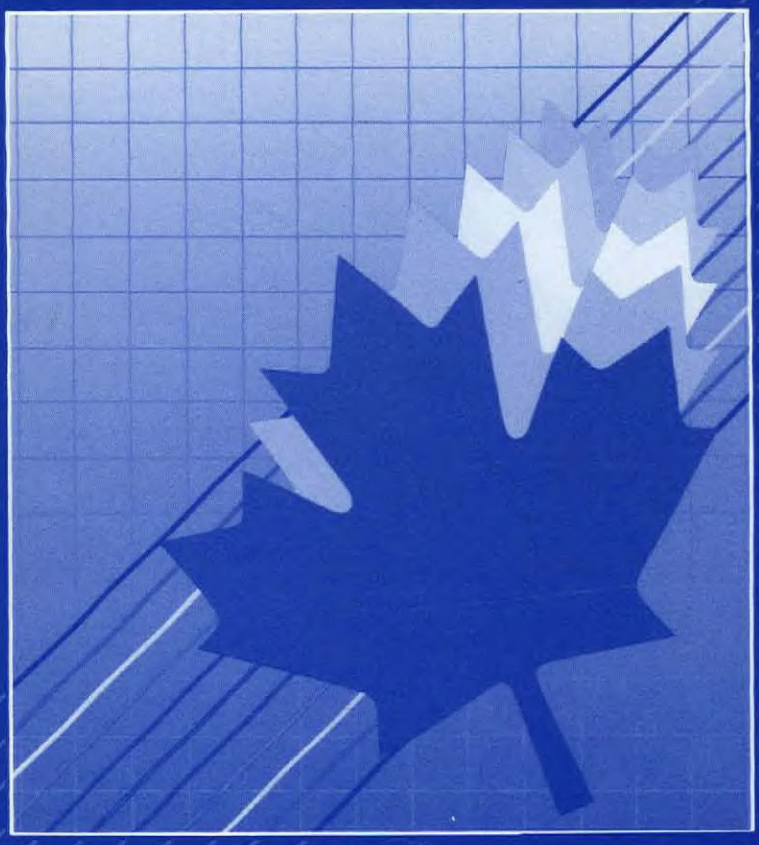
Sciences et Technologie

THE CHANGING STRUCTURE OF SUPPORT FOR UNIVERSITY RESEARCH IN BRITAIN

Report on a Visit
(May 15 - 31, 1987)



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FORWARD

The purpose of this visit report is twofold: to decriptively outline the structure of support for university research in Britain in order to provide a guide to those who may need an introduction or quick reference, and to examine transitions within that system which either eminate from public policy decisions or which have important public policy ramifications.

I would like to acknowledge the generous support received from the British Council which organized the schedule, arranged many of the meetings, assisted financially, and extended the invitation to visit the U.K. in the first place. Of particular help were Charles Chadwick and Ken Wallace (Ottawa), Barbara Davis (London) and Janette Simpson (Manchester).

Highlights

REORGANIZATIONS AND POLICIES:

- the overwhelming impression of this visit was that the structure of support for university research is being revised along very broad lines. It is not only involving the research councils and the UGC but is systematically making higher education policy an integral part of industrial policy. While this approach clearly appeals to those who are principally concerned with the economy and employment, the 'growing pains' that have been, and continue to be, felt by the university sector have been severe. In addition, there are serious doubts as to whether short-term science can lead to long-term economic growth and vitality. Therefore, exactly how healthy British university science and education will be in the future is very unclear.

- the University Grants Committee will be reorganized as the **University Funding Council.** (sections 2f and 5b)

- the funding for polytechnics has been removed from the local education authorities and has been reorganized under the new **Polytechnic and Colleges Funding Council.** (section 5b)

- the **Research Councils** are responding to constrained budgets by increasingly developing industry-oriented programs (often in collaboration with such agencies as DTI). Despite considerable success in these programmes, councils such as SERC are being faced with having to cover the indirect costs of research, award only a small proportion of 'Alpha' grant applications and equipment requests, cut back on the number of PhD scholarships awarded, and even cancel grant competitions. The cost of subscription to international projects and organizations like the **European Space Agency** and **CERN,** being payable in foreign currency as they are, are further constraining already tight budgets. The **Advisory Board for Research Councils** has lost some of its say over the size and distribution of the Science Budget. (sections 2g-j)

- the **Department of Trade and Industry** is becoming increasingly influential over the direction and level of funding of higher education. This is due largely to its design of new programs which are being co-sponsored by the **Science and Engineering Research Council,** encouraged by Sir Keneth Baker (ex-Minister for DTI and currently Secretary of State for Education and Science) and which advance the Government's objectives of increasing university-industry collaboration and of increasing industry's support for higher education. (sections 2h, 2l, 3a-h)

- suggestions which have been circulating about the formation of a **Ministry of Science** have been laid to rest.

- the **'Save British Science' Movement,** which was formed in 1984 to campaign against cuts to higher education and which now has a membership of roughly 5,000 scientists, has politically marginalized itself by arguing for the re-enactment of the Robbins Committee recommendations of the 1960s for an unlimited expansion of research funds.

- the **Technical Change Center** will be closed as of July 31, 1987 due to the withdrawl of core funding by the **Economic and Social Research Council** and to the loss of legitimacy from the Advisory Council for Applied Research and Development which was expected to give the new Center for Exploitable Science and Technology to TCC. (section 2k)

- the **Science Policy Support Group** which was housed at the TCC will be unaffected by the closure. (section 2k)

- the **Center for Exploitable Science and Technology** is expected to be announced shortly under the chairmanship of Sir Robin Nicholson who was, until 1986, the Chief Science Advisor to Cabinet Office. CEST will likely be located in ACARD although Cambridge University and the University of Warwick are distant possibilities. (section 2e)

- the **Advisory Council for Applied Research and Development** is becoming more influential. Attached to Cabinet Office, ACARD not only has direct ties to the Prime Minister but it also now has a small Science Secretariat, a Technology Assessment group, across Whitehall responsibility for science and (in all probability) the Center for Exploitatable Science and Technology. It is responsible for the size of the Science Budget and, although it effectively has no budget of its own its small elite Council commands considerable influence.

- although a principle overall thrust of the Government has been towards privatization and a reliance on 'free market forces', policies relating to research and higher education have shown a marked tendency towards centralization. There is a real push towards commercialization, industry-oriented research and training, and a concentration of resources.

- Following a 'real time' evaluation of the **Alvey Project** in 5G information technologies by **PREST** and **SPRU,** Alvey is expected to go into Phase Two in the near future. Principal areas of investigation will be in Intelligent Knowledge Based Systems (IKBS), Software Engineering, Ultra- and Very-Large Scale Integration, and Man-Machine Interface.

ISSUES AND MOODS:

- There were very few complaints from the university community about the need for **selectivity** or for getting **value for money.** However there were strong reservations concerning the **method of evaluation and decision,** and with some of the policy thrusts towards, for example, **concentration of funds, the move towards the three tier system,** and **contract teaching.**

- The concentration of funds through the ranking of departments and universities was seen, even by those in some of the richest departments, as leading to a rotting away of the so-deemed 'lesser' departments or campuses. The example of Salford was often was to demonstrate that while it may still be open (indeed it is prospering due to the inflow of indutrial money)it is no longer a university but a consulting establishment. (section 5d)

- It was often asked 'in a tiered university system, would the Government pay to move a researcher and his family? And would the Government rank each researcher and allocate a campus to that person?'

- The move towards 'contract teaching' was seen as an attempt by the Government to push this activity (which had largely been the responsibility of the Manpower Services Commission) onto those universities which were to receive cuts. By adding a research contract component the Government could, it was widely argued, "gain the appearance of encouraging the private sector and the economy while actually reducing the committment of Government to higher education".

- The new formula for funding being used by the UGC is widely seen as being innappropriate - especially as it is 'driven' by student demand projections which (1) have been too low for the past two years and (2) do not relate in any apparent way to the performance of research. In addition the 'Judgement Factor' is viewed as unacceptable in its imprecision. (section 2f)

- It is not the impression of researchers that funding cuts are 'aimed' at basic sciences in favour of applied research. There is, however, a new 'British disease': "Short-Termism"

- While research evaluation and the evaluation of funding it now expected to be a permanent feature of the higher education landscape there is a growing disenchantment with bibliometrics and co-citation analysis (which were pioneered by John Irvine & Ben Martin). Increasingly 'real-time' evaluation is being used. Two major centres involved in the development of this is PREST at the University of Manchester and SPRU at Sussex University. In many instances the two units take complementary perspectives and are collaborating on many of the same projects. For example, both are working on the Alvey Project. PREST is focusing on management questions

(staffing levels, property rights, inter-firm collaboration, etc.) while SPRU is focusing on strategies (what is appropriate for the U.K., can it compete internationally, can indicators of this be developed, etc.). Real-time evaluation is also raising questions about how the evaluation actually changes the behaviour and outcome of the project. Nevertheless, new techniques in research evaluation are not likely to supercede traditional methods which relie on surveys, interviews, experience and intuition.

1. Introduction

For the past seven years, Britain's scientific and higher education communities have been learning to live with zero-growth budgets, as well as a series of policy and institutional re-orientations. The resulting pressures have prompted a running debate between government and the universities which argue that the nation's capability has been diminished in almost every field of research, sacrificed to a blind commitment to reduced public spending.

Beneath the debate over financial support, however, lies a deeper conflict over the future of university-based research and education. Through both choice and necessity, the cuts are resulting in significant structural changes in the way British science is organized.

It was the purpose of a recent visit to Britain to closely study these changes in the hope that we, in Canada, could more effectively manage similar pressures that are effecting Canadian universities, Research Councils and government.

2. The British Structure

2a. The Higher Education System

In Britain today there are 53 universities, all of which except three (Open, Buckingham, & Cranfield) are funded by the University Grants Committee. In addition there are 29 polytechnics, 346 other colleges under local education authority (LEA) and 30 voluntary colleges which are directly funded by the Department of Education and Science.

In 1983-84 there were 534,000 full-time and sandwich higher education students and 316,000 part-time students. Of the full-time students, 268,000 attend university - 31,000 (11.5%) of whom are postgraduates. Of the 266,000 poltechnic students 11,000 (4%) are postgraduates. A breakdown, by field of study, of the university students is as follows:

U.K. Full-Time and Sandwich Home Students by Field (Universities Only), 1983-84

	'000s	%
Education	10	3.7
Medicine	30	11.0
Engineering	35	13.0
Agriculture	5	1.7
Science	65	25.2
Social Studies	62	23.0
Professional	6	2.1
Languages	33	12.2
Arts	22	8.1
Total	268	100.0

In 1986-87 The University Grants Committee spent more than £669m on higher education while Research Councils spent nearly £540m.

2b. The Dual Support System

University research in the U.K. is supported through the 'dual support system'. This system evolved during the 1960s in the post-Robbins era of university expansion and was firmly established in 1965 with the organization of today's major research councils through the Science and Technology Act (1965).

The separate science budget which is given to the Department of Education and Science (DES) was also established in 1965, the allocation of which is recommended by the Advisory Board for Research Councils (ABRC).

The rationale of the dual support system is that a basic level of resources is provided through the UGC to enable individuals and groups in universities to pursue and test innovative ideas in research to the point where it appears that they are worthy of development on a larger scale. At that point, a case is made to the Research Councils, or to other bodies such as charitable foundations, for additional funding to further pursue research ideas. The case for additional funding is judged on its merits through peer review and independent referees. The additional funding is not meant to cover total additional costs; the universities must contribute to overhead costs, and is expected to make some contribution to specific costs - for example, by sharing the costs of an item of equipment.

In recent years the level of total resources available has not permitted the support of all worthy applications for additional funding by the Research Councils. Nor have the universities been able to provide and maintain well equipped laboratories across a full range of research areas. This situation, one that is becoming familiar in Canada, has led to a number of inefficiencies in the system.

One is that applications to the Research Councils are increasingly including costs - such as items of equipment, materials and chemicals - which in the past the university might have been expected to provide itself. In fact the dividing line between the responsibilities of the Research Councils and the universities, which has never been clear, is becoming increasingly less defined. In some instances, applicants, universities, research communities, and Research Councils may all operate using different assumptions about who should cover costs.

More generally there is a tendency on the part of the Research Councils to make the funds available for university research grants stretch as far as possible by spreading them out among too many groups. Despite the fact that a large proportion of applicants may be of high calibre, bringing down the average size of grants - given the real costs of research - may in fact be a false economy. Nevertheless the British government seems unwilling to substantially increase the Research Council budgets, preferring instead to promote reorganization through fiscal restraint and management.

2c. The Advisory Council for Applied Research and Development (ACARD)

The Advisory Council for Applied Research and Development (ACARD) was established in 1976 to advise the government on the exploitation of research and technology. *ACARD reports, through the Cabinet Office and Chief Science Advisor , to the Prime Minister. There exists, also within the Cabinet Office, a small Science Secretariat for the Chief Science Advisor and a recently established technology assessment branch. It is this new branch which is responsible for the collection of departmental statistics on R&D spending for the Annual Review.

In 1982 the mandate of ACARD was expanded significantly to include the co-ordination, with the ABRC, of research supported through the Department of Education and Science.

ACARD is made up of of 16 members, the majority of whom come from industry. It is complemented by a number of 'Assessors' who are made up of the Chief Scientific Advisor (Cabinet Office), and of the Chief Scientific Advisors of the Departments of Energy, of Transport, of Trade and Industry, of the Environment, and of the Ministry of Defence.

With the cuts to higher education which were made between 1979-1984, the more recent reorganization and evaluation of funding, and the development of university-industry programmes, ACARD has become politically influential. With the announcement of a Center for the Exploitation of Science and Technology (CEST) and the new Advisory Council on Science and Technology, both of which will have very close ties with the Cabinet Office and the Prime Minister's Office, ACARD will become even more so. This influence will extend to higher education research.

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* Most, but not all, government departments have chief scientists. These positions correspond roughly to an ADM (Research and Development) in the Canadian government.

2d. The Advisory Board for Research Councils (ABRC)

The Advisory Board for Research Councils was established in 1972 to advise the Secretary of State for Education and Science on his responsibilities for civil science. It is Chaired by Professor Sir David Philips and includes 23 other prestigious members such as the Chief Scientific Advisor. In recent years the ABRC has been an effective voice both for the university communities and the Research Councils and for the policy directions of the government, however that influence seems to be eroding. The most recent blow to ABRC's influence will be the establishment of a new Advisory Council of Science and Technology which will coordinate R&D spending across the board in Britain. This new body, which will likely report to a Cabinet committee and be Chaired by the Prime Minister, will have close links with both the new Center for the Exploitation of Science and Technology (which will be announced soon after the election on June 11, 1987) and the existing Science and Technology Assessments Office in the Cabinet Office. Thus the ABRC will still have influence over the allocation of Research Council Budgets but it will have little to say on behalf of university research or on the size of the science budget.

2e. The Center for Exploitaable Science and Technology (CEST)

In October 1983, the Advisory Council for Applied Research and Development (ACARD) announced the establishment of a study on "Promising Areas of Science". The purpose of this study was to survey current scientific developments and advise the Cabinet Office of work which showed commercial and economic promise in the medium and long term. It was also intended that the committee for the study, which was Chaired by Dr. C.H. Reece of Imperial Chemical Industries, should assist those in the Cabinet Office involved in the preparation of the Annual Review.

In its work the Committee asked a series of fundamental questions. These included:

1. Which areas of generic technology are supported by a particular area of strategic science?

2. Has the U.K. the scientific resources to advance an area of strategic research? If not, how quickly can resources be acquired?

3. Within a generic technology, what classes of new products and processes will become possible within a ten or twenty year horizon?

4. What indicators are there of the likely costs of translating knowledge from the generic pool into marketable products and processes?

5. In which areas of existing industrial and commercial activity will the new products and processes find initial application?

6. What evidence is there for a foreign industrial presence in the relevant areas and what implications does this have for U.K. market share?

In addition to its surveying activities, the Committee invited the Science Policy Research Unit - particularly John Irvine, Ben Martin (as well as Diana Hicks and David Crouch) - to review previous appraisals of scientific developments that showed, over a ten year timeframe, promise for commercialization. The SPRU group studied the U.K., the U.S., Japan, France, and West Germany and subsequently published its findings in a book entitled Foresight in Science in November 1984.

Other groups were also involved in the study, notably the Science and Engineering Policy Studies Unit of the Royal Society, which is under the Directorship of Dr Peter Collins, and the SERC. The Royal Society, at the invitation of the Advisory Board for Research

Councils, embarked on a study in 1984 on the health of basic science in Britain. The study focused both on long term basic science and on research that was closer to commercialization over a twenty year period. The results were published in 1986 in Nature and argued for the continued development of quantitative methods to studying basic scientific research.

The SERC published its report entitled A Strategy for the Support of Core Research in September 1984. This report represented the SERC strategy for defining and developing the research themes that are crucial in underpinning the science-base sectors of the national economy and for which a strong core science capability is required. In developing their strategy the SERC emphasized the importance of multidisciplinary research and the difficulties imposed by the compartmentalization of funding research.

In May 1986 the Committee, through ACARD, published its report on Exploitable Areas of Science. Its principal recommendation was that "a process should be established for identifying exploitable areas of science, which has some certainty of continuity". The purpose of such a process would be to establish (1) what is possible in scientific and technological terms, and (2) what is commercially desirable.

When the report was first published its recommendations were well received and it was generally expected that the Secretariat for such a process would be set up at the Technical Change Center (TCC). However with the recent closure of TCC the fate of a Center for Exploitatable Science and Technology has yet to be announced. However it is likely that a Center will be announced shortly:

1. to be located in the Cabinet Office (although the University of Warwick and Cambridge University have also been suggested); and,

2. to be under the Directorship of Sir Robin Nicholson (who was the Chief Science Advisor prior to Dr John Fairclough).

2f. The University Grants Committee (UGC)

The University Grants Committee (UGC) was established in 1919 under the Department of Science (DES) however it was not until the 1960s - with Harold Wilson's famous speech in 1963 on 'the white heat of technological revolution' - that a need was perceived to link the science budget and the UGC's recurrent grant to universities under a 'dual system'. This move was facilitated by the establishment in 1962 of the Education Act (1962) which forbade Local Education Authorities (LEA) from spending any funds on postgraduate students.

Under this system of dual support (see section 2b above) the UGC block grant to universities was intended to cover basic teaching and research costs while the Research Councils would pay for additional equipment, unusual consumables, access to facilities, etc. which were necessary for research to be brought to a higher level. These latter categories of costs have often, but erroneously, been referred to in government circles as 'marginal costs'.

In 1984 the UGC was called upon by the government to review the status of university research and to administer a second round of cuts to universities, both of which had been dictated by then Minister of Education, Sir Keith Joseph. (The first cuts came in 1981.) Faced with either compliance with the request or the future erosion of the UGC's own influence, the UGC agreed to administer the cuts. This decision was met with considerable criticism from the university community as, not only had the UGC agreed to simply administer the government's plans but, they had undertaken both the task of providing the government with advice on the future shape of the university system and of establishing the actual criteria upon which the cuts would be based. These cuts ranged between universities from 44% to 2%. However the rationale underpinning the cuts was not clear.

It seems that they were not based on analysis but rather were the result of what the government believed it could afford. The guidelines, which were were set out in a 1984 UGC report entitled A Strategy for Higher Education into the 1990s, principally emphasized the need for a more selective approach to research (although critics argue that this was only because the government had no more money after the 1981 budgets). It is widely believed that the cuts to university budgets hit the non-technological universities hardest, however it is clear that among the most devistated were the highly technological City-based universities which had begun life in the expanding university system of the 1960s as Colleges of Advanced Technology (CAT). Two 'survivors' of this group are Salford University and the University of Warwick, however it can be argued that they have survived not as universities, but as contract establishments.

In January 1985 the government, through the Secretary of State, issued a letter of guidance to the UGC and in May 1985 the UGC in turn issued Circular Letter 12/85 entitled Planning for the Late 1980s in which

universities were invited to state their cases for funding to 1990. In this letter the proposed organization of the review was described, as was the information which the UGC needed from the universities, and the strategic framework within which universities should formulate their plans. Universities were asked to provide a statement of their overall objectives for the rest of the decade; a forecast of their student numbers by subject area; a statement describing their research plans and priorities; together with research profiles of individual subject areas; and a set of financial forecasts.

At the same time the UGC set out the structure for a new funding formula which would renovate the traditional block grant procedure effective AY 1986-87.

The new formula is based on four elements upon which resources which are thought appropriate for teaching and research are allocated. The resources for both activities are calculated on the basis of a so-called 'T Factor' (teaching), 'SR Factor' (staffing and research), 'JR Factor' (judgement on research) plus a 'Special Factor'.

- **The T Factor** is based on planned student numbers.

- **The SR Factor** is based on planned student numbers, plus proposed faculty/salary requirements, plus the need to support Research Council major projects which are jointly funded through the Department of Supply and Services (DSS). This last consideration is related in the formula to the income of universities from the Research Councils and is fixed at 40% - nominally called the overhead costs. Income from industry - which, for the purposes of the formula is limited to £10m for the system as a whole - is distributed proportionately.

- **The JR Factor** is the UGC's judgement on the research performance of a university department.

- **The Special Factor** is reserved, for example, for university departments which are involved with a national museum in the maintenance of important collections.

Calculations were based on submissions of 20 academic subject groups (the equivalent of Canadian departments) for student number planning, and on submissions of 37 Cost Centers for financial planning and allocation. An example of a Cost Center, which is the building block of financial accounting in British universities, is the Clinical Medicine Cost Center of University College, London which comprises not only Clinical Medicine but the departments of:

- General Medicine;
- Community Medicine;
- Pathology;
- Obstetrics;
- Surgery;
- Orthpedics;
- Larynxology; and,
- Urology.

These submissions, after being 'formulized', are scaled on a five-point scale and endorsed by a subject area sub-committee.

In response to early submissions from universities which were subsequently found to have been rated too low using the new formula, a brake (or 'safety net') was put in place against any formula induced funding erosion. This is currently in place, will be extended for one year, and will likely be in place for the duration of the five year period.

Despite the fact that the formula is principally driven - even for research - by projected student numbers (which have been roundly criticized), and the fact that even the UGC admits that the sub-committee endorsements are often based on Research Council perceptions of Cost Centers, the first block grants to universities based on the new formula and government rationalization were awarded in May 1986.

In February 1987 the Croham Report (Review of the University Grants Committee) was released with the recommendation that the UGC become the University Grants Council. The substantial changes involved have largely been accepted (see section 5b).

2g. The Research Councils

There are five Research Councils in Britain plus an Advisory Board for Research Council (ABRC). These are the:

- Medical Research Council (MRC);
- Agriculture and Food Research Council (AFRC);
- Science and Engineering Research Council (SERC);
- Natural Environment Research Council (NERC); and
- Economic and Social Research Council (ESRC).

All Councils and the ABRC report to the Department of Education and Science (DES).

This organization of university research funding came into being through the Science and Technology Act of 1965 which established the SERC, NERC, and the then SSRC (Social Sciences Research Council). The SSRC became the ESRC in 1983 as a result of a directive from the then Minister of Education and Science, Sir Keith Joseph. Many social scientists in the university community viewed this change, plus a cut of the Council's budget, as simply "reflecting the Minister's and Prime Minister's shared distaste of social science research and their equating of sociology and sociologists with socialism".

Founding Dates of British Research Councils

MRC	1919
AFRC	1931
SERC	1965
NERC	1965
SSRC	1965
(ESRC)	(1983)

Together, the Research Council budgets amounted to more than £566.8m in 1986-87.

British Research Council Budgets, 1986-87

MRC	£127.7
AFRC	£ 51.6
SERC	£299.1
NERC	£68.8
ESRC	£19.6

Unlike the Canadian Research Councils, those in the U.K. are involved in funding university research as well as being responsible for major installations (see sections 2g and 2h).

2h. The Science and Engineering Research Council (SERC)

The Science and Engineering Research Council, which until April 1981 was known as the Science Research Council, was established by Royal Charter on April 1, 1965.

In 1972 the White Paper Framework for Government Research and Development - otherwise known as the Rothchild Report - defined the purpose of the financial support through the five Research Councils and the University Grants Committee as "to develop the sciences as such, to maintain a fundamental capacity for research, and to support higher education". This research is additional to the mainly applied R&D funded by Government Departments (principally through the customer/contractor arrangement) to meet governmental objectives. The same document defined the primary purpose of SERC as "to sustain standards of research and postgraduate education in universities". Accordingly, the Council supports research in universities and polytechnics directly through the provision of research grants and postgraduate scholarships and indirectly by provision of central research facilities and through membership of international scientific organizations.

In addition, the Council is the U.K. agency through which is channeled support for the scientific programme of the European Space Agency (ESA), the European Organization for Nuclear Research (CERN), the European Incoherent Scatter Scientific Association (EISCAT), the Anglo-Australian Telescope (AAT), the provision of neutron beam facilities at the Institute Laue-Langevin in Grenoble, and the civil science interests of NATO. A major issue facing SERC and the British Government is the effect a weak U.K. currency has on international scientific memberships (for example, at CERN) which is paid in foreign currency and thus uncontrollably increases this activity as a proportion of the Council budget. The British Government at the moment spends a total of approximately 3% of its Science Budget on such activities.

The SERC is organized under four Boards, each of which has a part-time chairman. These are the Engineering Board, the Science Board, the Nuclear Physics Board and the Astronomy, Space and Radio Board.

The Engineering Board is responsible for the support of research and postgraduate training in academic institutions in all branches of engineering, computing science, and materials science and technology. Responding to its concerns that its Committee-based support should be mission oriented rather than subject oriented, the Board re-structured its committees in 1979 into four major programme areas of national, or strategic, importance. These programmes are in process engineering, marine technology (which will be restructured or terminated in the near future), the Teaching Company Scheme (see section 3g), and biotechnology. The budget of the Engineering Board in 1986-87 was £85.6M.

The Science Board is responsible for the support of research and postgraduate training in the biological sciences, chemistry, mathematics, physics (other than astronomy, nuclear physics and space research), and science-based archeology. In addition, the Science Board supports the development of such national and international facilities as:

- the central laser facility at the Rutherford Appleton Laboratory;
- the synchrotron radiation source at the Daresbury Laboratory; and,
- the spallation neutron source at the Rutherford Appleton Laboratory (ISIS).

In 1986-87 the budget of the Science Board was £87.2M.

The Nuclear Physics Board is responsible for supporting research and postgraduate training in particle physics and the physics nuclear structure. Access to major international particle physics facilities is provided by membership to CERN in Geneva. Back-up for university scientists using these and other high energy physics accelerators is provided by the Rutherford Appleton Laboratory. In 1986-87 the Board's budget was £70.0M.

The Astronomy, Space and Radio Board is responsible for the support of research in astronomy and geophysics through grants to universities and through the provision of major national and international ground-based and space-based research facilities. Support for the Board's programme is also provided through the programmes of the Royal Greenwich Observatory, the Royal Observatory - Edinburgh, and the Rutherford Appleton Laboratory. Major national facilities include the U.K. Infra-red Telescope in Hawaii, the U.K. Schmidt Telescope in Australia, the 1 and the 2.5 meter Isaac Newton Telescopes, the 4.2 meter William Herschel Telescope (all three being in the Canary Islands), the Satellite Laser Ranging system, and the Starlink interactive image processing system. In 1986-87 the Board's budget was £54.2M.

In 1986-87, SERC awarded approximately 2,500 new research studentships (a quarter of which go to industrial/academic research collaboration) and more than 2,000 advanced course studentships. SERC does not accept applications from individual students. Instead, studentships are awarded through the head of the department or research school where the awards are to be held.

At the same time, SERC Boards recommended nearly 2,500 research grant applications (from a total exceeding 4,888) and 147 cooperative grants (from a total number of applications approaching 300).

The concerns of SERC include the following:

- the push for more and more collaborative schemes with industry amounts to good politics which will make life cheaper for SERC. But (a) what have it got they to do with good research, and (b) if programmes such as the Teaching Company Scheme (see section 3g) are such good ideas why hasn't industry set them up before? In other words, there is concern that schemes of this sort will be successful principally because industry gets something for free;

- the indirect costs of university research are difficult to monitor but there is a general impression that more and more such costs are being covered by SERC grants. Hence research grants are actually buying less research.

- SERC can no longer afford to fund all of its mandated areas due to tighter and tighter constraints on the size of its budget and on government accounting requirements. The decline of sterling against other European currencies has effectively pushed up the cost of subscription to international facilities. The increases to Council budgets have not kept up with inflation, nor do they begin to acknowledge any 'sophistication factors' in doing research. Council competitions have been cancelled in the past year. There will likely be further cancellations.

Recent assessments on the state of research equipment in British universities were prompted in part by similar reports conducted by Canada's Natural Sciences and Engineering Research Council and the National Science Foundation in Washington. The major recommendation, forwarded in the face of no new money, was that better use should be made of equipment sharing. (Following on this recommendation, many in the Research Councils and university community were concerned that the Government would use this report to continue its push for a three tier university system (see section 5d) and technology centers.

2i. The Natural Environment Research Council (NERC)

Established by Royal Charter in 1965, the Natural Environment Research Council (NERC) is responsible for supporting and carrying out research in the physical and biological sciences which explain the natural processes of the environment. The Council carries out this research and training through its own research institutes and through grants, fellowships, and other postgraduate awards to higher education establishments.

In 1986-87 the total expenditure of NERC was £68M which came from the Science Budget. In addition, the Council received nearly £32M from commissioned research. The Council is increasingly seeking to expand the commissioned component of its budget. In large part this is being done through its Public Relations Section and through its Research Marketing Group. In 1985-86, for example;

- the Research Marketing Group was a leader in finding public and private partners for an initiative called ARIA (Agricultural Research in Africa).

- in the Marine Sciences area NERC joined with the Water Research Center to form a marketing joint venture.

- an agreement with Marconi Underwater System Ltd. was also signed for the commercial exploitation of the GLORIA ocean survey technology.

Budgetary pressures continue to affect the major activity of NERC - that of supporting university research. Although in the latest competition over 300 applicants (asking for £12.5M) were graded 'Alpha' by peer review, only 115 awards were made equaling £3.9M over three years. Similarly, despite an increasingly high demand, total training awards to PhD students remained at 300 while 200 MSc students received scholarships for a total of £6.0M.

The Council also supports research in universities and polytechnics by establishing research contracts and by provision of research vessels, major equipment, computing and sensing facilities and the NERC aircraft. Council also contributed, in 1986-87, £1.0M to the U.K. subscription for the Ocean Drilling Programme. Taken together these activities account for approximately 26% of the NERC's Science Budget vote.

Budget realities coupled with increasing demand from university research is forcing Council to re-examine its support and science priorities as existing resources are seen as seriously underfunding research and ship time as well as research students upon whom the future of British environmental science relies.

2j. The Economic and Social Research Council (ESRC)

The Social Science Research Council (SSRC) had its name, and many would argue its orientation, changed in 1983 by Sir Keith Joseph - then Secretary of State for Education and Science - following a famous speech in which Joseph denounced the existence of the social sciences. Since that time the Council has proceeded fairly quietly, producing its first Five Year Corporate Plan which covers the period 1986-91. Its budget to 1989 will remain at £19.5M. However in order to serve both the basic and applied research needs of the university community the ESRC will be reducing its support to PhD students at least over the next five years, and possibly longer. (In part this decision was supported by the 1984 Whiston Report on Completion Rates of PhD Students in the Social Sciences which was carried out by Tom Whiston of the Science Policy Research Unit.)

The ESRC operates largely through eight subject committees. These deal with:

- **Economic Affairs;**
- **Education and Human Development;**
- **Environment and Planning;**
- **Government and Law;**
- **Industry and Employment;**
- **Social Affairs;**
- **Research Resources and Methods; and**
- **International Activities.**

The ESRC has recognized, however, that these categories do not optimally reflect the research supported through their grants. The Council prefers to describe its principal activity as supporting 'basic research with policy implications.'

The Council has recently undertaken a study of the character and number of social scientists leaving Britain.

Traditionally the President of the ESRC has been appointed by the Secretary of State for Education and Science however recently an open (public) competition was announced for the vacancy. Cautious optimism is the mood within the social science community which is watching developments closely.

2k. The Technical Change Center (TCC)

The Technical Change Center (TCC) was established in 1981 under the Directorship of Sir Bruce Williams. The remit of the Center was "to study the choice, management and acceptability of technical change". Its core funding, upon which the Center relied, came from the Economic and Social Research Council (ESRC), the Science and Engineering Research Council (SERC), and the Leverhulme Trust. Some additional monies have been available in the form of industrial sponsorships and subscriptions to the TCC's Industry Club which provided industry with day-long seminars and advice. Associate members of the Club were principally civil servants.

In 1986, with the retirement of the Director, the ESRC undertook an informal review of the TCC's activities and came to the conclusion that the activities of the Center had not received a sufficient level of recognition for its research, nor had it conducted research of sufficiently high calibre. It was decided that changes needed to be made and these would be the primary goal of the incoming Director, Dr Geoffrey Cooper. Prior to coming to TCC Dr Cooper had been Head of Research and Development for Chloride Limited, a major chemical producer in Britain.

Under Dr Cooper the TCC as totally re-organized. Nearly 100% of its staff was let go and replaced by a smaller, more visible, group which included John Irvine who had previously been with the Science Policy Research Unit. The 'New TCC' was divided into groups responsible for:

- Policy Studies;
- Industry Studies, and
- Communications.

Under these groups a set of seven research areas were appointed by the Management Committee. These were:

1. Identifying Priority Areas of Science and Technology;
2. The Funding of Innovation;
3. The Planning, Management and Evaluation of Research and Development;
4. Technology Transfer;
5. The Management of Technical Change;
6. Education and Training; and,
7. The Social, Economic and Political Impact of Technology.

However none of these research programmes ever really got underway. This was partly because the supply of highly qualified personnel expert in Science Policy Studies who were simultaneously available at the time that TCC was re-staffing was very small, and partly because in May 1987 the ESRC announced its decision to withdraw its £400,000 of core funding by September 1987. An unsuccessful effort to raise replacement funds was mounted and on June 1, 1987 the Management Committee of TCC announced that it would close in July 1987.

The Science Policy Support Group, which is housed at the TCC, will not be affected. Being an independent group headed by Dr John Ziman and Dr Peter Healey, the Group will likely return to its previous offices at Imperial College, University of London.

21. The Department of Trade and Industry (DTI)

The general objective of DTI is "to encourage, assist and ensure the proper regulation of trade, industry and commerce in Britain in order to increase the national production of wealth and of world trade". In order to achieve these goals DTI uses its budget (1986-87) of £441.9M and a wide array of programmes.

Science, technology and technological innovation are increasingly being identified as key elements in achieving its mandate. This is being reflected in DTI's internal organization which now includes a long-term science strategy and planning group, as well as a number of major technology projects such as Alvey. Reflecting the tenor of the times, however, these programmes are being designed from the outset to focus either on 'strategic clusters' of technologies or on key linkages which can be strengthened (such as university-industry links, or training industrially relevant personnel through every level of the education system).

Over the past year DTI has undertaken an internal evaluation and consolidation of its programmes. At the same time it began a consideration of its policies for the future. Recognizing that 95% of world R&D is conducted outside the U.K. and that political economic considerations will dictate that, in all areas including scientific and technological research, Britain's future be increasingly be linked to that of the EEC, DTI has decided to emphasize and develop its collaborative strengths. This is particularly important given the number of 'Big Science' questions which are being considered at the moment: for example, the Skybus, participation in CERN, involvement with ESPRIT (the information technology programme), and questions relating to space such as whether to accept the French 'Hermes' as the major European competitor to the Space Shuttle or whether to become involved once again (reversing a 1984 decision) in developing an independent launch capability with Rolls Royce (which has been ailing in recent years, particularly in its aerospace activities).

DTI is divided into two main directorates: the Research and Technology Policy branch which is principally involved in conducting R&D, and the Quality of Design and Education branch which is involved in assisting industry through the design of conversion- and short-courses. The later directorate is increasingly becoming both involved and influential in funding of higher education. The LINK Programme (discussed in section 3h) is located here.

The Research and Technology Policy branch is divided into five broad groups, namely: General Industrial R&D, Aeronautics, Space, Research Establishments, and Evaluation. Many of these groups directly involve university research in their activities while others have indirect implications. The largest group is the General Industrial R&D section which accounts for approximately 42% of the total DTI expenditure. It's activities and budgets (1986-87) include the following:

	£
- the Alvey Programme	17.2M
- Electronics	6.7M
- Information Technology (IT)	20.8M
- Telecommunications	1.9M
- Mechanical and Electrical Engineering	20.1M
- Materials and Chemicals	12.2M
- Metal and Minerals	5.8M
- Maritime Technology and Shipbuilding	6.0M
- Vehicles	10.3M
- Biotechnology	5.5M
- Research Associations (RA)/University Collaboration Scheme; and	0.1M
- Measurements	2.5M

The Aeronautics Group is involved in general aircraft and aero-engine R&D, launch aid (established under the 1982 Civil Aviation Act for specific, high-cost and long timescale projects), and Concorde. It is through this group that Airbus is being funded (£86.0M).

The Space Group is principally involved in projects with the European Space Agency (ESA) which account for 4/5 of the sections expenditures (£51.2M). DTI, through this group, is to take the U.K. lead on the ESA Columbus programme. It is also principally involved in the National Space Technology Programme.

DTI runs four research establishments which together account for approximately 4% of the department's budget. The labs are:

- the Laboratory of the Government Chemist (LGC);
- the National Engineering Laboratory (NEL);
- the National Physical Laboratory (NPL); and,
- the Warren Spring Laboratory (WSL).

Since 1982 (which was designated IT82) when the now Minister of Education and Science, Kenneth Baker, was Minister of Trade and Industry, DTI has been heavily involved - along with the Department of Education and Science - in a series of policies designed to prepare a next generation of school leavers who are 'computer literate'. To this end DTI helped with its 'Micros in Schools' Programme, 'Software in Schools' Programme, and in setting up a total of 175 Information Technology Centers. These activities cost DTI approximately £10M in 1986-87.

3. University-Industry Linkages

3a. SERC and Industry

The SERC has become increasingly keen to encourage collaboration between academic institutions and industry in both research and postgraduate education. In addition to jointly funded arrangements with public bodies and large companies on specific research programmes, SERC has established five generally applicable schemes whose common objective is the promotion of communication and collaboration between industry and academia. These are Cooperative Research Grants, Industrial Fellowships, Industrial Studentships, Cooperative Awards in Science and Engineering, and the Teaching Company Scheme. These programmes, and others, are briefly outlined below.

3b. Cooperative Research Grants

Cooperative Research Grants are available for research in any discipline supported by SERC. Applications are judged on the basis of both scientific and technical merit and the quality of collaboration. SERC supports the academic partner by means of a research grant. The industrial partner matches this by doing part of the work itself and by providing financial and other support to the academic partner. Applications are routed through the academic partner and to be eligible, the industrial partner must be engaged in U.K. industrial operations and must have appropriate research facilities in the U.K. Applications are accepted thrice annually.

3c. Industrial Fellowships

This programme, which began in 1981, is funded jointly by SERC and the Royal Society. It allows a scientist, mathematician or engineer to move, as an Industrial Fellow, from a university or polytechnic to industry and vice versa for a period of between six months and two years. Awards can also be held on a part-time basis. It is intended that Fellows engage in a project of importance to both the industrial and academic partner. Thus the project must be a piece of research and development which is of significance to the company's engineering programme as well as to the direction of research and teaching at the educational institution. In addition to R&D, design-oriented projects are also encouraged.

Fellows normally retain their existing employment so that the arrangements for their national insurance, etc. remain the responsibility of the employer. The Fellow's stipend is therefore paid directly to the employer and will normally be the existing salary for an academic. Travel costs are paid by the employer.

To date approximately 45 awards have been made since the programme's inception. These have been split between industrialists moving into universities and academics moving into industry. A total of 34 universities are currently taking part in the scheme. Despite the programme's moderate success, difficulty has been encountered in involving small firms. This is principally due to their problems in letting key staff leave for any prolonged period.

3d. Industrial Studentships

An Industrial Studentship is an arrangement by which any SERC studentship can be supplemented by a British employer in agreement with SERC. It is intended to assist individuals who already have industrial employment experience but who wish to obtain postgraduate training. SERC will pay a flat rate to the employer of £2,665 per annum. In addition, SERC will pay the approved college fees as well as travel costs which exceed £50 per day between the student's home and his university, college or polytechnic. The employer agrees to continue to employ the student who must normally have gained one year's approved postgraduate industrial experience immediately before taking up the award. The employer then pays the student's normal salary, national insurance, superannuation contributions, and so on.

3e. Cooperative Awards in Science and Engineering (CASE)

SERC's CASE program supports research students who are working on projects of between one and three years duration. The projects are jointly devised and supervised by academic departments and collaborating bodies drawn from industrial and commercial organizations in both the public and private sectors. Local Authorities and Research Council institutes (others than those of SERC) are also eligible.

Each year approximately 900 CASEs are offered for projects across all science and engineering subjects although the majority are in fairly applied areas of information technology and materials research. Under the scheme departments receive the usual research training support grant from SERC for each student but, in addition, cooperating bodies are required to make a cash contribution to the department of £840. Cooperating bodies are expected to provide employment for students for at least three months, pay the student's travel costs and pocket expenses while working, possibly make an extra contribution to the student as an incentive, and make a contribution in cash and in kind to the academic department for the support of the project.

3f. The Teaching Company Scheme

The Teaching Company Scheme was devised in 1974-75 by a working party appointed jointly by the then Science Research Council and the Department of Industry. The Council published a consultative document and pilot programmes were initiated at three companies. A second working party later recommended a scheme with a target of 20 companies by 1981 at a cost of £2M. This proposal was endorsed in January 1977 by the SERC and by DTI. A review in 1981 (when there were 46 Programmes) recommended further expansion of the scheme. There are currently more than 200 teaching company programmes in operation.

In a teaching company scheme, a university or polytechnic team takes part in a company plan intended to achieve a substantial and comprehensive change in the company's techniques and procedures. From the company's point of view, the aims of the scheme are two fold:

- to raise industrial performance by the use of academic expertise and the introduction of advanced technology; and
- to develop and retrain existing staff and to encourage able graduates to train for careers in industry.

The permanent academic staff contributing to each programme are assisted by high calibre graduates, recruited in consultation with the company for two year academic appointments as Teaching Company Associates. The Associates, normally based full-time in the company, work in collaboration with company and academic staff on tasks within the programme. In addition, the university/polytechnic arranges induction, tuition, and so on according to personal and programme needs. Associate appointments may lead to higher degrees but more importantly they invariably lead to posts in industry.

The scheme makes a grant towards the basic salaries of the Associates and academic support costs. This is normally complemented by an average contribution of one-third from the company.

The majority of the 200 programmes currently in operation are concerned with batch manufacture in the mechanical and electrical engineering industries, but the scheme is being widened.

3g. The LINK Programme

The LINK Programme was announced in December 1986 and is housed at DTI under the Quality Design and Education branch. It was initiated through the Group on Long-Term Studies which is involved in (1) attempting to identify technologies which could have a relevance to U.K. industry and (2) in helping to establish linkages that encourage the economic development of the technology.

The objectives of LINK are to stimulate collaborative research programmes with joint industry and government funding and, in so doing, to 'pull-out' or 'pull-through' university research into the marketplace. An implicit objective of the programme is to increase idustrial spending on R&D. The emphasis seems to be on developing research that has a market or product already in mind (although perhaps not in the mind of the researcher).

Applicants to the programme must have an identified client from the start, although this could be either an external (i.e. industrial) sponsor or an internal (i.e. government department, section or lab) sponsor. Through this scheme government will contribute up to 50% of eligible costs for collaborative projects involving higher education and/or other research establishments and industrial/commercial companies. The remaining project costs will be met by the firm or firms involved in the project. Eligible costs for higher education will follow normal Research Council practices. In general, the nearer the technology is to the marketplace, the greater the proportion of the funds contributed by industry. Intellectual property rights are negotiable and will be agreed between all partners before the start of a project.

Final choice of LINK projects is a matter for the LINK Steering Group (LSG) which is made up of senior industrialists and representatives of government, Research Councils and the wider scientific community. As the programme evolves and grows the management of LINK projects will be increasingly decentralized and will use existing machinery and advisory bodies in Research Councils and government departments.

Project proposals can originate in industry, higher education or in other research establishments. There is an effort underway to make LINK as unbureaucratic as possible in order to expedite the processing of applications. There is a small LSG Secretariate supporting LINK however wherever possible industrialist's and researcher's usual government contacts will also be their LINK contact. How well this aspect of the programme will work has yet to be seen, but there are reservations concerning the extreme decentralization being proposed. The progress of each project will be subject to 'real-time' evaluation to monitor the quality of the work and ensure its rapid take-up.

LINK has no central funding. It is an 'across Whitehall' initiative and, while the first two projects are to be announced by July 1987, the target is to have a budget of £400m involving 7 central government agencies by 1992.

Commentators who are both supportive and hostile of government R&D policies seem to share the belief that LINK will become an important force. If LINK's target is met it will have substantial ramifications for the character and funding of university research.

3h. The Application of Computers to Manufacturing Engineering (ACME)

The ACME Directorate was created by SERC in 1984 to provide what was perceived as being a much needed stimulus for coordinating research and training in the vital area of Advanced Manufacturing Technology. The role of the Directorate is to identify the research needs of industry vis a vis this technology and thence to promote highly innovative and related research in academic institutions. In so doing, ACME is responsible to both DTI and the Engineering Board of SERC.

The programme of research covers all aspects of manufacturing from definition of the product in the marketplace through to invoicing the customer, and also from piece part procurement through to final inspection and successful installation at a customer site. The SERC argues that as a result of taking this wide approach, a number of 'slices' are taken vertically through the needs of a particular industry (such as the footwear manufacturing industry).

However to ensure the effective concentration of funds the Directorate exercises a high degree of selectivity in choosing projects.

Specific areas of research funded by the Directorate are:

- **methodologies for integration of the manufacturing system**, including non-technical issues and the development of standards;
- **computer aided engineering design** of a product and the means of its production;
- **planning and management** of the production activity;
- the development, control and operation of **advanced production machines**, such as sensing and in-process gauging, vision, distributed manufacturing systems, and so on;
- **infrastructure**, adapting enabling technologies to manufacture; and,
- **advanced manufacturing processes**, such as precision forming and use of adhesives.

As of September 1986 a total of 54 institutions had been awarded 158 grants for a total of £13.5M.

Since its inception, ACME and SERC have fostered linkages with the Alvey Directorate for encourage interdisciplinary work . It also has close contact with the Teaching Company Scheme, (see section 3f) especially after the initial stages of research, as a vehicle for transferring the results to research projects to industry. Cross-fertilization is also encouraged with CASE students (see section 3e).

3i. British Expertise in Science and Technology (BEST)

BEST is a national database, now situated at St Andrew's University, of research and expertise in the U.K.'s universities and polytechnics and government research establishments. The database is divided into two types of entry: expertise and services. Expertise records focus on individual researchers and provide detailed information, including:

- qualifications and professional memberships;
- positions held;
- relevant publications and patents;
- expertise and current research;
- duration, amount and title of current project funding;
- contact details.

Service records provide full details of the services and facilities available in U.K. universities, polytechnics and government research establishments. The listing includes information about:

- available services;
- capital equipment;
- number of personnel providing the service;
- contact details.

Entries are solicited from researchers and establishments at no charge and are verified by a team of BEST editors. The database is updated every 6 months. Access to the database is available to subscribers who pay a substantial initial fee (which includes a small number of free accesses) and a subsequent access charge. The target for subscribers is 15,000 and presently stands at approximately 7,000.

BEST was set up following the publication of the ACARD Report on Improving Research Links Between Higher Education and Industry, which recommended that a national database on research be established in order to increase university-industry linkages, to help stave off any potential 'brain drain' in key areas, and to serve the growing needs of both communities. A university-based steering committee was set up in 1984 to outline the design and requirements of such a database. The committee, which included representatives from DTI, SERC, the British Technology Group, the Confederation of British Industry, University Directors of Industrial Liaison (UDIL), and the Association of Polytechnic Industrial Liaison Officers (AILO), invited private sector companies to put forward proposals for the development and operation of the database. The contract was eventually given to Longman Cartermill, a longstanding publishing group. Start-up funds were made available by DTI, SERC and Longman.

4. Highly Qualified Personnel

4a. Biotechnology

In 1986 the Biotechnology Directorate of SERC commissioned the Institute of Manpower Studies to update their 1983 study of supply and demand trends for highly qualified personnel in U.K. novel biotechnology. A sub-theme of the study was to examine the extend of the 'biotechnology brain drain'. (see section 5c)

The report, entitled Monitoring the Biotechnology Labour Market, finds that there has been a steady growth in demand for highly qualified biotechnologists (HQB) and that indusrty is filling vacancies at the expense of research posts in higher education. There appears to be little demand for MSc trained biotechnologists, the PhD and Postdoctoral Fellows still being preferred. One exception where limited demand for MSc graduates or similar diplomma holders is in the area of biochemical engineering.

About 3,500 staff are employed at the graduate level or above in novel biotechnology in the U.K. About half of these are in industry while the remainder are in research centres and in institutes of higher education. The majority of organizations employed less than 10 such staff, but there are a small number of firms who employ a large portion of biotechnologists.

The majority of organizations recruited less than 5 new staff in 1985-86. Widespread skill shortages were not a feature of the biotechnology labour market, but recruitment difficulties were evident for an increasing range of specialist skills in plant molecular biology and bioprocess technology. Universities typically had problems in attracting researchers because of the short term character of the contracts being offered.

4b. Chemical Engineering

In May 1986 the Chemical Engineering Committee (now the Process Engineering Committee) of the SERC issued a report on The Future Supply of Academic Manpower in Engineering: A Case Study in Chemical Engineering. The report examines in detail a number of important factors such as

- the age distribution of academics,
- recruitment projections,
- "new blood" lectureships,
- other research personnel,
- research studentships,
- salary levels, and
- chemical engineers in industry.

Since the Finniston Report on Engineering Manpower in 1983 the question of an adequate supply of engineers in Britain has been increasingly seen as being highly important.

The report concluded that "unless positive action is taken, teaching and research in University and Polytechnic departments of Process Engineering will collapse in the next twn to fifteen years because of a lack of suitably qualified and motivated academic staff. On average, 14 people per year need to be recruited rising to 20 per year in 1995-2000. Recruitment rates in recent years have been much lower and difficulties in recruiting are already apparent. The present body of academic research workers and research students will not provide the necessary recruits.....The major deterent against an academic career lies in the salary levels which are much lower than for Chemical Engineers in industry. The discrepancy is a particularly serious deterent to those in the vital age group of 25-35. Young academics regard research as a major motivator, and perceive research output as the major criterion for promotion. However they find that they are able to devote less time and energy than they expected to their research." The authors then go on to note that "closer links with indusrty, and more recognition of industrially-related research, would improve the attractiveness of academic research."

4c. The Brain Drain

The question of a 'brain drain' in Britain is no longer the political priority item it was in 1983. Since that time three studies on biotechnology have been released by the Institute of Manpower Studies, the most recent (1987) of which shows that the rate of loss of U.K. staff to overseas posts has declined since 1983, particularly amoung senior staff. This, IMS claims, has in part been due to reduced overseas demand (particularly in the U.S. and in Canada) and imporoved opportunities in the U.K.

The Royal Society study on the loss of British specialists over the past five years in

- plastics,
- chemistry,
- biochemistry,
- earth sciences, and
- electronic engineering

will be released in July 1987, and although the Director of their Science and Engineering Policy Studies Unit is not willing to discuss their findings in detail he did say "there is no problem". He did note, however, that it was interesting to discover that while only one American was made a Fellow of the National Academy of Science while he resided in the U.K., 82 British scientists have been made Fellows of the Royal Society while they lived in the U.S.

One other piece of activity in trying to recover British researchers has been made by Moxon Associates, a London-based personnel agency which was hired by British Telecom to try to recruit from North America. Moxon Associates has, since 1982, done similar work in the areas of Marine Engineering, Biotechnology and Telecommunications. Although the campaign, which is run by one individual, claims considerable success in attracting researchers back to England, no data has been made public.

5. Recent Reports

5a. The Merrison Report

On April 1, 1982 the ABRC and the UGC jointly forwarded The Merrison Report - less commonly known as The Report of a Working Party on the Support of University Scientific Research - to Sir Keith Joseph. The committee, under the chairmanship of Dr Alec Merrison, was appointed in March 1980 with the following terms of reference:

> -"To review the current arrangements for the support of university research in the natural and social sciences;
>
> - to consider how far these arrangements make for the most effective use of existing and likely future resources;
>
> - and to report to the ABRC and the UGC."

The committee was appointed following a period in which wide concern was being expressed about the health of the dual support system for research in universities (see section 2b). This concern related not so much to the principles of the dual support system but to the stresses which were (and still are) appearing in its operation during a period of economic restraint.

The committee examined the needs of:

- teaching and research staff;
- technical staff and support staff;
- research students;
- departmental and laboratory running costs;
- equipment;
- computing facilities;
- research grants and contracts; and
- space.

After documenting the need for strong increases in the level of support for university research, the Merrison committee noted that

> "our task is not to design a radically new structure but to propose ways of adjusting the present one to accommodate current economies required of universities"

and then stated that

> "we recognize that the prospects for achieving any significant shift in our near future are next to impossible but we have come to the conclusion that as a longer term objective....universities should channel proportionately more of their funds into research....

> ....We are convinced that whatever research is done should be of high quality and properly supported, and this means that universities will need to concentrate research funds into selected areas."

The importance of university-industry linkages was noted and the Research Councils were encouraged to "maintain the relative importance of equipment grants which are essential to the research base".

5b. The Croham Report

In February 1987 The Review of the University Grants Committee (which is more popularly known as the Croham Report) was presented to Parliament by the Secretary of State for Education and Science. The committee was appointed in July 1985 with the following terms of reference:

> "to review, within the context of expected developments in higher education, the University Grants Committee's constitutional position and role in relation to the Government and to the universities, its membership, its internal structure and working methods, and its secretariat."

With the assistance of consultants from the Institute of Education, University of London the committee met 20 times and considered written submissions and evidence from more that 250 individuals and institutions.

In its report the Committee noted that 79% of higher education funding comes from the public purse. They stated that "for the foreseeable future [higher education's] main source of income will remain the taxpayer." They also noted the interest of Government in making universities and polytechnics more responsive to financial management, control and accountability while at the same time recognizing the need for university autonomy. However, "a precondition for well-informed public debate about higher education policy is the free flow of data....The Government ought to state clearly its broad policy objectives in the interest both of effective management of the university system and of public understanding."

The Croham Committee then went on with its pincipal recommendation:

> - **The UGC should be reconstituted as a University Grants Council, an independent body under the sponsorship of the Secretary of State for Education and Science.**

This proposal has been accepted and the new body, to be re-organized shortly, will be called the University Funding Council. (see section 2f)

5c. The White Paper

In April 1987, the Secretary of State for Higher Education presented a White Paper to Parliament entitled Higher Education: Meeting the Challenge. In this paper the Government set out some aspects of its policy on higher education. It also extends certain themes treated in an earlier Government Green Paper called The Development of Higher Education into the 1990s. In this White Paper, the aims of higher education were clearly outlined. These were

- **to serve the economy more effectively,**
- **to have closer links with industry and commerce, and to promote enterprise, and**
- **to pursue basic scientific research and scholarship in the arts and humanities.**

In order to therefore encourage a strengthening of British higher education along these lines, the White Paper focuses principally on the Government's approach to funding.

Polytechnics and colleges are at present almost wholly dependent on public funds for their recurrent and captial expenditure. The funds they receive have usually been described as "allocations" or "grants", paid by a local authority or central Government. The resources maid available are intended to secure delivery of educational services which are of satisfactory or better quality and which are responsive to the needs of students and employers. Institutions receiving such funds are accountable for the uses to which the funds are put and for the effectiveness and efficiency with which they are employed.

In the White Paper the Government has proposed, in place of grants, a system of contracting between institutions. It is the intention of this change to:

- **"encourage institutions to be enterprising in attracting contracts from other sources, particularly the private sector, and thereby to lesson their present degree of dependence on public funding,**
- **sharpen accountability for the use of the public funds which will continue to be required, and**
- **strengthen the commitment of institutions to the delivery of the educational services which it is agreed with the new planning and funding body they should provide."**

These recommendations have been roundly criticized by senior officials in both the university and polytechnic communities. Mark Richmond, Vice-Chancellor of the University of Manchester and who is seen to be leading the attacking on Government proposals, has vigourously argued that "if

relentlessly pursued, contract funding can only seriously damage research and scholarship and accelerate the brain drain...[They will convert higher education into a series of] high throughput training factories and will be highly corrosive. The test of a successful contract is likely to be value for money, with the money component tightly controlled and the value judged primarily as short-term benefit."

In addition to its contract teaching proposals, the White Paper also announced the establishment of the Polytechnics and Colleges Funding Council (PCFC). The PCFC (like the re-organized University Funding Council) will be an independent non-departmental body appointed by the Secretary of State for Education and Science. It will have a small membership with a strong industrial and commercial element, as well as members from institutes of higher education. The Secretary of State will provide general guidance to the PCFC and will have reserve powers of direction. The new PCFC will be charged with the development of the system of contracting.

This reorganization has been met with surprisingly little resistence, beyond the insistance that a contract system be put in place, despite the fact that the Local Education Authorities have had the sole responsibility for Polytechnics removed from them. The regional responsiveness of Polytechnics in the future will be a concern.

5d. The Oxburgh Report

On October 21, 1986 the UGC announced the establishment of a committee whose task was to review the Earth Sciences in British universities. This review followed a Report on Geodesy which was completed in 1984 and a Report of the Royal Society which was tabled in 1985. The UGC's committee's terms of reference were:

- to consider the present provision for teaching and research in the Earth Sciences, including staff, equipment and facilities;

- to advise on the future patter of provision, including the possibilities for rationalization, in the light of the need for a strong teaching and research base, the requirements of industry and the need to make the most effective use of resources;

- to have regard, also, to the relationship of the Earth Sciences to other disciplines within universities and to teaching and research outside universities; and

- to make recommendations to the UGC.

The committee, under the chairmanship of Cambridge professor E.R. Oxburgh, met four times and considered survey responses and evidence given by 100 individuals. On May 5, 1987 the committee published its recommendations which included:

- There should be about 10 "large" Earth Sciences departments in the U.K.;

- Some training in the Earth Sciences should be available to undergraduate students in most universities;

- **The UGC should support Earth Sciences in universities at one of three levels:**

  Level 1: Well-found centres for research & teaching
  Level 2: Well-found centres for honours teaching,
  Level 3: General Earth Science centres.

- Universities, either separately or together, should bid for support at one of the three levels.

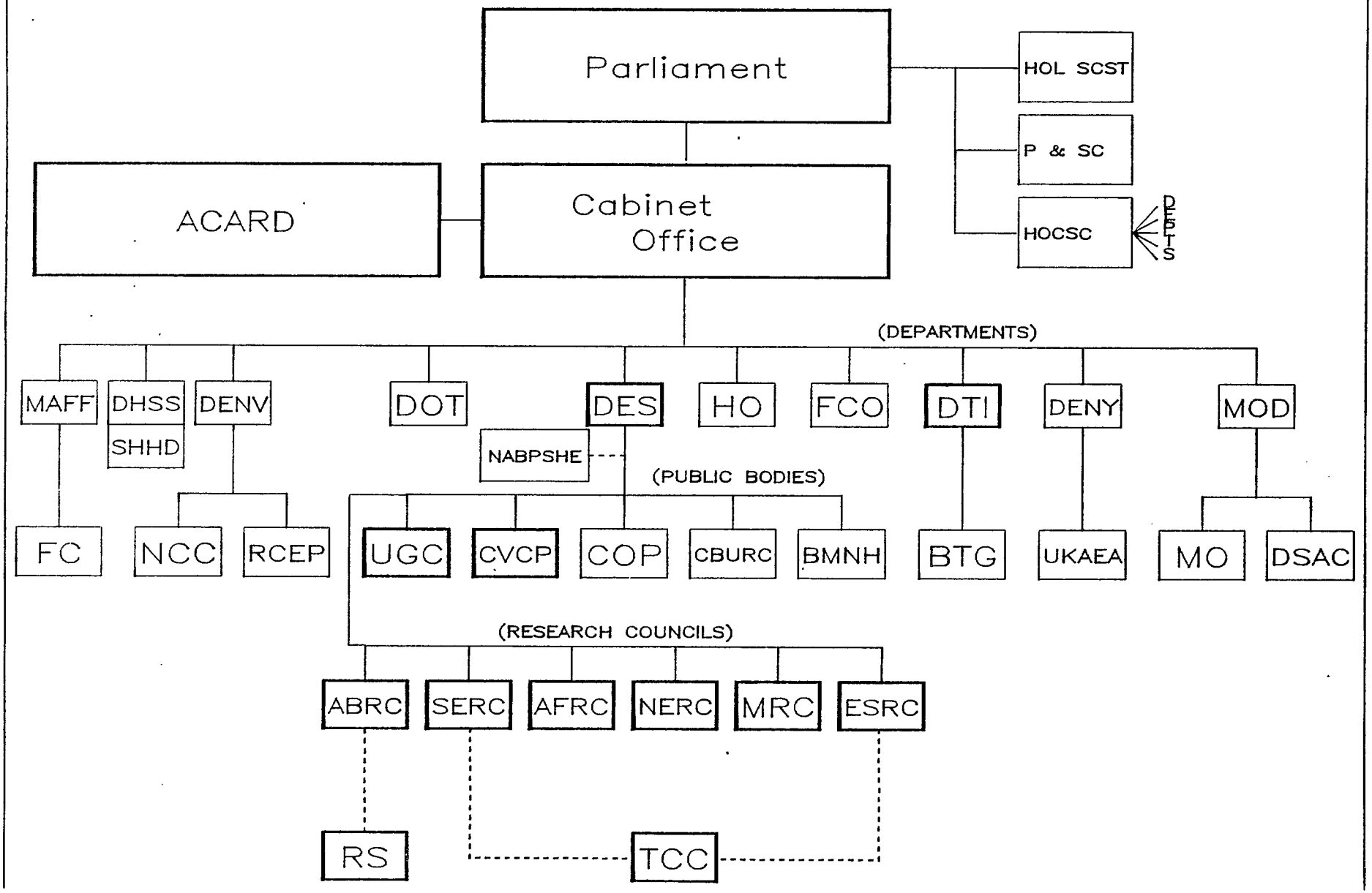
- Once a bid has been accepted, the UGC should undertake to undertake to include a particular level of support for Earth Sciences in block grant for a fixed period.

These findings have been taken seriously by the UGC as they dove-tail into their new methods of calculating university and department grants. However, there are a number of major concerns being expressed in the university community generally. The focus of discontent lies

on the strong move on the part of the Report, the UGC and the Government to break the Earth Sciences in a three tier system of higher education. In such a system, there would be a small number of universities which could award doctorates, a larger number which could award the MSc, and a larger number of universities which could only offer BSc courses. The argument is made that quality teaching and the idea of 'a modern university' is inconceivable without the presence of researchers and of research students. It is also a concern that in such a system departments would have to apply to the UGC to be designated as a higher level centre. While these sentiments may have the ring of an over-reaction (given that the report only dealt with the Earth Sciences), it is important to note that the report is being considered as a model by the Government to be used either for the study of other disciplines or for the study of the university system as a whole.

6. Appendices

SCIENCE & TECHNOLOGY RELATED AGENCIES IN BRITISH GOVERNMENT



LIST OF ABBREVIATIONS USED

ABRC	Advisory Board for Research Councils
ACARD	Advisory Council for Applied Research and Development
ACME	Application of Computers to Manufacturing Engineering
AFRC	Agriculture and Food Research Council
BEST	British Expertise in Science and Technology
CASE	Cooperative Awards in Science and Engineering
CEST	Centre for Exploitable Science and Technology
CVCP	Committee of Vice-Chancellors of Polytechnics
DENV	Department of the Environment
DENY	Department of Energy
DOT	Department of Transport
DTI	Department of Trade and Industry
ESRC	Economic and Social Research Council
FO	Foreign Office
HO	Home Office
HQB	Highly Qualified Biotechnologists
HQP	Highly Qualified Personnel
IMS	Institute for Manpower Studies
MOD	Ministry of Defence
MRC	Medical Research Council
NABPSHE	National Advisory Board for Public Sector Higher Education
NERC	Natural Environment Research Council
PREST	Policy Research in Engineering, Science and Technology (University of Manchester)

RS	The Royal Society
SERC	Science and Engineering Research Council
SPRU	Science Policy Research Unit (University of Sussex)
SPSG	Science Policy Support Group
TCC	Technical Change Centre
UGC	University Grants Committee
UKAEA	United Kingdom Atomic Energy Authority

LIST OF INDIVIDUALS MET IN U.K.

Dr. Ronald Baker:
Director, Office of International Trade (Europe), State of Maryland, U.S.A.

Dr. John Bauman:
Secretary, Natural Environment Research Council

Mr. Tony Benn:
Member of Parliament

Sir Herman Bondi:
Master, Churchill College, Cambridge University

Mr. Hugh Cameron:
Research Fellow, PREST, University of Manchester

Mr. Mark Chappell:
Science Councelor, Canadian Embassy, London

Dr. Norman Clark:
Senior Research Fellow, SPRU, Sussex University

Dr. Peter Collins:
Director, Science and Engineering Policy Studies Unit, Royal Society

Dr. Geoffrey Cooper:
Director, Technical Change Centre

Dr. Collin Divall:
Research Fellow, Liberal Studies of Science, Manchester University

Dr. John Fairclough:
Chief Science Advisor, Cabinet Office

Dr. Luc Georghiou:
Programme Coordinator, PREST, Manchester University

Dr. Maurice Goldsmith:
Director, International Science Policy Foundation

Dr. Phil Gummett:
Senior Research Fellow, PREST, Manchester University

Mr. Ken Guy:
Research Fellow, SPRU, Sussex University

Mr. Frank Haworth:
Director, LINKs Secretariat, Department of Trade and Industry

Mr. Peter Healey:
Executive Assistant, Science Policy Support Group

Ms. Diana Hicks:
Doctoral Candiate, SPRU, Sussex University

Dr. Mike Hipkins:
Research Advisor, Advisory Board for Research Councils

Dr. Paul Hoch:
Director, Science Policy and Innovation Centre, Warwick University

Ms. Cynthia Holmes:
Analyst, University Statistical Record

Dr. Erik Millstone:
Research Fellow, SPRU, Sussex University

Dr. L. Pearce-Williams:
Professor, Department of the History of Science, Cornell University, U.S.A.

Mr. Richard Pearson:
Assistant Director, Institute for Manpower Studies, Sussex University

Mr. Charles Price:
American Ambassador to the United Kingdom

Dr. Rustum Roy:
Professor of Science Studies, Cornell University, U.S.A.

Lord Sherfield:
Chairman, House of Lords Select Committee on Science and Technology

Mr. Jon Turney:
Science Correspondent, Times Higher Education Supplement

Mr. John Walsh:
Secretary's Office, Science and Engineering Research Council

Dr. Harold Wassenhaus:
Executive Director, Office of International Trade, State of Maryland, U.S.A.

Mr. Leslie Webb:
Evaluation Officer, University Grants Committee

Dr. Doug Wilkie:
Department of Microbiology, University College, University of London

Mr. Roger Williams:
Chairman, Department of Government, Manchester University

Mr. Hugh Wilson:
Research Associate, Science Studies Unit, Edinburgh University

Dr. John Ziman:
Director, Science Policy Support Group

MATERIALS DEPOSITED IN LIBRARY

ABRC:	Report on the Working Party on the Support of University Scientific Research
	Report of the Working Party on the Private Sector Funding of University Research
	Evaluation of National Performance in Basic Research
ACARD:	Exploitable Areas of Science
	The Science Base and Industry
Alvey:	The Alvey Programme
	Evaluation Update 1
	Evaluation Update 2
	Evaluation of the Alvey Programme
BEST:	British Expertise in Science and Technology
Bondi:	Science and Government
	1984: The Impact of Science on Society
	The Rigid Body Dynamics of Unidirectional Spin
	The Wunsch Lecture, January 22, 1987
	Policies of R and D
DES:	The Development of Higher Education into the 1990s (Merrison Report)
	Projections of Demand for Higher Education in Great Britain: 1986-2000
	Higher Education: Meeting the Challenge (White Paper)
IMS:	Contract Researchers in Universities
Maryland:	Medical Equipment and Biotechnology Trade
NERC:	Report for 1985-86
PREST:	Annual Report: 1985-86

Evaluation of the Structure and Organization of the Alvey Programme

An Evaluation of the Directorate Model for Supporting Engineering Research

SERC: Report on a Study of Support for Engineering

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Biobulletin (March 1987)

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A Strategy for Higher Education Into the 1990s

Review of the University Grants Committee (Croham Report)

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