboratories can become fossilised. In this respect it is worth considering the Japanese model, where vitality is fostered by Government Laboratories acting as hosts for projects, each project having a maximum period of funding, usually five years, followed by bids for funds for new projects in open competition.

The independent research and technology organisations (IRTOs) have a role to play as contract research organisations providing specialist skills "on demand" for those organisations that cannot justify the cost having them in-house. IRTOs also have an important role to play in short- and medium-term development work, including confidential pre-contract R&D and contract work for specific customers or multi-client groups. Furthermore, IRTOs have a role in providing their members with information.

The Government's role of "informed customer" is less effective than in some other countries, and would benefit from more secondments of leading academics and industrialists. Such secondments are common in the USA.

(iii) the operation of Government schemes designed to promote collaboration in industrial application of research;

One very successful scheme in promoting collaboration is the CASE scheme which should continue to be given a high priority and should be expanded. First, the "Company CASE" scheme works well, in that the company is able to place the award at a university chosen by the company. Second, given the international nature of UK industry, there should be a broadening of the scheme to include foreign students:

1. EU nationals, who should qualify for maintenance grants just as UK students do; and

2. foreign students sponsored by multinationals with interests in the UK.

In both cases, the dividends would eventually flow back to the UK.

It is intolerable that Government schemes for funding collaborative research on occasion generate expectations greatly in excess of the resources available. This leads to needless waste and frustration for those applying. Funding schemes must provide potential applicants with as much information as possible on the criteria for eligibility and the likelihood of a proposal being funded. Such information is of vital importance so that potential applicants can make soundly based decisions on whether to invest resources in developing an application. These resources can be very considerable, especially in the case of collaborative proposals.

In all the schemes care should be taken to ensure that the rules do not create unnecessary problems. Generally, processes need to be more transparent, more stable, and the amount of paperwork reduced.

We also believe that the principle of Treasury attribution is hindering UK efforts to collaborate, especially in competition with Germany. We recommend looking at the German model, which provides extra support to a reasonable fraction of the best of the successful EU projects.

Tax incentives to industry could also serve to promote the uptake of the results of industrial and academic collaborations. We support enhanced tax relief for companies supporting teaching or research in, or in collaboration with, an academic institution.

(iv) intellectual property rights and patenting;

In some emerging areas of research some unforeseen problems are emerging concerning intellectual property. These include new types of IPR, such as computer-generated information and simulated results.

Some universities, particularly those that do not have a major commitment to research, may have problems as owners of IPR; for example, they may not be able to exploit it or protect it properly through expensive litigation. They should be encouraged either to leave the IPR in the ownership of the individuals who generated it and/or the bodies that funded it, or else to aid its transfer as soon as is practicable to a body which could exploit it. IPR arrangements should provide incentives for individuals to collaborate with industry and set up spin-off companies.

IPR agreements must allow university invention to lead to a reward, but the reward and demands must be realistic. A clear distinction must be made between the science content and its application; exploiting firms have a responsibility not to obstruct other uses of the science content.

The group was somewhat concerned that some of the existing schemes for deciding who receives the rewards arising from innovation may not be well conceived in that they do not always benefit the intended recipients. In particular, there is a low level of financial reward to individual inventors in the UK. This can inhibit their commitment to exploit their inventions. Many universities provide a good reward scheme, but Government service and industry have a problem with poor or non-existent schemes; in other words, section 40 of the 1977 Patent Act does not work. Inventors in other countries can be better off.

(v) the provision of finance to support enterprises involved in the application of research and invention;

One model which we support strongly is that of US government contracts awarded in Silicon Valley. These require that 25% of the value of such contracts be sub-contracted to other companies at arms length. If this is not done then the amount is recovered dollar for dollar by the US government. This system has allowed many smaller companies to expand.

The venture capital market, trusts and Enterprise Investment Schemes could be made more attractive by increasing the allowed investment amount per individual. A case can be made for more tax incentives to encourage investors to become involved in more speculative ventures. The capital gains relief roll-over for manufacturing firms provides distinct advantages. In the US there is a culture of individual patrons who are prepared to invest in speculative ventures. The same is less true of the UK, and steps should be investigated to encourage such patrons to invest.

(vi) the role of the Foresight Programme in fostering networks and identifying priorities;

The Society's views on Foresight are set out in the attached document.

We have some doubt that Foresight has had any real significant impact on the longer-term priorities of its main target audiences. We are concerned that the Research Councils claim that Foresight has had such impact. Our concern stems from the now dated conclusions of the exercise and from their apparent generality. One major problem with the Foresight programme was that the Steering Committee set its own priorities over and above those of the fifteen individual Panels. Consequently, some of the ranked criteria of the Steering Group may be neither relevant nor appropriate. This is of special concern in that the Research Councils have to pay attention to the priorities of the Steering Committee.

We believe that the Foresight programme was a good idea that was ineffectively run. Its main benefit has been some fostering of networks. There have been secondary benefits, for example that attention has been drawn to research areas which were less evident, such as the food and drink industry.

Some problems arose because the process was rushed to accommodate political deadlines. This diminished the value of the exercise. Furthermore, the Treasury and other Government departments need to be seen to be involved in implementing the

Foresight recommendations if the Foresight Initiative is to work effectively and have credibility with industry.

(vii) the role of the Engineering and Physical Sciences Research Council in fostering technology transfer;

Since the EPSRC confines its funding to the academic sector with minimal exceptions, its role must be to promote research and training for research in this sector. The EPSRC itself does not have the capability for technology transfer. Its role is the encouragement of collaboration and cultural transfer; here, the CASE scheme is an important catalyst.

The EPSRC's remit is too nationally inward looking and UK focused. It must be noted that UK companies are not wholly dependent on the UK science base for their technologies.

The EPSRC also has a role in telling industry about the successes which have come from work which they have funded. EPSRC could for example demonstrate how work undertaken five to ten years ago has contributed to current successes.

The Interdisciplinary Research Centres have had mixed success. The best of them offer examples which could be repeated. Such centres could be funded on a five year basis with the objective of providing a training focus and subsequent dissemination of knowledge into industry. We have suggested above roles for Government Laboratories and IRTOs as hosts for projects on a similar scale.

There is also a need to ensure that the individual rather than the project is supported, since present committee-based procedures can favour incremental research.

(viii) progress made towards implementing those recommendations of the Science and Technology Committee in the previous Parliament in their report on The Routes Through Which the Science Base is translated into Innovative and Competitive Technology relevant to fields of engineering and physical sciences.

The statements in the previous report are largely qualitative and, since many of the recommendations were not specific or time constrained, it makes appropriate action problematic and progress difficult to measure. Our impression is that not much has changed markedly for the better, with the possible exception of Inward Investment (paragraph 335). Some other areas have clearly got much worse such as the continuing rundown of the academic capital base and reward structure. We urge the present inquiry to identify a number of practical steps to improve innovation in industry and commerce, and that all its recommendations be clearly focused on specific named communities.

For further details please contact *science.advice@royalsoc.ac.uk*